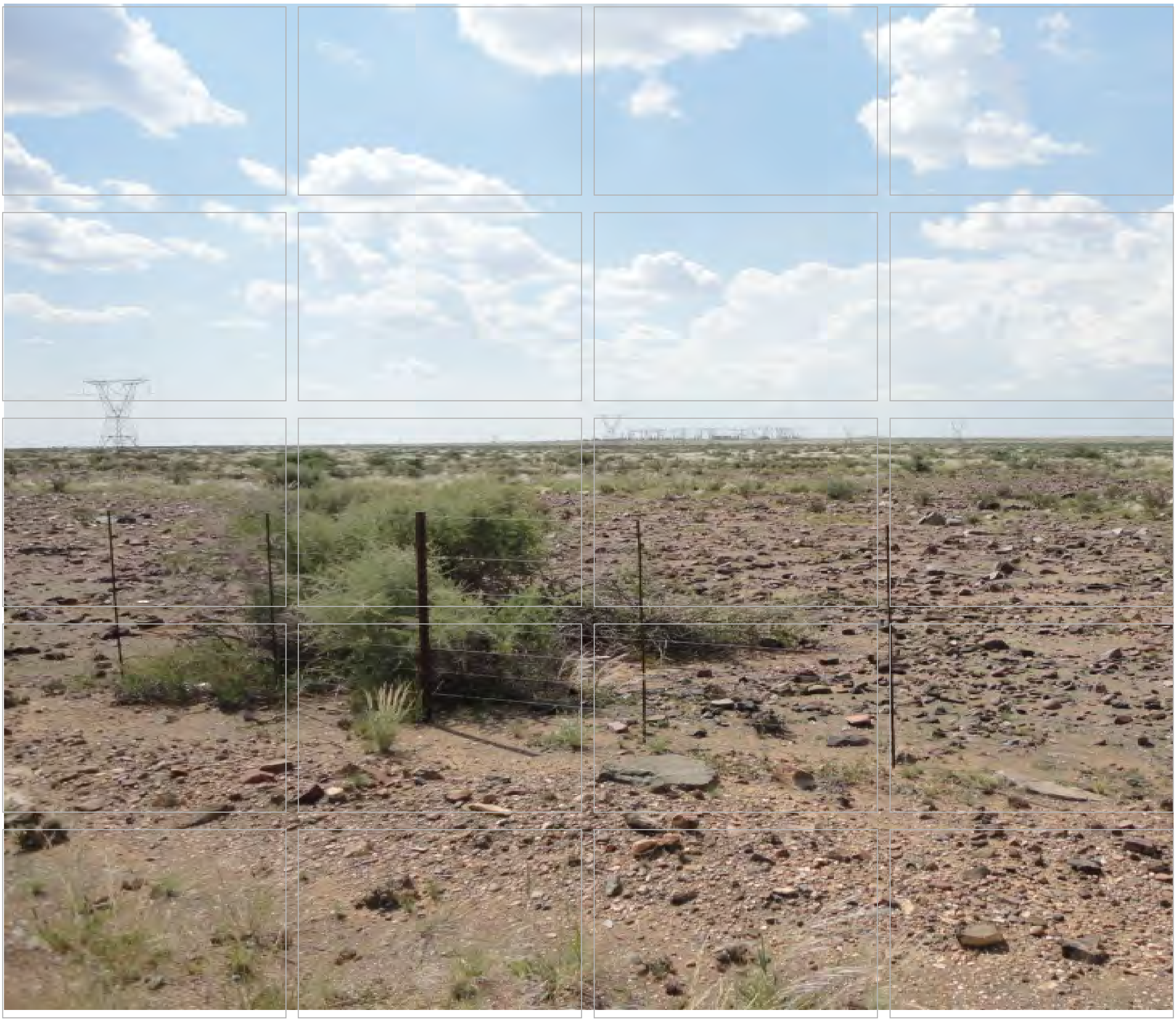

Final Environmental Impact Report

Proposed Olyven Kolk Farm 4 Solar Power Plant, Northern Cape

Rotifield Pty Ltd

DEA Ref: 12/12/20/2170

August 2012

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Rotifield Pty Ltd

Final Environmental Impact Report

Proposed Olyven Kolk Farm 4 Solar Power Park, Northern Cape

August 2012

DEA Reference: 12/12/20/2170
ERM Reference: 0126393
www.erm.com/EIA-AES

For and on behalf of
Environmental Resources Management

Approved by: Stuart Heather-Clark

Signed:

Position: Partner

Date: 27 August 2012

TABLE OF CONTENTS

ACRONYMS

BID	Background Information Document
DEA	Department of Environmental Affairs
DoE	Department of Energy
DENC	Northern Cape Department of Environment and Nature Conservation
DMA	District Management Area
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIR	Environmental Impact Assessment Report
EMP	Environmental Management Programme
ERM	Environmental Resources Management
ESA	Early Stone Age
GN	Government Notice
I&APs	Interested & Affected Parties
IBA	Important Bird Area
IEP	Integrated Energy Plan
IPP	Independent Power Producer
IRP	Integrated Resource Plan
ISMO	Independent System Operator
LSA	Late Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NEMPAA	National Environmental Management: Protected Areas Act
NERSA	National Energy Regulator of South Africa
SAHRA	South African Heritage Resources Agency
REFIT	Renewable-energy feed-in tariffs
ToR	Terms of Reference

ABBREVIATIONS

%	Percent
cm	Centimetres
CO_2	Carbon Dioxide
GWh	Giga Watt Hour
kg	Kilograms
km	Kilometres
km^2	Square kilometres
kV	Kilovolt
m	Metres
MW	Mega Watts
m^2	Square meters
R	South African Rand

DEFINITIONS AND TERMINOLOGY

Alternative: A possible course of action, in place of another, that would meet the same purpose and need (of the proposal). Alternatives can refer to any of the following but are not limited to: alternative sites for development, alternative projects for a particular site, alternative site layouts, alternative designs, alternative processes and alternative materials.

Cumulative Impacts: Impacts that result form the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combines to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do-nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Environment: The surroundings within which humans exist and that are made up of:

i. the land, water and atmosphere of the earth;
ii. micro-organisms, plant and animal life;
iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being. This includes the economic, social, cultural, historical and political circumstances, conditions and objects that affect the existence and development of an individual, organism or group.

Environmental Assessment: The generic term for all forms of environmental assessment for projects, plans, programmes or policies. This includes methods/tools such as environmental impact assessment, strategic environmental assessment, sustainability assessment and risk assessment.

Impact: The positive or negative effects on human well-being and / or on the environment.

Environmental Management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental Management Programme: An operational plan that organises and coordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supplies water to a reservoir that supplies water to that activity). These types if impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and Affected Parties (I&APs): Individuals, communities or groups, other than the proponent or the authorities, whose interests may be positively or negatively affected by the proposal or activity and/or who are concerned with a proposal or activity and its consequences.

Competent Authority: The environmental authority at the national or provincial level entrusted in terms of legislation, with the responsibility for granting or refusing environmental authorisation in respect of an activity.

Mitigate: The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action.

Scoping: The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addresses in an environmental assessment. The main purpose of scoping is to focus the environmental assessment on a manageable number of important questions. Scoping should also ensure that only significant issues and reasonable alternatives are examined.

Significance: Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. magnitude, intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgements and science-based criteria (i.e. biophysical, social and economic).

Stakeholder engagement: The process of engagement between stakeholders (the proponent, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities.

1 INTRODUCTION

1.1 OVERVIEW

AES Solar Energy Limited, hereafter referred to as AES, appointed *Environmental Resources Management Southern Africa (Pty) Ltd*, hereafter referred to as ERM, as independent environmental consultants to undertake the Environmental Impact Assessment (EIA) process for the proposed photovoltaic (PV) solar power plant at Olyven Kolk Farm 4 (a portion of the Rotifield Olyven Kolk solar power plant) in the Northern Cape Province.

The site is located on the remaining portion of portion 14 (a portion of portion 4) of Olyven Kolk Farm, No. 187 which is situated in the Siyanda District (see *Figure 1.1*). The proposed development includes the installation and operation of solar panels (PV arrays) with a projected output of up to 40 megawatts (MW) to be constructed in phases over time. It is intended that the electricity generated by the proposed facility will feed into the national electrical grid network.

A Final Environmental Impact Report (EIR) for the proposed Olyven Kolk solar power plant was previously compiled and submitted to the Department of Environmental Affairs (DEA) in November 2011 (12/12/20/2170) and the environmental authorisation was obtained on 01 March 2012. AES have subsequently signed over the development to Rotifield Pty Ltd, and changing the proponent name is part of this Application.

In order to comply with the Department of Energy (DoE) Request for Proposal (RFP) for their Renewable Energy Independent Power Producer (IPP) Procurement Programme, Rotifield has requested that the existing authorisation be split into Olyven Kolk Farm 2, Olyven Kolk Farm 3 and Olyven Kolk Farm 4. This EIR therefore covers solar power plant proposed on Olyven Kolk Farm 4, however, reference is still made to the Olyven Kolk site, as the whole site was assessed during the EIA process.

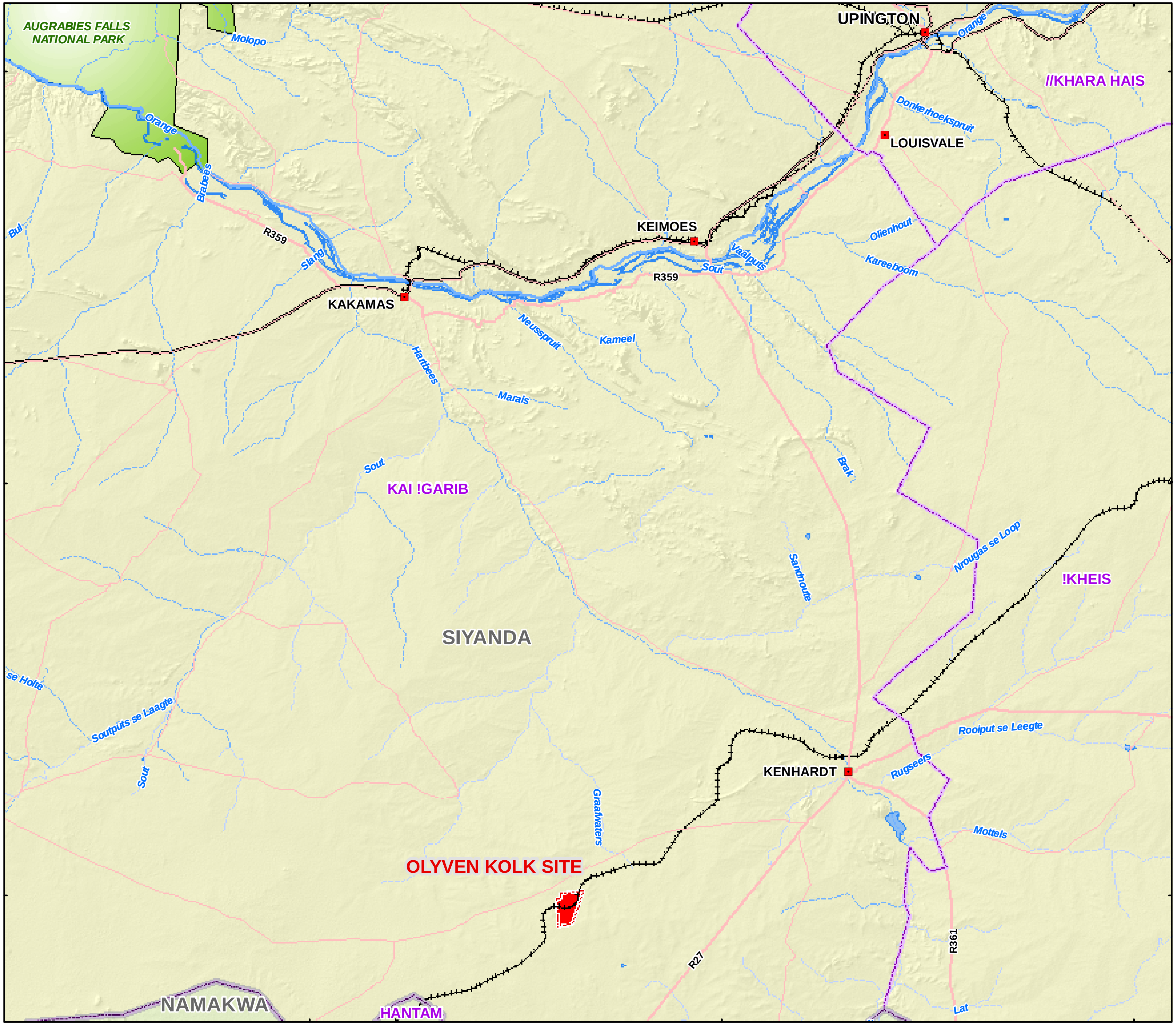
The proposed solar power plant will consist of the following key components:

- PV solar panels/modules (arranged in arrays);
- PV module mountings;
- DC-AC current inverters; and
- Underground cabling.

In addition, associated infrastructure will be required such as a temporary construction camp, offices and control building, meteorological building and access roads.

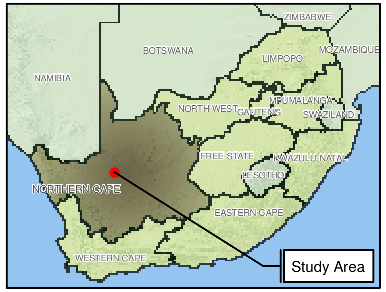
This Environmental Impact Report (EIR) has been compiled as part of the EIA process in accordance with regulatory requirements stipulated in the EIA

Regulations (Government Notice R543 – R546 of 18 June 2010) promulgated in terms of Section 24(5) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), as amended.



Legend

- MainTowns
- Perennial Rivers
- Non Perennial Rivers
- Dry Rivers
- National Roads
- Main Roads
- Secondary Roads
- Railway Line
- Conservation areas
- Perennial Dam
- District Municipalities
- Local Municipalities
- Olyven Kolk Site



SCALE:
0 5 10 15 20 25
Kilometres
N

TITLE:

Figure 1.1
Location of Project Site

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 500 000

DRAWING:	REV:
Fig1.1_Location of Project Site.mxd	2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Demarcation Board (2011)
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig1.1_Location of Project Site.mxd

1.2 *PURPOSE OF THE REPORT*

The information contained in the EIR along with comments and inputs received from stakeholders and commenting authorities will assist the competent authority, the National Department of Environmental Affairs (DEA) in deciding whether or not to grant environmental authorisation and inform the conditions associated with authorisation.

Fundamental to an environmental assessment is the identification, prediction and evaluation of the actual and potential environmental consequences of an activity and the options for mitigation of negative impacts and enhancement of positive impacts (DEAT, 2003). It is often possible to introduce measures to avoid, mitigate or compensate for many of the negative environmental impacts of a particular development provided that these potential impacts are identified early in the planning process. At the same time, it would be important to also look at opportunities for enhancement of positive impacts or benefits.

The objectives of this document are to:

- Communicate the results of the EIA process for the proposed development and alternatives considered;
- Ensure that the impacts identified during the EIA process are adequately addressed;
- Show the proponents response to the environmental concerns raised, and efforts taken by the proponent towards mitigating/ enhancing the impacts/ benefits;
- Provide a record of comments and responses received from I&APs during the process; and
- Facilitate informed, transparent and accountable decision-making process by the relevant authorities.

1.3 *THE PROJECT PROPONENT*

Rotifield Pty Ltd is a Joint Venture company that has TRE and Guma as shareholders. TRE is subsidiary of Tozzi Holding S.p.A. (hereinafter "Tozzi Group"). They operated in the electrical plant and instrumentation system industries since the early 1950s, both in Italy and overseas, is a leading Italian operator active in the development, construction and operation of renewable power plants (hydro electric, photovoltaic, wind energy and bio-mass) and it has already gained an extensive experience as EPC and O&M contractor for photovoltaic, wind and hydroelectric plants.

Through Tre&Partners S.p.A. (hereinafter "Tre&Partners"), a joint venture set up in February 2009 with AXA Private Equity, TRE owns hydropower plants and wind farms operating and under construction for a total capacity roughly equal to 410,5 MW (respectively 279 MW operating and 74 MW under construction as regards the wind business and 49,2 MW operating and 8,4

MW under construction as regards the hydro business). In July 2011 TRE widen its activity in the photovoltaic sector setting up another joint venture with AXA Private Equity, TRE Solar S.r.l. Through other subsidiaries, TRE owns 49,7 MW of operating and under construction photovoltaic plants. TRE developed, built and sold to Terna S.p.A. additional 66,1 MW of photovoltaic plants which increase the Tozzi Group track record in the PV industry up to 153,5 MW and it is developing its photovoltaic business in South Africa having attended to the 2nd Bid Date of the RFP with a 75 MW photovoltaic plant.

Guma, a well established South African black owned company, is an investment power house intensely focused on adding value and initiating growth by means of operational and managerial participation worldwide. Guma is characterized by strong business development skills, adding value into its investments also through the high managerial competences of its team and through a systematic approach. Its headquarters are located in Johannesburg, South Africa, and operates throughout the African continent, as well as Canada, Australia, Europe, Middle East and Asia through various subsidiaries and over 12,000 highly skilled staff members. With regards to the energy industry, besides South Africa, Guma established and is currently developing its businesses in Zambia, Kenya, Zimbabwe, Ghana, DRC and Sudan. Finally, Guma has been recipients of numerous business and Black Economic Empowerment awards and nominations.

1.4 DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

1.4.1 ERM Southern Africa

ERM was appointed by Rotifield to undertake the EIA for the proposed solar power plant. ERM is a global environmental consulting organisation employing over 3,500 specialists in over 145 offices in more than 41 countries. Founded in 1971, ERM has built an organisation based on the supply of a full range of environmental and social policy, scientific, technical, and regulatory expertise. Our primary focus is to provide quality work and service to our clients in these areas.

From a regional perspective ERM has been involved in numerous projects in Africa over the past 30 years and in 2003 established a permanent presence in Southern Africa to meet the growing needs of our clients. The Southern African ERM offices are based in Cape Town, Johannesburg, Pretoria and Durban. ERM Southern Africa has a staff complement of over 120 dedicated environmental professionals offering expert skills in EIA, EMP, EMS, risk assessment, EHS management and auditing, corporate social responsibility and socio-economic impact assessment, climate change services, specialist groundwater services as well as contaminated site management. ERM Sothern Africa has recently undertaken a number of EIAs for solar farms, including PV solar plants in the Northern Cape and the Free State.

1.4.2 EIA Project Team

The Partner in Charge of the EIA, Stuart Heather-Clark, is a certified environmental assessment practitioner and the project has been conducted in terms of the code of ethics promulgated by the Certification Board for Environmental Assessment Practitioners of South Africa (EAPSA), which includes a requirement for independence. Stuart has overall responsibility for the team and delivery of the EIA study. Stuart has more than 15 years experience in the field of Impact Assessment in South Africa, and is the Practice Leader for the Impact Assessment and Planning Team in ERM Southern Africa.

ERM, consultants and the specialists appointed by ERM during the course of this EIA have no financial ties to, and nor are they a subsidiary, legally or financially, of Rotifield. Remuneration for the services by the applicant, Rotifield in relation to this EIA is not linked to approval by any decision-making authority and ERM has no secondary or downstream interest in the development.

1.5 REPORT STRUCTURE

The structure of this Final EIR is as follows:

Table 1.1 Report Structure

Section	Contents
Chapter 1 Introduction	Contains a brief description of the proposed activity and an outline of the report structure.
Chapter 2 Regulatory Framework	Outlines the legislative, policy and administrative requirements applicable to the proposed development.
Chapter 3 Approach and Methodology	Outlines the approach to the EIA study and summarises the process undertaken for the project to date.
Chapter 4 Project Description	Includes a detailed description of the proposed project activities and the alternatives.
Chapter 5 Biophysical Baseline	Describes the receiving biophysical baseline environment.
Chapter 6 Social Baseline	Describes the receiving socio-economic baseline environment.
Section 7 Impacts on soils, surface and groundwater	Describes and assesses the potential impacts of the proposed development on soils, surface and groundwater.
Chapter 8 Impacts on Ecology and Biodiversity (Flora and Fauna)	Describes and assesses the potential impacts of the proposed development on flora and fauna. Mitigation measures are also recommended.
Chapter 9 Impacts on Birds	Describes and assesses the potential impacts of the proposed development on birds and describes relevant mitigation measures.
Chapter 10 Visual Impacts	Describes and assesses the potential visual impacts of the proposed development and describes relevant mitigation measures.

Section	Contents
Chapter 11 Impacts on Archaeology, Palaeontology and Cultural Heritage	Describes and assesses the potential impacts of the proposed development on cultural heritage aspects and describes relevant mitigation measures.
Chapter 12 Socio-Economic Impacts	Describes and assesses the potential socio-economic impacts of the proposed development and describes relevant mitigation measures.
Chapter 13 Other Impacts	Describes and assesses other potential impacts of the proposed development and describes relevant mitigation measures.
Chapter 14 Cumulative Impacts	Qualitatively assesses potential cumulative impacts.
Chapter 15 Decommissioning	Indicates that decommissioning impacts would be similar to construction impacts.
Chapter 16 Conclusions and Recommendations	Summarises the key findings of the EIA and provides recommendations for the mitigation of potential impacts and the management of the proposed project.
Chapter 17 References	Contains a list of references used in compiling the report.

In addition, the report includes the following annexures:

Annex A: Legislative Framework
Annex B: Photographs
Annex C: Public Participation Documentation
Annex D: Issues and Response Report
Annex E: DEA acceptance of Scoping
Annex F: Ecological and Biodiversity Specialist Report
Annex G: Bird Specialist Report
Annex H: Archaeological, Heritage and Paleontological Specialist Report
Annex I Visual Specialist Report
Annex J: Drainage Lines Report
Annex K: Environmental Management Programme

1.6 OPPORTUNITY TO COMMENT ON THE ENVIRONMENTAL IMPACT REPORT

Interested and Affected parties (I&APs) and authorities were provided with an opportunity to comment on any aspect of the proposed activity and the EIR. A hardcopy of the EIR was made available at the Kenhardt Library and electronically at http://www.erm.com/EIA-AES.

A notification letter was sent to all registered and identified I&APs to inform them of the release of the EIR and where the report could be reviewed.

Stakeholders were instructed to forward comments to ERM at the address, tel. /fax numbers or e-mail address shown below. The deadline by which comments are to reach ERM is Monday 5th December 2011. This allowed for a 40- day commenting period.

Attention: *Tougheeda Aspelling*
AES Olyven Kolk Solar Power Plant
DEA Ref: 12/12/20/2170
ERM Ref: 0126393
ERM Southern Africa (Pty) Ltd
Postnet Suite 90,
Private Bag X12
Tokai, Cape Town,
7966
Tel: (021) 702 9100; Fax: (021) 701 7900
E-mail: aes.solarfarm@erm.com

2 REGULATORY FRAMEWORK

The proposed activity is subject to legislative and policy requirements at a national and provincial level. A detailed description of relevant legislation pertaining to the EIA process for the proposed solar power plant project and the permitting thereof, is contained in *Annex A*. The relevance of this legislation and policy is summarised below.

2.1 ENERGY RELATED POLICY, PLANNING, STRATEGIES AND GUIDELINES

National Policy regarding the need for expansion of electricity generation capacity in South Africa are informed by ongoing strategic planning by the Department of Energy (DoE), the National Energy Regulator of South Africa (NERSA) and Eskom.

The following are of particular relevance to the proposed solar power plant project:

- **The Electricity Regulations on New Generation Capacity Government Notice R721 (August 2009),** provides for the establishment and regulation of power purchase agreements with independent power producers (IPPs), guidelines governing procurement and renewable feed-in tariff (REFIT) programme. The proposed renewable energy facility will provide an additional electricity supply through renewable energy sources. AES, as the IPP, will be required to comply with guidelines governing the bid programme and REFIT.

- **Electricity Regulation Act and Regulations (Act 4 of 2006) and amendments:** The aims of the Electricity Regulation Act is to achieve efficient, effective and sustainable electricity supply, development and operation to ensure the needs of electricity users in South Africa are met and their interests safeguarded. This will be achieved through the facilitation of investment in the supply industry, access to electricity, promotion of use of diverse energy sources, promotion of competitiveness and a fair balance between the players in the industry and end users.

- **National Integrated Resource Plan (NIRP), 2003/ 2004/ 2010:** The NIRP provides a long term (2003-2022), cost effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

- **Integrated Energy Plan (IEP), 2003:** The IEP provides a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. Although the IEP recognises that South Africa is likely to be reliant on coal for at least the next 20 years as the predominant source of energy, it also recognises the potential and need to diversify energy supply.

- **White Paper on the Energy Policy of the Republic of South Africa, 1998:** identifies key objectives for energy supply within South Africa, such as increasing access to affordable energy services, managing energy-related environmental impacts and securing energy supply through diversity. The White Paper supports investment in renewable energy initiatives.

- **Renewable Energy Policy in South Africa, 1998:** This policy supplements the Energy Policy and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in SA. Government has set the following 10-year target for renewable energy: *"10 000 GWh renewable energy contribution to final energy consumption by 2013 to be produced mainly from biomass, wind, solar and small scale hydro. This is approximately 4% (1 667 MW) of the estimated electricity demand (41 539 MW) by 2013"* The White Paper on Renewable Energy also states that *"It is imperative for SA to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet".*

In addition, the Department of Energy (DoE) has embarked on a renewable energy Independent Power Producer Procurement Programme (IPP Procurement Programme) with an initiation to submit proposals for the finance, construction, operation and maintenance of renewable energy generation facilities. For further details see the DOE's website: http://www.ipp-renewables.co.za/

2.2 *NATIONAL ENVIRONMENTAL POLICY, REGULATIONS AND GUIDELINES*

The relevant legislation pertaining to the Environmental Authorisation for development projects is the National Environmental Management Act (NEMA) (Act No. 107 of 1998) as amended and the Environmental Impact Assessment (EIA) Regulations of 2010 promulgated under NEMA. The relevance of this legislation is summarised below.

2.2.1 *National Environmental Management Act (NEMA)*

NEMA requires that activities be investigated that may have a potential impact on the environment, socio-economic conditions, and cultural heritage. The results of such investigation must be reported to the relevant authority. Procedures for the investigation and communication of the potential impact of activities are contained in Section 24 (7) of the Act.

Section 24(C) of the Act defines the competent decision-making authority which is normally the provincial environmental department. However, as set out in Section 4.1 of the 'Guideline on Environmental Impact Assessments for Facilities to be Included in the Electricity Response Plan', Government Notice (GN) 162 of 2010, all EIA applications from Independent Power Producers (IPPs) or those involving co-generation, where these are included in the

Integrated Resource Plan (IRP), the National Department of Environmental Affairs (DEA) shall be the competent authority.

2.2.2 *EIA Regulations*

The EIA Regulations, June 2010 (Government Notice R544, R545 and R546) identify activities which may have a detrimental effect on the environment and the listed activities which may be triggered by the proposed solar power plant include:

GN 544:

Activity 11: *'The construction of (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line'.*

Activity 24: *'The transformation of land bigger than 1000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, at the time of the coming into effect of this Schedule or thereafter such land was zoned open space, conservation or had an equivalent zoning'.*

GN 545:

Activity 1: *The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.*

Activity 8: *'The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex'.*

Activity 15: '*Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply'.*

GN R546:

Activity 14: *'The clearance of an area of 5 hectares or more of vegetation where 75% of the vegetative cover constitutes indigenous vegetation.*

- *(a) In the Northern Cape*
  - *(i) All areas outside urban areas.'*

Activity 16(iv): *'The construction of infrastructure covering 10 square meters of more where such construction occurs within a watercourse of within 32 metres of a watercourse measured from the edge of the watercourse, excluding where such construction will occur behind the development setback line'.*

It is important to note that the above thresholds and activities also apply to phased developments "*where any phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.*"

Government Notice R543 sets out the procedures that need to be complied with and the documentation required for the Scoping and EIA processes.

2.2.3 Other Applicable Legislation and Guidelines

National Level

- National Environmental Management: Protected Areas Act (NEMPAA) (Act 57 of 2003);
- Environmental Conservation Act (No 73 of 1989 Amendment Notice No. R1183 of 1997);
- Conservation of Agricultural Resources Act (Act 43 of 1983);
- National Water Act (Act No. 36 of 1998);
- Mineral and Petroleum Resources Development Act (Act No 28 of 2002)
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004);
- Development Facilitation Act (Act No 67 of 1995);
- National Heritage Resources Act (Act No. 25 of 1999);
- Occupational Health and Safety Act (Act No. 85 of 1993);
- Subdivision of Agricultural Land Act (Act No. 70 of 1970); and
- Noise Control Regulations promulgated in terms of the Environment Conservation Act (Act No. 73 of 1989).

Provincial Level

- Northern Cape Planning and Development Act (Act 7 of 1998); and
- Northern Cape Nature Conservation (Act 9 of 2009).

Local Level

- Municipal Systems Act (Act No 32 of 2000).

2.3 RELEVANT GOVERNMENT DEPARTMENTS AND REGULATORS

There are a number of Ministries and Departments that have an interest in and will take responsibility for ensuring that the proposed solar power plant project is implemented in an environmentally responsible manner. The regulatory framework governing energy generation projects such as the proposed solar power plant project is as follows:

2.3.1 National Level

Department of Environmental Affairs (DEA): Responsible for Environmental Policy and controlling authority in terms of NEMA and EIA Regulations promulgated in terms of NEMA. As Eskom is a statutory body DEA is the competent authority for this project and charged with the responsibility of considering whether or not to grant environmental authorisation and under what conditions.

Department of Energy: Responsible for policy relating to all energy forms, including renewable energy. Also the controlling authority in terms of the Electricity Act (Act No. 41 of 1987)

Department of Water Affairs: The department promotes effective and efficient water resources management to ensure sustainable economic and social development.

National Energy Regulator of South Africa (NERSA): Responsible for regulating all aspects of electricity sector and will ultimately issue licences for solar powered developments.

South African Heritage Resources Agency (SAHRA): Regulating enforcement of the National Heritage Resources Act (Act No 25 of 1999) and associated provincial regulations which provides legislative protection for listed or proclaimed sites, nature reserves and proclaimed scenic routes.

Department of Transport and Public Works: Responsible for roads and granting of exemption permits for the conveyance of abnormal loads on public roads.

2.3.2 Provincial Level

Northern Cape Department of Environment and Nature Conservation (DENC) is the provincial department responsible for tourism, environmental affairs and conservation in the Northern Cape.

With regard to the EIA for the Olyven Kolk Solar Power Farm project, DENC are regarded as an important commenting authority and will provide comment on the EIA and input to the national Department's decision-making process.

Northern Cape Department of Transport, Safety and Liaison: Responsible for the granting of exemption permits for the conveyance of abnormal loads on public roads.

Department of Agriculture and Land Reform and Rural Development: Responsible for land and agrarian transformation, promoting and facilitating increased production and providing expertise for improved livelihoods, sustainable rural development and food security for all.

2.3.3 *Local Level*

Certain Departments, such as the Planning and Roads Departments, from the Siyanda District Municipalities will also be involved as commenting authorities for the EIA. External to the EIA but also relevant to the project are land-use planning applications which are dealt with by the planning departments at a local government level.

In terms of the Municipal Systems Act (Act No 32 of 2000), it is compulsory for all municipalities to conduct an Integrated Development Planning (IDP) process to prepare a five-year strategic plan for the area under their control. Bioregional Planning involves the identification of priority areas for conservation and their placement within a planning framework of core, buffer and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance.

2.4 *PERMITTING REQUIREMENTS*

Activities undertaken during site preparation, construction and operation may require additional permits, over and above the Environmental Authorisation. AES is responsible for ensuring that the necessary permits are in place in order to comply with national and local regulations. Additional permit requirements are described below.

2.4.1 *Heritage*

The protection and management of South Africa's heritage resources is controlled by the National Heritage Resources Act (NHRA). The objective of the NHRA is to introduce an integrated system for the management of national heritage resources.

The protection of archaeological and palaeontological resources is the responsibility of a provincial heritage resources authority and all archaeological objects, palaeontological material and meteorites are the property of the State. Section 35 states that "*Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority*".

Section 38 (8) of the National Heritage Resources Act which states that any person who intends to undertake a development categorised as-
(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
(c) any development or other activity which will change the character of a site -
(i) exceeding 5 000 m^2 in extent;
must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Given that the proposed solar plant project may exceed 5 000m^2 in extent and will change the character of the site the proposed development comment will be requested from the South African Heritage Resources Agency (SAHRA) and Heritage Northern Cape (Ngwao Boswa Kapa Bokoni) serving as a commenting authority. Heritage issues have been assessed as part of the EIA process with the assistance of specialist heritage practitioners.

2.4.2 *Water Use*

In terms of the National Water Act (Act 36 of 1998) and associated regulations, there are licensing procedures that need to be followed for particular "water uses". Water uses that may be of relevance to the development of solar power plants and associated road construction include the following:

- taking of water from a water resource, including a water course, surface water, estuary or aquifer (i.e. borehole);
- altering the bed, banks, course or characteristics of a water course; and/or
- impeding or diverting of a flow in a water course.

Given the minimal volumes of water required for the plants operations, it is unlikely that a water use licence will be required. The Department of Water Affairs (DWA) have stipulated that projects of this nature take necessary measures to ensure that water needs are adequately catered for by a usage assessment. In the event that a water usage licence is required, this will be processed only once the Power Purchase Agreement has been awarded.

2.4.3 *Abnormal Vehicle Loads*

The components for the solar power plant will be delivered to site using road transport and due to the size of the components, the vehicles used to deliver components will be considered abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989). A permit for a vehicle carrying an abnormal load must be obtained from the relevant Provincial Authority. The vehicle must comply with the Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads, issued by the Department of Transport, 2009.

2.4.4 *Plant Species*

Two plant species observed on site require a permit obtainable from DENC should the development require the removal or cause destruction or disturbance of these species, *Hoodia gordonii* and *Aloe claviflora*. Any individuals of these species falling within areas that will need to be cleared for the development, should be located, marked and translocated within the site to an area outside the development footprint. Prior to commencement of construction activities, AES should apply with the consent of the landowner for such a permit and the translocation of plants should take place under the supervision of an ecologist or someone else with experience in this regard.

3 APPROACH AND METHODOLOGY

3.1 THE EIA PROCESS

EIA is a systematic process that identifies and evaluates the potential impacts (positive and negative) that a proposed project may have on the bio-physical and socio-economic environment and identifies mitigation measures that need to be implemented in order to avoid, minimise or reduce negative impacts and enhance positive impacts. The overall EIA process required for developments in South Africa is shown schematically in *Figure 3.1* The EIA is not fully a linear process, but one where several stages are carried out in parallel and where the assumptions and conclusions are revisited and modified as the project progresses. The following sections provide additional detail regarding the key stages in the EIA process. These stages are:

- project initiation;
- scoping study phase; and
- integration and assessment phase.

3.2 PROJECT INITIATION PHASE

The project initiation phase began with a project inception meeting followed by a review of available and relevant background information. Key activities during this phase of the project included the following:

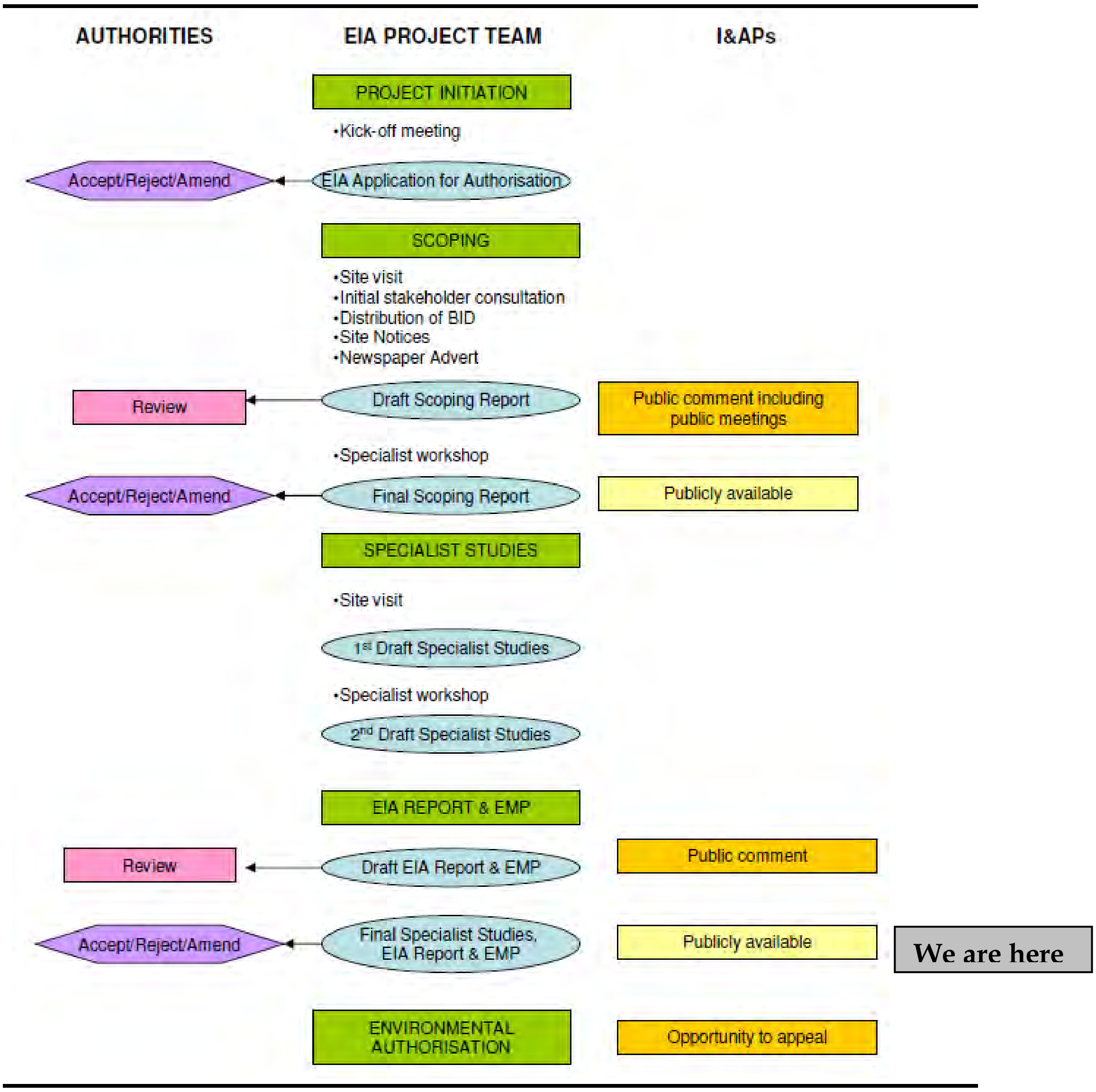
- Submission of an EIA Application to DEA on 01 February 2011 and receipt of the DEA reference number (12/12/20/2170) for the project on 15 February 2011;

- An initial site visit by ERM on 07 March 2011;

- Compilation of a preliminary database of neighbouring landowners, authorities (local and provincial), Non-Governmental Organisations and other key stakeholders into a database of registered I&APs continues to be expanded during the ongoing EIA process; and

- Compilation of a Background Information Document (BID) for distribution to I&APs.

Figure 3.1 EIA Process Flow Diagram



3.2.1 *Scoping Phase*

Environmental scoping has several important functions aimed at facilitating decision-making. These include the following:

- providing a description of the proposed project and associated activities;
- reviewing existing information to gain an understanding of the baseline environmental conditions;
- identifying any gaps in information and uncertainties;
- investigating and screening of alternatives;
- obtaining input from I&APs about their issues and concerns;
- identifying and assessing potential environmental and social impacts associated with the project; and
- identifying potential mitigation and management measures.

Accordingly, the Scoping Report provided a detailed overview of the project, the associated Public Participation Process, and outlined the proposed EIA methodology. It also included a preliminary identification and evaluation of potential impacts which was presented together with a Plan of Study for the EIA. The Draft Scoping Report was released for a 40 day public review period (26 June to 5 July 2011) prior to submission to the DEA. The Scoping Report was received by the DEA on 14 July 2011 and ERM received acceptance of the Scoping Report by the DEA on 28 July 2011 (*Annex D*).

Scoping Phase Public Participation

The tasks relating to public participation during the Scoping Phase are summarised in *Table 3.1*.

Table 3.1 Public Participation Tasks: Scoping Phase

Activity	**Description and Purpose**
Preparation of a preliminary stakeholder database	A preliminary database has been compiled of neighbouring landowners, authorities (local and provincial), Non-Governmental Organisations and other key stakeholders. This database of registered I&APs has been and will continue to be expanded during the EIA process.
Erection of site notices	On-site notices were placed at the site in 07 March 2011.
Newspaper advertisements published	The project was advertised in the Die Gemsbok (Afrikaans and English) on 18 March 2011. The advertisements informed the public of the project and requested them to register as I&APs if they would like to participate in the EIA process. I&APs that responded to the advertisements were included on the project database.
Distribution of a Background Information Document (BID)	A BID was compiled and distributed to I&APs. The purpose of the BID was to convey information on this project and to invited I&APs to register their interest in the project.
Release of the Draft Scoping Report for stakeholder comment	The Draft Scoping Report was released for a 40-day public and authority comment period (26 June to 5 July 2011). A notification letter was sent to all registered and identified I&APs to inform them of the release of the report and where the report could be reviewed.
Preparation of an ongoing Comments and Response Report	Throughout the EIA process to date, issues and concerns raised by I&APs and authorities, and communicated to ERM have been collected and recorded in a Comments and Response Report which will be included in this EIR (*Annex D*).
Public Meeting	A public meeting was held during the Scoping Commenting Period on 28 June 2011 to afford I&APs and the general public the opportunity to comment on the project and engage with the EIA team on the Scoping Report.
Preparation and release of the Final Scoping Report	All comments received on the Draft Scoping Report were acknowledged and incorporated into the Final Scoping Report. The Final Scoping Report was submitted to the DEA for approval. A notification letter was sent to all registered and identified I&APs to inform them of the availability of the Final Scoping Report on 15 July 2011.

Authority Consultation and Involvement

Authority consultation and involvement up until the release of the Scoping Report included:

- Submission of an EIA Application for Authorisation form to DEA on 01 February 2011. DEA's Acknowledgement of Receipt and approval to proceed with the Scoping Study was received on 15 February 2011, DEA Reference 12/12/20/2170.

- A Draft Scoping Report was submitted to the DEA Case Officer and authority stakeholders and I&APs were notified of the release of the report for comment. The DEA acknowledged receipt of the Draft Scoping Report on 09 June 2011.

- On 22 June 2011, the DEA requested a list and contact details of all the authorities that the Draft Scoping Report was submitted to.

- After the close of the commenting period, the Final Scoping Report was submitted to the DEA on 14 July 2011 and ERM received acceptance of the Scoping Report by the DEA on 28 July 2011 (*Annex D*).

The next key interaction with DEA will be the submission of the Final EIR and EMP for consideration of environmental authorisation.

3.2.2 Integration and Assessment

The final phase of the EIA is the Integration and Assessment Phase, which is described in detail in the Plan of Study for EIA and included in the Scoping Report. A synthesis of the specialist studies, which addresses the key issues identified during the Scoping Phase, was documented in the Draft EIR. Relevant technical and specialist studies were included as appendices to the Draft report.

The Draft EIR was made available to I&APs for a 30-day comment period and a notification letter was sent to all registered and identified I&APs to inform them of the release of the Draft EIR and where the report could be reviewed. The Draft EIR was made available to authorities for a 40-day comment period (until 5th December 2011). Comments received on the Draft EIR were assimilated and the EIA project team have provided appropriate responses to the comments received. A Comments and Responses Report is appended to the Final EIR in *Annex D*, and is submitted DEA as part of this EIR for decision-making.

Specialist Studies

During the Specialist Study phase, the appointed specialists gathered data relevant to identifying and assessing environmental impacts that might occur as a result of the proposed project. They assisted the project team in assessing potential impacts according to a predefined assessment methodology included in the Scoping Report. Specialists have also suggested ways in which negative impacts could be mitigated and benefits could be enhanced.

The independent specialists responsible for the specialist studies are listed in *Table 3.2.*

Table 3.2 Independent Specialist Studies and Appointed Specialists

Specialist Study	**Name and Organisation**	**Qualifications**
Hydrology and Erosion Potential	Mike van Wieringen (M.van Wieringen & Associates)	Professional Engineering, Professional Natural Science
Botany and Terrestrial Ecology	Simon Todd (Simon Todd Consulting)	MSc Conservation Biology, University of Cape Town
Bird study	Andrew Jenkins (AVISENSE Ornithological Consulting)	PhD Zoology, University of Cape Town
Archaeological, Heritage and Palaeontology study	Tim Hart (ACO Associates *cc.*)	PhD Archaeology, University of Cape Town
	David Halkett (ACO Associates *cc.*)	MA Archaeology, University of Cape Town BA Hons Archaeology, University of Cape Town
Landscape and Visual	Stephen Stead (Visual Resource Management Africa cc)	B.A (Hons) Environmental Sciences: Geography, University of KwaZulu Natal (Pietermaritzburg)
Socio-economic	Kerryn McKune Desai (ERM)	MA Geography of Third World Development Royal Holloway, University of London BA Hons Environmental & Geographical Science, University of Cape Town

The specialist reports and declarations of each specialist are included in *Annex F – J* with the exception of the socio-economic study undertaken by ERM's social specialist Kerryn McKune Desai which is presented in *Chapters 6* and *11* of this EIR.

Environmental Impact Report (EIR)

A synthesis of information, which addresses the key issues and opportunities identified during the EIA process, has been documented in this EIR. Recommendations on the mitigation of adverse impacts and the enhancement of positive impacts associated with the proposed project are included. These mitigation measures / enhancements are translated into specific actions in the draft Environmental Management Programme (EMP) (*Annex K*).

Public Participation

The tasks outlined in *Table 3.3* relating to public participation have been and will be further undertaken as part of the EIA phase.

Table 3.3 Public Participation Tasks: Impact Assessment Phase

Activity	Description and Purpose
Release of the Draft EIR for stakeholder comment	This Draft EIR and EMP have been released for a comment period ending on 5th December 2011. A notification letter was sent to all registered and identified I&APs to inform them of the release of the report and where the report could be reviewed. In order to make the project documentation more accessible to the largely Afrikaans speaking community the Non-Technical Summary (NTS) was translated into Afrikaans and provided to stakeholders on request. The report has also been submitted to DEA and Commenting Authorities to obtain their input and comment on the Draft EIR.
Preparation and release of the Final EIR	No comments have been received to date on the Draft EIR and EMP. Should any comments be received these will be incorporated into a comments and response report and this will be provided to the DEA with relevant responses provided by the EIR team. This Final EIR has been submitted to the DEA for approval. A notification letter has been sent to registered I&APs to inform them of the availability of the Final EIR.
Public Notification of DEA Decision	The DEA will review the Final EIR, including the project information and either approve or decline the application for environmental authorisation. Once ERM is informed of DEA's decision, IAPs will be notified of the decision and their right to appeal.

Rotifield are committed to engaging with local communities and stakeholders throughout construction and operation of the project.

Authority Consultation and Involvement

The Northern Cape Department of Environment and Nature Conservation (DENC), the provincial commenting authority, has been engaged for their comments on the Draft EIR as have other commenting authorities, including but not limited to the Heritage Northern Cape and the Department of Agriculture. No substantial comments on the Draft EIR have been received to date. Acknowledgements of the notification of the release of the Draft EIR were received.

Splitting of the Environmental Authorisation and Changing the Site Name

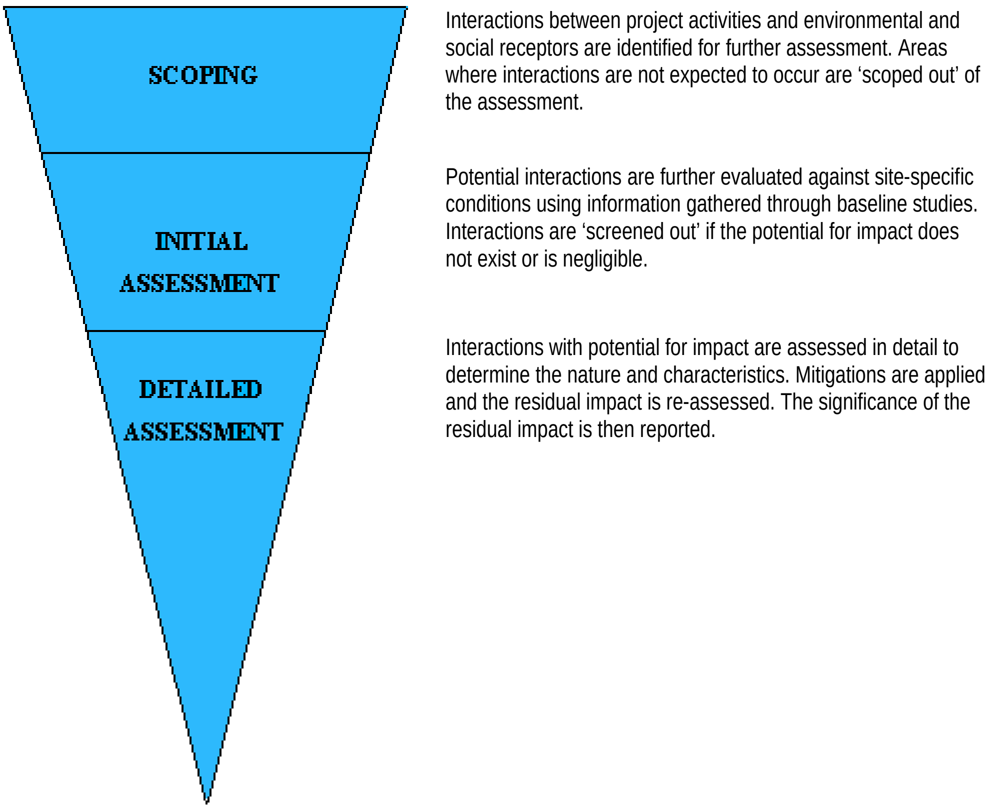
The applicant has requested that the name be changed from AES Solar to Rotifield and that the environmental authorisation (EA) obtained on 01 March 2012 for the Olyven Kolk site (DEA Ref: 12/12/20/2170) be split into three separate EAs. The Olyven Kolk Farm 4 EIR and EMP will be loaded onto the project website and registered I&APs will be notified of the submission of the application and EIA documents to split the authorised Olyven Kolk Project in preparation for bid submission to DoE.

3.3 IMPACT ASSESSMENT METHODOLOGY

3.3.1 *Impact Assessment Process*

The following diagram (*Figure 3.2*) describes the impact identification and assessment process through screening, scoping and detailed impact assessment. The methodology for detailed impact assessment is outlined in *Section 3.3.2*, below.

Figure 3.2 Impact Assessment Process



3.3.2 *Impact Assessment Methodology*

The purpose of impact assessment and mitigation is to identify and evaluate the significance of potential impacts on identified receptors and resources according to defined assessment criteria and to develop and describe measures that will be taken to avoid or minimise any potential adverse effects and to enhance potential benefits.

Impact Types and Definitions

An impact is any change to a resource or receptor brought about by the presence of a project component or by the execution of a project related activity. The evaluation of baseline data provides crucial information for the process of evaluating and describing how the project could affect the bio-physical and socio-economic environment.

Impacts are described as a number of different impact types, summarised in *Table 3.4*. Impacts are also described as *associated* are those that will occur and *potential* are those that may occur.

Table 3.4 Impact Nature and Type

Nature or Type	Definition
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
Cumulative impact	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

Assessing Significance

Impacts are described in terms of '*significance*'. Significance is a function of the **magnitude** of the impact and the **likelihood** of the impact occurring. Impact magnitude (sometimes termed *severity*) is a function of the **extent, duration and intensity** of the impact. The criteria used to determine significance are summarised in *Table 3.5*. Once an assessment is made of the magnitude and likelihood, the impact significance is rated through a matrix process as shown in *Table 3.6*.

Significance of an impact is qualified through a statement of the **degree of confidence**. Confidence in the prediction is a function of uncertainties, for example, where information is insufficient to assess the impact, then the degree of confidence is low. Degree of confidence is expressed as low, medium or high.

Table 3.5 Significance Criteria

Impact Magnitude	
Extent	**On-site** – impacts that are limited to the boundaries of the site. **Local** – impacts that affect an area in a radius of 20km around the development site. **Regional** – impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem. **National** – impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.
Duration	**Temporary** – impacts are predicted to be of short duration and intermittent/occasional. **Short-term** – impacts that are predicted to last only for the duration of the construction period. **Long-term** – impacts that will continue for the life of the Project, but

	ceases when the Project stops operating. **Permanent** – impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.
Intensity	BIOPHYSICAL ENVIRONMENT: *Intensity can be considered in terms of the sensitivity of the biodiversity receptor (ie. habitats, species or communities).* **Negligible** – the impact on the environment is not detectable. **Low** – the impact affects the environment in such a way that natural functions and processes are not affected. **Medium** – where the affected environment is altered but natural functions and processes continue, albeit in a modified way. **High** – where natural functions or processes are altered to the extent that it will temporarily or permanently cease. ***Where appropriate, national and/or international standards are to be used as a measure of the impact.*** *Specialist studies should attempt to quantify the magnitude of impacts and outline the rationale used.* SOCIO-ECONOMIC ENVIRONMENT: *Intensity can be considered in terms of the ability of project affected people/communities to adapt to changes brought about by the Project.* **Negligible** – there is no perceptible change to people's livelihood **Low** - People/communities are able to adapt with relative ease and maintain pre-impact livelihoods. **Medium** - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support. **High** - Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.
Likelihood - the likelihood that an impact will occur	
Unlikely	The impact is unlikely to occur.
Likely	The impact is likely to occur under most conditions.
Definite	The impact will occur.

Once a rating is determined for magnitude and likelihood, the following matrix can be used to determine the impact significance. *Table 3.7* shows the various colours used to distinguish both positive and negative significance levels.

Table 3.6 *Significance Rating Matrix*

SIGNIFICANCE				
		LIKELIHOOD		
		Unlikely	**Likely**	**Definite**
MAGNITUDE	**Negligible**	Negligible	Negligible	Minor
	Low	Negligible	Minor	Minor
	Medium	Minor	Moderate	Moderate
	High	Moderate	Major	Major

Table 3.7 *Significance Colour Scale*

Negative ratings	Positive ratings
Negligible	Negligible
Minor	Minor
Moderate	Moderate
Major	Major

In *Table 3.8*, the various definitions for significance of an impact are given.

Table 3.8 *Significance Definitions*

Significance definitions	
Negligible significance	An impact of negligible significance (or an insignificant impact) is where a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.
Minor significance	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.
Moderate significance	An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'moderate' impacts have to be reduced to 'minor' impacts, but that moderate impacts are being managed effectively and efficiently.
Major significance	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a development. It is then the function of regulators and stakeholders to weigh such negative factors against the positive factors such as employment, in coming to a decision on the Project.

Once the significance of the impact has been determined, it is important to qualify the **degree of confidence** in the assessment.

Mitigation Measures and Residual Impacts

For activities with significant impacts, the EIA process is required to identify suitable and practical mitigation measures that can be implemented. The implementation of the mitigations is ensured through compliance with the EMP. After first assigning significance in the absence of mitigation, each impact is re-evaluated assuming the appropriate mitigation measure/s is/are effectively applied, and this results in a significance rating for the residual impact.

3.4 IDENTIFICATION OF MITIGATION MEASURES

The project team with the input of the client, has identified suitable and practical mitigation measures that are implementable and agreed to mitigate the impacts identified as being significant. Mitigation that can be incorporated into the project design in order to avoid or reduce the negative impacts or enhance the positive impacts have been defined and require final agreement with the client as these are likely to form the basis for any conditional approvals by DEA.

3.5 SPECIALIST STUDY METHODOLOGY

3.5.1 Vegetation and Terrestrial Ecology

A desk-based study was carried out to identify flora and fauna species likely to be found within the study area. A site visit was undertaken on 13 and 14 May 2011 to assess the flora and fauna (mammals, reptiles and amphibians) of the site. The site was walked and plant species observed were recorded and where necessary, photographed for verification and documentation purposes. The various habitats were delineated on a satellite image of the site. Particular attention was given to potentially sensitive habitats or areas that appeared to be species-rich or harbour different or unique species, such as drainage areas and rocky ridges. Reptiles, amphibians and mammals which were observed were recorded as was any characteristic evidence of presence or activity such as scat, diggings, burrows etc. Within certain habitats such as rocky outcrops, the area was actively searched for reptile species characteristic of these areas or species of conservation concern which were identified beforehand as potentially occurring at the site.

Sensitivity maps of the study area were compiled based upon the findings of the site visit and available literature. The impact assessment phase involved the determination and evaluation of the nature of likely impacts of the development and recommendations on mitigation.

3.5.2 *Avifauna*

The study involved a site visit on 21 and 30 May 2011 to directly assess the habitats present within the inclusive impact zone, and to determine the *in situ* avifauna and identify any known or potential bird flight corridors present in the area. The on-site information was integrated with the bird atlas (SABAP 1 & 2) and other relevant bird data available for the general area in order to develop an inclusive, annotated list of the avifauna expected to occur on the site (expanding on an initial list compiled at the scoping phase). Areas identified to be important to birds were identified and mapped. Particular attention was given to Red-listed, endemic, restricted-range and known, collision, displacement or disturbance-prone species on each list and they were flagged for particular attention in evaluating the risks posed by such a development. The impact assessment phase involved the determination of the nature of likely impacts of the development and recommendations on mitigation.

3.5.3 *Archaeology, Palaeontology and Cultural Heritage*

Archaeology and Heritage

A desktop study was carried out on publicly available scientific publications to determine the archaeological history of the study area. In addition, an archaeological and heritage field survey was undertaken on 04 and 05 June 2011. Archaeological materials and structures were inventoried, with GPS positions, with approximate ages and descriptions recorded, as necessary. Existing heritage structures in the Study Area were identified and inventoried, with their GPS positions, age and descriptions recorded. The impact assessment phase involved the determination of the nature of likely impacts of the development and recommendations on mitigation.

Palaeontology

A desktop study was undertaken assessing the potentially fossiliferous rock units (groups, formations etc) represented within the study area, determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous paleontological impact studies in the same region, and the author's field experience. A paleontological field survey was not deemed necessary. Finally the impact assessment phase involved the determination of the nature of likely impacts of the development and recommendations on mitigation.

3.5.4 *Visual*

A site visit was undertaken on 31 May 2011 to identity the visual resources of the area and characterise the landscape character where the proposed solar power plant is to be located. This included identification of sensitive viewpoints. Photographs were taken from these viewpoints both for records, and for use in determining the potential visibility of the solar power plant from sensitive viewpoints. Photomontages were produced showing solar panels superimposed on the panoramic photographs. These photomontages were used to assist with determining the nature of likely impacts of the development and recommendations on mitigation.

3.5.5 Hydrology and Erosion

The investigation comprised a desk study of available literature followed by a two day visual survey on site. The desk study reviewed, the South African Council for Geoscience 1:250 000 geological map and memorandum, 1:50 000 topocadastral maps, and Google Earth images as well as a preliminary geological report for a nearby farm provided by ERM.

Air-photo interpretation of the colour Google Earth image was carried out prior to visiting the site and re-assessed after visiting the site. On site, the site was traversed by vehicle and on foot. Soil types, rock outcrops, vegetation patterns, the drainage regime and any other indicators relating to ground and water conditions were noted and mapped. The investigation reflects surface observations only. All sub-surface conditions are consequently interpretive and predictive and need to be confirmed or disproved by sampling and excavation or probing. A preliminary impact assessment was undertaken.

3.5.6 Socio-economic

The socio-economic specialist study was undertaken by an ERM social specialist, Kerryn McKune Desai. The study began with the compilation of a baseline description. The baseline study was based on a combination of primary and secondary information available for the district and local area. The secondary information review included the following data sources:

- Integrated Development Plan: Siyanda District Municipality 2007 -2011;
- Statistic South Africa 2001 Census;
- DMA: A Case Study of Siyanda District Municipality (Northern Cape), 2003;
- Integrated Economic Development Plan: Siyanda District Municipality, 2006;
- Statistics South Africa Community Survey 2007; and
- Publications of the Demarcation Board of South Africa.

The primary data used for the socio-economic specialist study was derived from semi-structured, qualitative interviews (face to face interviews and telephonic interviews) and feedback received through the public consultation process. The interviewees include the directly affected landowner, local residents, government officials and others. *Table 3.9* provides a list of respondents for primary data collection. Comments received thus far during the public consultation process have been incorporated into the socio-economic baseline and the socio-economic impact assessment (*Chapters 6 and 12 respectively*).

Table 3.9 Primary Data Collection, Respondents

Respondent	Designation	Date of Interview
Chris Fourie	Land Owner	11 July 2011
Abrie Coetzee	Neighbouring Landowner	25 July 2011
Piet Buys	Neighbouring Landowner	25 July 2011
Michael Stoeltzing	Neighbouring Landowner	14 July 2011
Elma Jordaan	Sister in Charge at the CHC: Kenhardt	14 July 2011
Many Titus	PR Councillor: Kenhardt	14 July 2011
S Jacob	Speaker: Kenhardt	14 July 2011
Rowy Olly	Mayor of Kenhardt	14 July 2011
Christa Mengrooff	CDW: Kenhardt	14 July 2011
Edith Williams	Local resident: Kenhardt	14 July 2011
Elbie Visser	Local resident: Kenhardt	14 July 2011
Cllr Styles	Ward 9 Councillor: Kenhardt	14 July 2011
Charlotte Titus	IDP/LED Officer: Kai Garip LM	12 July 2011
Andrie Mateus	Coordinator: Emerging Farmers	13 July 2011

The limitations of the baseline study are that the secondary information used, may be outdated and therefore not provide an accurate picture of the local municipality's current situation.

The impact assessment phase incorporated the identification and assessment of socio-economic impacts (direct, indirect and cumulative) that may result from the construction and operation phases of the project. These impacts were identified and assessed based on the data gathered from both the primary and secondary sources (1) past PV projects and professional expertise. Mitigation measures that address the local context and needs have been recommended.

3.6 ASSUMPTIONS AND LIMITATIONS

An EIA is a process that aims to identify and anticipate possible impacts based on past and present baseline information. As the EIR deals with the future there is, inevitably, always some uncertainty about what will actually happen. Impact predictions have been made based on field surveys and with the best data, methods and scientific knowledge available at this time. However, some uncertainties could not be entirely resolved. Where significant uncertainty remains in the impact assessment, this is acknowledged and the level of scale is provided.

In line with best practice, this EIR has adopted a precautionary approach to the identification and assessment of impacts. Where it has not been possible to make direct predictions of the likely level of impact, limits on the maximum likely impact have been reported and the design and implementation of the project (including the use of appropriate mitigation measures) will ensure that these are not exceeded. Where the magnitude of impacts cannot be predicted with certainty, the team of specialists has used professional experience and

(1) The secondary data is not current and subsequent changes in the demographic profile should be considered.

available scientific research from solar power facilities worldwide to judge whether a significant impact is likely to occur or not. Throughout the assessment this conservative approach has been adopted to the allocation of significance.

3.6.1 Gaps and Uncertainties

Inevitably knowledge gaps remain. For instance, there is an incomplete understanding of cumulative impacts as it is not known how many of the proposed solar power plants in the vicinity of Olyven Kolk Farm will be granted authorisation and selected as projected in the IPP procurement process.

Gaps in Project Description

- Location of solar arrays- the assessment is based on a preferred and final layout based on revision of earlier layouts to accommodate environmental sensitivities. Final layout has been confirmed, however precise locations of the solar arrays may be microsited to allow for more detailed geotechnical studies, and that this will seek to ensure that all locations remain in areas of low sensitivity as defined by this study and that the specialists will sign off the revised positions.
- Location of borrow pit- it has not yet been determined if rock or soil material will be taken from the existing borrow pit on site or from another within close proximity to the site if required.
- Temporary construction camp- it has not yet been determined whether a construction camp is required for the construction phase of the development. An alternative being considered for the construction camp accommodating workers in Kenhardt and the use of worker transport shuttles to/from Kenhardt.
- It is not yet clear, if the sections of the power plant south and north of the railway will be connected by an overhead line or by an underground cable, using the existing culverts under the railway where possible.

Gaps in Baseline Information

- Limited understanding of the locations of bat roosting caves and migration routes in South Africa are poorly known and not well documented.

Gaps in Understanding of Impacts

- It should be noted that as large scale impact solar power plants are new to South Africa, the impacts associated with them have not been scientifically researched in the country, and therefore the specialists have used the precautionary principal where necessary in undertaking their respective impact assessments.

4 PROJECT DESCRIPTION

This Chapter provides a description of the proposed Olyven Kolk Farm 4 solar power plant. The main project activities for the construction, operation and decommissioning phases are discussed in this section as well as the motivation for the project and the consideration of alternatives.

4.1 MOTIVATION

The electricity consumers in South Africa are supplied by the state owned utility, Eskom. The latter is a vertically integrated, regulated power utility with operations at all levels of electricity supply business, including generation, transmission and distribution.

It is anticipated that for now, Eskom will act as the single buyer to procure electric power from independent power producers (IPPs) which could use either conventional generation technologies or renewable generation technologies. The establishment of an independent system operator (ISMO) is expected to take over the power purchasing function from Eskom in the future. In addition to supplying power to electricity consumers in South Africa, Eskom also exports power to other countries such as Lesotho, Swaziland, Botswana, Namibia, Mozambique and Zimbabwe. South Africa has at present a total of some 43,900 MW of generation capacity, some 40,600 MW of which, i.e. about 92 percent is owned by Eskom and the rest is owned by IPPs.

Emergency load shedding in South Africa during 2007 and 2008 highlighted the challenges facing South Africa in terms of electricity generation, transmission and distribution. The National Energy Response Plan (NERP), drafted at the time, acknowledged the role that IPPs (including those harnessing renewable energy resources) can play in ensuring sustainable electricity generation, and sets a goal that 30 percent of all new power generation will be derived from IPPs (1).

In August 2011, the release of the request for qualification and proposals by the South African Department of Energy presented opportunities for the renewable energy industry, promoting competiveness for renewable energy with conventional energy generation technologies. Initially, it was indicated that the market mechanism to be used for the purchase of power would be premised on predetermined renewable-energy feed-in tariffs (REFITs). However, the South African government has since abandoned REFIT in favour of a selection process that would involve price and non-price criteria. This decision followed concerns regarding REFIT's legal compatibility with government procurement rules and cases of such schemes in other countries having led to prices that could not be sustained.

In South Africa the government has developed a policy framework (the White Paper on Renewable Energy) and set a target of sourcing 10,000 GWh from renewable energy projects by 2013 (1). This amounts to approximately 4 percent of South Africa's total estimated energy demand by 2013. At the Copenhagen Conference in December 2009 South Africa's president also set a target for the reduction of CO_2 (2) emissions, as laid out in the Integrated Resource Plan (IRP 2010) (3) which sets a target reduction of CO_2 emissions by 34 percent by 2020. The utilisation of renewable energy will play a major role in achieving this goal. South Africa's commitment to achieving this goal was reiterated by Minister Edna Molewa at the December 2010 Climate Change Conference in Cancun, Mexico. At present, South Africa generates approximately 77 percent of its power consumed from coal (4) and as a country, South Africa is among the largest emitters of CO_2 globally.

Beyond the positive climate impact however, solar energy is very well placed to rapidly come on line and contribute to alleviating the power gap in South Africa.

As the proposed development is located near the Eskom Aries substation and associated infrastructure, it promotes grid support, reduces the need for long potentially less energy efficient interconnection lines and may result in a more secure energy supply for energy users in the local area. A generating facility may increase the locality's priority in Eskom's distribution network and therefore potentially reduces the risks of future load shedding in the area. The intention of Rotifield in establishing a solar energy facility is to assist in reducing South Africa's dependence on non-renewable fossil fuel resources and contribute to climate change mitigation.

The potential for the Northern Cape to become a hub especially for the generation of electricity through solar energy is recognized by the Provincial Government. The Premier of the Northern Cape, Ms H. Jenkins stated in her address to delegates of the Northern Cape Climate Change and Green Jobs Summit in Upington on 14 April 2011,"*The Northern Cape has been identified as one of the provinces best suited and strategically poised for a number of solar and wind renewable energy projects. These projects will be responsible for creating a number of green jobs in the province and will also be contributing to the clean energy that will be put on to the electricity grid. These projects will also contribute in reducing South Africa's green house gas emissions at a national level."*

The development of solar energy in the Northern Cape provides the opportunity for the establishment of a new industry in the province. Existing levels of employment are low within the province and wider site locality. Employment is considered to be the single biggest opportunity outside of the advantages expressed above, associated with the project. Training provided

(1) National Energy Regulator of South Africa **South Africa Renewable Energy Feed-In Tariff** (2009) NERSA Publications.
(2) Carbon dioxide is generated as a by product of the combustion of fossil fuels such as coal, petroleum and natural gas and is referred to as a greenhouse gas . Increasing concentrations of greenhouse gases in the atmosphere are causing an unprecedented rise in global temperatures, with potentially harmful consequences for the environment and human health.
(3) Department of Energy Integrated Resource Plan (2010).
(4) Eskom website. Date accessed 19 October 2011. http://www.eskom.co.za/c/article/199/understanding-electricity/

to employees will provide individuals with a skill set that will be highly desirable throughout the industry sector in South Africa as the renewable energy industry and specifically, the solar energy sector rapidly develops, thereby increasing potential opportunities available to such individuals.

Furthermore, the site location in one of the highest irradiation areas in South Africa maximizes the total power produced, given the same infrastructure.

A summary of the project motivation is provided in *Box 4.1* below.

Box 4.1 ***Project Motivation***

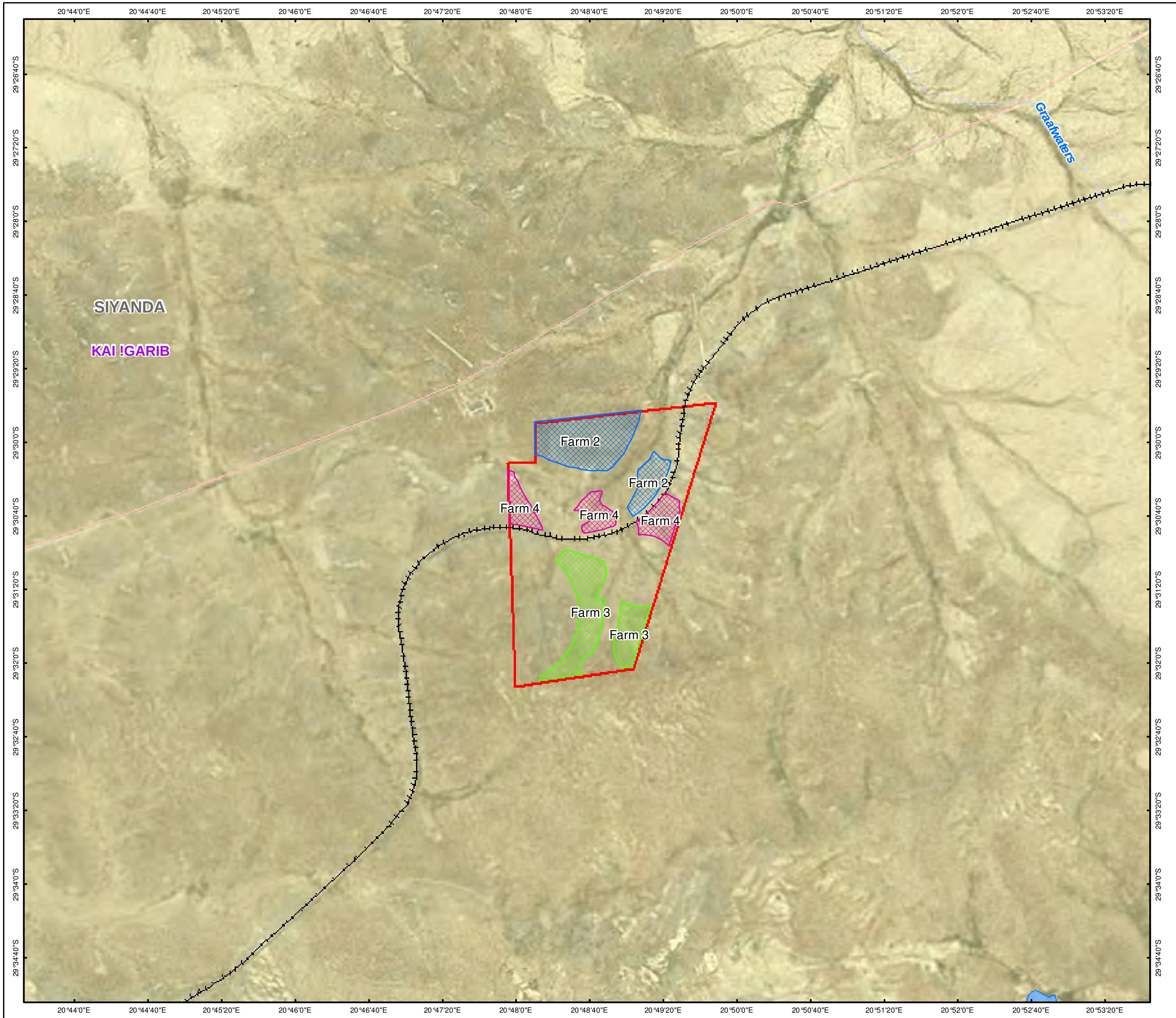
- Direct and indirect job creation in the Northern Cape;
- Reduce South Africa's dependence on fossil fuel resources;
- Improve reliability and range of electrical services;
- Meet demand for diversified energy sources;
- Ensure the future of sustainable energy use;
- Reduce CO_2 emissions and the nation's carbon footprint;
- Promote environmental, social and economically sustainable development;
- Contribute to reaching South Africa's goal of 10,000 GWh of renewable energy by 2013; and
- Contribute to meeting the NERP goal of 30 percent of all new energy from IPPs.

4.2 PROJECT LOCATION

The proposed solar power plant is located on the remaining portion of 14 (a portion of portion 4) of Olyven Kolk Farm, No. 187 which is situated within the Siyanda District Municipality in the Northern Cape Province (see *Figure 4.1*). The site is located approximately 126 km south west of Upington and is accessible from the R27 (tarred road) along the Sishen -Saldanha railway line service road. The nearest town to the site is Kenhardt, which lies approximately 44 km north east of the site. The proposed site is approximately 400 m from the Eskom 400 kV Aries Substation.

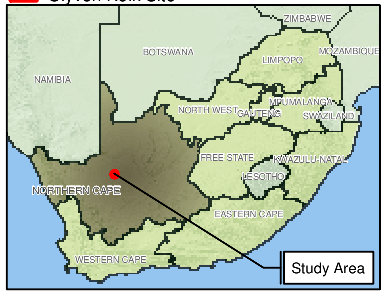
The area of the proposed site is approximately 1,010 ha (10.10 km^2). The footprint of solar panel area will be around 80 ha. However, it is necessary for space to be kept between PV rows to avoid shadow effects from one row to the next one, which increased the footprint of the PV area. These spaces will remain free from any construction. The outstanding area will be used for access roads, technical buildings and other facilities or will remain undeveloped.

This site has now been divided into three portions, Olyven Kolk Farm 2, Olyven Kolk Farm 3 and Olyven Kolk Farm 4. All three sites are located on the farm portion described above.



Legend

- MainTowns
- Perennial Rivers
- Non Perennial Rivers
- Dry Rivers
- Main Roads
- Secondary Roads
- Railway Line
- Perennial Dam
- District Municipalities
- Local Municipalities
- Farm 2
- Farm 3
- Farm 4
- Olyven Kolk Site



SCALE:
0 500 1 000 1 500 2 000
Metres
N

TITLE:
Figure 4.1
Location of Project Site

CLIENT:
ROTIFIELD PTY LTD

DATE: Aug 2012	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 60 000

DRAWING: Fig4.1_Location of Project Site.mxd
REV: 2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Demarcation Board (2011) Bing Maps: Aerial – Bing Maps ©2010 Microsoft Corporation Reproduced under license with ArGIS 10. Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\Aug 2012\Fig4.1_Location of Project Site.mxd

4.3 *PV PLANTS AND POWER GENERATION*

Solar energy systems produce energy by converting solar irradiation into electricity or heat. PV facilities use PV panels comprising many individual PV cells which absorb solar energy. This excites electrons inside the cells and produces energy. The electricity produced by the cells is direct current (DC). The feeding of electricity into the grid requires the transformation of DC from the PV array into alternating current (AC) by an inverter.

The PV cells are commonly constructed from silicon. The cells are linked together behind a glass sheet (for protection) and they operate as a single combined PV panel.

4.4 *PROJECT COMPONENTS*

It is anticipated that as each phase of the facility is completed, it will feed electricity into the national power grid. The size of each phase will be dependent on procurement requirements as well as grid ability to connect. Once all phases are constructed, the Olyven Kolk Farm 4 will feed a total of 40 MWs into the grid. The key components of the proposed solar power farm include the following, which are discussed in more detail below:

- PV solar panels/modules (arranged in arrays);
- PV module mountings;
- DC-AC current inverters and transformers; and
- Underground cabling/ overhead power lines.

An indicative site layout has been developed and this is shown in *Figure 4.6*.

4.4.1 *PV Arrays and Mountings*

The development will include PV solar panels that will occupy up to 150 ha (1.50 km^2) of the site area in total. The PV panels will be 1.2 m in length and 0.6 m in width and each have an output of 80 W. These will be connected in strings and arrays to form units with a total power of 1 MW each (around 12,500 panels/MW). Fourtyof these units will make up the 40 MW Olyven Kolk Farm 4 solar power plant.

The panels will be mounted on fixed structures, approximately 2.5 m in height from the ground. The distance or spacing between rows will be around 3 m. The panels will face north in order to capture maximum sunlight. *Figure 4.2* shows a typical array of PV panels.

Figure 4.2 PV Array

4.4.2 *Electrical Connections and Controls*

The PV panels arrays (1 MW) will be connected via underground cables, to an inverter, transforming the direct current (DC) produced by the panels into alternating current (AC). The inverters will connect to a number of step-up transformers, which will elevate the voltage to transmit the current to the Eskom Aries Substation via the medium voltage (MV) interconnection line.

Based on the current constraints on site, the power plant will consist of two main sections, one north of the Sishen –Saldanha railway line and one south. These will be connected either by an overhead line or by an underground cable, using the existing culverts under the railway where possible.

A low voltage internal electric grid will be installed for powering the solar power plant facilities e.g. office and storage facilities and control room.

4.4.3 *Grid Connection*

The electricity generated will be fed into the national grid at the Eskom Aries Substation which borders the site to the west via overhead lines, 600- 700 m in length (see *Figure 4.3*). The interconnection line will have a maximum voltage of up to 400kV.

Figure 4.3 Aries Substation in background

Source: Simon Todd, 2011

4.4.4 Access Roads and Internal Paths

There are two access points to the site under consideration. One option is to access the site from the Sishen -Saldanha railway line service road and the point of access to the site would be in the west of the site, to the north of the railway (see *Figure 4.6*). The other possible option under consideration is accessing the site from the north west via the Eskom Aries Substation. Within the site area, an internal perimeter road inside the plant fence will be required to facilitate the movement of construction and maintenance vehicles around the site. This road will comprise levelled land and will not be gravelled or paved and existing farm tracks will be up-graded where necessary. Internal paths will be created to enable access within the facility.

Between PV arrays, a minimum spacing of 3 m is required between each row to avoid shadowing of the panels by adjacent rows. These spaces will not be gravelled or paved.

4.4.5 Additional Infrastructure

Additional infrastructure that will be required for the project includes the following:

- one or more permanent meteorological stations may be erected to collect data on the solar resource at the site;
- a small site office and storage facility, including security and ablution facilities;
- security system- closed circuit video-surveillance system;
- site fencing
- car park;

- temporary construction camp (to house 60-80 people) (1) ;
- permanent accommodation (for 4-5 people); and
- a lay-down area for the temporary storage of materials during the construction activities.

The existing boreholes (subject to appropriate permissions, current abstraction limits and water quality) will be used for the water required for ablution facilities and for periodic cleaning of the solar panels during operations. It is expected that during the operational phase of the project approximately 20m^3 of water per 1 MW per year will be required to clean the panels.

Should rock or soil material be required for the construction of project infrastructure this material will be sourced from an existing borrow pit on site or within close proximity to the site.

4.5 *PROJECT STAGES AND ACTIVITIES*

The project life-cycle can be divided into three key stages as follows:

- site preparation and construction;
- operation (including maintenance and repair); and
- decommissioning.

Each of these stages is outlined in the sections below.

4.5.1 *Site Preparation and Construction*

Prior to construction of the solar power plant, the site would be prepared. The 1,010 ha site is generally flat and low lying. Site preparation activities would include the following activities:

- vegetation clearance – removal or cutting of any tall vegetation if present (bush cutting);
- levelling and grading of areas where the array will be sited to remove steep slopes and undulations would normally occur but this is not deemed necessary given the flat nature of the terrain on the site ;
- levelling of hard-standing areas e.g. for temporary laydown and storage areas;
- erection of site fencing;
- construction of temporary construction camp if required; and
- upgrading of farm tracks/ construction of on-site access roads.

Once the site has been prepared, prior to the installation of the PV components, the following construction activities will take place:

- installation of structures to support the PV modules;

(1) It has not yet been determined whether a construction camp is necessary. An alternative being considered for the construction camp is worker transport shuttles to/from Kenhardt where workers would be accommodated.

- construction of electrical and control room;
- construction of site office and storage facilities, including security and ablution facilities and associated septic tanks; and
- construction of inverter and transformer foundations and housing; and
- installation of cables.

The PV, electrical and structure equipments will be procured in South Africa where available, or from an international manufacturer when sourcing from within the country is not possible. It is expected that these components will be delivered to site via road in small trucks. Once the PV components have arrived on site, technicians will supervise the assembly of the panels and test the facility. The solar panels will be installed on mounting structures anchored to the ground through poles which will be screwed or piled into the ground.

Phased Approach to Construction

The development will be constructed in a phased approach. The exact size of each phase will be dependant on the various consents and authorisations to be obtained for the project, primarily the Power Purchase Agreement, as well as the interconnection technical constraints to be discussed and agreed with Eskom in the Interconnection Agreement. Installation of the full 40 MW will take between 12 and 18 months to complete.

During the site preparation period, the workforce required for site security, manual labour, civil works, transportation of goods and other similar services will be most likely drawn from the local labour pool. During the first phase of construction, a highly-skilled team of solar energy technicians (the majority of which would likely be from overseas as a workforce with the required skills is not currently available in the South African market) will train a number of the potential employees preferably from the province, where available. Up to 300 people will be required to construct the total 40 MW plant, however any accurate employment number is dependant on how the phasing of the project is undertaken. For the purposes of the impact assessment we have assumed that the development will take place in consecutive phases rather than all at once.

4.5.2 Operation

Once each phase of the facility is complete and operational it is expected that it will have a lifespan of at least 20 years. Measuring the performance of the plant will be done remotely, through the use of a monitoring system. Day to day facility operations will involve both regular on site preventive and corrective maintenance tasks in order to keep the PV plant in optimal working order throughout the operational period. Intermittent cleaning of the panels will be carried out as necessary which is anticipated to be once or twice a year. Faulty components will be replaced as soon as problems are identified.

4.5.3 Decommissioning

Once the facility reaches the end of its lifespan the arrays may be refurbished or replaced to continue operating as a power generating facility or the facility could be closed and decommissioned. If decommissioned, all components would be removed and the site rehabilitated. The solar panels would be recycled as appropriate. The preferred panel manufacturer, First Solar, undertakes a module or panel collection and recycling programme in which the glass and encapsulated semiconductor material is processed into new modules or other products.

4.6 CONSIDERATION OF ALTERNATIVES

In terms of the EIA Regulations, Section 28(1)(c) and NEMA, Section 24(4), feasible and reasonable alternatives are required to be considered in the EIA process. *'"Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives to –*

(a) the property on which, or location where, it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity (No Go)'.

This section outlines the alternatives considered in for the Olyven Kolk Farm 4 solar power plant.

4.6.1 Site Location Alternative

As part of the site selection process a number of potential sites were investigated in the Northern Cape through a desk-top analysis and intrusive studies e.g. soil analysis. The Olyven Kolk Farm 4 site was identified based on a number of criteria including:

- **Solar resource:** Analysis of available data from existing weather stations and satellite records suggests that the site has sufficient solar resource to make a solar energy facility viable. The site is located in one of the most irradiated areas of the country.

- **Site extent:** Sufficient land was required to enable sufficient power supply and to allow for a minimum number of PV panels to make the project feasible.

- **Grid access:** Access to a substation with potential for more feed-in capacity and adequate transmission lines were key considerations for site location i.e. proximity to Eskom's Aries Substation.

- **Land suitability:** Sites that facilitate easy construction conditions (relatively flat land with deep soft soil and few rock outcrops or waterbodies) were favoured during site selection.

- **Landowner consent:** The selection of sites where the land owners are supportive of the development of renewable energy is essential for ensuring the success of the project.

- **Environmental and socio-economic impacts:** Consideration was given to identifying a site with low agricultural potential, low levels of biodiversity value and potential visual impacts during site selection.

- **Workforce:** The availability of a potential work force in the surrounding area was taken into consideration.

4.6.2 *Site Layout Alternatives*

The PV plant layout and project component design have undergone a number of iterations primarily based on environmental and social considerations which were identified during the EIA process. The final design of the facility including the final layout, size, type and number of PV arrays has been determined using specialists recommendations including:

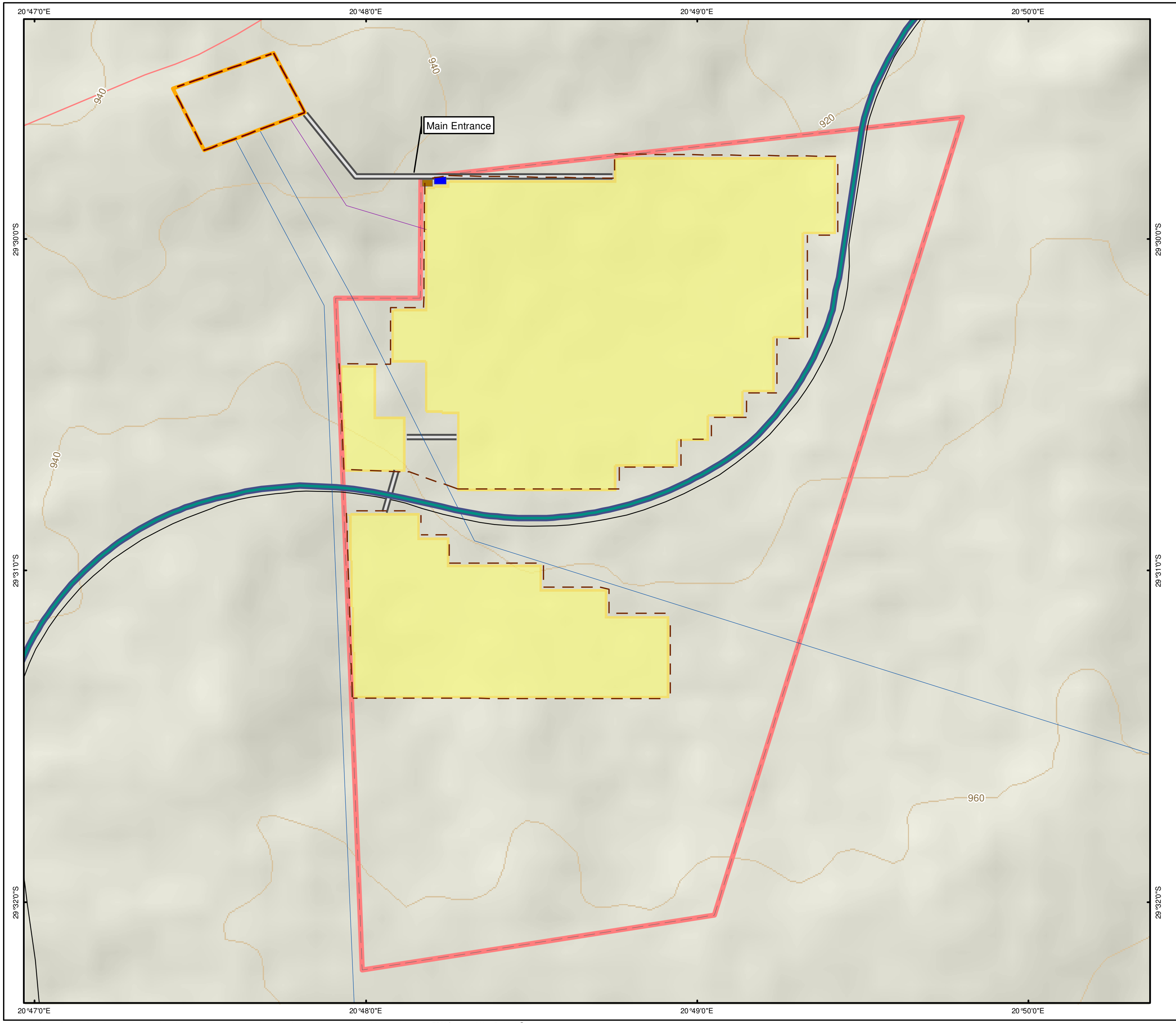
- Drainage analysis and avoidance of existing drainage lines; and
- Avoidance of ecologically sensitive areas of the site, important for flora and birds.

An indicative site layout was initially developed (see *Figure 4.2*), Site Layout Alternative 1. After field surveys, each specialist prepared site sensitivity maps identifying habitats or areas of various sensitivities for each receptor or resource. These were overlaid with Site Layout Alternative 1. After a mitigation workshop held in July 2011 by the EIA team, particular areas posing additional environmental and social constraints or specific unsuitable locations for the arrays were identified by the specialists and communicated to the technical team. *Figure 4.5* illustrates the areas of sensitivity on site including areas considered unsuitable by the environmental specialists based on potential impacts to drainage lines, ecology and avifauna. The technical team then generated a revised 'buildable areas map' based on these environmental and social constraints as well as further technical constraints and from there developed a revised layout of the arrays, Site Layout Alternative 2 (see *Figure 4.6*). This process has encompassed the consideration of layout alternatives in the EIA process and Site Layout Alternative 2 is the preferred layout and is considered to be the final layout.

Based on the constraints identified, the size of the plant has decreased from an output capacity of up to 200 MW to 40 MW, and significant changes have been made to the site layout. The aim of considering layout alternatives was to balance the technical and financial objectives of maximising the output of the proposed facility with the other critical environmental and social constraints including physical environment, visual, botanical, fauna, heritage, archaeological, paleontological and avifauna.

The evolution of the changes to the project specifications from the 200 MW plant to the 40 MW is illustrated in *Figure 4.4* to *Figure 4.6*, below. Then, in order to split the application, Site Layout Alternative 2 has been divided into the Olyven Kolk Farm 2 (75 MW), Olyven Kolk Farm 3 (75 MW) and Olyven Kolk Farm 4 (40MW) (See *Figure 4.7*).

It is reiterated that Site Layout Alternative 2 is the preferred and final layout design applied for in this EIR. However, in the event of amendments to the layout, any changes will be submitted to the DEA prior to construction.



Legend

- Secondary Roads
- Railway Line
- Proposed Access Roads
- Railway Service Road
- Fence
- Existing 400kV Transmission Lines
- Proposed Grid Interconnection
- Accommodation Block
- Control Building
- Eskom Aries Sub-station
- Solar Panel Arrays
- Olyven Kolk Site

SCALE:

0 250 500 750 1 000

Metres

N

TITLE:

Figure 4.4
Site Layout Alternative1 -
Project Infrastructure - 200 MW Plant

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

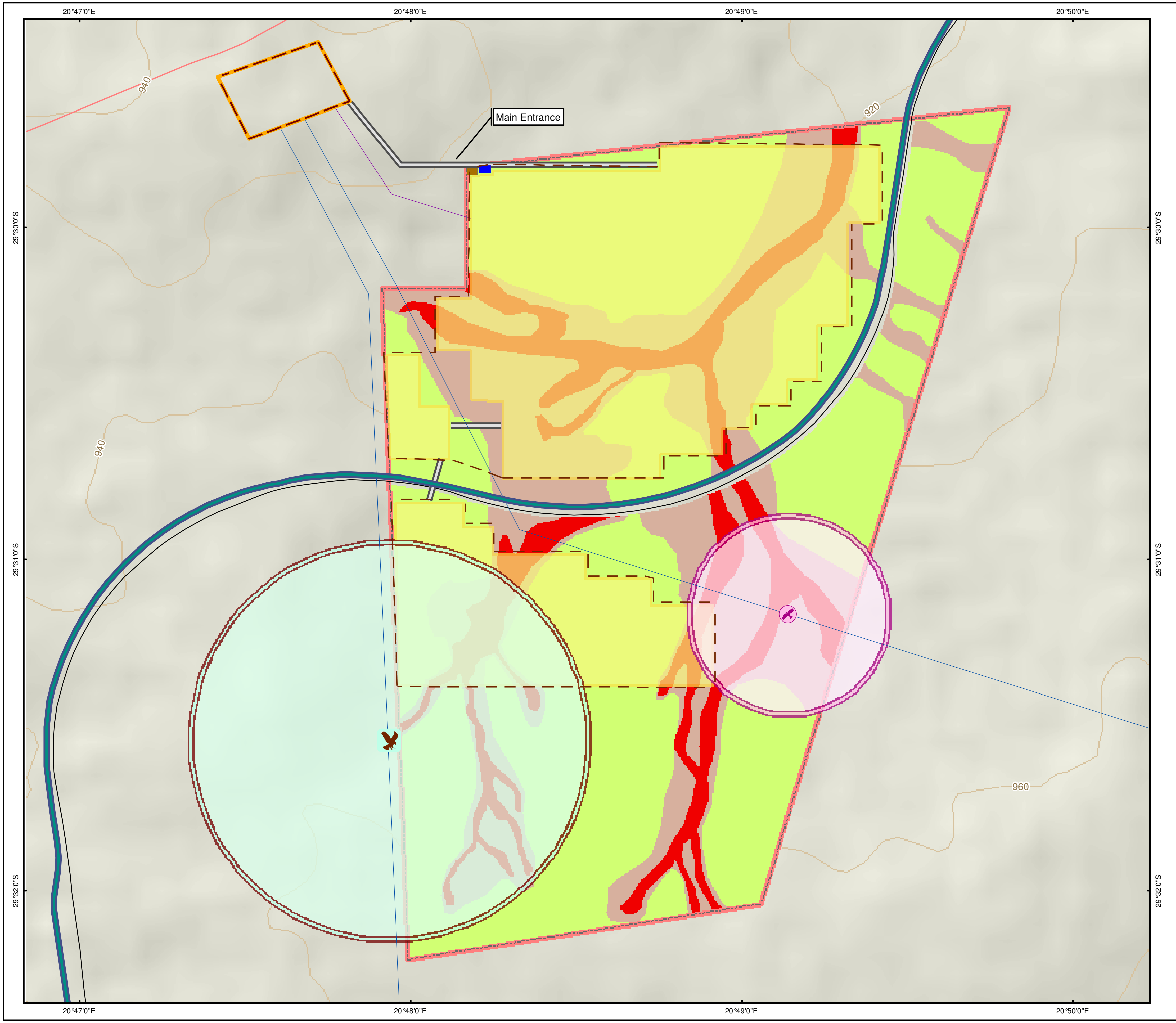
DRAWING:	REV:
Fig4.4_Site Layout Alternative 1-Infra_200MW_Rev2.mxd	2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

	SIZE:
Projection: Geographic, Datum: WGS84 Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI) Inset Map, Esri Data & Maps	A3

C:\0126393_AES\Mapping\MXD\October2011\Fig4.4_Site Layout Alternative 1-Infra_200MW_Rev2.mxd



Legend

- Lanner Falcon Bird's Nest
- Martial Eagle Bird's Nest

Bird Exclusion Zones

- 500m Buffer
- 1000m Buffer

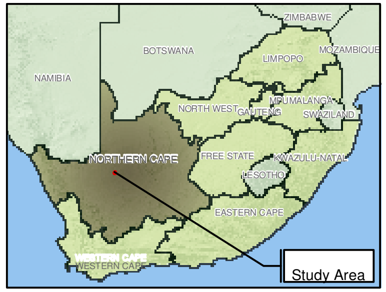
- Secondary Roads
- Railway Line

- Proposed Access Roads
- Railway Service Road
- Fence
- Proposed Grid Interconnection
- Existing 400kV Transmission Lines

- Accommodation Block
- Control Building
- Eskom Aries Sub-station
- Solar Panel Arrays
- Olyven Kolk Site

Ecological Sensitivity

- Medium
- Medium - High
- High



SCALE:

0 250 500 750 1 000

Metres

N

TITLE:

Figure 4.5
Site Layout Alternative1 - Project Infrastructure - 200 MW Plant

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING: Fig4.5_Site Layout Alternative 1-Constr_200MW_Rev2.mxd

REV: 2

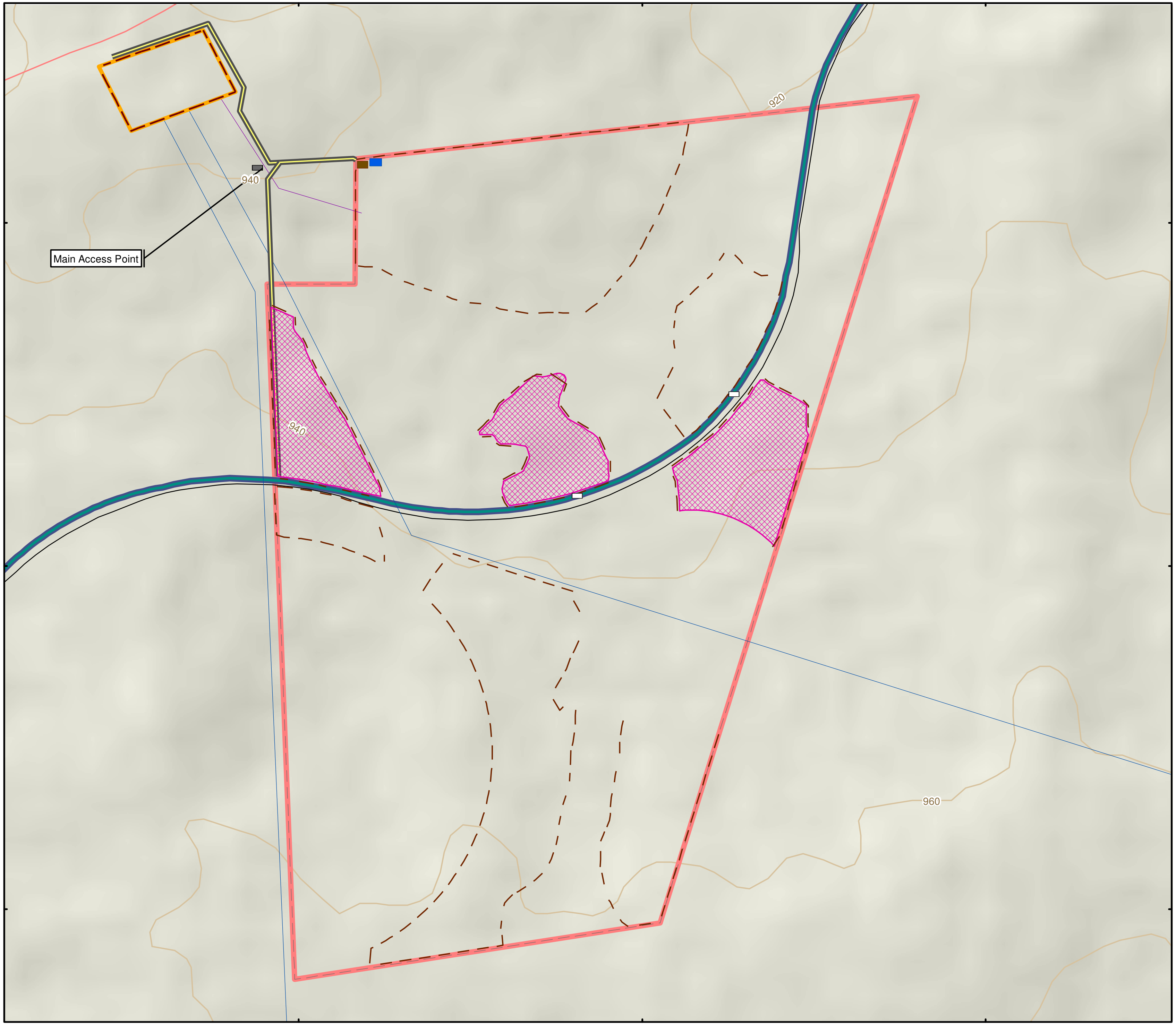
ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI)
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig4.5_Site Layout Alternative 1-Constr_200MW_Rev2.mxd



Legend

- Main Access Point
- Possible Site Access Points
- Secondary Roads
- Railway Line
- Proposed Access Roads
- Railway Service Road
- Fence
- Proposed Grid Interconnection
- Existing 400kV Transmission Lines
- Accommodation Block
- Control Building
- Eskom Aries Sub-station
- Olyven Kolk Farm 4
- Olyven Kolk Site

SCALE:
0 250 500 750 1 000
Metres

N

TITLE:

Figure 4.6
Farm 4, Site Layout Alternative 2, v2
Project Infrastructure - 40 MW Plant

CLIENT:

ROTIFIELD PTY LTD

DATE: Aug 2012	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING:
Fig4.6_Farm 4 Site Layout Alternative 2v2-Infra_190MW_Rev2.mxd

REV: 2

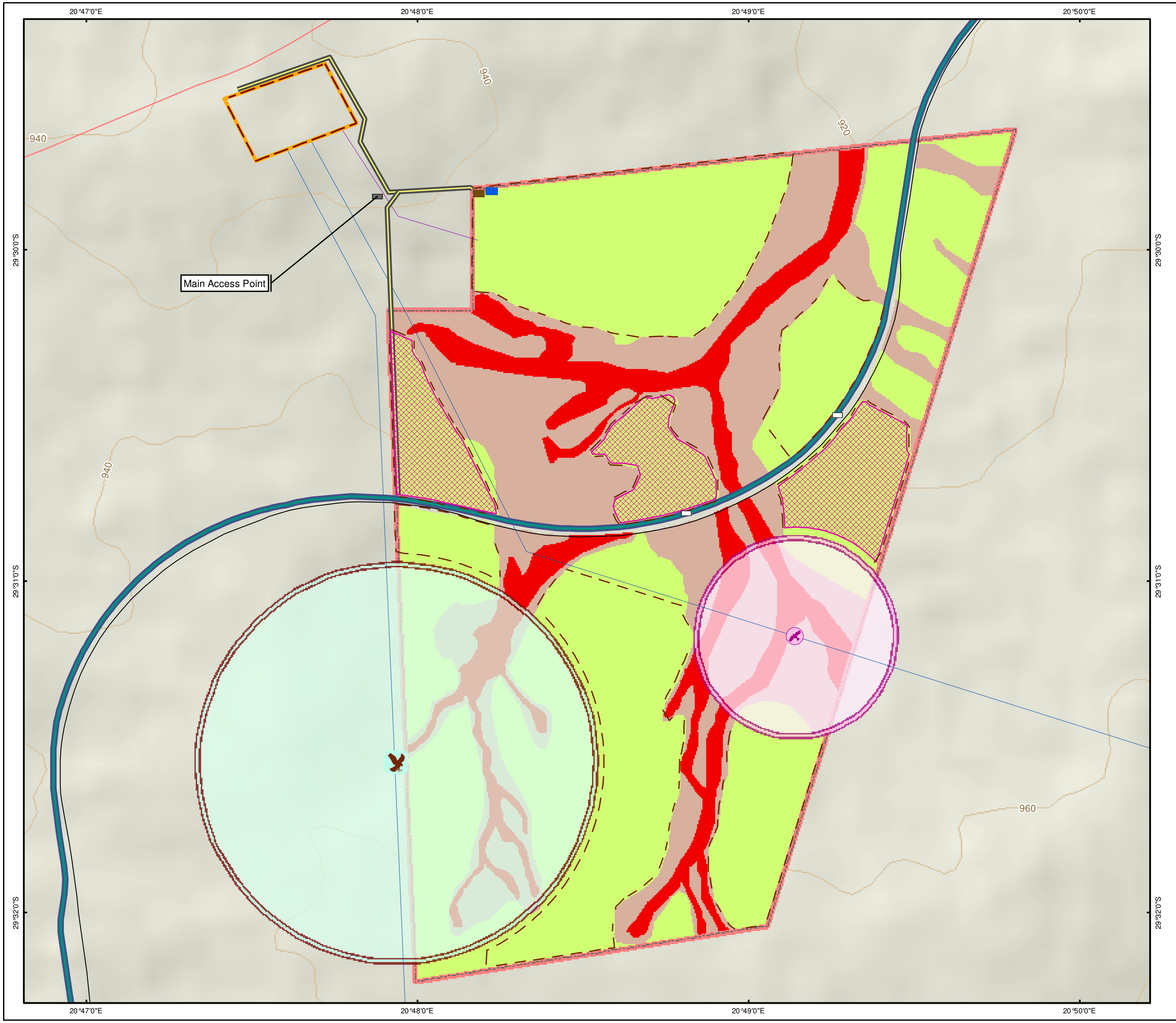
ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI)
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\Aug2012\Fig4.6_Farm 4, Site Layout Alternative 2v2-Infra_190MW_Rev2.mxd



Legend

Lanner Falcon Bird's Nest

Martial Eagle Bird's Nest

Bird Exclusion Zones

500m Buffer

1000m Buffer

Secondary Roads

Railway Line

Proposed Access Roads

Railway Service Road

Fence

Proposed Grid Interconnection

Existing 400kV Transmission Lines

Accommodation Block

Control Building

Eskom Aries Sub-station

Olyven Kolk Farm 4

Olyven Kolk Site

Ecological Sensitivity

Medium

Medium - High

High

SCALE:

0 250 500 750 1 000

Metres

N

TITLE:

Figure 4.7
Farm 4, Site Layout Alternative 2 , V2
Project Constraints - 40 MW Plant

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2012	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING:	REV:
Fig4.7_Farm 4 Site Layout Alternative 2v2-Constr_190MW_Rev2.mxd	2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

	SIZE:
Projection: Geographic, Datum: WGS84 Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI) Inset Map, Esri Data & Maps	A3

C:\0126393_AES\Mapping\MXD\October2011\Fig4.7_Farm 4_Site Layout Alternative 2v2-Constr_190MW_rev2.mxd

4.6.3 *Grid Connection Alternatives*

The options of connecting the solar power plant to Eskom's national grid are subject to on-going discussions between Rotifield and Eskom. The most efficient and practical option which is considered viable for the site is connection into the existing Eskom Aries substation located adjacent to the Olyven Kolk Farm 4 via a relatively short overhead transmission line. Other alternative grid connection scenarios (direct connection to a 400 kV line next to the site, or direct connection to a 132 kV line far from the site) are not considered viable as they would either require building a 400 kV step-up transforming station on site or constructing a long 132 kV overhead transmission line. Construction of a 400kV transforming station would increase the footprint and cost of the project considerably. The 132 kV transmission line would also increase the cost of the project and result in increased impacts on birds, visual and vegetation when compared with the preferred option of a shorter connection to the adjacent substation.

4.6.4 *Technological Alternatives*

Solar energy is considered to be the most suitable renewable energy technology for this site, based on the site location, ambient conditions and energy resource availability. There are a number of different solar energy technologies that include:

- Fixed PV plants;
- Tracking PV plants (with solar panels that rotate to follow the sun's movement);
- Concentrated Solar Power (CSP) plants; and
- Concentrated PV Plants.

Financial, technical and environmental factors were taken into account when choosing the type of solar power technology for the site, including the local solar resource and its likely generation output, the economics of the proposed facility and availability of government feed-in tariffs and energy production licenses, and the requirement for other development inputs such as water resource requirements. PV is considered to be the most environmentally suitable technology for the preferred site as large volumes of water are not needed for power generation purposes compared to the CSP option. CSP requires large volumes of water for cooling purposes. PV is also preferred when compared to CSP technology because of the lower visual profile.

The remaining types of technologies were evaluated and the preferred configuration was selected based primarily on the operating environment. The suitability of different types of PV solar panels was assessed including thin film and polycrystalline panels. Based on performance in high temperature environments similar to those typical of the Northern Cape, thin film panels were selected as the preferred option. The Olyven Kolk Farm 4 solar power plant will install fixed structures rather than tracking systems as they require less repair work and maintenance during the operational life of the project. This decision is based on the benefits demonstrated by fixed structures with a longer track record in other markets, showing their high reliance during long periods operation over time. High capacity inverters (typically 1MW) are considered more robust than smaller inverters and thus were selected as part of the preferred configuration.

4.6.5 No-go Alternatives

The no-go alternative implies that the proposed project would not be executed. Assessment of the no-go alternative will require an evaluation of the relative trade-offs between the economic and social development benefits and carbon offsets associated with the project against the environmental and social costs of the project.

Assuming that the solar power plant would not be developed at the proposed site, the site would remain in its current state. There would be no negative environmental and social impacts associated with the development of a solar power facility. The agricultural potential (although limited for this site) would not be lost due to the establishment of the facility. Similarly, there would be no positive impacts if the power plant is not executed, there will be no increase in electricity generation, no CO_2 offsets associated with the proposed development, no economic benefit to the landowners associated with the potential income generated through the operation of the facility and there would be no contribution to meeting South Africa's targets for renewable energy generation.

The direct benefits associated with both the construction and operational phases of the solar power plant such as increased employment opportunities and associated economic benefits would also not occur should the development not go ahead. It should be noted, that requests for employment opportunities have been found to be the overwhelming theme from respondents to consultation activities to date.

5 ENVIRONMENTAL BASELINE

The environment consists of interacting physical, biological, social, economic and cultural factors. It is essential that the baseline conditions of an environment are characterised in order to be in a position to accurately predicting the potential effects a development may have on that environment. This section describes the existing physical and biological environment of the Olyven Kolk Farm 4and surrounding area.

5.1 PHYSICAL BASELINE

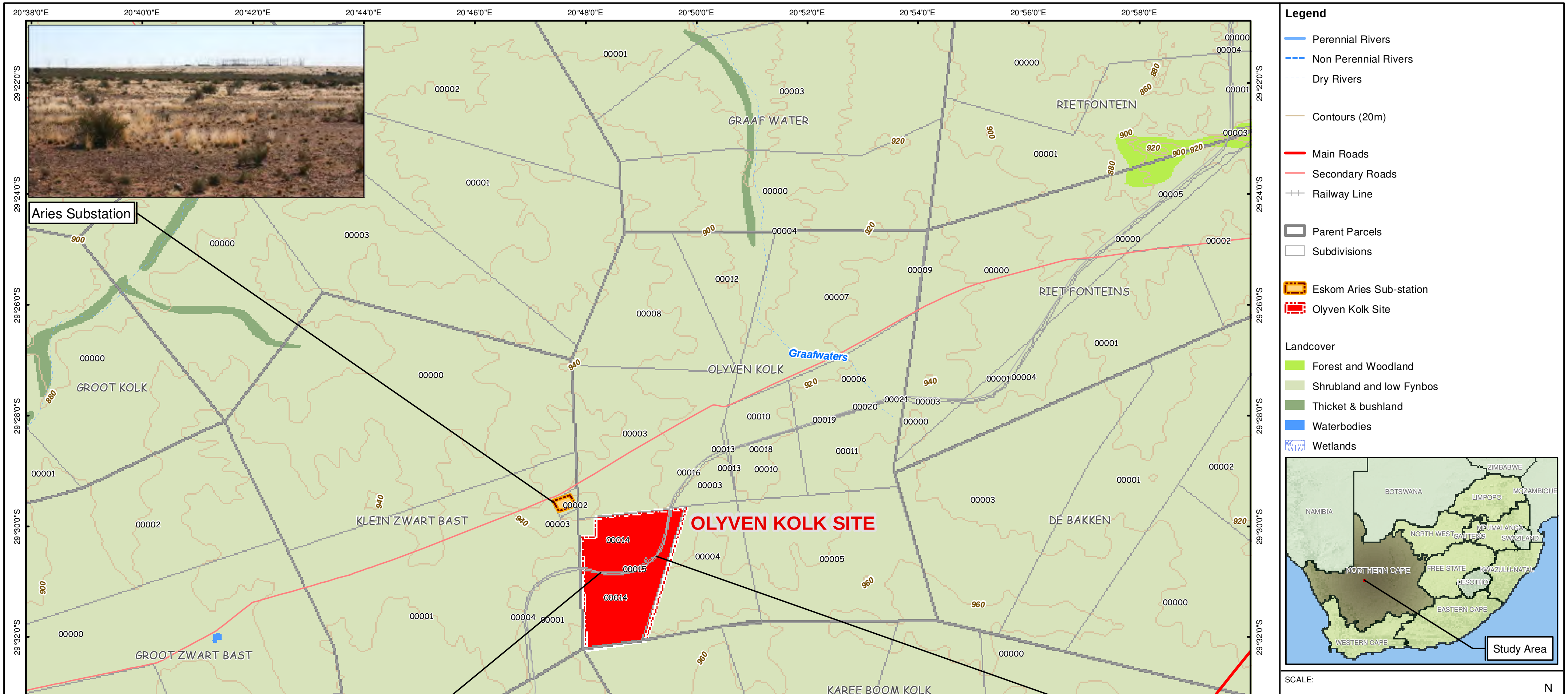
5.1.1 Site Setting

The proposed solar power plant will be situated in an arid, rural environment, the remaining portion of portion 14 (a portion of portion 4) of Olyven Kolk Farm, No. 187 which is situated in the Siyanda District of the Northern Cape Province. The site is located approximately 126 km south west of Upington and is accessible from the R27 (tarred road) along the Sishen -Saldanha railway line service road (gravel road). The nearest town to the site is Kenhardt, which lies approximately 44 km north east of the site. The proposed site is approximately 400 m from the Eskom 400 kV Aries Substation. The total area of the site is 1,010.47 ha.

The topography of the wider area is characteristically flat to slightly undulating. Sporadic hills to the south of Kenhardt create some topographical relief. The Bushmanland Basin, which the site falls into, comprises a number of ephemeral pans and extensive systems of intermittent river channels, however none of which are found with the site.

The Olyven Kolk Farm 4 is relatively flat with shallow drainage lines running in a south to north direction. The site consists of bare soil with scattered shrub vegetation. This habitat features slightly irregular plains with dwarf shrubland dominated by a mixture of low sturdy and spiny (and sometime succulent) shrubs including *Rhigozum*, *Salsola*, *Pentzia* and *Eriocephalus* spp. Grasses found include 'white' grasses such as *Stipagrostis* spp.

Although the site is remote, there are a number of existing man-made features including a number of power lines, Eskom's Aries Substation, a railway line and service road in the local landscape which are key visual features within the immediate site setting.



TITLE:

Figure 5.1
Site Settings of Olyven Kolk

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 130 000

DRAWING: Fig5.1_Site Settings of Olyven Kolk.mxd

REV: 2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

Projection: Geographic, Datum: WGS84
Chief Directorate National Geo-Spatial Information
Source: EnPat (2001) Demarcation Board (2011)
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig5.1_Site Settings of Olyven Kolk.mxd

5.1.2 *Climate*

The Northern Cape's weather is typical of semi-desert and desert areas, regarded as warm to hot. Rainfall occurs predominantly in summer and autumn while winters are typically very dry. Mean annual precipitation in the area ranges between 100 mm and 200 mm. The hottest month in summer is generally January (day-time temperatures of approximately 32°C) and the coldest month in winter is generally June (daytime temperature of approximately 18 °C). Frequent frost events occur during the winter months and humidity levels are generally very low, leading to a high number of cloud-free days per year. The prevailing winds are northerly and westerly. The Northern Cape Province is known to have the highest levels of solar irradiation in South Africa.

5.1.3 *Landscape and Topography*

The landscape of the site and surrounds is relatively flat and slopes to the north north east, with an elevation difference of approximately 40 m over a distance of 4.6 km, which equates to an average slope of approximately half a degree. The highest areas are found to the north west of the site with lowest areas in the north east. To the south of the Sishen- Saldanha railway the landscape is undulating.

Figure 5.2 Flat Terrain on the site

The low-lying areas are grassy, containing low lying thorny shrubs whilst drainage lines feature taller, woody vegetation. Land-use in the area is predominantly pastoral farming with scattered farmsteads. There is a small laborer's cottage and sheds located within the site. *Figure 5.2* shows the flat terrain of the landscape looking north into the site from the railway.

5.1.4 Geology

The entire site is underlain by bedrock of the Dwyka Group, Karoo Supergroup [1]. This bedrock typically comprises of underformed dark grey to red-brown diamictites and tillites with subordinate sandstone and dark grey to green mudstones. From field observations, it is evident that dolerite sills of Karoo age are present within the Dwyka rocks. Red-brown, aeolian sands, possibly derived from the Gordonia Formation, Kalahari Group are present in small pockets and are concentrated as alluvium mainly but not only, in the drainage lines found within the site.

There are few small rock outcrops tillite and dolerite found in the north west higher areas of the site, the western edge immediately south of the railway and the southern extremity.

A large borrow pit is found adjacent to the railway, close to the centre of the site and consists of moderately to highly weathered dolerite. The overburden to this borrow area comprises a very thin gravelly soil layer over nodular to honeycomb calcrete up to 0.7 m thick grading downwards into highly weathered and calcareous dolerite becoming less weathered and less calcareous with depth.

Figure 5.3 illustrates the geology of the site.

5.1.5 Soils

Across much of the site, the soil is very shallow with exposed bedrock or bedrock close to surface over most of the site except for in the drainage channels where it is expected to attain thicknesses in excess of 1-2 m. A good indicator of the presence of soils of the order of a metre or more thick are the presence of Aardvark and Suricate burrows and during field investigations, these were found in abundance along the eastern boundary of the site.

Eight characteristic soil facets were found across the site and these are listed in *Box 5.1* in order of increasing soil thickness. See *Annex J* for further details.

(1) Department of Geoscience. Sheet 2920 Kenhardt, 1:250 000 Geological Map of the Department of Geological Survey of R. S. A.

Box 5.1 Soil Facets (according to increasing soil thickness)

1. Flat areas with very thin clayey sand generally overlying shale that retain surface water as small pans after rain.

2. Mainly doleritic coarse sub-angular gravel on surface with minor sandstone and tillite finer gravel becoming a sandy gravel with depth. Minor dolerite rock outcrops in higher areas. Soil thickness probably 0 – 0.3 m on average. Expect mostly dolerite bedrock but large areas of tillite also present.

3. Mainly finer shale and tillite sub-rounded gravels on surface becoming a sandy gravel with depth. Minor tillite rock outcrops in places. Soil thickness probably 0 – 0.5 m on average. Expect mostly tillite bedrock although dolerite might also be present.

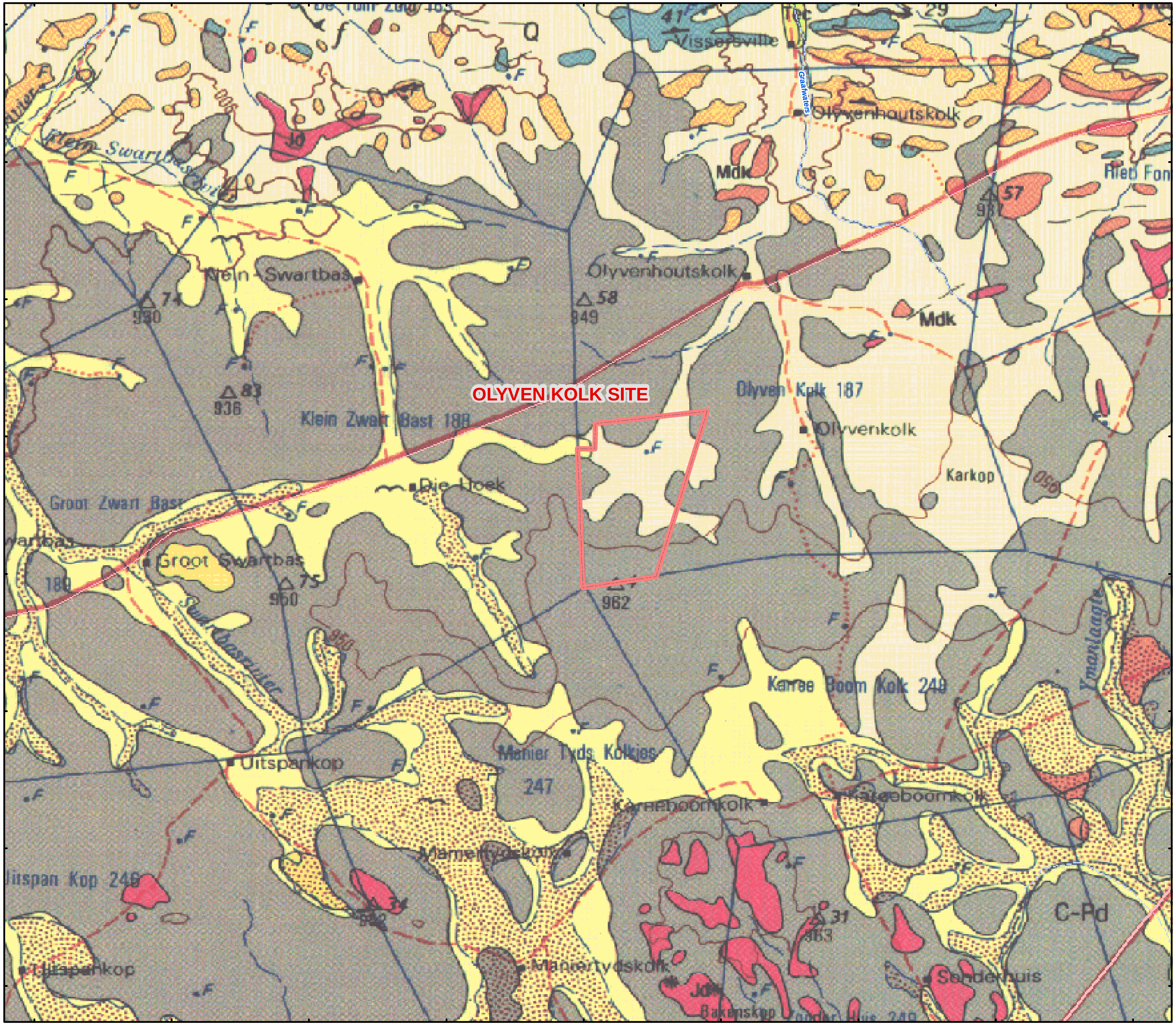
4. Mixed doleritic, shale and tillite, fine to medium gravels on surface overlying gravelly sand becoming sandy gravel then very highly weathered tillite. Some very minor rock outcrops in places. Soil thickness probably 0 – 0.6 m on average.

5. Calcareous gravels on surface underlain by very thin calcareous sands grading into nodular then honeycomb calcrete resting on calcretized tillite and, in some areas, dolerite. Soil thickness 0 – 0.3 m with calcrete down to 0.3 – 0.8 m.

6. Patches of fine surface gravels resting on mixed sands and gravels on tillite and shale. Soil thickness generally thin averaging 0.1 – 0.4 m on average.

7. Patches of coarse and fine surface gravels resting on transported, mainly alluvial and hillwash, sands with minor gravel. Soil thickness expected to be 0.3 – 1.2 m on average.

8. Red sands typically alluvial on surface but of aeolian origin. Indurated to form a duricrust locally known as dorbank on slopes. Thickness 0.5 to possibly in excess of 1.5 m in low lying areas.



Legend

- MainTowns
- Perennial Rivers
- Non Perennial Rivers
- Dry Rivers
- Main Roads
- Secondary Roads
- Olyven Kolk Site

Main Geological Units

- C-Pd, Mbizane Formation (Permo-Carboniferous Dwyka Group, Karoo Supergroup
- Q, Quaternary to Recent sands and sandy soil of the Gordonia Formation (Kalahari Group)
- Quaternary to Recent alluvium

SCALE:

0 1 2 3 4 5

Kilometres

N

TITLE:

Figure 5.3
Geology of the wider Olyven Kolk Area

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 100 000

DRAWING: Fig5.3_Geology of the Olyven Kolk Area.mxd — REV: 2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

Projection: Geographic, Datum: WGS84
Source: Geosciences Council - 2920.tif
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig5.3_Geology of the Olyven Kolk Area.mxd

5.1.6 *Hydrology- Groundwater and Surface Water*

Groundwater

The Department of Water Affairs and Forestry map (1) classifies the regional aquifer as a minor aquifer with least vulnerability (2) and low susceptibility (3).

Two boreholes are found in close to each other in the centre of the northern portion of the site, to the north of the railway. One is currently being pumped and supplies two stock watering troughs. The water appears to be of good quality, clear and drinkable. The water table in the second borehole was plumbed and found to reside at a depth of 19 m.

No natural seeps or springs were found on the site.

Surface Water

The proposed site is located in a particularly arid area of the country. From satellite imagery it appears there are a number of shallow drainage lines running through the site in a south to north direction.

The drainage pattern is heavily influence by a number of lineations that traverse the site. These lineations are thought to represent major joint orientations, minor dykes and or the surface exposure of sills. The natural drainage pattern is a dendritic one with the main limbs corresponding in terms of orientation with these lineations (*Figure 5.4*). The drainage paths are ill-defined and typically comprise wide areas within broad gentle valleys that are discernible mostly by a change in vegetation type (see *Section 5.2.1*).

No large drainage lines enter the site from beyond its boundaries and most of the surface catchment for the single main drainage line that leaves the site to the north east lies within the sites boundaries. The headwaters of the drainage lines along the eastern boundary do however extend beyond the boundary to some small extent.

The railway acts as a cut-off across the entire site which concentrates the flows through culverts beneath the railway. Berms have been placed above many of these culverts to divert water into them and have thus further modified the natural drainage pattern. Concentrated water flows will clearly occur where these culverts discharge. They however discharge directly onto the service road and no provision is made for water flows over or under the road. Each of the culverts caters for a distinct catchment area and these are added to by the catchment area to the north of the railway. These catchments and the corresponding culvert positions are shown *Figure 5.4* below.

(1) Department of Water Affairs and Forestry. (1999) Aquifer Classification of South Africa, 1: 3 000 000.

(2) Likelihood of contaminants reaching a receptor

(3) Potential significance of contaminants reaching a receptor

Figure 5.4 Drainage Pattern, Culverts and Catchments

Key: Culverts are shown as square boxes along the railway line. Catchment areas are illustrated by numbers positioned beside the drainage lines.

For more details regarding the culverts (type and size of culvert) and catchments (i.e. area), see *Annex J*.

There are no perennial streams on the site and it is expected that running water would only be found during and immediately after significant rainstorms. The site however, was visited soon after a period of good rains but no surface water whatsoever was observed. A small, shallow dam has been excavated towards the north west corner of the site as shown in *Figure 5.4*. It is not expected to hold water very often or for very long.

Run-off within the site occurs over the entire site in the form of sheetwash with only a few short sections of narrow incised channels, generally less than 0.5 m deep and 0.5 m wide. These are to be found mainly in a small area between the eastern boundary and the railway line where it parallels it and where erosion of vehicle tracks running normal to the contours has occurred in the centre of the site.

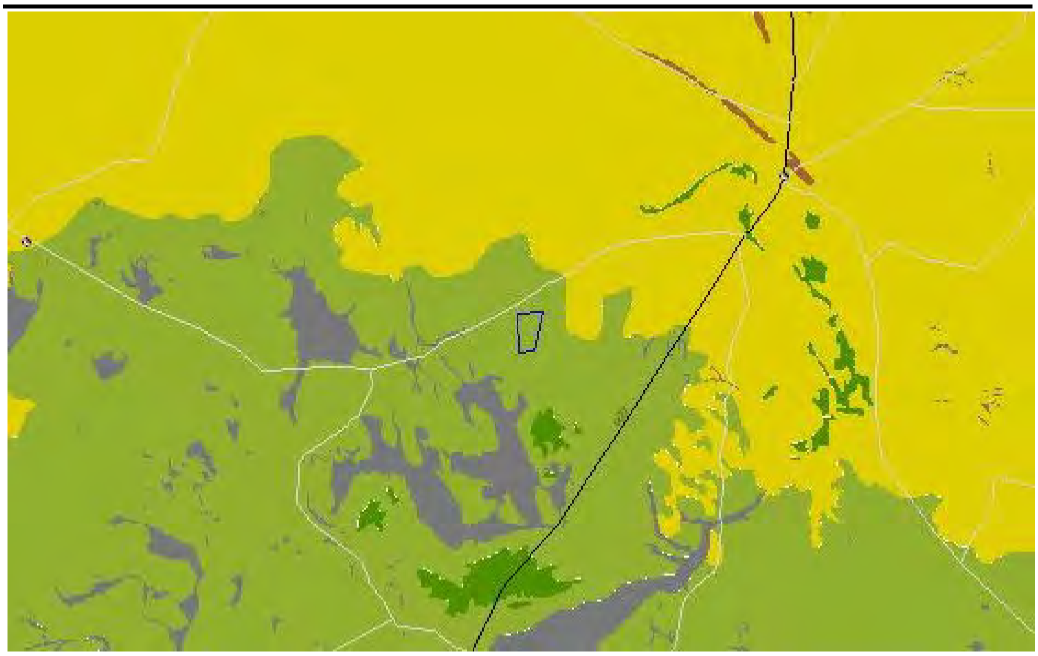
5.2 BIOLOGICAL BASELINE

This section describes the existing biological environment within and around the Olyven Kolk Farm 4.

5.2.1 *Flora*

According to the national classification of the Vegetation of South Africa (Mucina & Rutherford, 2006), the entire site falls within a single vegetation type, Bushmanland Basin Shrubland (*Figure 5.5*). This is not a threatened vegetation and the conservation status of this vegetation type is classified as Least Threatened and less than 1% has been transformed (Mucina & Rutherford 2006). The vegetation type is however not protected as none falls within a formal protected area.

Figure 5.5 Vegetation Map of Southern Africa showing Vegetation Types



Source: Source: Mucina et al. 2006, Key: Green area in which the site falls in Bushmanland Basin Scrub vegetation. See *Annex F* for detailed key.

The national vegetation map has been mapped at a very coarse scale and the map does not adequately reflect the vegetation pattern on the ground. This is exemplified by the fact that despite being classified as a shrubland, a significant proportion of the site is in fact grassland with very little shrub cover. Several different habitats with characteristic plant communities can be discerned at the site. These are:

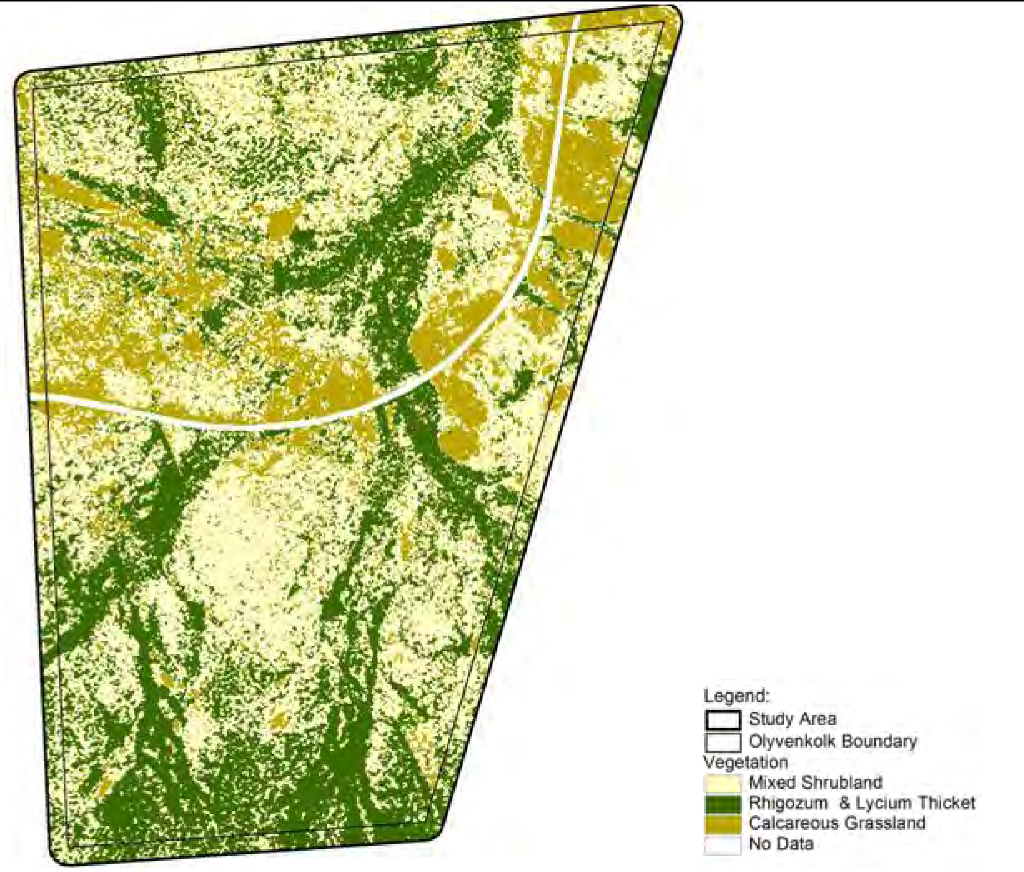
- Calcareous Grassland;

- Mixed Rocky Shrubland; and
- Drainage Lines and run-on areas which are characterized by Rhigozum and Lycium Thicket.

These are described further below. Overall, the vegetation of the site is relatively homogenous and a large proportion of the species present are common to all the different communities which were observed at the site and are described below. It is only the relative abundance of the common species or the presence of certain subdominant species which differentiate the communities. The major driving variables of this differentiation are soil depth, substrate type and moisture availability which is usually related to landscape position.

The vegetation map derived from the satellite imagery of the site is depicted in *Figure 5.6*, below. It is clear that the different vegetation units are not always clearly differentiated from one another and there is a lot of patchiness with many small patches of one plant community scattered within another. Although the vegetation map certainly aids in the identification of the drainage areas, those parts of the drainage areas that had not developed taller dense vegetation are mapped as Mixed Shrubland and ultimately, the drainage areas were mapped, for the purposes of the sensitivity analysis by hand based on the notes and observations from the site visit. The Calcareous Grassland and Mixed Rocky Shrubland, are not differentiated in terms of the sensitivity map due to their similar sensitivity and also because they form a complex mosaic that occurs at much finer scale than the footprint and scale of flexibility of the development.

Figure 5.6 Fine-scale vegetation map of the site derived from Satellite Imagery



Source: Simon Todd, 2011

Calcareous Grassland

Areas of calcareous grassland occur scattered across the site, wherever the underlying calcrete is near to the surface or has been exposed. Plant cover is generally quite low and dominated by bushman grasses such as *Stipagrostis ciliata* and *S.obtusa*. Species richness in these areas is generally quite low as a result of the paucity of the shrub species present. An above average richness of geophytes was however observed. Since these areas usually occur in flat to very gently sloping areas, the risk or erosion or other detrimental disturbance effects is low. This community is considered to be of Low to Moderate Sensitivity.

This is the shortest and most open vegetation type at the site, and apart from scattered shrubs, rarely exceeds 40 cm in stature.

Figure 5.7 Calcareous Grassland found on the site

The soil is usually very shallow with a lot of expose calcrete on the surface. The vegetation is low and open and dominated by *Stipagrostis* spp.

Mixed Rocky Shrubland

Rocky shrublands with a variably developed grass layer compose the largest proportion of the site. Cover varies from reasonably high to very low depending on the nature of the underlying substrate. Fairly extensive stony plains largely devoid of plant cover occur in many areas within this vegetation type. At the time of sampling the abundance of grasses was very high as a result of the above-average rainfall the area had experienced, but during drier periods the shrub layer would be more conspicuous. Typical species include shrubs such as *Eriocephalus spinescens*, *Pteronia sordida*, *Lycium cinereum* and the forb *Monsonia umbellata*. Typical grasses include *Stipagrostis ciliata*, *S.brevifolia, S.uniplumis* and *Aristida congesta*. This community contained the highest species richness relative to the other communities. This is also a generally open and fairly low vegetation type, with the average height of shrubs being in the order of 40-50 cm. The proportion of larger elements such as Lycium and Rhigozum is generally low but increases in areas with above-average moisture availability, such as those areas which receive run-off from adjacent slopes.

This community was also the only one observed to contain species of conservation concern such as *Hoodia gordonii* and *Aloe claviflora*. *H. gordonii* is listed as a protected species under NEMBA (Act 10 of 2004) as well as provincial legislation while *Aloe claviflora* is protected in the Northern Cape Province in terms of the Northern Cape Nature Conservation Act, No. 9 of 2009.

Figure 5.8 Mixed Rocky Shrubland found on the site

This is the dominant plant community across the majority of the site and is typically dominated by shrubs such as *Eriocephalus* and *Pteronia* with a grass component consisting largely of various *Stipagrostis* species as well as *Aristida congesta*.

Rhigozum & Lycium Thicket

As previously indicated, the lower slopes and bottomlands of the site are the only areas which contain an appreciable amount of topsoil. These areas are dominated by taller shrubs such as *Rhigozum trichotomum*, *Lycium cinereum* and *Phaeoptilium spinosum* with an understorey of forbs and grasses. Common and dominant grasses within these areas included *Stipagrostis ciliata*, *Schmidtia kalahariensis* and *Eragrostis porosa*. The presence of this community is also indicative of the drainage areas of the site which are broad and diffuse as a result of the low overall slope of the area. Drainage lines at the site are not well developed as a result of the low slope and position of the site near the top of the catchment. These areas are the most impacted by livestock grazing as indicated by the high density of *Lycium* and *Rhigozum* which are known indicators of grazing pressure and degradation. However, since this community represents a widespread plant community which occurs on coarse sandy soils throughout Bushmanland, it is not broadly characteristic of drainage lines per se.

Figure 5.9 Rhigozum Thicket found on the site

Only ccurs on the deeper soils which occur in the low-lying and drainage areas of the site. The community is dominated by *Rhigozum trichotomum*, *Lycium* spp and *Phaeoptilium spinosum*.

The areas dominated by *Rhigozum* contained the lowest abundance of other plant species which can be ascribed to the negative effects of grazing as well as the suppression of the other plant species by *Rhigozum*. No plant species of conservation concern were observed within this habitat. Typically, the dominant woody shrub species in this community are around 1 m in height but may be as tall as 2 m indicating that at least the taller elements would probably need to be reduced in height to prevent shading the PV arrays.

Figure 5.10 **Rhigozum** ***thicket community with a poorly developed grass layer***

Poor developed grass layer is likely to be a result of heavy grazing and/or suppression of the grass layer by the dense *Rhigozum* stands.

5.2.2 *Mammals, Reptiles and Amphibians*

The site does not have a very rich faunal community, which can be ascribed to the arid nature of the area and the low variety of different habitats present at the site.

Mammals

Although over 40 mammals have distribution ranges which include the site, a large proportion of these are not likely to occur at the site due to the lack of suitable habitat. In particular, species associated with rocky outcrops are not likely to occur at the site such as Klipspringer, Rock Hyrax, Dassie Rat, Western Rock Elephant Shrew and Smith's Red Rock Rabbit.

The only antelope which occur at the site are Steenbok *Raphicerus campestris* and Common Duiker *Sylvicapra grimmia*.

Aardvark *Orycteropus afer*, Porcupine *Hystrix africaeaustralis* and Bat-Eared Fox *Otocyon megalotis* diggings and burrows were observed at the site during field investigatiosns indicting the presence of these species in the area. Although they were not observed during the site visit, other medium sized mammals likely to occur at the site include Caracal *Caracal caracal*, Black-backed Jackal *Canis mesomelas*, Cape Fox *Vulpes chama* and Aardwolf *Proteles cristatus*.

The small mammal community at the site is likely to be dominated by widespread species such as the Four Striped Grass Mouse *Rhabdomys pumilio*, Namaqua Rock Mouse *Micaelamys namaquensis*, Cape Short-tailed Gerbil *Desmodillus auricularis* and Round-eared Elephant Shrew *Macroscelides proboscideus*. Species associated with sandy substrates such as Brants's Whistling Rat *Parotomys brantsii* and *Gerbillurus paeba* will be largely restricted to the low-lying areas dominated by *Rhigozum* and *Lycium* vegetation. The overall abundance of small mammals at the site is likely to fluctuate widely from year to year depending on rainfall which regulates small mammal abundance through its effects on plant cover and food availability.

Reptiles

The site lies in or near the distribution range of at least 40 reptile species, which is considered moderately low indicating that the site has a relatively depauperate reptile assemblage. Available data suggests that the site has a reptile fauna which is low in tortoises and snakes, but relatively rich in lizards, skinks and geckos, typical across bushmanland in general. Species associated large rocky outcrops such as Girdled Lizards (*Cordylus* spp) are not likely to be present at the site, while species which favour sandy, stony and open ground are likely to be dominant.

Although no reptile species which occur at the site are listed as endangered, the Bushmanland Tent Tortoise is protected under provincial ordinance and is also listed under Appendix II of Cites which regulates trade in these species.

Amphibians

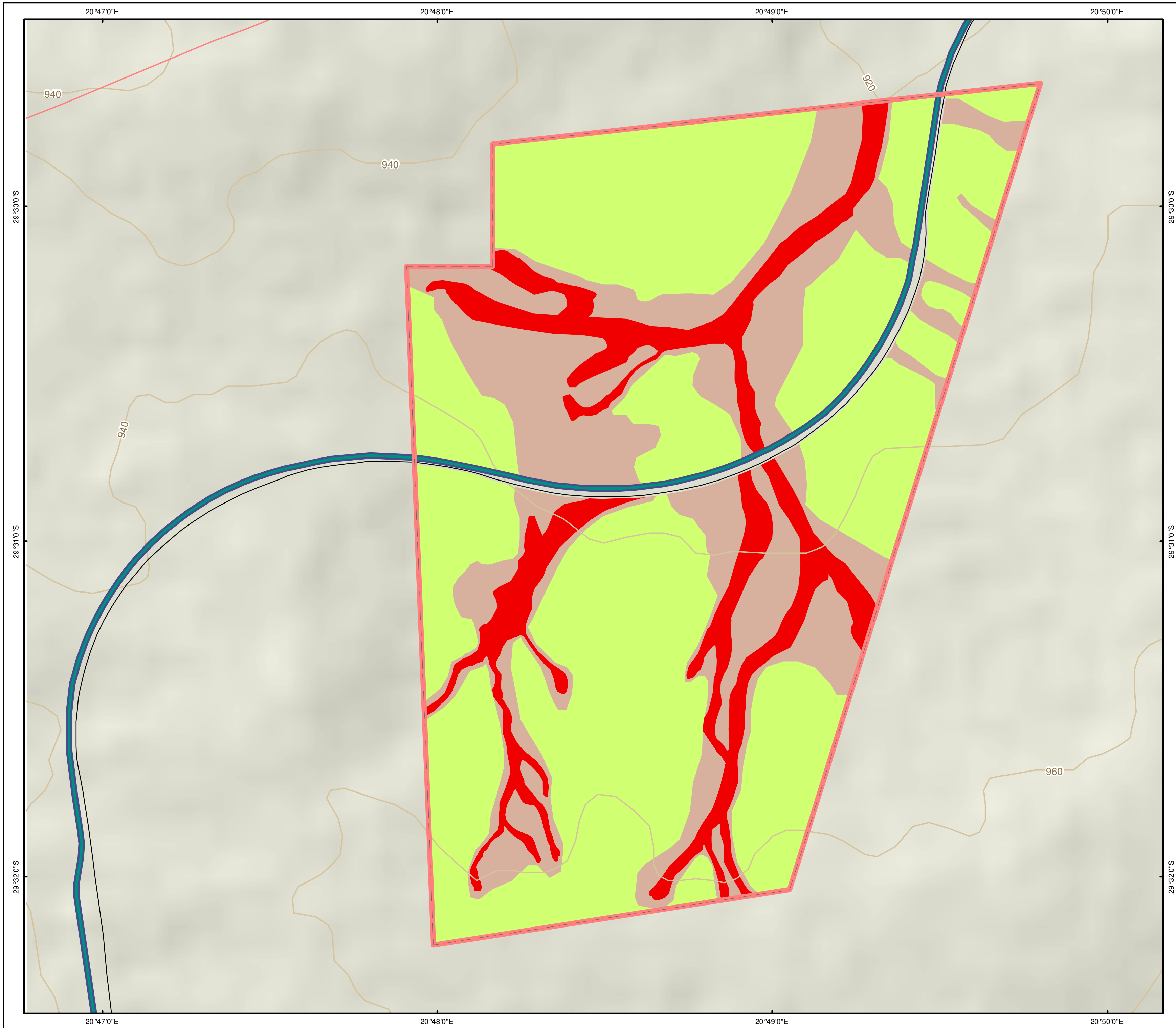
The site lies within or near the range of as many as nine amphibian species, although a number of these require more or less permanent water and are therefore extremely unlikely to occur at the site given the scarcity of water in the area. It is considered likely that only toad species such as the Karoo Toad *Vandijkophrynus gariepensis* occur at the site as these are able to tolerate extended dry periods. The only potential breeding habitats at the site appear to be man-made and include a small earth dam, livestock watering troughs and temporary pools caused by the railway line preventing free flow of water across the site.

5.2.3 Ecological Sensitivity of Site

In terms of the distribution of the different ecological sensitivity categories at the site, those areas with deeper soils comprising the lower slopes and bottomlands of the site are classified as **High** Sensitivity. These essentially correspond to areas referred to as drainage lines. The poorly developed nature of the drainage areas at the site, can be ascribed to the position of the site at the very top of the catchment with little potential for runoff accumulation. Nevertheless, a cautious and conservative approach is warranted regarding the development potential of these areas. From a species richness perspective, these areas are not significant as plant diversity within these areas is low. Due to the deeper soils and landscape position of these areas, these areas would however be vulnerable to disturbance as this would render them susceptible to erosion. These areas are also important from a functional perspective because they provide cover for larger mammal species and would also serve as movement corridors. The presence of different vegetation units within an area is also ecologically important because each unit offers different resources and opportunities for the fauna at the site thereby contributing to the overall diversity of the area. While parts of the site have been classified as **High** Sensitivity, it should be noted that this is to a large extent relative to the other parts of the site. In absolute terms the site in general is <u>low sensitivity</u> when compared to high-biodiversity-value ecosystems with a high threat status or high levels of endemism.

The middle and upper slopes of the site as well as those low-lying areas with a calcrete substrate are classified as **Low** to **Medium** Sensitivity. These areas would be more tolerant of disturbance as there is little soil cover that could be displaced and the risk of erosion would be low. Some of these areas do however contain the highest levels of plant diversity present at the site, including at least two protected species (*Hoodia gordonii* and *Aloe claviflora*). Development within these areas could proceed with minimal overall ecological impact, provided that due attention is paid to translocating individuals of the protected species and other standard mitigation measures are applied.

Figure 5.11 illustrates the ecological sensitivity of the site.



Legend

- Contours (20m)
- Secondary Roads
- Railway Line
- Railway Service Road
- Olyven Kolk Site

Ecological Sensitivity

- Medium
- Medium - High
- High

SCALE:

0 250 500 750 1 000

Metres

N

TITLE:

Figure 5.11
Ecological Sensitivity of the Olyven Kolk Site

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING:
Fig5.11_Ecological Sensitivity of the Olyven Kolk Site.mxd

REV:
2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI)
Inset Map, Esri Data & Maps

SIZE:
A3

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5.2.4 Birds

Avian Habitats

The habitat on site from an avian perspective is relatively uniform, dominated by open, flat, sandy Karoo veld (*Figure 5.12*), with thicker, woody growth along the main drainage lines. The lattice-type steel pylons which support the Eskom transmission power lines provide nesting habitat for birds that would normally nest in trees (e.g. passerines, corvids, raptors), and for birds that normally use nests built by these tree-nesting species (e.g. falcons).

The site is not located close to any established Important Bird Areas.

Figure 5.12 Typical flat, open Karoo Vegetation

Note: 400 kV transmission lines in the background

Avian Species

More than 130 bird species could possibly occur on the site, including up to 11 red-listed species, 56 endemics or near-endemics, and four red-listed endemics (Ludwig's Bustard *Neotis ludwigii*, Black Harrier *Circus maurus*, Red Lark *Calendulauda burra* and Sclater's Lark *Spizocorys sclateri*).

Red-listed species recorded in atlas data for the area include Kori Bustard *Ardeotis kori*, Ludwig's Bustard *Neotis ludwigii*, Lanner Falcon *Falco biarmicus* and Sclater's Lark *Spizocory's sclateri*. A number of localised endemics also occur within the area (e.g. Black-eared Sparrowlark *Eremopterix australis*). The site falls within the documented range of the red-listed endemic Red Lark *Certhilauda burra*. The Rooiberg Dam, which is known to occasionally support numbers of flamingo, is located about 40 km to the north-east of the proposed development site.

Nine species have been identified within the study area as 'priority' species based on their high abundance within the area, restricted range and/or their status as an endemic species.

Table 5.1 Priority Bird Species likely to be found within the Site

Common name	Scientific name	SA conservation status/ (Global conservation status)	Regional endemism	Preferred habitat
Ludwig's Bustard	*Neotis ludwigii*	Vulnerable (Endangered)	Near-endemic	Open Karoo
Kori Bustard	*Ardeotis kori*	Vulnerable	-	Open Karoo
Martial Eagle	*Polemaetus bellicosus*	Vulnerable (Near-threatened)	-	Open Karoo, power pylons
Secretarybird	*Sagittarius serpentarius*	Near-threatened (Vulnerable)	-	Open Karoo
Lanner Falcon	*Falco biarmicus*	Near-threatened	-	Open Karoo, power pylons
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	-	Wetlands, flying over
Lesser Flamingo	*Phoenicopterus minor*	Near-threatened	-	Wetlands, flying over
Red Lark	*Calendulauda burra*	Vulnerable	Endemic	Open Karoo
Sclater's Lark	*Spizocorys sclateri*	Near-threatened	Endemic	Open Karoo

Eighteen bird species were recorded during the site visit. Significant observations included an adult Martial Eagle *Polemaetus bellicosus* perched near a nest in a transmission pylon on the western boundary of the site and a pair of Lanner Falcons at an old Martial Eagle nest on a pylon to the east of the site. The locations of these nests are shown in *Figure 5.14*.

Martial Eagle occupy a breeding territory approximately centred on the Aries substation. This has not generally been a productive territory, with breeding recorded only once in the period 2002 to 2006 (Jenkins *et al.* 2007). The presence of an adult eagle near a well built-up nest structure and some fresh droppings or whitewash accumulated under the nest pylon (Aries-Helios tower 11) suggests that the site may well be active this season.

Lanner Falcons do not build their own nests. When they nest in trees or equivalent man-made structures such as pylons, they usually use stick to nests built by other birds as platforms for breeding. The pair seen on site seemed interested in a second Martial Eagle structure on the Aries-Kronos line and it is likely that they may well breed on this nest later in the year.

Figure 5.13 Martial Eagle Nest on the Aries-Helios 400 kV Transmission Line

A Kori Bustard power line collision victim was found under the Aries-Helios Power line. Regional endemic species, such as Northern Black Korhaan *Eupodotis afraoides* Karoo Korhaan *Eupodotis vigorsii*, Rufous-eared Warbler *Malcorus pectoralis* probably occur commonly on the site, although only the latter species was seen during the site visit.

Figure 5.14 Distribution of Raptor Nests within the Site

Note: These nests are found on Eskom transmission lines

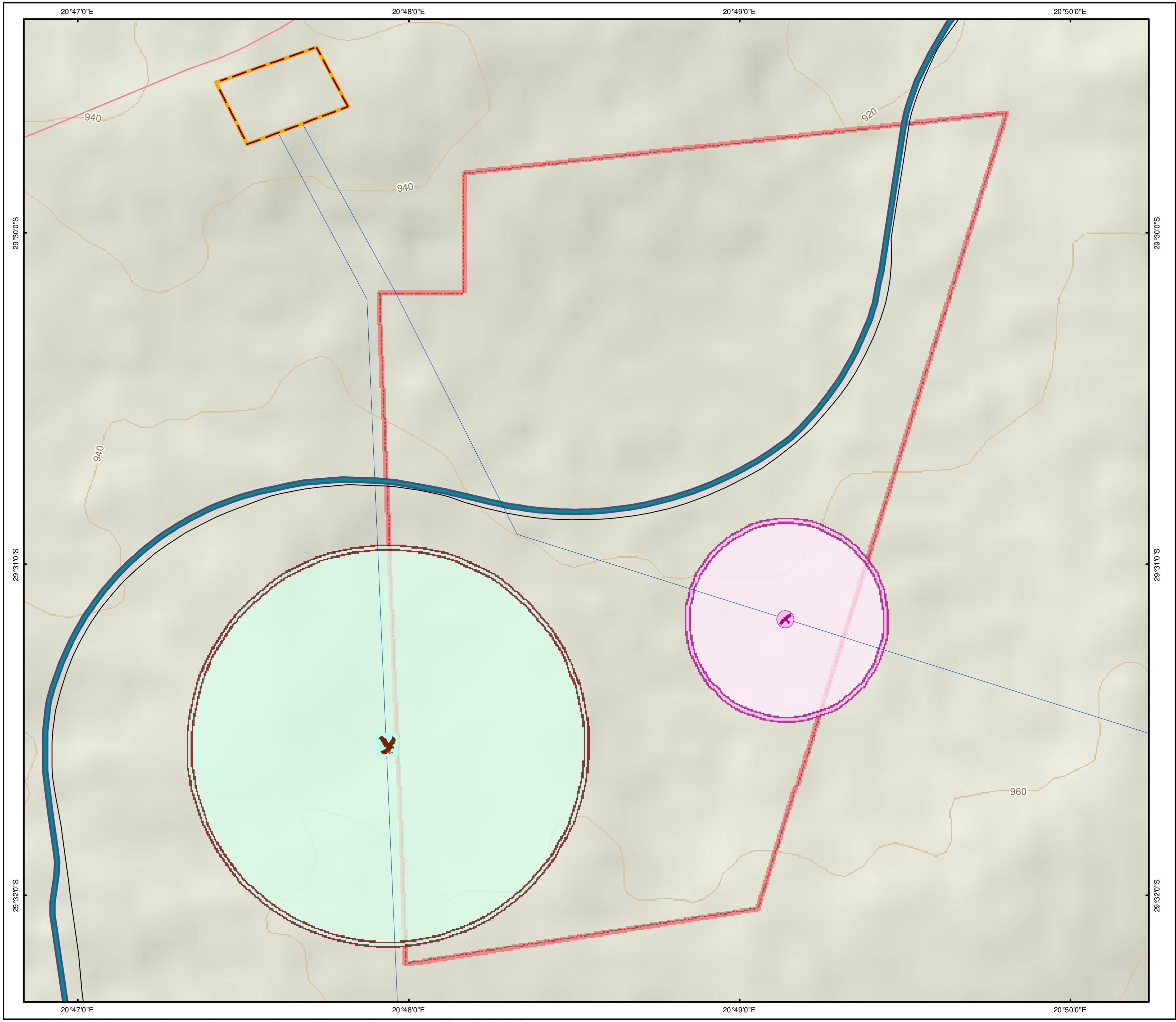
The worst affected taxa are likely to be the two raptor species (Martial Eagle and Lanner Falcon) resident and nesting on existing power transmission pylons within the proposed development area. These birds (especially the eagles) will be significantly disturbed by the construction process, possibly to the extent of breeding failure or even territory abandonment. Based on their sensitivity it is considered that the development should be excluded from:

- Within a 1 km radius of the Martial Eagle nest site; and
- Within a 500 m radius of the Lanner Falcon nest site.

These areas to be excluded are shown in *Figure 5.15* and discussed further in *Annex G*. Avoidance of these areas is advised as far as possible, whilst still ensuring that the project is feasible. If required, relocation measures as suggested by the expert may be followed.

5.2.5 Protected and Conservation Areas

There are no protected nature conservation areas within the site or near surrounds. There are a number of reserves and conservation areas within the wider region including: Augrabies Falls National Park (located approximately 90 km north west of the site) and Witsand Nature Reserve (located approximately 150 km north east of the site).



Legend

Lanner Falcon Bird's Nest

Martial Eagle Bird's Nest

Contours (20m)

Secondary Roads

Railway Line

Railway Service Road

Existing 400kV Transmission Lines

Bird Exclusion Zones

500m Buffer

1000m Buffer

Eskom Aries Sub-station

Olyven Kolk Site

SCALE:

0 250 500 750 1 000

Metres

N

TITLE:

Figure 5.15
Bird Exclusion Zones

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING: Fig5.15_Bird Exclusion Zones.mxd

REV: 2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI)
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig5.15_Bird Exclusion Zones.mxd

6 SOCIO-ECONOMIC BASELINE

6.1 INTRODUCTION AND BACKGROUND

The Olyven Kolk Farm 4 is located in the Northern Cape Province within the Siyanda District Municipality. Until recently the site fell within the Riemvasmaak District Management Area (DMA) [1]. The Kalahari including the Augrabies National Park, private farmlands near the town of Kenhardt and the Riemvasmaak Community Conservancy area all fell within the DMA. In May 2011, local municipal elections were held in South Africa, and these elections were marked by the disbarment of all DMA's in the country. This involved the incorporation of all DMA's into existing local Municipalities and under the 2011 municipal demarcations, the former Riemvasmaak DMA was broken into two and incorporated to the Mier and Kai !Garib Local Municipalities (See *Figure 6.1)*. This process formed part of the government's plan to improve service delivery across the country. As of 18 May 2011, the Olyven Kolk Farm 4 is located within the Kai !Garib Local Municipality.

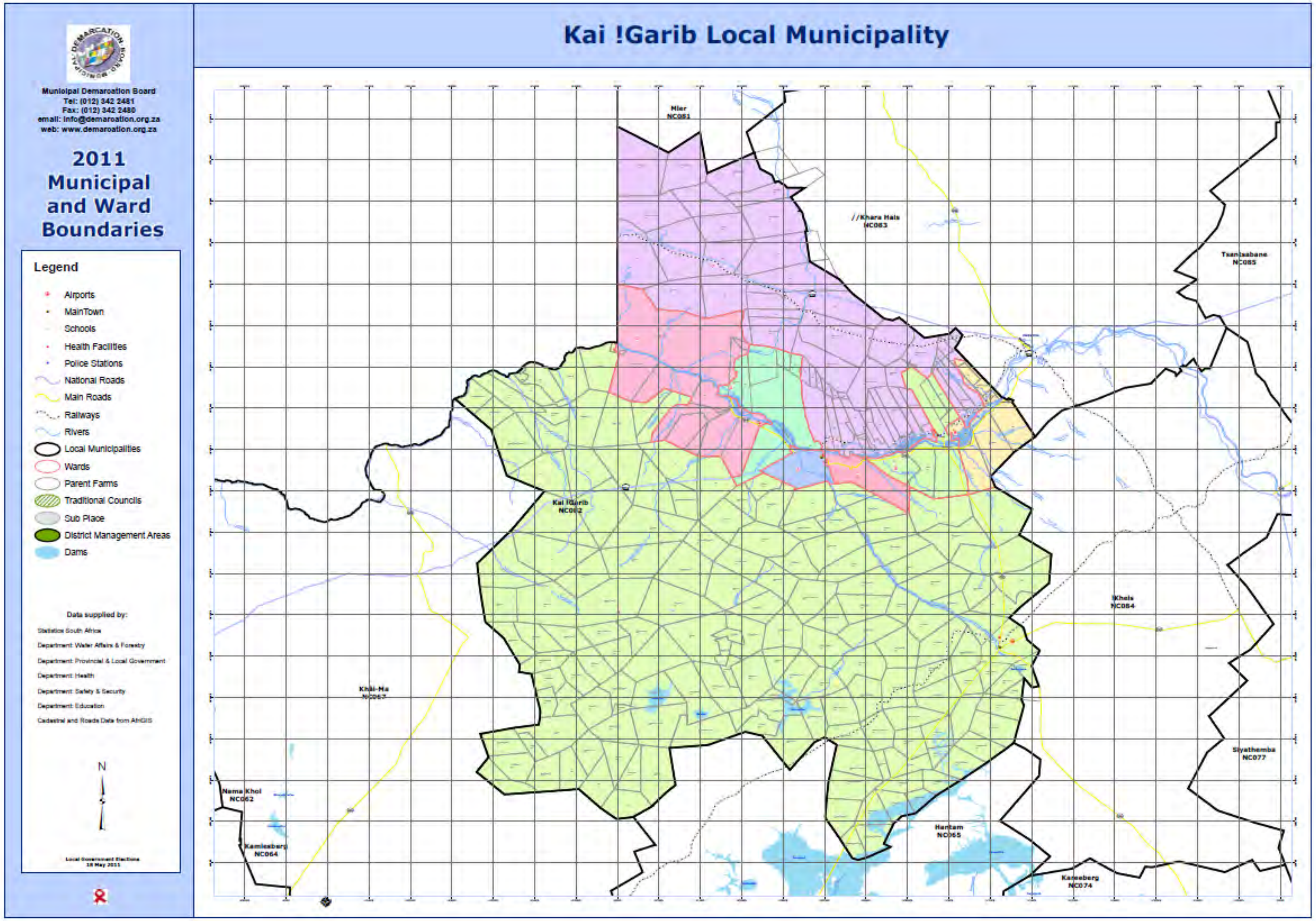
Figure 6.2 shows the location of the Olyven Kolk Farm 4.

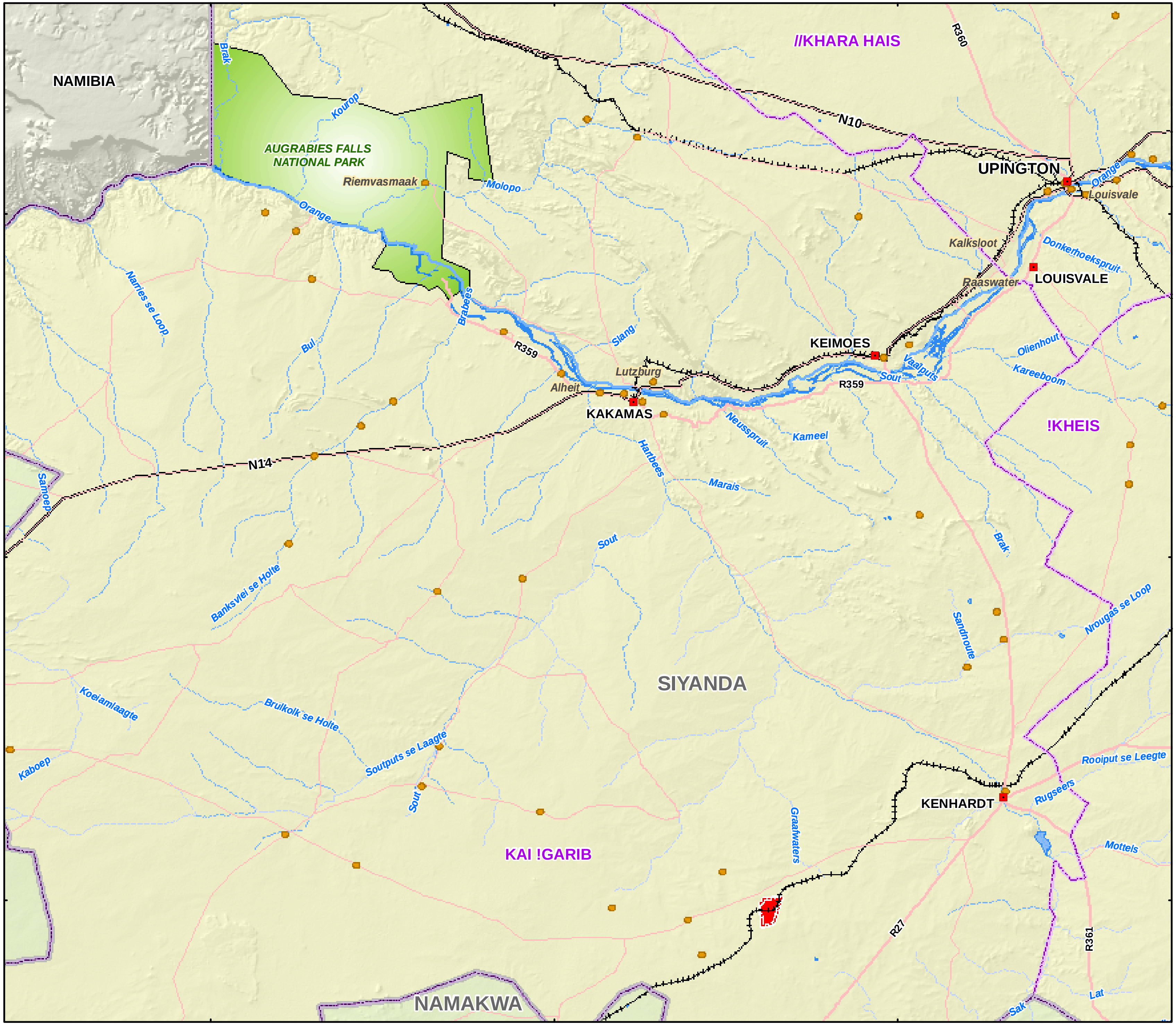
The Olyven Kolk Farm 4 is located in an isolated rural area comprising predominantly of grazing farmlands. The closest town/settlement of Kenhardt is located 44 km from the site. For the purpose of this socio-economic study, the study area considered includes the town of Kenhardt, as the town plays a role in the provision of social services to the community living in and around the project site and the DMA (data only available for the DMA).

Statistical data is not available at a DMA level and therefore the available data referring to the DMA is incorporated at a District level.

(1) An area is gazetted as a DMA if it cannot/ will not be able to fulfil the objectives of Section 24 of the Demarcation Act.

Figure 6.1 New Municipal Demarcation for the Siyanda District Municipality





Legend

- MainTowns
- Perennial Rivers
- Non Perennial Rivers
- Dry Rivers
- National Roads
- Main Roads
- Secondary Roads
- Railway Line
- Cultural Features
- Conservation areas
- Perennial Dam
- Local Municipalities
- District Municipalities
- Olyven Kolk Site

SCALE:

0 5 10 15 20 25 30

Kilometres

N

TITLE:

Figure 6.2
Socio-Economic Map

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 600 000

DRAWING: Fig6.2_Socio-Economic Map_Rev2.mxd

REV: 2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368
ERM

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Demarcation Board (2011)
Inset Map, Esri Data & Maps

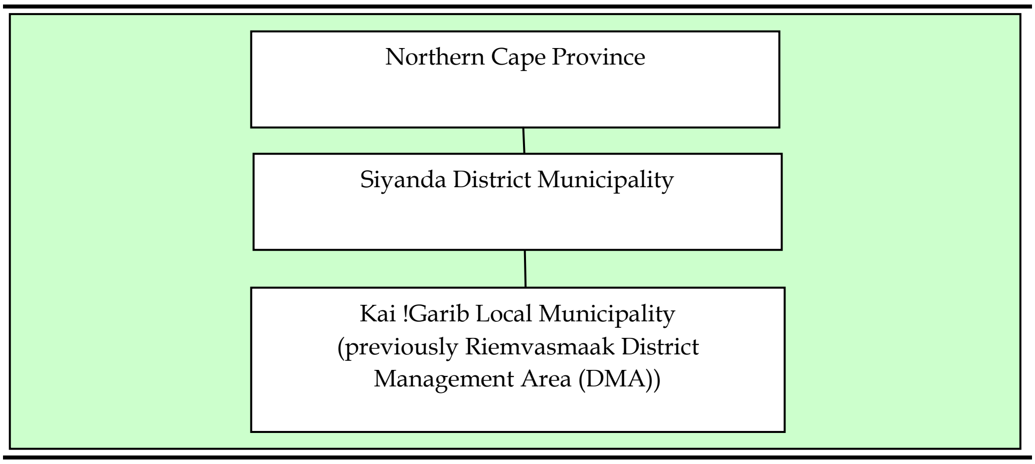
SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig6.2_Socio-Economic Map_Rev2.mxd

6.2 *ADMINISTRATIVE STRUCTURE AND AREA*

The Provincial Government is responsible for ensuring cooperation and collaboration between municipalities within the Province and for ensuring that each municipality performs their designated functions. In turn, each of the District Municipalities is responsible for the development and implementation of their Integrated Development Plans and for the overall provision of services and infrastructure within the District.

Figure 6.3 Administrative Structure (for Project Area)



6.3 *OLYVEN KOLK FARM 4 AND SURROUNDS*

The project site falls within Olyven Kolk Farm (portion RE 14/187). This land parcel is currently managed by the landowner and at present there are no residents inhabiting the site. The site is bounded by four neighbouring farms, owned by separate individuals and companies. Only one of the three neighbouring farmers (and his wife) resides permanently on his farm.

The neighbouring farms vary in size and a brief description of each and the land use of these farms is set out below:

- Olyven Kolk (a portion of portion 4/187) Farm is 1,052 ha in size and borders the project site to the east. The farm owner inherited the farm in 2007, but the farm has been in his family since 1996. The farm is used for livestock farming and there are currently 250 sheep on the farm. He does not have anyone in his employ and he uses a neighbouring landowner's worker to look after the sheep during the week. The landowner visits the farm on weekends. There is minimal infrastructure on the farm and this includes a caravan, one building, a borehole, and two sheep holding camps.

- Olyven Kolk (multiple portions/187) Farm is 7,000 ha in size and borders the project site to the north. The farm was recently purchased by a developer and no one is currently residing on the farm. The buyer plans to use the farm for PV power generation and use the remaining portion of the farm to continue with livestock grazing.

- Klein Zwart Bast (multiple portions of 188) Farm is 5,500 ha in size and borders the project site to the west. The farm is currently used for livestock farming and also houses the Eskom's Aries substation. At present the farm is also being leased to a solar PV developer, who intends to develop a solar plant on the site. There is a homestead on the farm.

- Karee Boom Kolk (portion 1/248) Farm is 2,500 ha in size and borders the project site to the south. The landowner is a third generation farmer, and he resides on the farm with his wife. The farm is used for sheep and cattle farming. The landowner makes use of temporary labour from Kenhardt to help him with the daily running of the farm. There is minimal infrastructure on the farm including a large house, several outside buildings and the landowner uses solar panels to generate electricity for domestic electricity use.

6.4 POPULATION DEMOGRAPHICS

6.4.1 Population Description

In the most recent census statistics available, Siyanda District's (1) population was estimated to be 238,063 for the year 2007, indicating a population growth of 17 percent since the 2001 population census (2). The population density in the District that year was 1.7 people/km^2 and the ratio of females to male was 52:48. The DMA at the time had a population of 8,600. Despite the vast area which the DMA covered, the area was sparsely populated.

In 2011, the population of Kenhardt was estimated to be 3,800 (3). In contrast to the District gender ratio, Kenhardt has a higher ratio of males to females (4).

6.4.2 Age Distribution and Ethnicity

The age profile for the District illustrates a developing population with 43 percent of the population below 35 years. A further 27 percent are between the age of 35 and 59 and 25 percent of the population are below the age of 20 years. The remaining five percent of the District population are above 65 years of age.

The population of the area is primarily coloured and the most common language spoken is Afrikaans.

(1) Hereafter referred to as 'District'
(2) Community Survey, 2007
(3) Personal Comms: Community Development Worker (CDW)
(4) Personal Comms: CDW

6.4.3 *Migration Patterns*

There is a relatively high level of migration out of the area, which can be attributed to the lack of employment opportunities in the region. Most people move to Upington, Johannesburg or Cape Town. Many of those who can afford to leave the area do not return. This is likely to be attributed to the lack of public infrastructure and transport in the local area as well as the sparsity of employment opportunities.

6.5 EDUCATION AND LITERACY

The majority of the District's population over 20 years of age have completed secondary schooling (30 percent), followed by 24 percent having completed some primary schooling and 17 percent having no formal education. The level of education of the remaining 29 percent of the population is unclear (1).

Kenhardt has nursery, primary and high schools but no tertiary institutions. Typically, students who want to further their studies go to Upington (where there is a Further Education and Training (FET) College), Kimberly or Stellenbosch. A significant portion of the youth in Kenhardt have completed Grade 10 or Matric, the bulk of whom cannot afford to continue their studies beyond school.

In Kenhardt, each year the schools hold a "back to school campaign" (2),to encourage students to continue their studies. Before 1994, there was no high school in the area and therefore most learners completed only primary schooling (Grade 7), fortunately that changed with the establishment of the high school. There are a limited number of bursary opportunities for students who want to further their education, as such only a few people leave to pursue further education. *Figure 6.4* and *Figure 6.5* show the two schools found in the area.

(1) Siyanda District Municipality: IDP 2007 - 2011
(2) Personal Comms: CDW

Figure 6.4 Kenhardt Primary School

Figure 6.5 Kenhardt High School

6.6 HEALTH CARE SERVICES

The closest health centre to the site is the Kenhardt Community Health Centre (CHC) located in Kenhardt (see *Figure 6.6)*. CHCs are medical facilities funded and administered by local municipalities. The CHC is open 24 hours a day and there is always a medical professional available. The closest government doctor is located in Keimoes (78km away), but there is a private doctor available in Kenhardt who charges R280 per consultation. There are ten staff members at the CHC - six general nurses and four auxiliary nurses.

The facility services an estimated 7,000 people from Kenhardt and the surrounding areas. The CHC is understaffed with a nurse-patient ratio of 1:1,166.

The health conditions experienced in the community are generally asthma, hypertension, high blood pressure, diabetes, tuberculosis (TB) and HIV/AIDS. TB is prevalent in the area due to poor living conditions and lack of access to medicine. Alcohol and drug abuse (a common drug used is tik) is increasing and local residents attribute this to a lack of recreational facilities in the area.

The CHC is actively educating the community of Kenhardt on health issues, some of the tools they use include:

- Information brochures at the clinics;
- community development workers who provide information to the community;
- radio and TV;
- information drives; and
- door to door consultation especially in relation to TB and HIV.

Figure 6.6 *Kenhardt Community Health Centre (CHC)*

6.7 ECONOMY AND LIVELIHOODS

The dominant economic sectors in terms of revenue generated in the District are agriculture, hunting, forestry fishing (45 percent), construction (14 percent), wholesale & retail (11 percent), community, social & personal services (15 percent), construction & manufacturing (nine percent), private households [(1)] (nine percent), transportation (three percent), finance

(1) Domestic workers

(five percent) and mining (three percent) [1]. Most agricultural activities are concentrated along the Orange River and include crop and some livestock farming.

6.7.1 Agriculture

Kenhardt and the surrounding areas are sustained by the agricultural sector (which is dominated by sheep farming). The sheep bred in the area are Dorper sheep valuable for their meat. There are no crops in the area because of the arid conditions and lack of available water resources. Most of the commercial farms are located on the outskirts of town including those owned by emerging farmers from the town.

The farms in the vicinity of the Olyven Kolk Farm 4 are used mainly for livestock farming (including sheep, goats and cattle). The climate of the area does not allow for crop farming. During the dry months the farmers provide the livestock with lucerne for extra feed.

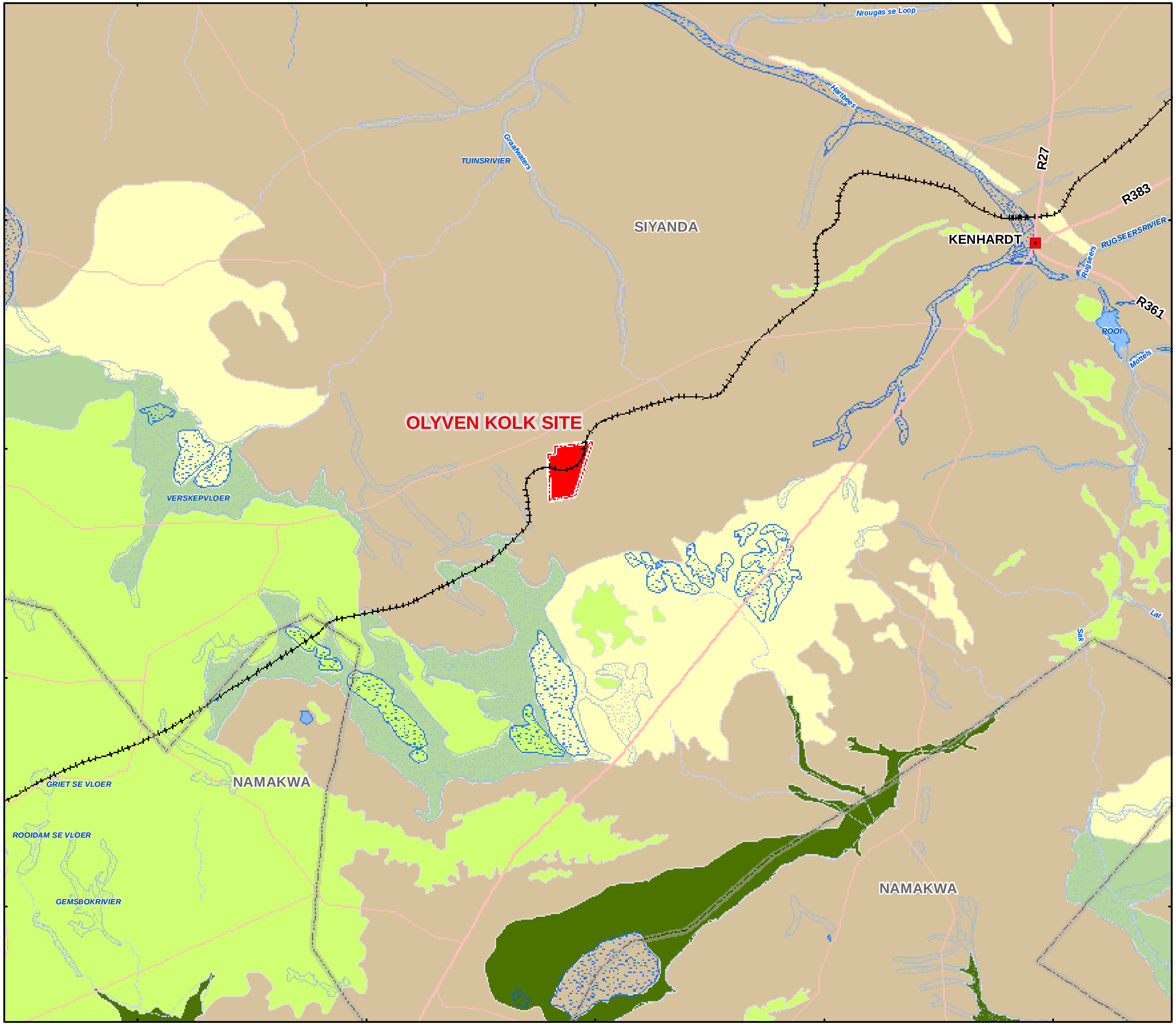
There are three major issues facing the productivity of farming in the area including, a shortage of water resources, stock theft (especially for farms along the R27) and jackals who kill the livestock.

As part of the land restitution process, the government bought some farms in Keimoes, Kenhardt and Kakamas and these farms were given to developing farmers [2] for communal usage. At present there are 150 emerging farmers, 40 of whom are from Kenhardt. The farmers keep sheep for subsistence purposes only. The government has not given the farmers any additional financial support for the sheep farming, making it difficult for these farmers to establish a viable commercial farm. The government only provides assistance to farmers when there is a national agricultural crisis such as foot and mouth disease.

Figure 6.7 shows the agricultural potential of the land associated with the proposed Olyven Kolk Farm 4. The site consists mainly of "*soils not suitable for arable agriculture; suitable for forestry or grazing where climate permits*."

(1) Siyanda District Municipality: IEDP, 2006

(2) Developing or emerging farmers is a term used to define previously disadvantaged farmers who enter into commercial farming.



Legend

Main Towns	Perennial Dam
Perennial Rivers	Non Perennial Dam
Non Perennial Rivers	Dry pan
Dry Rivers	District Municipalities
Main Roads	Olyven Kolk Site
Secondary Roads	
Railway Line	

Soil Potential

- No dominant class
- Not suitable for agrculture; suitable for conservation
- Soils highly suited to arable agriculture
- Soils not suitable for arable agriculture
- Soils of intermediate suitability for arable agriculture
- Soils of poor suitability for arable agriculture

SCALE:

0 5 10 15
Kilometres

N

TITLE:

Figure 6.7
Agricultural Potential

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 300 000

DRAWING: Fig6.7_Agricultural Potential.mxd

REV: 2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI)
Inset Map, Esri Data & Maps

SIZE: A3

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6.7.2 *Local Businesses*

A small number of small-scale businesses are found in Kenhardt including butcheries, tuck shops, a liquor store, mini-market (see *Figure 6.8*), clothing and general store, brick-makers (transported and sold in Kakamas and Upington), tourism related businesses such as Kenhardt Hotel and most recently a waste recycling facility has been established which employs five people [1].

Figure 6.8 *Local Store*

6.7.3 *Household Income*

Household incomes in the District are relatively low with the majority of the population earning less than R1,800 a month [2]. At a district level, a high number (22 percent) of households are dependent on state grants [3], with 52 percent dependent on the child grant of R280 per month [4]. Government grants range between R280 and R1,146 per month. Poverty is high in the town [5]. It is estimated that the highest earner in the area earns approximately R15,000 a month.

6.7.4 *Employment, Unemployment and Skills*

Throughout the District, the level of unemployment is higher (at 29 percent) than the percentage of the population employed (23 percent). This can be attributed to the general lack of employment opportunities available in the

(1) Personal Comms., Local Residents, CDW and Cllr
(2) Siyanda District Municipality IDP, 2007 -2011
(3) Old age pension, child grants, disability grants and foster care grants
(4) Siyanda District Municipality: IEDP, 2006
(5) Personal comms with Cllr and CDW

District. The portion of the population which is regarded as economically inactive [1] is 48 percent [2].

The main employers in the District are the agricultural sector (34 percent), communication sector (19 percent), mining sector (14 percent), and trade sector (nine percent) [3].

According to local residents, there are few employment opportunities in and around the Kenhardt area, resulting in the high levels of unemployment. At present there are six sources of income generation [4], namely:

- short-term contract work;
- farming;
- social grants;
- retail shops (e.g. Pep Store);
- Municipality; and
- State departments.

Some of the local people also undertake seasonal work in Kakamas harvesting wine grapes.

The Department of Water Affairs initiated capital project to construct a water pipeline from the Orange River to Kenhardt provided a significant amount of short-term contract work for the local community during the construction phase from 2009 to 2010.

The majority of the community do not have any formal skills because of the lack of capacity building programmes, lack of tertiary institutions and general lack of job opportunities.

6.8 VULNERABLE AND MARGINALISED GROUPS

Vulnerability is a measure of the resilience of individuals, households and communities to withstand shock (SIDP, 2004). Generally, vulnerable groups in the area are those who have no productive assets (farms), lack vocational skills, are isolated or excluded, and lack guidance and social support structures.

According to the local residents there are two groups of people who are regarded as vulnerable namely the elderly and the youth.

The elderly (age 65 and above) represent about five percent of the District population. The majority of the elderly survive on a government pension of R1,140 per month. For most of the elderly their pension is the sole income for their households and everyone in the family relies on it. Furthermore, some of

(1) Economically inactive population refers to students, elderly, sick, differently-abled persons and people who choose not to work.
(2) Siyanda District IEDP, 2006
(3) Siyanda District Municipality: IEDP, 2006
(4) Personal comms: IDP/LED Officer

the elderly who live alone are victimised by local thieves who rob them of their pension every month end.

The general lack of employment opportunities in the area has caused high levels of unemployment amongst the youth, making it difficult for people to uplift themselves. It is considered that the lack of employment opportunities and the need to earn an income has led to an increase in criminal activities.

6.9 TOURISM AND HERITAGE

The tourism sector in the District is not well developed and the local authorities have plans to encourage the growth of this sector (1). The main tourist attraction in the District is the world famous Kgalagadi Transfrontier Park. The park attracts thousands of tourists to the region on an annual basis thus having a positive influence on the smaller local tourist enterprises in the area. The park is located 450 km north of the site. Approximately 13 km outside Upington, there is the Spitskop Nature Reserve and the Augrabies National Park.

A tourist information office was found in Kenhardt but it was closed after several months. Accommodation facilities in Kenhardt, include Ouma Miemie's Guest House, De Oude Herberg, Sonop Guest House, Ou Werf, Bushmanland Guest House and the Kenhardt Hotel. Most contractors who come to do some work in the area stay at these facilities. The main tourist attraction in the local area is the kokerboom (2) (quiver tree) forest (*Aloe dichotoma*) located approximately 7 km from town where several hundred kokerbome grow. At present, plans are underway to establish a kokerboom tourist route in Keimoes. There are also bushman paintings in the area, graveyards of two soldiers and several memorial sites such as the library and the English Church in the town. Below are pictures of the Kokerboom (*Figure 6.9*), Ouma Miemie's Guest House (*Figure 6.10*) and Kenhardt Hotel (*Figure 6.11*) all of which can be seen when travelling along the main road through Kenhardt.

(1) Siyanda District Municipality: IDP 2007 - 2011
(2) Kokerboom is a founding tree of the area, where the town was founded.

Figure 6.9 Kokerbome Tree

Figure 6.10 Ouma Miemie's Farmstall and Guest House

Figure 6.11 Kenhardt Hotel

6.10 EXISTING INFRASTRUCTURE

The following infrastructure is located on or in the vicinity of the proposed development site:

- Eskom's 400 kV Aries Substation located approximately 400 m northwest of the site (see *Figure 6.12*);
- the Sishen-Saldanha Railway Line and associated un-tarred service road transects the site (see *Figure 6.13*); and
- a 400 kV line from Aries substation which runs south through the site.

Other infrastructure found in the area include: other transmission lines to the Aries substation, fences, boreholes, farm houses and sheds/ out buildings.

Figure 6.12 Eskom's Aries Substation in the Distance

Figure 6.13 Sishen-Saldanha Railway Line

6.10.1 Other Planned Developments in the Vicinity of the Project Site

At present, there are three other projects proposed in the area close to the Olyven Kolk Farm 4. These include two proposed solar power plants and the proposed expansion / upgrading of the Sishen–Saldanha railway line. None of these plans have been finalised, at present the respective developers are conducting studies to determine the viability of the projects. The planned solar plants are considered further in *Chapter 13*, Cumulative Impacts.

6.11 GENERAL INFRASTRUCTURE AND SERVICES

6.11.1 Water

Approximately 93 percent of households in the District have access to tap water, via a tap in their homes or a communal tap (1) with the remaining population relying on underground water resources such accessed via boreholes. There is, however, a lack of good quality groundwater in the District resulting in many farms being uninhabitable. The groundwater levels reportedly subside because of over-pumping and the rainfall is too low to replenish groundwater sources (2).

In Kenhardt, boreholes used to be the main source of water until the Department of Water Affairs installed a 75km water pipeline from the Orange River. The water is treated in Keimoes in order to provide clean drinking water to the community. The project cost the approximately R70 million to implement. The local community receives 10kl free water per month.

6.11.2 Sanitation

The delivery of flush toilets in the District has been relatively slow with only 71 percent of households having access to flush toilets (3). This has been attributed to the lack of water resources. The lack of water has also resulted in the lack of a proper sewage system, thus many households make use of septic tanks. The municipality provides the community with sewage tanks, which are drained on daily basis by sewage trucks. Approximately 10 percent of the population do not have any toilet facilities and the remainder of households use alternate sanitation facilities.

6.11.3 Housing

Approximately 77 percent of the District population reside in formal housing, with 10 percent living in informal housing, nine percent live in workers cottages and four percent reside in other forms of housing (4). According to local residents, there are very few informal houses in the area. The government is currently building more RDP houses which will each comprise two bedrooms and an open plan living area.

(1) Community Survey, 2007
(2) Siyanda District Municipality IDP, 2007 - 2011
(3) Community Survey, 2007
(4) Community Survey,2007

Figure 6.14 House in Kenhardt

6.11.4 Energy

Approximately 85 percent of the Districts population has access to electricity. The remaining 15 percent of the population rely on paraffin, candles and firewood for cooking, lighting ad heating (1).

Similar to the district level, the majority of people in Kenhardt have access to electricity and use it as their main source of energy, although many people use gas and wood for cooking. The electricity is supplied by Eskom and the local community receive 50 free units per month. The farming community typically use solar energy given that the farms are often located far from the electricity supply network.

6.11.5 Crime

There are low levels of crime in Kenhardt and most people feel relatively safe (2). Stock theft is a problem in the rural areas, especially for farms located close to main roads. Other crimes recorded for the area include burglary, rape and murder. A resident stated that crime (particularly theft) increases around the time that government grants are paid.

6.11.6 Public Transportation

There are no public transport services servicing Kenhardt. Individuals travelling to Keimoes or Upington must hire a private vehicle at a cost of R1,200. As a result, people cannot regularly afford to leave Kenhardt. Road infrastructure is poor and most roads in the area are gravel with the exception

(1) Community Survey, 2007
(2) Personal comms, Kenhardt Residents

of the main road, the R27, which passes through the town, see *Figure 6.15* and *Figure 6.16*.

Figure 6.15 Local Secondary Road, Kenhardt

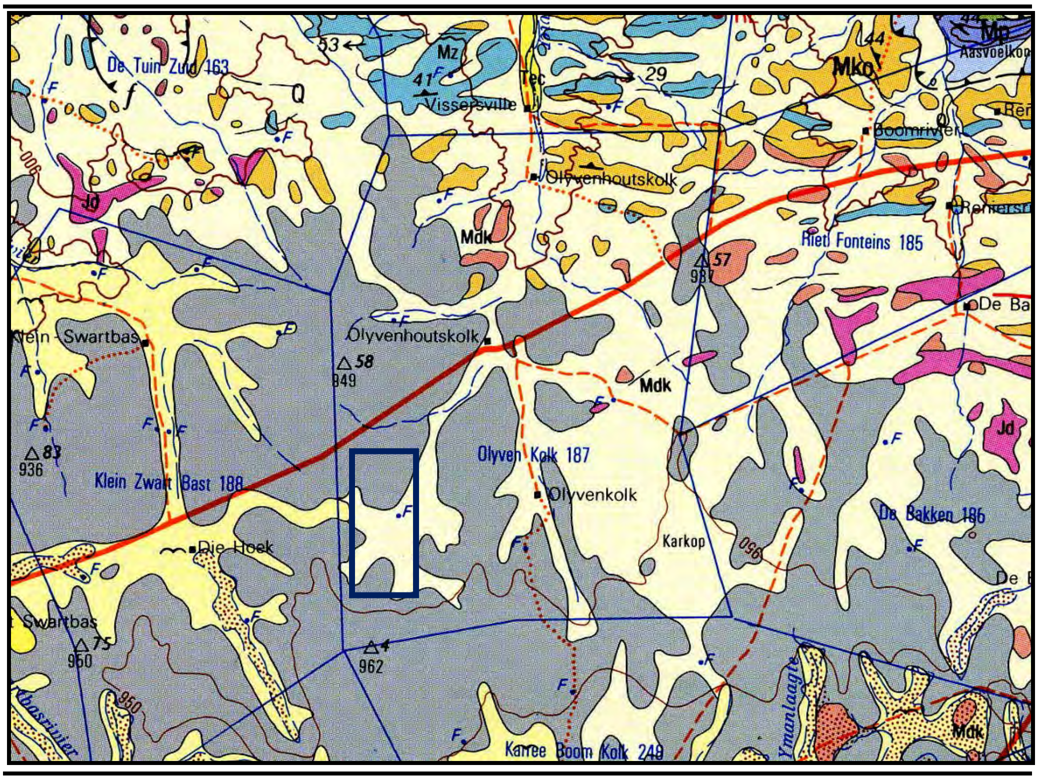
Figure 6.16 Tarred Main Road (R27), Kenhardt

6.12 *ARCHAEOLOGY, PALAEONTOLOGY AND CULTURAL HERITAGE*

6.12.1 *Palaeontology*

The Olyven Kolk Farm 4is underlain by glacial-related sediments of the Permo-Carboniferous Dwyka Group (Mbizane Formation) that are generally of low palaeontological sensitivity (see *Figure 6.17*). From desk based research, the main categories of fossils recorded from the Mbizane beds include a small range of interglacial trace fossils, petrified woods and other plant materials, palynomorphs and supposed stromatolites (the last possibly spurious). Quaternary aeolian sediments of the Gordonia Formation (Kalahari Group) as well as alluvial gravels, sands and calcretes of comparable age, all of low palaeontological sensitivity are also found within the study area. Fossils preserved within alluvial sediments will be largely safeguarded by the proposed final layout that avoids drainage areas.

Figure 6.17 Geological Map showing Olyven Kolk Farm 4



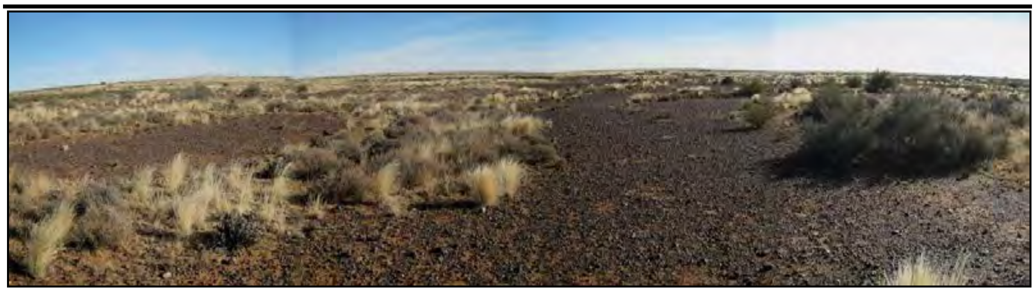
Extract from 1: 250 000 geological map 2920 Kenhardt (Council for Geoscience, Pretoria) showing the approximate location of the Olyven Kolk Farm 4(dark blue rectangle). The area is underlain by Dwyka Group glacial deposits (grey) as well as Quaternary to Recent alluvium and wind-blown sand (pale yellow) that are mainly associated with shallow drainage courses.

6.12.2 *Archaeology*

Pre-colonial

Extensive scatters of stone artefacts dating from the Early Stone Age (ESA) [(1)], Middle Stone Age (MSA) [(2)] and Late Stone Age (LSA) [(3)] were recorded on gravel pavements across the study area (*Figure 6.18*). Few areas of the site lacked traces of these artefacts and it is likely that this is largely due to the surface being obscured by windblown sand rather than artefacts not being present in these areas. In some areas density of artefacts appears to be higher than other areas but it would be difficult to define individual sites and scatters. All observations made during the site investigations are of the surface as there were no indications that there would be deeply stratified material anywhere on the site (for example caves). It should be noted that associated organic remains were noted with any of the stone scatters.

Figure 6.18 Typical Gravel Pavement context where most Stone Artefacts are found



A few isolated large implements were recovered which resembled sub-classic bifaces which originate from the ESA but the items were very weathered and observations remain equivocal (*Figure 6.19*). One clear biface of a size suggestive of Fauresmith type was recognised (*Figure 6.19*).

Most of the material observed can probably be ascribed to the MSA (*Figure 6.20*), and distinctive flakes were noted some of which were retouched. Two scatters of stone tools with a fresh appearance interpreted as Late Stone Age (LSA) were also observed on site although no distinctive formal LSA implements were recovered or noted (*Figure 6.21).* Three typical lower grindstones were found in close association with these artefacts seeming to confirm our interpretation. No LSA ceramics were observed nor were any organic materials found in association.

The patination and sandblasting on many of the artefacts is consistent with significant vintage. Flakes, blades, chunks and cores make up the majority of the scatters, and retouch was present on some items. The most predominant raw material observed on site was grey quartzite with some fine grained chert.

(1) Early Stone Age: The archaeology of the Stone Age between 700 000 and 2500 000 years ago.
(2) Middle Stone Age: The archaeology of the Stone Age between 20-300 000 years ago associated with early modern humans.
(3) Late Stone Age: The archaeology of the last 20 000 years associated with fully modern people.

Figure 6.19 Bifaces- Sub-classic Handaxes (ESA)

These are uncommon on the site. The biface example at right is fresher in appearance and displays greater workmanship, possibly a Fauresmith type variant. The leftmost two examples are adjudged to be sub-classic handaxes from the ESA period.

Figure 6.20 Middle Stone Age artefacts made primarily on local quartzite

Figure 6.21 Fresh flakes and cores in association with a lower grindstone judged to be LSA artefacts

Graves

No burial graves were observed.

6.12.3 Cultural Heritage & Built Environment

The Olyven Kolk Farm 4 represents very typical landscape characteristics for the wider area. Flat, featureless with scrubby low vegetation and bare patches of gravel pavement, the farm continues to be used for small stock farming. There are two buildings on the site associated with the farm. These are situated north of the railway in close proximity to each other. One is a shed built with corrugated iron, while the other is a small brick dwelling or a labourers cottage (*Figure 6.22*) with a metal sheet roof. Neither of these constitutes features of heritage interest.

Figure 6.22 Shed built with Corrugated Iron (Left) and Labourers Cottage (Right)

The labourer's cottage is not currently inhabited.

Man made features within or in close proximity to the site include, Eskom's Aries sub-station located approximately 400 m from the site, a number of 400kV power lines of which one passes through the site and another borders the site, and the Sishen- Saldanha railway and associated service road. These features are all prominent features in the landscape.

The cultural landscape in the study area may be described as a partially organically-evolved landscape through farming. There are elements of natural vegetation interspersed with grazing land.

7 IMPACTS ON SOILS, HYDROLOGY AND HYDROGEOLOGY

Note: *The Impact Assessment and the proposed mitigation measures outlined in this chapter are based on the original Layout Alternative 1, but the residual impacts after mitigation have been adjusted on the basis of the revised and preferred Final Layout (Alternative 2) as informed by the EIA process.*

This chapter identifies and assesses the potential impacts the proposed Olyven Kolk Farm 4 solar power plant may have on soils, surface- and groundwater. The construction and operation of the project may impact the soils, surface and groundwater in the area and these potential impacts are summarised in *Table 7.1*. It should be noted that there are no permanent surface water bodies on site. Although the site is flat, there are ill-defined, dendritic drainage paths which are discernible mostly by a change in vegetation type. Darker green, more bushy *Rhigozum* sp. tend to inhabit drainage paths areas with the size and density of cover increasing as the soil moisture and soil thickness increases towards the centers of the drainage lines and downstream (see *Chapter 5*). The railway line acts as a cut-off across the site concentrating any surface water flows through the culverts beneath the railway line. For the purpose of this assessment, surface water features refer to the shallow drainage lines found within the site.

Table 7.1 Impact characteristics: Impacts on soils, surface water and groundwater

Summary	Construction	Operation
Project Aspect/ activity	(i) Soil compaction, removal of topsoil and erosion associated with site clearance and preparation, construction of compacted gravel tracks, laydown area etc. (ii) Impact on surface water and groundwater resulting from fuel, oils or cement spills (iii) Increase in sediment load in drainage lines, change of drainage patterns and as a result of filling and presence of workers and erosion.	(i) Soil erosion around cleared areas, roads and at the foot of PV panels. (ii) Reduced wind erosion. (iii) Impact on surface water and groundwater resulting from fuel and oil spills. (iv) Increase of sediment load in drainage channels and surface water bodies as a result of erosion. (v) Reduction of groundwater recharge due to sealed surfaces and PV panels.
Impact Type	Direct	Direct

Summary	Construction	Operation
Receptors Affected	(i) Soils on site underlying construction areas, PV sites, roads etc. (ii) Surface and groundwater quality at or near the site.	(i) Soils in the vicinity of cleared areas or roads and PV sites. (ii) Surface and groundwater quality at or near the site.

7.1 LOSS OF TOPSOIL, SOIL COMPACTION AND EROSION

7.1.1 *Impact Description and Assessment*

Construction Phase Impacts

Preparation of the site for the establishment of PV arrays, underground cables, access road(s), temporary lay-down area and buildings (control and accommodation buildings) during the construction phase will require vegetation clearance, some site levelling and grading and soil compaction.

The area required for the PV array locations, buildings and access tracks linking infrastructure will be considerable. For Site Layout Alternative 1, the total footprint of development will be approximately 150 ha. Internal tracks that are developed around the perimeter of the site and within the site between components of the plant will be up to 5m wide with drainage trenches adjacent to the paths.

Construction on the site could lead to increased erosion by concentrating water flows and removing the natural erosion protection as well as increasing run-off off the site and thus reducing infiltration and groundwater recharge. The vegetation, surficial gravel layer and soil duricrust that is present on site all act as protection against erosion by water and wind. Removal of these by excavation, grading or clearing will encourage erosion. The vegetation cover is the most important physical factor influencing soil erosion. An intact cover reduces impact from rain-drops on the soil, slows down surface run-off, filters sediment and binds the soil together for more stability. The intensity of potential erosion is also influenced by precipitation which is generally low in this semi-arid region between 100 mm and 200 mm per annum.

Run-off within the site occurs over the entire site in the form of sheetwash and there are few short sections of narrow incised channels. Compaction of soils from increased levelling and grading of areas of the site will result in lower permeability and therefore decrease infiltration and increased runoff. Without appropriate measures, runoff from PV panels, compacted areas and hardstanding areas in addition to erosion by wind may increase erosion and increase the sediment load entering the drainage lines. Potential impacts to surface water are assessed further in *Section 7.2.*

In addition, the permanent removal of the topsoil horizon changes the soil profile which may inhibit rehabilitation which may, in turn, increase the erosion potential of the soil.

Soil may be impacted as a result of spills or leaks of fuels and oils and lubricants from construction vehicles. These impacts are dependent on the size of the spill and the speed with which it is addressed and cleaned up. The likelihood of a spill is also associated with the volume of product that may be stored onsite. Typically for a development of this nature, above ground storage tanks for diesel and varying amounts of hydraulic oils, transformer oil and used oils will be required onsite during the construction phase.

Box 7.1 Construction Impact: Loss of topsoil, soil compaction and soil erosion

Nature: The loss of topsoil, changes in the soil profile through compaction, potential soil erosion and contamination will have a **negative direct** impact on the soils of the site.

Impact Magnitude –Medium

- **Extent:** The extent of the impact is **local** since the impacts are predominantly limited to the boundaries of the site but may extend beyond the site where drainage lines pass.
- **Duration:** The duration would be **long-term** since although removal of topsoil and compaction in areas of the site will occur largely during the construction phase, the effect may continue through the project lifecycle.
- **Intensity:** The intensity is **medium** since although topsoil removal and soil compaction may be limited to specific areas of the site, potential erosion may affect a larger area.

Likelihood – It is **likely** that this impact will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-VE)

Degree of Confidence: The degree of confidence is **medium**.

Operational Phase Impacts

Soil erosion caused by stormwater or surface water runoff may occur during the operational phase as a result of additional impervious surfaces onsite such as the gravel compacted roads, car park and the lay down and storage areas used for the construction phase resulting in increased runoff. In addition, although the disturbance associated with the construction phase is over, unless measures are undertaken, loss of topsoil may continue during the operational phase of the project. No topsoil clearing is anticipated during routine operation and maintenance of the facility although effects of wind and could proliferate erosion where vegetation cover particularly where soil has been removed.

Layout Alternative 1 involves the installation of PV arrays and other solar components across the drainage lines both north and south of the railway that passes through the site. Obstructions such as poles supporting the solar structures, building foundations and compacted gravel tracks on site may direct flows and concentrate them to erode gullies or dongas, the depths of which will be dictated by the depth of soil cover present. Flows diverted along tracks and infilled trenches will also result in similar occurrences especially if not orientated along the contours.

Wind erosion is predominantly governed by wind speed and duration and winds are known to be strong in the study area. The PV panels are likely to have a positive impact on wind erosion as they act as wind breaks and therefore the wind will put soil in motion for a smaller distance which will result in less abrasion and less soil erosion.

Soil contamination associated with leaks and spills are reduced during the operation phase since limited on-site storage of fuels will take place and site activities will be reduced.

Box 7.2 Operational Impact: Loss of topsoil, soil compaction and soil erosion

Nature: Routine operational and maintenance activities may result in a **negative direct** impact on the soils of the site whereas PV panels acting as wind breaks result in a **positive direct** impact on soils of the site.

Impact Magnitude –Low

- **Extent:** The extent of the impact is **local;** the impacts are predominantly limited to the site boundaries but may extend to the immediate vicinity of the site.
- **Duration:** The duration would be **long-term** as the soils may be affected at least until the project stops.
- **Intensity:** The intensity is **low** since the impact will be limited to areas that are already disturbed or to areas in close proximity.

Likelihood – It is likely that these impacts will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-VE)

Degree of Confidence: The degree of confidence is **medium**.

Decommissioning

As mentioned in *Chapter 4*, once the Olyven Kolk Farm 4 solar power plant has reached the end of its life (20 years) the solar panels may be refurbished or replaced to continue operating as a power generating facility, or the facility can be closed and decommissioned. If decommissioned, all the components of the solar power plant will be removed and the site would be rehabilitated.

Removal of site equipment including PV arrays, buildings, underground cables and access roads, will induce more disturbance to the site and have a potential for soil contamination as a result of spills or leaks of fuels, oils and lubricants from vehicles or storage tanks if managed inappropriately. This impact would be **negative direct** and the significance would be **minor**.

However, the concrete foundations of the PV array would be removed to below ground level and would be covered with topsoil and be replanted to allow a return to agricultural land use (cultivation and grazing) which will have a **positive direct** impact on the soils on site.

7.1.2 *Mitigating Loss of Topsoil, Soil Compaction and Erosion*

It is possible to mitigate the majority of the potential impacts outlined above in order to contribute to reducing the significance of the residual impacts associated with loss of topsoil, contamination of soil, soil compaction and erosion to an acceptable level.

Proposed mitigation measures are detailed below for each of the project phases and will be further detailed in the Environmental Management Plan (EMP) to ensure mitigation measures are followed.

Design Phase

- Keep open the main drainage lines or hydraulic corridors traversing the site especially immediately below the culvert outlets (at the railway). These need to be wide as the water flow depths are small and widths of the order of 100 m are indicated if the formation of gullies is to be avoided;
- Should the drainage lines not be avoided, maintain adequate breadth and width below panels and supports so as not to trap debris; and
- Where possible, avoid underground cables.

Construction Phase

- Protect disturbed surfaces against erosion;
- Build regular diversion humps in gravel compacted roads;
- Restrict removal of vegetation and soil cover to those areas necessary for the development;
- Implement soil conservation measures such as stockpiling top soil or gravel for remediation of disturbed areas;
- Stockpiles should be vegetated or appropriately covered to reduce soil loss as a result of wind or water to prevent erosion;
- Disturbed areas should be rehabilitated as soon as possible to prevent erosion;
- Work areas should be clearly defined and demarcated, where necessary, to avoid unnecessary disturbance or areas outside the development footprint;
- Fuel, oil and used oil storage areas should have appropriate secondary containment (i.e. bunds);
- Spill containment and clean up kits should be available onsite and clean-up from any spill should be appropriately contained and disposed of;
- Construction vehicles and equipment should be serviced regularly and provided with drip trays, if required; and
- Construction vehicles should remain on designated and prepared compacted gravel roads.

Operational Phase

The following mitigation measures should be implemented during the operational phase:

- Lay down or infrastructure assembly areas which should not be required during the operational phase of the solar power plant should be re-vegetated with indigenous vegetation to prevent erosion;
- Bi-annual monitoring of erosion in the vicinity of roads, PV arrays and other hard-standing surfaces should be conducted before and after the rainy season to ensure erosion sites can be identified early and remedied; and
- Establishing an Environmental Management System to monitor compliance, check quality controls and ensure the EMP is being followed.

Decommissioning Phase

The following mitigation measures should be implemented during the decommissioning phase:

- Work areas should be clearly defined and demarcated, where necessary, to avoid unnecessary disturbance or areas outside the development footprint;
- Fuel, oil and used oil storage areas should have appropriate secondary containment (i.e. bunds);
- Spill containment and clean up kits should be available onsite and clean-up from any spill should be appropriately contained and disposed of; and
- Construction vehicles and equipment should be serviced regularly and provided with drip trays, if required.

7.1.3 Residual Impact

As mentioned in *Chapter 4*, after field surveys, each specialist prepared site sensitivity maps identifying habitats or areas of various sensitivities for each receptor or resource. One of the key mitigation measures recommended by a number of specialists was to avoid disturbance to the drainage lines on site including keeping all solar components, roads, buildings, hard standing areas etc out of the drainage corridors. Based primarily on this constraint, Site Layout Alternative 2 was developed.

The revision of the site layout from Site Layout Alternative 1 to the preferred Final Layout (Alternative 2) and the implementation of the above mitigation will result in a reduction of the impacts to soil and erosion during the construction phase to minor as outlined in *Table 7.2.*

Table 7.2 Pre- and Post-Mitigation Significance: Loss of topsoil, soil compaction and erosion

Phase	**Significance (Pre-mitigation) Site Layout 1**	**Significance (Pre-mitigation) Site Layout 2**	**Residual Impact Significance (Post-mitigation) Layout 2**
Construction	**MODERATE (-VE)**	**MINOR(-VE)**	**MINOR(-VE)**
Operation	**MINOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Decommissioning	**MINOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**

7.2 IMPACT ON SURFACE WATER AND GROUNDWATER

7.2.1 *Impact Description and Assessment*

Construction Phase Impacts

As mentioned in *Section 7.1,* soil compaction and vegetation clearance may increase the intensity and volume of surface water runoff as a result of a decrease in water infiltration recharging the groundwater. This may impact the drainage lines within the site by exacerbating erosion features and increasing the sediment load of the water entering these channels when they are flowing. As the solar arrays are to be constructed across the drainage lines for Site Layout Alternative 1, damage and disturbance to the drainage lines would occur from installation machinery and workers. Solar arrays typically require levelled surfaces for their installation and to install the solar infrastructure across the drainage lines would likely require some filling of the drainage lines which would result in the change of the existing natural drainage pattern on site. In addition, increased run off from hard standing areas could result in blockage of drainage lines and damage to solar infrastructure and installation equipment by debris and flooding, deepening and sidewards erosion of channels, loss of infiltration and an increased risk of flooding downstream.

Groundwater may be impacted as a result of infiltration of contaminants associated with spills or leaks of fuels, oils and lubricants from construction vehicles or storage tanks. These impacts are dependent on the size of the spill and the speed with which it is addressed and cleaned up as well as the vulnerability and susceptibility of the aquifer (least vulnerability (1) and low susceptibility (2)). The likelihood of a spill is also associated with the volume of product that may be stored onsite which is likely to be minimal during the operational phase.

(1) Tendency or likelihood for contaminants to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer.

(2) Qualitative measure of the relative ease with which a groundwater body Can be potentially contaminated by anthropogenic activities and includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification.

Box 7.3 *Construction Impact: Impact on Surface and Groundwater*

Nature: Surface and groundwater impacts resulting from soil compaction, filling of drainage lines, increased sediment load or through leaks or spills would result in a **negative direct** impact.

Impact Magnitude – Medium

- **Extent:** The extent of the impact is **local** since the impacts are limited predominantly to the boundaries of the site or in the vicinity of the site.
- **Duration:** The duration for impacts to the drainage channels would be **permanent** since their natural pattern would be permanently altered. Impacts to water quality from spills would be **short- term** depending on the size or nature of the spill.
- **Intensity:** The intensity is **low** since runoff is expected to be low and the quantity of dangerous goods stored onsite will be relatively small, however the direct impact intensity to the drainage line from disturbance of the natural drainage patterns would be **medium**.

Likelihood – It is likely that this impact will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-VE)

Degree of Confidence: The degree of confidence is **medium**.

Operational Phase Impacts

Soil erosion caused by storm water or surface water runoff may occur during the operational phase and result in an increase in the sediment load of onsite drainage channels. In Site Layout Alternative 1, the solar arrays would be located across/ within the drainage channels. Heavy rainfall could have potentially detrimental effects on the solar infrastructure as it concentrates its flow within the drainage lines. Blocking of the drainage lines would alter natural drainage pattern on site. Obstructions such as foundations and roadways will direct flows and concentrate them to erode gullies or dongas, the depths of which will be dictated by the depth of soil cover present. Similarly, flows diverted along tracks and infilled trenches will also result in similar occurrences especially if not orientated along the contours. These impacts will last the duration of the operational phase.

Surface water and groundwater impacts associated with leaks and spills are reduced during the operation phase since no on-site storage of hydrocarbons will take place and site activities will be reduced.

Due to proposed hard standing areas (lay down areas, building foundations, compacted gravels roads), compacted soil (rows between arrays) and PV panels covering large parts of the site (approximately 435 ha) recharge to groundwater from rainfall is expected to be reduced on site.

Box 7.4 Operational Impact: Impact on Impact on Surface- and Groundwater

Nature: Increased sediment loads in drainage channels, spills and leaks during routine operational and maintenance activities and reduced groundwater recharge may result in a **negative direct** impact on surface- and groundwater.

Impact Magnitude –Low

- **Extent:** The extent of the impact is **local** since the impacts are limited predominantly to the boundaries of the site or in the vicinity of the site.
- **Duration:** The duration for contamination would be **short to long-term** depending on the size of the spill. The duration for increased sediment loads and reduced groundwater recharge would be **long-term**.
- **Intensity:** The intensity is **low** since the size of a spill is likely to be small given the limited volume of product to be stored onsite. Intensity for change in flow during the operation phase and increased sediment load will be **medium** and for reduced groundwater recharge **low** since the natural groundwater recharge from rainfall in the area is low.

Likelihood – It is likely that this impact will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-VE)

Degree of Confidence: The degree of confidence is **medium**.

Decommissioning

Removal of site equipment including PV arrays, buildings, underground cables and access roads, will have a potential for groundwater contamination related to infiltration of contaminants as a result of spills or leaks of fuels, oils and lubricants from construction vehicles or storage tanks if managed inappropriately. This impact would be **negative direct** and the significance would be **minor**.

However, the rehabilitation of the entire site will reduce erosion and therefore decrease sediment loads in surface water courses on site. Groundwater recharge will increase as a result of reduction of sealed surfaces and rehabilitated soils. In general, decommissioning will have a positive direct impact on surface- and groundwater if managed appropriately.

7.2.2 *Mitigating impacts on surface and groundwater*

Design Phase

- Keep open the main drainage lines or hydraulic corridors traversing the site especially immediately below the culvert outlets (at the railway). These need to be wide as the water flow depths are small and widths of the order of 100 m are indicated if the formation of gullies is to be avoided;
- Should the drainage lines not be avoided, maintain adequate breadth and width below panels and supports so as not to trap debris; and
- Where possible, avoid underground cables.

Construction Phase

- Protect disturbed surfaces against erosion;
- Soil stockpiles should be protected from wind or water erosion through placement, vegetation or appropriate covering;
- Proper drainage controls such as culverts, cut-off trenches should be used to ensure proper management of surface water runoff to prevent erosion;
- Cleared or disturbed areas should be rehabilitated as soon as possible to prevent erosion;
- Fuel, oil and used oil storage areas should have appropriate secondary containment (i.e. bunds);
- Spill containment and clean up kits should be available onsite and clean-up from any spill should be appropriately contained and disposed of; and
- Construction vehicles and equipment should be serviced regularly and provided with drip trays, if required.

Operational Phase

The following mitigation measures will be implemented during the operational phase:

- Fuel, oil and used oil storage areas should have appropriate secondary containment (i.e. bunds); and
- Areas disturbed during construction should be re-vegetated with indigenous vegetation to prevent erosion.

Decommissioning Phase

The following mitigation measures should be implemented during the decommissioning phase:

- Work areas should be clearly defined and demarcated, where necessary, to avoid unnecessary disturbance or areas outside the development footprint; Fuel, oil and used oil storage areas should have appropriate secondary containment (i.e. bunds);
- Spill containment and clean up kits should be available onsite and clean-up from any spill should be appropriately contained and disposed of; and
- Construction vehicles and equipment should be serviced regularly and provided with drip trays, if required.

7.2.3 Residual Impact

The drainage lines on site would be strongly impacted by the design layout, Site Layout Alternative 1. The most significant consequence of the revised layout is that it avoids transgressing these drainage lines and allows for a buffer around these drainage lines (see *Figure 4.7*). This will ensure that the drainage lines will not be impacted by construction, operational and decommissioning activities as far as possible. Consequently, flow regime will not be impacted. Taking into consideration the proposed mitigation outlined above the impacts on surface water and waterbodies will be reduced to impacts of minor significance (*Table 7.3*).

Table 7.3 Pre- and Post-Mitigation Significance: Impacts on surface and groundwater

Phase	**Significance (Pre-mitigation) Site Layout 1**	**Significance (Pre-mitigation) Site Layout 2**	**Residual Impact Significance (Post-mitigation) Layout 2)**
Construction	**MODERATE (-VE)**	**MINOR(-VE)**	**MINOR(-VE)**
Operation	**MODERATE (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Decommissioning	**MINOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**

8 *IMPACTS ON FLORA AND FAUNA*

Note: *The Impact Assessment and the proposed mitigation measures outlined in this chapter are based on the original Layout Alternative 1, but the residual impacts after mitigation have been adjusted on the basis of the revised preferred and Final Layout (Alternative 2) as informed by the EIA process.*

This chapter discusses the impact the proposed Olyven Kolk Farm 4 solar power plant may have on flora and fauna (excluding birds) including the destruction, degradation or fragmentation of habitat. The potential impacts are assessed and mitigation measures to reduce the impacts are outlined below in *Table 8.1.* ERM appointed Simon Todd Consulting to undertake an ecological and biodiversity assessment of the Olyven Kolk Farm 4 to establish the current baseline and assess the potential impacts of the development on terrestrial vertebrate fauna and flora. The full findings of this study are included in *Annex F* and are summarised in this chapter.

The ecological and biodiversity sensitivity map of the site is shown in *Figure 5.11* and provides a spatial representation of the sensitive habitats located on the site identified by the Ecological and Biodiversity study. In terms of the distribution of the different ecological sensitivity categories at the site, those areas with deeper soils comprising the lower slopes and bottomlands of the site are classified as *High Sensitivity* and the middle and upper slopes of the site as well as those low-lying areas with a calcrete substrate are classified as *Low* to *Medium Sensitivity*. These areas would be more tolerant of disturbance as there is little soil cover that could be displaced and the risk of erosion would be low. Some of these areas do however contain the highest levels of plant diversity present at the site, including at least two protected species (*Hoodia gordonii* and *Aloe claviflora*).

However, the site in general is of low sensitivity when compared to high-biodiversity-value ecosystems with a high threat status or high levels of endemism. There are no threatened species which occur at the site and the dominant vegetation type, Bushmanland Basin Shrubland, occupies an area of 34 690 km^2, making it one of the most extensive vegetation types within South Africa.

Table 8.1 Impact Characteristics: Impacts on Flora and Fauna (excluding Birds)

Summary	Construction	Operation
Project Aspect/ activity	(i) Loss of vegetation associated with site clearance, road construction, building and solar PV support construction etc. (ii) Potential of disturbance resulting in invasion of alien species. (iii) Erosion of lower slopes and clearing of topsoil (loss of habitat & habitat fragmentation). (iv) Impact on fauna associated with site clearance, road construction, building and solar PV support construction etc (v) Impacts on drainage areas.	(i) Damage to natural vegetation through movement of vehicles and maintenance activities. (ii) Disturbance to fauna associated with the operation of the solar power plant and movement of vehicles.
Impact Type	Direct	Direct
Receptors Affected	(i) Natural vegetation within the site clearance areas. (ii) Fauna on site including amphibians and reptiles.	(i) On-site vegetation (ii)Fauna on the Olyven Kolk Farm 4 .

8.1 DESTRUCTION AND LOSS OF NATURAL VEGETATION

8.1.1 Impact Description and Assessment

Construction Phase Impacts

Clearance of vegetation is required for the establishment of solar infrastructure including for the arrays, buildings (control and accommodation buildings), fencing, perimeter roads/tracks, car parks and storage and lay-down areas resulting in permanent loss of vegetation within the site. For Site Layout 1, the footprint of development will be approximately 340 ha. This includes the solar panels and the necessary space required to be kept between rows to avoid shadow effects from one row to the next one. These rows will remain free from any construction although vegetation in these areas will be cut back to allow movement of vehicles during the construction phase. For Olyven Kolk Farm 4 (40 MW), approximately 80 ha will be required for the total development foot print. Although not all the vegetation between the arrays will be cleared but cut back, significant disturbance and loss is nevertheless likely to occur.

According to Mucina & Rutherford (2006) the entire site falls within a single vegetation type, Bushmanland Basin Scrubland (*Figure 5.9*) and as described in Chapter 5, several different habitats with characteristic plant communities can be discerned at the site including:

- Calcareous Grassland;
- Mixed Rocky Shrubland; and
- Drainage Lines and run-on areas which are characterized by Rhigozum and Lycium Thicket.

Bushmanland Basin Scrubland is not a threatened vegetation type, and the conservation status of this vegetation type is classified as Least Threatened.

The site is already quite fragmented. There is evidence of grazing pressure which can be seen in the form of relatively open grass and herb layers and a network of animal paths through the vegetation. The various characteristic plant communities on site have been classified according to their sensitivity from *Low* to *High Sensitivity* (see *Chapter 4*). The most sensitive habitat to change within the site is the drainage lines. In order to maintain the connectivity of the site and differentiate those areas which receive the bulk of the run-off from the surrounding areas, those areas which receive the bulk of the run-off have been classified as *High Sensitivity*.

Under Site Layout Alternative 1, a significant proportion of the development footprint lies within areas of High and *Medium-High* Sensitivity. This is undesirable given the high risk of negative ecological impact that would be associated with development within these areas. Since a large proportion of the footprint under Layout Alternative 1 lies within areas classified as High Sensitivity, the intensity of the impact of the development on the ecology of the site under Alternative 1 is regarded as high.

Loss of vegetation and the effect on the local ecology would result in long term impacts, as the proposed solar plant would be operational for approximately 20 years. Apart from the direct loss of vegetation, the disturbed areas will be vulnerable to erosion.

Box 8.1 Construction Impact: Destruction and Loss of Natural Vegetation

Nature: The construction phase will require the construction of access roads between the PV arrays as well as the clearing of vegetation for the arrays, buildings and lay-down areas.

Impact Magnitude –Medium- High

- **Extent**: The extent of the impact will be **local** as it impact will be limited to the site and near surroundings. Erosion may however also affect adjacent and downstream areas.
- **Duration**: The duration would be **long-term** as the natural vegetation of the site would be affected at least until the project stops operating.
- **Intensity**: The intensity is **high** as the development will result in the loss of vegetation in affected areas

Likelihood – There is a very **high** likelihood that this impact will occur across the majority of the development footprint.

IMPACT SIGNIFICANCE (PRE-MITIGATION) –MODERATE to MAJOR (-VE)

Degree of Confidence: The degree of confidence is **high**.

8.2 IMPACT ON PROTECTED PLANT SPECIES

8.2.1 Impact Description and Assessment

Construction Phase Impacts

As previously discussed, the site is already quite fragmented with the rocky shrubland community constituting the largest proportion of the site and forms the majority of those areas classified as Moderate Sensitivity. Species of conservation concern such as *Hoodia gordonii* and *Aloe claviflora* were observed in this community. *H.gordonii* is listed as a protected species under National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) as well as provincial legislation, while *A. claviflora* is protected in the Northern Cape Province in terms of the Northern Cape Nature Conservation Act, No. 9 of 2009.

Although it was not possible to thoroughly search the entire development site for these species, the density of plants was observed to be quite low. The construction phase will require the clearing of vegetation in areas which were observed to contain these protected plant species. These species are largely found within the area to the south of the railway line. The local populations of these species will therefore be impacted the removal, destruction or disturbance of these species occur without appropriate mitigation and the necessary permits (see *Section 8.6* below).

Box 8.2 Construction Impact: Impact on Protected Plant Species

Nature The construction phase will require the clearing of vegetation in areas which were observed to contain plant species protected under NEMBA and provincial legislation. The local populations of these species will therefore be impacted unless mitigation measures are implemented.

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Impact Magnitude –Medium

- **Extent**: **Local**, the extent of the impact will be limited to the site.
- **Duration**: The duration of the impact will be long-term as the habitat will be unavailable to these species until the project is decommissioned.
- **Intensity**: Although this would result in the destruction of listed plant species within the affected areas, the number of species and individuals affected is likely to low and so the intensity is seen to be low to medium.

- **Likelihood –** It is **definite** as protected plant species were observed within the development footprint indicating that this impact will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) –MINOR to MODERATE (-VE)

Degree of Confidence: The degree of confidence is **high** since the listed species were observed to occur at the site.

8.3 Erosion Potential

8.3.1 Impact Description and Assessment

Operational Phase Impacts

During the operational phase, human activity and disturbance levels at the site should be relatively low given the low maintenance requirements of the solar arrays. Day to day facility operations will involve both regular on site preventive and corrective maintenance tasks in order to keep the PV plant in optimal working order throughout the operational period. Intermittent cleaning of the panels will be carried out as necessary, although this is not anticipated to be regular.

However after construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. Furthermore, compacted gravel tracks may capture overland flow, concentrating the water from a large area onto the tracks which may cause severe erosion. The panels themselves may also cause erosion as result of the run-off collected from the panels and the impact that the water falling from the lower edge of the panels is likely to make on the ground partially for Site Layout Alternative 1, as the arrays transverse the drainage lines on site. It is therefore important that proper erosion control structures are built and maintained over the lifespan of the project. See *Chapter 7* for a detailed assessment of the impacts of the development on soil.

Box 8.3 Operation Impact: Potential Erosion

Nature Post construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. These impacts are **indirect negative** impacts.

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Impact Magnitude –Medium

- Extent: The extent of the impact will be limited to the **local** as the extent of the impact will be largely limited to the site, but downstream and adjacent areas may be affected
- **Duration**: Should severe erosion occur then the duration of the impact will be **long-term** as such erosion is not easily remedied.
- **Intensity**: The intensity of the impact is likely to be **medium** as there are no steep slopes at the site which would be vulnerable to extensive severe erosion.

- **Likelihood –** Based on the large number of tracks that will be required at the site and the fact that they will probably not be built along the contour, there is a **high** likelihood that some erosion would occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) –MODERATE (-VE)

Degree of Confidence: The degree of confidence is **high**

8.4 IMPACT OF ALIEN PLANT INVASION

8.4.1 Impact Description and Assessment

Operational Phase Impacts

Due to the increased levels of human activity at the site and the relatively large amount of disturbance and bare soil associated with the construction phase of the proposed solar plant ideal conditions for the invasion of alien plants will be created which will leave the site vulnerable to alien plant invasion post construction, during the operation phase. The introduction of alien plants may prevent the natural recovery of the natural vegetation on the site, reducing plant and animal diversity at the site as well as resulting in various other negative ecosystem consequences. Furthermore, the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.

It is likely that alien species will colonise the bare soils created during the construction phase as there is already a high level of alien plant invasion at the site and it will therefore be difficult to keep alien plants out of the disturbed areas.

Box 8.4 Operation Impact: Alien Plant Invasion

Nature The area disturbed and bare ground that is likely to be present at the site after construction will leave the site vulnerable to alien plant invasion. These impacts are **indirect negative** impacts.

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Impact Magnitude –Medium

- **Extent**: **Local**, the extent of the impact will be largely limited to disturbed areas of the site, but adjacent areas may also become affected in invasion is severe.
- **Duration:** Should alien plants become established this would be considered to have a **long-term** impact as these plants would probably persist at the site for years or decades. .
- **Intensity:** The intensity of the impact is likely to be of **low** to **medium** intensity as it is likely that the weedy grasses present at the site will colonise the disturbed areas and reduce the potential extent and severity of alien plant invasion.

- **Likelihood –** Since the development of the site will result in a fairly extensive disturbance, it is highly likely that some alien plant invasion will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR-MODERATE (-VE)

Degree of Confidence: The degree of confidence is **high.**

8.5 IMPACT OF MAINTENANCE ACTIVITIES ON VEGETATION

8.5.1 Impact Description and Assessment

Operational Phase Impacts

During the operational phase, day to day facility operations will involve both regular on site preventive and corrective maintenance tasks in order to keep the PV plant in optimal working order throughout the duration of the operational period. In this regard vegetation may need to be cleared or cutback from around or under the solar arrays during the operation phase to prevent any damage to the solar components. Mechanical means will be employed when clearing or cutting back vegetation and if these activities are not undertaken in the correct manner this could result in loss of vegetation.

Box 8.5 Operational Impact: Impact of maintenance activities on vegetation

Nature: Routine operational and maintenance activities may result in a **negative direct** impact on the natural vegetation of the Olyven Kolk Farm 4.

Impact Magnitude –Low

- **Extent:** The extent of the impact is **on-site** since the impacts are limited to the boundaries of the site.
- **Duration:** The duration would be **long-term** as the flora of the area would be affected at least until the project is decommissioned.
- **Intensity:** The intensity is **low** as vegetation may still be impacted from operational activities, such as disturbance from maintenance vehicles and there may be a fire regime change.

Likelihood – It is **likely** that this impact will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-VE)

Degree of Confidence: The degree of confidence is **medium**.

8.6 MITIGATION MEASURES

8.6.1 Design Phase

Mitigation to minimise the effects of loss of natural vegetation begins at the design phase by avoiding sensitive areas and limiting the disturbance or destruction of vegetation in those areas. This can be achieved at the site by:

- Removing array locations from all areas mapped as *Medium to High* and *High Sensitivity*, or within the drainage lines (see *Figure 5.11*) and ensuring that solar components and construction activities are confined to areas outside of these sensitive areas where possible.

- Before construction commences the development footprint area should be searched for listed plant species (*Hoodia gordonii* and *Aloe claviflora*) by an ecologist or similarly qualified person. All individuals located should be marked and translocated to similar habitat outside the development footprint under the supervision of an ecologist or someone with experience in plant translocation. A permit will be required to relocate listed plant species.

- Avoiding the development of new roads where possible to minimise impact to natural vegetation. Existing access roads should instead be upgraded where possible especially in areas classified as *High Sensitivity* (see *Figure 5.11*).

- Restricting internal gravel compacted roads and underground cabling to previously disturbed lands where possible.

8.6.2 Construction Phase

The following mitigation measures will need to be implemented during the construction phase:

- An Environmental Control Officer (ECO) should be appointed and his/her responsibilities should include monitoring and reporting as well as ensuring that the development takes place within the guidelines provided in this and the other specialist reports.

- Compile a monitoring schedule for the site based on the monitoring recommendations of all specialist reports.

- Areas to be cleared should be clearly demarcated.

- No natural vegetation should be transformed for temporary activities.

- Vegetation should only be cleared when and where absolutely necessary. If possible a vegetative cover should be left in place. It is preferable to mow the vegetation down to the required height than to use other more destructive clearing methods. Cut material should also be left in place or used as a cover to aid rehabilitation of cleared and disturbed areas.

- Where construction vehicles must traverse the site, they must remain on demarcated roads or tracks. If vehicles must leave the road for construction purposes, they should utilize a single track and should not take multiple paths.

- Where construction does not require the clearing of the vegetation, for example for the solar array support structures, then construction should occur by cutting back of vegetation rather than clearing s far as possible.

- If topsoil must be removed, it should be replaced or used as soon as possible elsewhere as it will contain seed of local species which will aid the natural recovery of the vegetation.

- Appropriate erosion control and water diversion structures should be constructed at the same time as the vegetation is cleared so that the loosened soil is not left vulnerable to erosion.

- Any individuals of protected species observed within the development footprint during construction, should be translocated under the supervision of the ECO.

Other general mitigation measures recommended for the site during the construction phase include:

- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.

- The large number of people on site during the construction phase will require that an on-site ablution, sanitation, litter and waste management program is implemented.

8.6.3 Operational Phase

The following mitigation measures will need to be implemented during the operational phase:

- Regular monitoring of the site (minimum of twice annually) for erosion problems is recommended, particularly after large summer thunder storms have been experienced.
- Thus vegetation should not be cleared lower than 30 cm above ground level.
- Any erosion problems observed should be rectified as soon as possible and monitored thereafter to ensure that they do not reoccur.
- All bare areas should be re-vegetated at least with a perennial grass layer of locally occurring species, to bind the soil and limit erosion potential.
- Regular monitoring for alien plants at the site should occur and could be conducted simultaneously with erosion monitoring.
- When alien plants are detected, these should be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur.
- Clearing methods should themselves aim to keep disturbance to a minimum.
- No herbicides to be used at the site.
- Vegetation that needs to be reduced in height should be mowed or brush-cut to an acceptable height, and not to ground level except where necessary. Given that the lower end of the panels will be more than a meter off the ground, this should not be problem across the majority of the site

8.6.4 Residual Impact

Under Site Layout Alternative 1, a significant proportion of the development footprint lies within areas of *High* and *Medium-High* Sensitivity which is undesirable given the high risk of negative ecological impact that would be associated with development within these areas. These areas represent the drainage lines found on-site and buffer a buffer area around the drainage lines. From a species richness perspective, these areas are not significant as plant diversity within these areas is low. Due to the deeper soils and landscape position of these areas, these areas would however be vulnerable to disturbance as this would render them susceptible to erosion. These areas are also important from a functional perspective because they provide cover for larger mammal species and would also serve as movement corridors as mentioned in *Chapter 5*.

Since a large proportion of the footprint under Layout Alternative 1 lies within areas classified as *Medium* to *High* and *High Sensitivity* and the significance of the impact of the development on the vegetation of Alternative 1 would potentially be of **moderate** to **major** significance. The footprint of the Olyven Kolk Farm 4 solar arrays have reduced slightly from Layout Alternative 1 to revised Layout Alternative 2, 435 ha to 357 ha (1) respectively. The most significant consequence of the revised layout is that it avoids transgressing these drainage lines and allows for a buffer around these drainage lines (see *Figure 5.11*).

Under, Alternative 2, the revision of the layout and with the recommended mitigation measures implemented, the impacts of the construction phase of the development on the flora would be significantly reduced and would largely result in **minor** significant impacts, with the exception of the destruction and loss of vegetation which is inherent to a development of this nature which will be **minor** to **moderate**.

During the operational phase, Site Alternative 2 poses a lower risk in terms of soil erosion and alien plant invasion as the revised layout avoids the vulnerable drainage areas and impact significance for these impacts is therefore reduced to **minor** for this alternative.

Table 8.2 Pre- and Post-Mitigation Significance: Impacts to vegetation

Phase	Significance (Pre-mitigation) Site Layout 1	Significance (Pre-mitigation) Site Layout 2	Residual Impact Significance (Post-mitigation) Layout 2)
Construction			
Destruction & Loss of Vegetation	MODERATE – MAJOR (-VE)	MODERATE (-VE)	MINOR- MODERATE (-VE)
Protected Plant Species	MINOR- MODERATE (-VE)	MINOR- MODERATE (-VE)	MINOR (-VE)
Operation			
Erosion Potential	MODERATE (-VE)	MINOR (-VE)	MINOR (-VE)
Alien Plant Invasion	MINOR - MODERATE (-VE)	MINOR (-VE)	MINOR (-VE)
Maintenance impact on vegetation	MINOR (-VE)	MINOR (-VE)	MINOR (-VE)

(1) The areas include spacing between rows of arrays.

8.7 IMPACT ON FAUNA

8.7.1 *Impact Description and Assessment*

Construction Phase Impacts

The potential impacts associated with vegetation loss are closely linked to potential impacts on fauna at the Olyven Kolk Farm 4 since the key determinant of faunal abundance is generally habitat quality. Fauna such as small mammals, reptiles and amphibians are likely to occur at various habitats throughout the site. Much of the site is fragmented and the natural habitat has been transformed for agricultural use, leaving only isolated pockets of natural habitat scattered throughout the site or along drainage lines. These pockets should, therefore, be seen as important to ensure ecological processes remain intact. Construction phase activities that will impact on animal life in the area include:

- Increased human activity and associated noise.
- Possible increase in hunting due to increased numbers of people in the area.
- Increased traffic of trucks and heavy machinery and associated noise.
- Increased noise levels due to construction activities.
- Increased dust levels due to construction activities.
- Stripping of vegetation and soil to clear and level areas for infrastructure
- Increased potential of soil erosion and contamination of soil, which will impact directly on vegetation and soil dwelling organisms, and indirectly on other animals.

These activities would have the combined effect of encouraging animals to move away and destroying or fragmenting habitats. These impacts to fauna can be grouped as follows, and these are assessed in further detail below:

- Disturbance and loss of habitat for fauna
- Poaching/hunting/poisoning
- Loss of landscape connectivity for fauna

<u>Disturbance and Loss of Habitat for Fauna</u>
The construction phase will result in a lot of physical disturbance (human presence, noise from machinery, vegetation clearance, etc) at the site as well as habitat destruction for resident faunal species. This will result in direct mortality for smaller fauna unable to move away from the construction activities and a loss of faunal habitat in general. The small mammal community likely to be impacted are widespread species such as the Four Striped Grass Mouse *Rhabdomys pumilio*, Namaqua Rock Mouse *Micaelamys namaquensis*, Cape Short-tailed Gerbil *Desmodillus auricularis* and Round-eared Elephant Shrew *Macroscelides proboscideus*. The human activity and noise generated by the construction will also frighten most medium and larger fauna such as Caracal *Caracal caracal*, Black-backed Jackal *Canis mesomelas*,

Cape Fox *Vulpes chama* and Aardwolf *Proteles cristatus* away from the area for the duration of construction activities.

Box 8.6 Construction Impact: Disturbance and loss of habitat for fauna

Nature: A significant number of construction workers will be on site during the construction phase posing a **negative direct** impact to some fauna as a result of poaching and hunting of fauna for food or other purpose.

Impact Magnitude –Medium

- **Extent: Local**, the extent of the impact will be limited to the site and near surroundings.
- **Duration:** The duration of the impact will be **short-term** or as along as construction is underway if a phased approach is required
- **Intensity:** As this impact will be concentrated on a few targeted species, the impact on these species could be of **high** intensity.
- **Likelihood –** There is a **high** probability that this would occur in an unregulated situation.

IMPACT SIGNIFICANCE (PRE-MITIGATION) MODERATE (-VE)

Degree of Confidence: Definite. Based on proposed project activities, this impact will occur to a greater or lesser extent.

Poaching/Hunting/ Illegal Collection

A significant number of construction workers will be present on site during the construction phase, posing a risk to fauna as a result of poaching and hunting of fauna for food or other purpose. Vulnerable species would include the Bushmanland Tent Tortoise *Psammobates tentorius verroxii* as well as mammals such as Steenbok *Raphicerus campestris* and hares (*Lepus* spp).

Box 8.7 Construction Impact: Direct faunal impacts due to poaching/hunting/illegal collection

Nature: Construction activities such as increased human activity on site and the proposed locations of the panels would result in a **negative direct** impact on faunal species present.

Impact Magnitude –Medium

- **Extent:** The extent of the impact to fauna is **local** since the impacts on fauna are not restricted to the site boundary.
- **Duration:** The duration would be will be long-term as the effects will remain even after construction
- **Intensity:** The intensity is **medium.**

Likelihood – It is **high** that as there is a very high likelihood that this impact will occur within the PV array areas as well as other areas of infrastructure construction.

IMPACT SIGNIFICANCE (PRE-MITIGATION) MODERATE (-VE)

Degree of Confidence: High. This impact can be assessed with a high degree of certainty.

Operation Phase Impacts

Loss of landscape connectivity for fauna

The site will be contained within a security fence which will restrict animal movement onto and off the site unless suitably sized gaps are provided for animals to move through. It should be noted that the fence is not to be located around the 1,010 ha site will rather the blocks or sections of solar arrays (see *Figure 4.4*) and project infrastructure.

Although the site does not have a very rich faunal community, there may be an interruption of animal movement due to fences and roads. The site is not sufficiently large to support populations or even individuals of larger fauna, with the consequence that any such fauna trapped inside the development will not be to survive or meet other individuals for social or mating purposes. The only antelope which occur at the site are Steenbok *Raphicerus campestris* and Common Duiker *Sylvicapra grimmia*. Aardvark *Orycteropus afer*, Porcupine *Hystrix africaeaustralis* and Bat-Eared Fox *Otocyon megalotis* diggings and burrows were observed at the site, indicting the presence of these species in the area.

Box 8.8 Operation Impact: Loss of landscape connectivity for fauna

Nature: Construction activities such as increased human activity on site and the proposed locations of the panels would result in a **negative direct** impact on faunal species present.

Impact Magnitude –Medium

- **Extent:** The extent of the impact to fauna is **local** since the impacts on fauna are not restricted to the site boundary.
- **Duration:** The duration of the impact will be **long-term** as the effect would persist as long as the fence was in place.
- **Intensity:** Since the presence of the fence would potentially prevent movement of a large proportion of the fauna at the site and could result in mortality of trapped animals, the effect is deemed to have a **high** intensity.

Likelihood – Depending on the construction of the fence, the effect would be **highly** likely under an unfavourable scenario and would not occur if the fence were constructed in manner which allowed the movement of fauna through the site.

IMPACT SIGNIFICANCE (PRE-MITIGATION) MODERATE (-VE)

Degree of Confidence: This effect can be assessed with a **high** degree of confidence, whether it would actually occur or not would however be dependent on the type of fencing that was used.

8.8 MITIGATION MEASURES

Disturbance and Loss of Habitat for Fauna

- The large burrow systems of aardvark, porcupines and other similar medium-sized mammals should not be disturbed or levelled as the animals are likely to be retreated into the burrows during the day time. If such burrows occur within areas that need to be cleared, then this should take place when it is certain that the animals are not within their burrows. The local conservation authorities may be able to assist the project on this front.

- Any slow-moving fauna, such as tortoises or snakes observed at the site during the construction phase should be removed to safety by the ECO.

- In order to reduce collisions of vehicles with fauna, speed limits should apply to all roads and vehicles using the site, a maximum of 30 km/hr is recommended for heavy vehicles. Animals should have right of way.

- All cleared areas which do not need to remain clear of vegetation should be rehabilitated or seeded with local perennial grass species if natural recovery does not take place within a year of being cleared.

Poaching/Hunting/ Illegal Collection

- The staff accommodation should be fenced off and no personnel should be allowed to wander around at the site for any purpose after hours.

- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden.

- Fires should only be allowed within fire-safe demarcated areas.

- No fuel-wood collection should be allowed on-site. As part of the EMP for the site, it should be mandatory for staff of both the developer as well as contractors to attend an environmental briefing and training session with respect to the guidelines outlined in the EMP.

Loss of landscape connectivity for fauna

- Any security or other fencing surrounding the site should be constructed so as to allow the free movement of animals (i.e include animal crossings at appropriate intervals), especially during the construction phase when animals may need to leave the site. Strand fending is highly preferable to mesh fencing in this regard.

- Electrified fencing can cause high mortality of tortoises; therefore no electrified strands should be placed within 20 cm of the ground on any fence within or surrounding the site. Most other animals should be able creep or dig under the electrified strand if it is not less than 20 cm off the ground.

8.8.1 *Residual Impact*

The footprint of the Olyven Kolk Farm 4 solar arrays have reduced slightly from Layout Alternative 1 to revised Layout Alternative 2 as mentioned in

Section 8.6.4. Alternative 2 will therefore result in a reduced habitat loss, but disturbance levels resulting from noise and human activity are likely to be of similar intensity. As a result of the reduced extent of habitat loss and the avoidance of ecologically sensitive areas identified within the site (i.e drainage lines and surroundings), impact significance is reduced to **minor-moderate** under Alternative 2 and with he implementation of mitigation measures outlined above this will be further reduced to **minor**.

Under Alternative Layout 2, the PV arrays are more widely distributed across the site and each section of PV array will be individually fenced off. As a result, the disruption of connectivity should be significantly reduced and the drainage lines which are likely to be important faunal habitat will not be affected. This and the consideration of the suggested mitigation will result in the impacts to fauna associated with the loss of ecosystem connectivity of **minor** significance.

In summary, with the revised, preferred Final Layout (Alternative 2), impact significance ratings will reduce for fauna with the implementation of the revised layout and mitigation measures identified above. The implementation of the mitigation will contribute to reducing the significance of the residual impacts on fauna (reptiles, amphibians and mammals) to **minor** (see *Table 8.3*) during the construction and operation phases.

Table 8.3 Pre- and Post-Mitigation Significance: Impacts on Fauna

Phase	**Significance (Pre-mitigation) Site Layout 1**	**Significance (Pre-mitigation) Site Layout 2**	**Residual Impact Significance (Post-mitigation) Layout 2)**
Construction			
Loss of habitat for fauna	**MODERATE (-VE)**	**MINOR - MODERATE (-VE)**	**MINOR (-VE)**
Direct faunal impacts	**MODERATE (-VE)**	**MODERATE (-VE)**	**MINOR (-VE)**
Operation			
Loss of landscape connectivity	**MODERATE (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**

8.9 IMPACTS TO BATS- HABITAT LOSS – DESTRUCTION, DISTURBANCE AND DISPLACEMENT

8.9.1 Impact Description and Assessment

Construction and Operation Phase Impacts

Although a number of species of bats have distribution ranges which include the site, these are not likely to have roost sites at the site due to the lack of suitable habitat. The site may be used as foraging area for bats. The clearance of natural vegetation during the construction phase may have altered the foraging or roosting habitat available to bat species, resulting in displacement of bats.

Increased noise and dust generated from machinery and other construction activities across the site may impact foraging behaviour of species that forage in open spaces. Given the nature of the terrain and the extent likely to be disturbed, and that bat activity is most prominent at night, impacts related to construction activities are likely to be **negligible**.

Similarly given the nature of the terrain and that Bushmanland Scrub is widespread in South Africa and of low species diversity, the loss of bat foraging habitat during the operational phase will have **negligible** impacts on bats.

Box 8.9 Construction Impact: Habitat Loss – Destruction, Disturbance and Displacement

Nature: Damage and loss of vegetation during site clearance in the construction phase and loss of habitat during the operational phase would result in a **negative direct** impact on bats.

Impact Magnitude – Negligible

- **Extent**: The extent of the impact is limited to **on-site**.
- **Duration**: The duration would be **short-term** (disturbances due to noise and dust) to **long-term** (as bat habitat will be affected until the project stops operating (i.e. over 25 years)).
- **Intensity**: Construction and operational activities will result in a **negligible** intensity impact.

Likelihood – It is **likely** that small areas of foraging habitat will be lost.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – NEGLIGIBLE (-VE)

Degree of Confidence: The degree of confidence is **low** since there is a need for research on bat populations in the study area.

8.9.2 Mitigation of Bat Habitat Loss- Destruction, Disturbance and Displacement

Design Phase

The objective of mitigation is to minimize the impacts on bats and their habitat and to maximize rehabilitation of disturbed areas. Specific measures that can be implemented at the design phase include:

- Keep road development to a minimum and where possible, upgrade existing roads rather than developing new road infrastructure.
- All project infrastructure to avoid drainage lines.

Construction and Operational Phase

- Caution should be taken to ensure construction footprints are kept to an absolute minimum, including storage of materials, stockpiling etc.
- Should any caves be identified on site during pre-construction bat monitoring, a buffer of at least 500 m should be implemented around such as cave, with no development occurring within this buffer zone.

8.9.3 *Residual Impacts*

Taking into consideration the revised layout and the suggest mitigation the residual impacts remain as **negligible**.

Table 8.4 ***Pre- and Post- Mitigation Significance: Habitat loss - Destruction, Disturbance and Displacement***

Phase	**Significance (Pre-mitigation) Site Layout 1**	**Significance (Pre-mitigation) Site Layout 2**	**Residual Impact Significance (Post-mitigation) Layout 2)**
Construction – habitat loss	**NEGLIGIBLE**	**NEGLIGIBLE**	**NEGLIGIBLE**
Operation – habitat loss	**NEGLIGIBLE**	**NEGLIGIBLE**	**NEGLIGIBLE**

9 IMPACT ON BIRDS

***Note:** The Impact Assessment and the proposed mitigation measures outlined in this chapter are based on the original Layout Alternative 1 and the residual impacts after mitigation have been adjusted on the basis of the revised and preferred Final Layout (Alternative 2) which has been informed by the EIA process.*

The potential impacts on birds resulting from the establishment of the Olyven Kolk Farm 4 solar power plant include impacts associated with habitat loss and disturbance or displacement from foraging or nesting areas and mortality due to collisions.

ERM appointed AVISENSE Consulting CC to conduct the specialist avifaunal assessment for the Olyven Kolk Farm 3. The findings of this study are detailed in *Annex G*. The specialist Andrew Jenkins of AVISENSE Consulting CC has previously undertaken a number of bird studies the immediate area of the site, in particular focusing on the Martial Eagle. The impacts on birds of the construction and operational phases of the development are summarised in *Table 9.1* and key sensitive species likely to be impacted are listed in the table. This section identifies appropriate mitigation measures to reduce these impacts.

Table 9.1 Impact characteristics: Impacts on Birds

Summary	**Construction**	**Operation**
Project Aspect/ activity	(i) Disturbance/displacement associated with noise and movement of construction equipment and personnel.Loss of avian habitat through site preparation, road upgrade and establishment of the car park, internal roads/ tracks, buildings (control and accommodation) and lay-down area.	(i) Loss of habitat to space occupied by solar panels, associated infrastructure. and disturbance / displacement associated with routine maintenance work. (ii) Mortality in collisions with solar panels and/or power lines, or by electrocution on new power infrastructure.
Impact Type	Direct	Direct
Receptors Affected	(i) All birds on site; key species: Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics. (ii) Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard and Karoo endemics.	(i) All birds on site; key species: Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard and Karoo endemics. (ii) All birds on site; Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, overflying wetland birds.

9.1 *HABITAT LOSS – DESTRUCTION, DISTURBANCE AND DISPLACEMENT*

9.1.1 *Impact Description and Assessment*

Construction Phase Impacts

Disturbance
Construction activities resulting in increased noise and disturbance (i.e. the presence of personnel and vehicles on site) are likely to cause disturbance of birds in the general surrounds, and especially of shy and/or ground-nesting species resident in the area.

The site is known to include probable nesting sites of Martial Eagle and Lanner Falcon, and may (at least seasonally or sporadically) support numbers of other Red-listed species, and of a suite of localised endemics. The proposed solar power plant is likely to have a limited, detrimental effect on these birds during the construction phase of the development. The Martial Eagle and Lanner Falcon residing in nests on the Eskom power lines will be significantly disturbed by construction activities, primarily from noise and movement of construction equipment and personnel on site, possibly to the extent of breeding failure or even territory abandonment.

Construction activities are likely to result in disturbance and displacement of:

- resident/breeding raptors (especially Martial Eagle and Lanner Falcon) from nesting and/or foraging areas;
- seasonal influxes of large terrestrial birds (especially Ludwig's Bustard and Kori Bustard) from nesting and/or foraging areas; and
- resident/breeding Karoo endemics – possibly including Black-eared Sparrowlark, Sclater's Lark and even Red Lark - by construction and/or operation and/or decommissioning of the facility.

Box 9.1 Construction Impact: Disturbance

Nature: Construction activities will result in disturbance due increased noise and movement of personnel and equipment on site would result in a **negative direct** impact on avifauna of the Olyven Kolk Farm 4 : affecting Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard and Karoo endemics.

Impact Magnitude –Medium-High
- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be **short-term** as this effect will not extend beyond the life of the project.
- **Intensity**: Some threatened species will be severely disturbed, so the magnitude of the change will be **medium-high**.

Likelihood – There is a **high** likelihood birds will be disturbed.

IMPACT SIGNIFICANCE (PRE-MITIGATION) –MODERATE- MAJOR (-VE)

Degree of Confidence: The degree of confidence is **high**

Habitat Loss

It is considered the most significant potential impact on birds of solar energy facilities is the displacement or exclusion of threatened, rare, endemic or range-restricted species from critical areas of habitat. Given the considerable space requirements of commercially viable facilities, this effect could be significant in some instances.

The scale of direct habitat loss resulting from the construction of the Olyven Kolk Farm 4 solar power plant and associated infrastructure depends on the scale of the development and the type of habitat in which it is located. The area of the proposed site is approximately 1,010 ha (10.10 km^2). The footprint of the development will be approximately 340 ha) (less than 30 percent of the site) for Site Layout Alternative 1. For Olyven Kolk Farm 4 (40 MW) Site Layout Alternative 2, approximately 90 ha will be required for the total development foot print (less than 10 percent of the total site. In addition, the presence of the control building and perimeter road within the site and installation of a power line will result around further loss of habitat. However the remaining areas of the site will remain undeveloped.

As described in *Chapter 5*, the habitat on site from an avian perspective is relatively uniform, dominated by open, flat, sandy Karoo veld and is regarded as having limited intrinsic avian biodiversity value. Some habitat destruction and alteration inevitably takes place during site preparation activities and the installation of solar infrastructure, buildings and construction of internal roads, power lines and associated roadways. Species likely to be impacted by direct habitat loss including breeding and foraging areas during the construction phase are the Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard and Karoo endemics.

Box 9.2 Construction Impact: Natural Habitat Loss

Nature: Construction activities resulting in loss of vegetation and habitat would result in a **negative direct** impact on avifauna of the Olyven Kolk Farm 4 site: affecting Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics.

Impact Magnitude – Low-Medium

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be **short-term** as the avian habitat would be altered beyond the completion of construction.
- **Intensity**: Loss of irreplaceable habitat for priority species will be minimal, so the magnitude of the change will be **low-medium**.

Likelihood – There is a **high** likelihood of natural habitat loss during construction.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR- MODERATE (-VE)

Degree of Confidence: The degree of confidence is **high**.

Operational Phase Impacts

Habitat Loss and Disturbance

The space occupied by solar panels and associated infrastructure will result in loss of vegetation and avian habitat for the life of the development. The flat, open landscape of the site and surrounds provide important foraging areas for numerous bird species including Red-list specied such as the Martial Eagle, which occupies a breeding territory approximately centred on the Aries substation. Species likely to be impacted by direct loss of breeding and foraging areas include the Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard and Karoo endemics. These species will be impacted for the duration of the projects development. As previously mentioned, for Site Layout Alternative 1, approximately 340 ha of the entire site, or 33 percent of the site would be affected.

Box 9.3 Operational Impact: Loss of Habitat and Disturbance

Nature: The space occupied by solar panels and associated infrastructure and disturbance or displacement by routine maintenance activities would result in a **negative direct** impact on Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics, to space occupied by solar panels and associated infrastructure.

Impact Magnitude – Medium

- **Extent:** The extent of the impact is **local**, affecting birds outside the development footprint.
- **Duration:** The duration would be **long-term** as the birds would be affected at least until the project stops operating.
- **Intensity:** Some priority species may be displaced for the duration of the project, and there will be some loss of habitat, so the magnitude of the change will be **medium**.

Likelihood – There is a **high** likelihood that some priority species will be disturbed/displaced.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-VE)

Degree of Confidence: The degree of confidence is **medium-high**.

9.1.2 Mitigation of Habitat Loss- Destruction, Disturbance and Displacement

Design Phase

- Exclude development within:
  - A 1 km radius of the Martial Eagle nest site (29º31.546 S, 20º47.935 E).
  - A 500 m radius of the Lanner Falcon nest site (29º31.166 S, 20º49.139 E).

  Ideally, these areas should remain undisturbed and undeveloped. These suggested areas to avoid are shown in *Figure 5.15*. The radii referred to, are working estimates, arrived at purely in terms of the specialists experience of disturbance susceptibility of the two species concerned, and not in terms of any supporting empirical evidence.

Construction Phase

Habitat loss and disturbance can be mitigated in the following ways:

- During the construction phase by on-site demarcation of the buffers identified above and any 'no-go' areas identified during pre-construction monitoring (see *Section 9.3* below). No-go areas will apply particularly to any Bustard, or Black Harrier nest sites that may be identified during pre-construction monitoring.

- Timing construction to avoid sensitive times (e.g. Martial Eagle pre-breeding, incubation and small nestling seasons from March/April to June/July).

- Relocate both the eagle nest structures to more distant pylons (e.g. Jenkins *et al.* 2007) in order to put greater distance between those birds likely to use them and the disturbance sources of the development. This would have to be done outside of the eagle and falcon breeding seasons (i.e. between December/January and February/March, and would involve deconstructing both nests, re-building both in specially designed galvanized steel baskets, and positioning these in the 'waist' area of towers at least three spans (+/- 1 km) further away from the development area. Such an exercise would require the cooperation of Eskom, and the practical assistance of their live-line maintenance team and would require active supervision by an experienced avian specialist at all times. However, if successful it would greatly reduce the potential impact of the proposed solar development, and would have the added benefit of removing the two large eagle nest structures from locations above the conductors on VVV transmission towers (where they could cause streamer-related outages) to safe positions below the conductors [(1)]. There is a good chance that both eagles and falcons will relocate to the new nest structures in the following breeding season, although this cannot be guaranteed.

Operational Phase

- Maintenance activities should be scheduled to avoid disturbances to sensitive areas (identified through operational monitoring) during breeding season. These sensitive areas will apply particularly to any Bustard, Black Harrier nest sites that may be identified during pre-construction monitoring.

(1) This would effectively improve Eskom's quality of supply to customers, and reduce associated maintenance costs (Jenkins et al. 2007).

- Carefully monitoring the local avifauna pre- and post-construction (see *Section 8.3* below), and implementing appropriate additional mitigation as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the priority species listed in this report, or when collision or electrocution mortalities are recorded for any of the priority species listed in this report.

- Ensuring that the results of pre-construction monitoring are applied to project-specific impact mitigation in a way that allows for the potential cumulative effects on the local/regional avifauna of any other solar energy projects proposed for this area. Viewed in isolation, each of these projects may pose only a limited threat to the avifauna of the area. However, in combination they may result in significant losses of habitat for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with new infrastructure.

Following findings of the proposed monitoring schedule, as set out in *Section 9.3* below, additional mitigation might need to be considered. Discussions between the project developer/operator and bird specialist would need to be undertaken to consider other feasible and practicable mitigation measures.

9.1.3 Residual Impact

The revision of the of Site Layout Alternative 1 to the preferred Final Layout (Site Layout Alternative 2) has taken into consideration the recommended buffer zones of around the Martial Eagle and Lanner Falcon nests. Creating a buffer around these nests and in combination with the suggested mitigation measures above will significantly reduce the magnitude and significance of the impacts to birds during both the construction and operational phase as outlined in *Table 9.2*.

In summary, the implementation of the above mitigation measures would contribute towards ensuring that the significance of habitat loss, disturbance and displacement impacts to birds during the construction phase is reduced to **minor**.

Table 9.2 Pre- and Post- Mitigation Significance: Habitat loss - Destruction, Disturbance and Displacement

Phase	Significance (Pre-mitigation) Site Layout 1	Significance (Pre-mitigation) Site Layout 2	Residual Impact Significance (Post-mitigation) Layout 2)
Construction – Habitat Loss	MINOR - MODERATE (-VE)	MINOR(-VE)	MINOR(-VE)
Construction – Disturbance	MODERATE-MAJOR (-VE)	MINOR -MODERATE (-VE)	MINOR (-VE)
Operation-Displacement	MINOR (-VE)	MINOR (-VE)	MINOR (-VE)

9.2 *COLLISION OR ELECTROCUTION OF BIRDS WITH POWER LINES*

Operational Phase Impacts

The solar plant, once constructed, may impact on bird populations in the area by contributing to bird mortality through birds colliding with power lines or associated pylons or electrocution.

Based on the current constraints on site, the solar power plant will consist of two sections for Site Layout Alternative 1, one north of the Sishen –Saldanha railway line and one south. These will be connected either by an overhead line or by an underground cable, using the existing culverts if possible. In addition, the electricity generated will be fed into the national grid at the Eskom Aries Substation which borders the site to the west via overhead lines. The interconnection line will have a maximum voltage of up to 132kV and there is a possibility that a second line will be required.

There will be increased risk of collision any new power lines installed for threatened large terrestrial birds (Ludwig's Bustard, Kori Bustard). Ludwig's Bustard is prone to erratic influxes to areas of the Karoo, apparently in response to past rainfall, but these factors are not well understood (Allan, 1994). In addition, injury or mortality of wetland birds (especially flamingos) using possible flight lines in and out of resource areas in the broader vicinity, in collisions with the PV infrastructure or associated new power lines. However, the expected frequency of the impacts and the intensity of those impacts can be regarded as medium for the following reasons:

- No large water bodies are situated near the proposed site (the Rooiberg Dam, which apparently sometimes supports numbers of flamingo, is located about 40 km to the north-east of the proposed development site, which is not considered to be close enough to the site to increase the impact intensity beyond medium).

- The proposed solar power plant is located in an area of homogeneous and not particularly bird-rich habitat (although levels of endemism are high), and distant from any established national Important Bird Area (IBA)

- The power line corridors that will link up with the existing transmission network will be relatively short (approximately 400 m).

Perching birds such as Martial Eagle and Lanner Falcons could be electrocuted on the new power lines and it is therefore important to deter them from perching on the structures. Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004b, Lehman *et al.* 2007). Electrocution risk is strongly influenced by the voltage and design of the power lines erected (generally occurring on lower voltage infrastructure where air gaps are relatively small), and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energized components.

It should be noted there are a number of existing power lines found in the vicinity of the site, with the Aries- Kronos power line transversing the site itself and there is existing evidence of bird collisions with power lines; a Kori Bustard power line collision victim was found under the Aries-Helios Power line during the site visit. The additional power line(s) associated with the proposed Olyven Kolk Farm 4 project will increase the risk of collision and electrocutions.

Box 9.4 Operational Impact: Collisions and Mortality

Nature: Operational activities through electrocution and collisions would result in a **negative direct** impact on the avifauna of the Olyven Kolk Farm 4.

Impact Magnitude – Medium

- **Extent:** The extent of the impact is **local**.
- **Duration:** The duration would be **long-term** as the birds of the area would be affected until the project stops operating (i.e. over 25 years).
- **Intensity:** Some of individuals of threatened species may be killed in collision/electrocution incidents, so the intensity will be **medium-high**.
- **Likelihood –** There is a **medium** likelihood that some individuals of priority species will be killed

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-VE)

Degree of Confidence: The degree of confidence is **medium**.

9.2.2 Mitigation

Design Phase

- Minimizing the length of any new power lines installed, and ensuring that all new lines are marked with bird flight diverters– either static or dynamic markers, generally fitted to the upper, earth wire in most power line configurations (Jenkins *et al.* 2010), and that all new power infrastructure is adequately insulated and bird friendly in configuration (Lehman *et al.* 2007). Note that current understanding of power line collision risk in birds precludes any guarantee of successfully distinguishing high risk from medium or low risk sections of a new line (Jenkins *et al.* 2010). The relatively low cost of marking the entire length of a new line during construction, especially quite a short length of line in an area frequented by collision prone birds, more than offsets the risk of not marking the correct sections, causing unnecessary mortality of birds, and then incurring the much greater cost of retro-fitting the line post-construction. In situations where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line.

Operational Phase

- Carefully monitoring the local avifauna pre- and post-construction (see *Section 9.3* below), and implementing appropriate additional mitigation as when collision or electrocution mortalities are recorded for any of the priority species listed in *Chapter 5*.

- Ensuring that the results of pre-construction monitoring are applied to project-specific impact mitigation in a way that allows for the potential cumulative effects on the local/regional avifauna of any other solar energy projects proposed for this area. Viewed in isolation, each of these projects may pose only a limited threat to the avifauna of the area. However, in combination they may result in significant losses of habitat for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with new infrastructure.

- Following findings of the proposed monitoring schedule, as set out in *Section 9.3* below, additional mitigation might need to be considered. Discussions between the project developer/operator and bird specialist would need to be undertaken to consider other feasible and practicable mitigation measures.

9.2.3 *Residual Impacts*

The revision of the of Site Layout Alternative 1 to the preferred Final Layout (Alternative 2) will not have any implications on the impact ratings. However, the implementation of the above mitigation measures would contribute towards ensuring that the significance of collisions and electrocution impacts to birds during the operation phase is reduced to **minor** as outlined in *Table 9.2*

Table 9.3 Pre- and Post- Mitigation Significance: Habitat loss - Destruction, Disturbance and Displacement

Phase	Significance (Pre-mitigation) Site Layout 1	Significance (Pre-mitigation) Site Layout 2	Residual Impact Significance (Post-mitigation) Layout 2)
Operation-Mortality	**MODERATE (-VE)**	**MODERATE (-VE)**	**MINOR (-VE)**

9.3 *MONITORING REQUIREMENTS*

Given that solar energy development is new to South Africa, and its potential impacts on birds are generally not well understood, it is recommended that attention be given to improving this understanding by initiating quantitative studies of the avifauna at proposed sites both pre- and post-construction.

The primary aims of this monitoring programme would be to:

- Determine the densities of birds resident within the impact area of the solar power plant before construction of the plant, and afterwards, once the plant, or phases of the plant, become operational.

- Document patterns of bird activity and movements in the vicinity of the proposed solar power plant before construction, and afterwards, once the plant is operational.

- Register and as far as possible document the circumstances surrounding all avian mortalities associated with the solar power plant and its ancillary infrastructure for at least a full calendar year after the plant becomes operational.

- Register and as far as possible document the circumstances surrounding all other avian interactions with the solar arrays of the solar power plant for at least a full calendar year after the plant becomes operational.

Bird density and activity monitoring should focus on rare and/or endemic, potentially disturbance or collision prone species, which occur with some regularity in the area.

Recommended monitoring protocols can be found in the Avifauna Specialist Study Report contained in *Annex G*. These provide details for monitoring the following:

- Avian densities before and after (every two months over the six months preceding construction, and at least once every two months over the same calendar period, at least six months after the PV plant is commissioned);
- Bird activity monitoring;
- Bird flight behaviour and activities around solar arrays;
- Monitoring of avian collisions;
- Monitoring of avian collisions: Assessing search efficiency and scavenging rates; and
- Monitoring of collisions: Collision victim surveys.

Failing the institution of a structured and formalised general monitoring effort (as outlined above and detailed in *Annex G*), at the very least a specialist ornithologist should periodically monitor activities at both of the key raptor nests, immediately preceding, during and after construction.

10 VISUAL IMPACT ASSESSMENT

Note: *The Impact Assessment and the proposed mitigation measures outlined in this chapter are based on the original Layout Alternative 1, but the residual impacts after mitigation have been adjusted on the basis of the revised preferred and Final Layout (Alternative 2) as informed by the EIA process.*

ERM appointed Visual Resources Management to conduct the specialist visual impact assessment for the proposed Olyven Kolk Farm 4 solar power plant. The findings of this study are detailed in *Annex I* and are summarised in this chapter.

This section considers the effects that the proposed Olyven Kolk Farm 4 solar power plant will have on the visual environment and characteristic features and on the people who view it. The potential visual impacts are summarised in *Table 10.1.*

Table 10.1 Impact characteristics: Visual Impacts

Summary	**Construction**	**Operation**
Project Aspect/ activity	Construction of the solar plant	Operation of the solar plant
Impact Type	Direct negative	Direct negative
Stakeholders/ Receptors Affected	Fixed receptors, Affected landowners, neighbouring land owners, road users, visitors to the area.	Affected landowners, neighbouring land owners, road users, visitors to the area.

10.1 INVENTORY PHASE- BASELINE

The potential visual impacts of the Olyven Kolk Farm 4 solar power plant are determined using a series of quantitative and qualitative criteria. These are described and in some cases ranked to determine both the expected level and significance of the visual impacts. These include:

- Site landscape character;
- Visual exposure;
- Receptor sensitivity;
- Key observation points; and
- Scenic quality.

Each of these aspects is summarized below. Further detail is provided in *Annex I.*

10.1.1 Site Landscape Character

Landscape character is defined by the U.K Institute of Environmental Management and Assessment (IEMA) as the '*distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is* *perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement*.' It creates the specific sense of place or essential character and 'spirit of the place'.

The vegetation at the Olyven Kolk Farm 4 site is characteristic of a typical Nama Karoo biome where the dominant vegetation is a grassy, dwarf shrubland. The general landuse of the area is for agricultural purposes and Kenhardt is considered the heart of the Dorper sheep-farming area. Hills to the south of Kenhardt contain the Quiver Tree Forest National Monument which is made up of 4000 – 5000 Quiver Trees.

The topography is characteristically flat to slightly undulating plains. Sporadic hills to the south of Kenhardt create some topographical relief. There is a large flat salt pan (Verneukpan) to the south and granite metamorphic outcrops in the area. 'The Bushmanland Basin, which the site falls into, forms an environment for a number of ephemeral pans and extensive systems of intermittent river channels. Approximately four km to the south of the Olyven Kolk Farm 4 site there are a number of large ephemeral waterbodies (pans) which may hold water at certain times of the year, during and immediately after the rains.

The following broad brush landscapes were defined within the greater Kenhardt district:

- Non perennial rivers and drainage lines;
- Disturbed context. E.g. Eskom Aries Substation;
- Railway line and access road; and
- Arid agricultural grazing landscape.

The various natural and modified landscapes of the wider areas and within the site are set out in *Figure 10.1* below. See *Annex I* for larger images.

The site is currently used for agricultural grazing and is crossed by intermittent tracks and fences. To the north of the property is a gravel district farm road connecting the R27 with the R358 to Pofadder. There are some isolated farmsteads on this road as well as the Eskom Aries Substation. The different components of modified landscape found in the vicinity of the site are a gravel airstrip, a railway line and service road, an Eskom substation including its associated power lines and a lattice communication tower.

The landscape of the site and surrounds which is relatively flat with shallow drainage lines running in a south to north direction as shown in *Figure 10.2* and the area to the east of the Sishen- Saldanha railway is more undulating. The slope across the site is shallow with topographical elevations across the site ranging from approximately 960 to 930m amsl.

Figure 10.1 Landscape character: Regional Landscape Character (top left), Existing visual context in terms of vegetation (top right), Existing Visual Context of the modified landscape (bottom left) and Site modifications (bottom right)

Figure 1: View of existing vegetation *(GPS 015)*

Figure 2: View of existing arid gravel soil, sparse grass clumps and sporadic tree clumps *(GPS 012)*

Figure 1: View towards Kenhardt and Quiver Forest *(GPS 009)*

Figure 2: View of regional sense of place *(GPS 018)*

Figure 1: View SSE of old quarry *(GPS 025)*

Figure 2: View towards Aeries showing existing structure on site in amongst trees *(GPS 026)*

Figure 3: Zoom of existing structure on site *(GPS 026)*

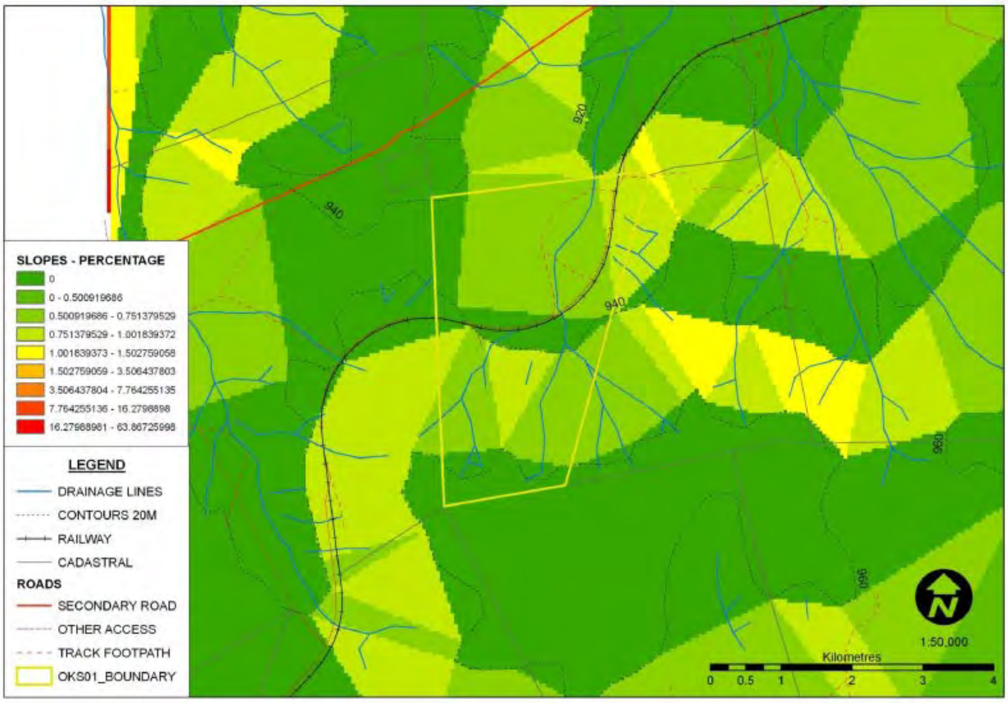
Figure 1: Existing site entrance gate looking towards Aeries sub-station *(GPS 023)*

Figure 2: Existing indusitial infrastructure (GPS 14)

Figure 3: Aries sub-station (GPS 013)

There are sporadic existing landscape modifications in the area which reflects previous and existing agricultural activities, including farm labourers cottages, disused dwellings, farm tracks, as well as railway lines, existing overhead power lines, sub-station and lattice mast.

Figure 10.2 *Slope Analysis Map*



10.1.2 *Scenic Quality*

Scenic quality is a measure of the visual appeal of a tract of land and comprises a number of elements:

- Landform;
- Vegetation;
- Water;
- Colour;
- Scarcity;
- Adjacent Landuse; and
- Cultural Modifications.

Two key landscape types were identified as dry river beds/ drainage lines and Arid Nama Karoo biome. These landscapes are then rated from 1 – 5 with the higher values being the most valued. Three categories of scenic quality are provided based on the apparent scenic quality.

Table 10.2 Scenic Quality Rating Critera

SCENIC QUALITY RATING CRITERA	
A - High	19 or more
B - Medium	12 - 18
C - Low	11 or less

Table 10.3 Landscape Types and Scenic Quality Rating

LANDSCAPE AREAS (PRU)	LANDFORM	VEGETATION	WATER	COLOUR	ADJACENT SCENERY	SCARCITY	CULTURAL MODIFICATION	TOTAL	SCENIC QUALITY RATING
Dry river beds/ drainage lines	1	4	3	3	2	4	0	17	**B**
Arid Nama Karoo biome	1	1	0	2	3	1	0	9	**C**

(A= score of ≥19; B = score of 12 – 18, C= score of ≤11)

The scenic quality of the site was defined as **Moderate** to **Low** due to the uniformity of the landscape. Adjacent scenic value is **Low** due to the presence of the Aries substation and the power lines which cut through the property. The scarcity value of the dry river beds / drainage lines is due to the High and Medium to High ecological ratings for these areas from the Ecology Impact assessment (Simon Todd Consulting).

10.1.3 Viewshed Analysis

A viewshed analysis was undertaken for both of the Alternatives taking 3 m as the proposed height of the PV structure and as seen in *Figure 10.3* the viewshed is similar for both alternatives. The viewshed is fairly widely dispersed within the two km high visibility buffer area except for the southern extent where views will be contained by slightly elevated terrain. Within the 5 km foreground / middle ground zone the viewshed is broadly linear in spatial distribution aligning to a NE to SW direction. In both instances the viewshed could be rated **medium** in extent.

10.1.4 Visual Exposure

Exposure or visual impact tends to diminish exponentially with distance. The area where a landscape modification starts to influence the landscape character is termed the Zone of Visual Influence (ZVI) and is defined as the *'area within which a proposed development may have an influence or effect on visual amenity (of the surrounding areas).'*

Figure 10.4 sets out the criteria used to determine the level of exposure to receptors. It is clear that the solar panels will be moderately visible from the agricultural farm buildings at a distance of 3.5 km from the site and will be highly visible within 2 km from the site.

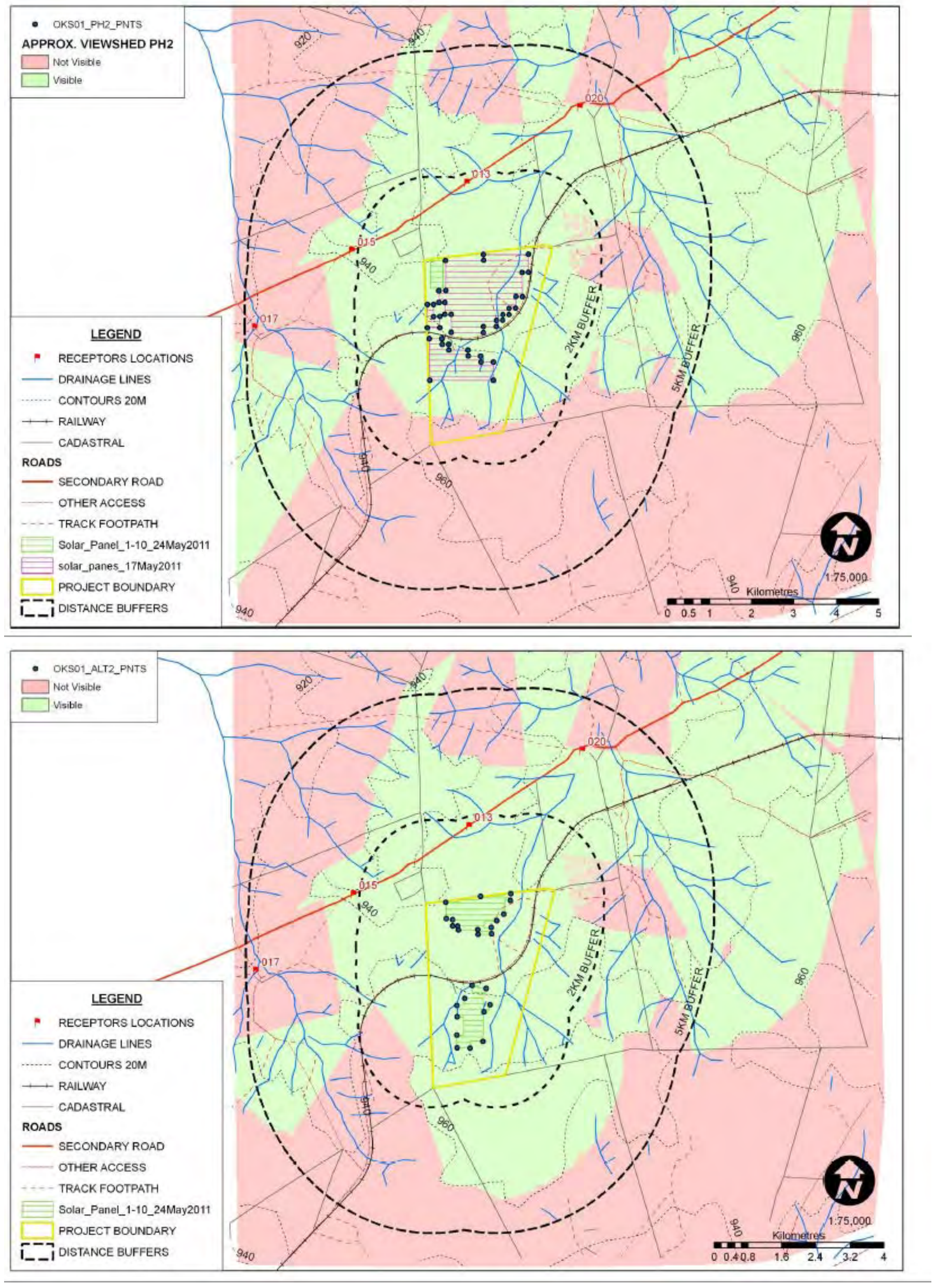
Table 10.4 Criteria for determining level of exposure

Receptor Communities	Solar Panels		Power Lines	
	Approx Distance (km)	Rating	Approx Distance (km))	Rating
Agricultural Farm buildings	3.5 km	M	5.5 km	M
Gravel District Road (Eastbound)	1.8 km	H	1 km	H
Gravel District Road (Westbound)	1.7 km	H	1 km	H
Agricultural Farmstead to the west of the site	4.3 km	M	4.3 km	M
Aries Substation	0.1 km	H	0.1 km	H

Visual Exposure Rating Criteria:

- High: Dominant or clearly noticeable (<2km)
- Moderate: Recognisable to the viewer (2 – 6km)
- Low: Minimally visible areas in the landscape (>6km)

Figure 10.3 Viewshed Analysis: Layout 1 (top), 190 MW Layout (bottom)



See Annex I for larger images.

10.1.5 *Receptor Sensitivity*

The following receptors were identified as being sensitive to the proposed development as they are located in the viewshed of the proposed component landscape modifications:

- Agricultural Farmstead (east of site);
- District Farm Road; and

- Agricultural Farmstead (west of site).

The criteria used to assess the sensitivity of each receptor is contained in the Visual Impact Assessment Specialist Report in *Annex J*. Sensitivity is ranked as L = Low, M = Moderate, H = High.

The overall sensitivity of the receptors would be **Low** due to the limited use of the views of the project site and the strong existing visual associations of the Aries Substation and transmission lines.

10.1.6 Key Observation Points

Key observation points are defined as *'the people located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed'.* The key observation points identified are listed in *Box 10.1* and the view towards the site from each of these points is shown in *Figure 10.4*.

Box 10.1 Key Observation Points

The following communities were identified as significant in terms of their proximity to the proposed landscape modifications:

1. Agricultural Farm buildings
2. District Farm Road
3. Agricultural Farmstead

Figure 10.4 Key Observation Points from the Olyven Kolk Farm

Existing view south to south east towards the site from the gravel road travelling west (GPS 13)

Modified view

For illustrative purposes

10.2 *IMPACT ASSESSMENT PHASE*

The suitability of landscape modification is assessed by measuring the degree of contrast of the proposed landscape modification with the existing landscape. This is done by evaluating the level of change to the existing landscape in terms of the line, colour, texture and form in relation the visual objectives defined for the area.

The Visual Impact Assessment Specialist Report provided in *Annex I* has a detailed outline of the methodology used to define the degree of contrast or rate of impact significance. The assessment examines the contrast rating for the Key Observation Points (KOP)identified in *Section 10.1.6*.

1. Agricultural Farm buildings
2. District Farm Road
3. Agricultural Farmstead

For each of these KOP's the key landscape features of the site were considered, dry river beds/ drainage lines and Arid Nama Karoo biome.

The other criteria used in the assessment include:

- **Scenic Quality** – see *Section 10.1.2;*

- **Sensitivity**- see *Section 10.1.5;*

- **VRM Class Objective** (1) - the steps involved in the classification process are:
    - Outlining and numerical evaluation of scenic quality;
    - Outlining of visual sensitivity levels;
    - Delineating distance zones;
    - Overlaying the scenic quality, sensitivity levels and distance zones using a matrix to develop visual resource inventory classes;
    - Adjusting the inventory to meet the landscape goals and designating VRM management classes with objectives for each class through the planning process.

- **Degree of Contrast**- contrast rating criteria for assessment of visual intrusion:

    - *None* - The element contrast is not visible or perceived.
    - *Weak* - The element contrast can be seen but does not attract attention.

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(1) Class I is assigned to those areas where a management or specialist decision has been made to maintain a natural landscape. The Class II objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low but should not attract the attention of the casual observer. The Class III objective is to partially retain the existing character of the landscape where the level of change to the characteristic landscape should be moderate and may attract attention but should not dominate the view of the casual observer. The Class IV objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high.

- *Moderate* - The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- *Strong* - The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

This has been combined with the ERM methodology to determine impact significance ratings.

10.2.1 Impact Description and Assessment- Site Layout 1

Construction and Operational Phase Impacts

Based on the criteria set out in *Section 10.2* and detailed in *Annex I*, the table below shows the contrast ratings for Site Layout 1.

Table 10.5 VRM contrast ratings for Site Layout 1

IMPACT SUMMARY SHEET		VRM			
KOP	**PRU Area**	**Scenic Quality**	**Sensitivity**	**VRM Class Objective**	**Degree of Contrast**
1	Dry river beds/ drainage lines	**B**	H	II	M
	Arid Nama Karoo biome	**C**	L	III	W
2	Dry river beds/ drainage lines	**B**	H	II	M
	Arid Nama Karoo biome	**C**	L	III	W
3	Dry river beds/ drainage lines	**B**	H	II	M
	Arid Nama Karoo biome	**C**	L	III	W

There are limited views of the site, however from an aesthetic perspective there is merit in design which takes the landscape into consideration. The landscape character of the site is defined by the topography with the washes and dry river beds being important ecological areas. As such it is recommended that development within these would **not meet the Class II visual objectives** to retain the existing character of the landscape. The level of change to the characteristic landscape would not be **low.**

Due to the low levels of scenic quality of the area as a result of the Aries substation and associated power lines, in conjunction with the limited visual resource drivers, there are no tourism related activities in the area. For Site Layout Alternative 1, the significance of the direct impacts on the biophysical environment would be **Major** as development would take place in the dry river beds which are identified as having a high ecological sensitivity. However, the surrounding communities would be able to adapt with relative ease and maintain pre-impact livelihoods and therefore impact significance is **Moderate** to **Major**.

Box.10.2 Construction and Operation Impact: Visual Impact of Site Layout 1

Nature: **Direct negative** impact with a potential for cumulative impacts from other similar projects which would be located around the Aries substation.

Impact Magnitude –High

- **Extent:** The extent is **Local** as the zone of visual influence would extend approximately two km around the site. There is potential for further cumulative impacts associated with development in dry river bed areas.
- **Duration:** The visual impacts would be **Long term** and continue for the life of the project but would cease should the project be decommissioned and the area rehabilitated back to agricultural land use.
- **Intensity:** The intensity of the direct impacts on the Biophysical Environment would be **High** as development would take place in the dry river beds which are identified as having a high ecological sensitivity. The intensity of the indirect visual impacts on the surrounding receptors is Low as the surrounding communities would be able to adapt with relative ease and maintain pre-impact livelihoods. Due to the low levels of scenic quality of the area as a result of the Aries substation and associated power lines, in conjunction with the limited visual resource drivers, there are no tourism related activities in the area. The overall intensity would be **Medium to High**.

Likelihood – As the impact would be to the aesthetics of the area associated with the direct impact on the biodiversity of the dry river areas, the impact will be **Definite**.

IMPACT SIGNIFICANCE (PRE-MITIGATION) –MAJOR (-VE)

Degree of Confidence: The degree of confidence is **HIGH**.

10.2.2 Mitigation Measures

- Redesign the proposed site footprint to ensure that the footprint does not intrude into Class 2 areas which have been highlighted as sensitive.

Construction Mitigation measures

- The clearing of vegetation should as much as possible be limited so as to reduce dust;
- On the areas that are cleared, dust prevention measures need to be implemented during construction to reduce visual impacts associated with dust;
- Fencing needs to be limited to only surrounding the specific sites where the PV panels are to be located and not constructed around the whole property;
- Agricultural land use should be retained on the remaining property so as to retain the agricultural sense of place;
- The construction camp, if required, should be located on an area that will eventually be constructed;
- A litter fence needs to be erected around the construction fence to reduce windblown litter;

- Littering needs to be a punishable offence; and
- The structures need to be simple in design and form in order to blend with the surrounding agricultural setting.

Operation Mitigation measures

- As much as possible, natural vegetation needs to be retained between the PV panel rows to reduce the effects of windblown dust; and
- Littering needs to be a punishable offence.

10.2.3 Impact Description and Assessment- Site Layout 2

Construction and Operational Phase Impacts

The implementation of the above design mitigation measures have resulted in the revised Layout Alternative 2. The proposed footprint of Site Layout Alternative 2, does not intrude into Class 2 areas which have been highlighted as sensitive.

For Site Layout Alternative2, on the criteria set out in *Section 10.2* and detailed in *Annex I*, the table below shows the contrast ratings for Site Layout 2.

Table 10.6 VRM contrast ratings for Site Layout 2

IMPACT SUMMARY SHEET		**VRM**			
KOP	**PRU Area**	**Scenic Quality**	**Sensitivity**	**VRM Class Objective**	**Degree of Contrast**
1	Dry river beds/ drainage lines	**B**	H	II	M
	Arid Nama Karoo biome	**C**	L	III	W
2	Dry river beds/ drainage lines	**B**	H	II	M
	Arid Nama Karoo biome	**C**	L	III	W
3	Dry river beds/ drainage lines	**B**	H	II	M
	Arid Nama Karoo biome	**C**	L	III	W

As previously mention, the mitigated layout does take the dry river bed areas into consideration and the development is located within the **Class III** areas. As such the Class III objectives are met with mitigation (dust control) as the proposed landscape modifications would partially retain the existing character of the landscape where the level of change to the characteristic landscape would be **moderate**. Given that the surrounding landscape context is strongly associated with the Aries substation and associated transmission lines, it is likely that the development may attract attention but would not dominate the view of the casual observer.

Impact significance for Site Layout Alternative 2 is predicted to be Minor as detailed in *Box 10.3*.

Box 10.3 ***Construction and Operation Impact: Visual Impact of Site Layout 2***

Nature: **Neutral**.

Impact Magnitude: Low

- **Extent:** The extent is **Local** as the zone of visual influence would extend approximately two kilometres around the site. There is potential for further cumulative impacts associated with development in dry river bed areas.
- **Duration:** The visual impacts would be **Long term** and continue for the life of the project but would cease should the project be decommissioned and the area rehabilitated back to agricultural land use.
- **Intensity:** The intensity of the direct impacts on the Biophysical Environment would be **Moderate** as development would not take place in the dry river beds which are identified as having a high ecological sensitivity. The intensity of the indirect visual impacts on the surrounding receptors is Low as the surrounding communities would be able to adapt with relative ease and maintain pre-impact livelihoods. Due to the low levels of scenic quality of the area as a result of the Aries substation and associated power lines, in conjunction with the limited visual resource drivers, there are no tourism related activities in the area. The overall intensity would be **Medium to Low**.

Likelihood – As the impact would be to the aesthetics of the area associated with the direct impact on the biodiversity of the dry river areas, the impact will be **Definite**.

IMPACT SIGNIFICANCE (PRE-MITIGATION) –MINOR (-VE)

Degree of Confidence: The degree of confidence is **HIGH**.

10.3 RESIDUAL IMPACTS

The bulk of the design phase mitigation measures have been incorporated into the revised site layout, Final Layout (Alternative 2). With the revised, preferred Final Layout (Alternative 2), impact significance ratings will reduce with the implementation of the revised layout and mitigation measures identified above. The implementation of the mitigation will contribute to reducing the significance of the residual impacts on the visual environment on to **minor** (see *Table 10.7*).

Table 10.7 ***Pre- and Post-Mitigation Significance: Visual Impact***

Phase	**Significance (Pre-mitigation) Site Layout 1**	**Significance (Pre-mitigation) Site Layout 2**	**Residual Impact Significance (Post-mitigation) Layout 2**
Construction Phase Visual Impact	**MAJOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Operational Phase Visual Impact	**MAJOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**

11 ARCHAEOLOGY, PALAEONTOLOGY AND CULTURAL HERITAGE IMPACTS

Note: *The Impact Assessment and the proposed mitigation measures outlined in this chapter are based on the original Layout Alternative 1, but the residual impacts after mitigation have been adjusted on the basis of the revised and preferred Final Layout (Alternative 2) as informed by the EIA process.*

ERM appointed ACO Associates cc to conduct a heritage impact assessment, as part of the EIA process for the proposed Olyven Kolk Farm 4 solar power plant. The findings of this study are detailed in *Annex H* and summarized in this chapter. This chapter discusses the potential impacts on archaeology, palaeontology and cultural heritage resources resulting from the establishment of the solar power plant on the Olyven Kolk Farm 4. The potential impacts are assessed and mitigation measures to reduce the impacts are outlined below.

Features of archaeological interest found at the site include scatters of stone artefacts dating from the Early Stone Age (ESA) (1), Middle Stone Age (MSA) (2) and Late Stone Age (LSA). These were found extensively on gravel pavements across the site. No burial graves were observed during the site visit. Two buildings are found on site, a shed and a labourer's cottage, neither of which constitutes a feature of heritage interest. Therefore, sense of place impacts related to features of cultural heritage are not anticipated to be of significance and are therefore not assessed in this chapter but are assessed in *Chapter 10, Landscape and Visual Impacts*.

Table 11.1 Impact characteristics: Impacts on Archaeology, Palaeontology and Cultural Heritage

Summary	Construction	Operation
Project Aspect/ activity	(i) Disturbance of or damage to archaeological, cultural heritage sites or palaeontology resources associated with site preparation and construction activities.	N/A
Impact Type	Direct	N/A

(1) Early Stone Age: The archaeology of the Stone Age between 700 000 and 2500 000 years ago.
(2) Middle Stone Age: The archaeology of the Stone Age between 20-300 000 years ago associated with early modern humans.

Summary	Construction	Operation
Receptors Affected	(i) Archaeological and cultural heritage interests within site clearance areas. (ii) On-site fossils.	N/A

11.1 DISTURBANCE OR DAMAGE TO ARCHAEOLOGY, PALAEONTOLOGY AND CULTURAL HERITAGE

11.1.1 *Impact Description and Assessment*

Construction Phase Impact

During site preparation works a number of project activities are likely to have the potential to interfere with archaeological and palaeontological resources present within the site boundary. These include, levelling and grading of areas where the array will be sited although the extent of levelling is likely to be minimal given the flat nature of the terrain on the site. Additional site levelling is required in preparation for the car park, temporary laydown and storage areas. In addition, trenching activities required for drainage and cable routes and the installation of array structures into the ground have the potential to impact features of archaeological and palaeontological interest.

Palaeontology
The impacts of the development on paleontological heritage will generally occur only in the construction phase. They stem from the disturbance, destruction or sealing-in of fossil material preserved at or beneath the ground surface. The Palaeozoic bedrocks as well as the superficial sediments (alluvium, wind-blown sands) within the Olyven Kolk Farm 4 are considered to be of low sensitivity.

The construction of a solar power plant requires minimal intrusive works and excavations of potentially fossiliferous bedrocks. Given this and since the palaeontological sensitivity of the rock units within the site is generally low, the area affected by intrusive construction activities is relatively small the magnitude of the impact is expected to be low. In addition it is not expected that the trenches required will not be deep enough to intersect with any major fossil bearing sediments.

Box 11.1 Construction Impact: Destruction or Disturbance of Palaeontology

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Nature: Site preparation activities associated with the development have the potential to have a direct negative impact on paleontological finds if these occur in the affected areas.

Impact Magnitude – Low

- **Extent:** The extent of the impact is **on-site**.
- **Duration:** The duration would be **permanent** if fossils are encountered and destroyed.
- **Intensity: Low**.

Likelihood – There is **unlikely** that this impact will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-VE)

Degree of Confidence: The degree of confidence is **MEDIUM**.

Archaeology

Scatters of Stone Age artefacts were recorded across the site on gravel pavements. These scatters have the potential to be impacted by construction activities including the movement of vehicles or presence of personnel on site. In general, the stone scatters are considered to be of minor importance or value and are probably not in their original context. The scatters observed on site are not associated with organic remains such as bone, which could provide valuable information on prehistoric lifeways and therefore merit these more importance of value.

Construction activities likely to impact the sites archaeological features (surface clearing, trenching for cables, array structure frames, buildings, car park and laydown areas) will be limited to a relatively small area of the site and the remainder of the site will remain relatively undisturbed and it is considered that the impact of disturbance of stone age material in the affected zones is sustainable.

Box 1.1 Construction Impact: Destruction or Disturbance of Archaeology

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Nature: Construction activities would result in a **negative direct** impact on archaeological interests on the solar plant site.

Impact Magnitude – Low

- **Extent**: The extent of the impact is **on-site.**
- **Duration**: The duration would be **permanent** as these resources are non-renewable and once destroyed, they can not be replaced.
- **Intensity**: Destruction or disturbance of archaeological resources will be of **negligible** intensity.

Likelihood – There is a **definite** likelihood that localised archaeological resources would be lost should the solar power plant be constructed on the Olyven Kolk Farm 4.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-VE)

Degree of Confidence: The degree of confidence is **medium to high**.

11.1.2 *Mitigating for Damage or Destruction of Archaeological and Paleontological Resources*

The objective of mitigation is to minimise impacts on archaeological and paleontological resources and ensure opportunities to identify such resources are maximised.

Design Phase

- Palaeontological fossils preserved within alluvial sediments will be largely safeguarded by avoiding the drainage areas on site.

Construction Phase

- Should any human burials, archaeological or palaeontological materials (fossils; bones; artefacts; cultural Material such as historic glass, ceramics, etc; sub-surface structures, graves etc) be uncovered or exposed during earthworks or excavations, they must immediately be reported to the South African Heritage Resources Agency (SAHRA). After assessment and if appropriate a permit must be obtained from the SAHRA or HNC to remove such remains.

11.1.3 *Residual Impact*

Should the mitigation measures listed above be undertaken upon finds of palaeontological interest (fossils, bones, artefacts etc.), impacts will be considered **positive** as the finds will be documented and data can be added to existing scientific data of the region. In addition, Site Layout Alternative 2 avoids the drainage lines and therefore palaeontological fossils preserved within alluvial sediments will be largely safeguarded.

The archaeological features of the site are not regarded as sensitive and it is expected that construction activities will result in minor impacts to the archaeological features of the site (see *Table 11.1*). It is inevitable that features of archaeological interest may be disturbed during construction activities give the extensive number of artefacts across the site and therefore the impact significance remains as **minor**, regardless of implementation of recommended mitigation measures.

Table 11.1 ***Pre- and Post-Mitigation Significance: Damage or destruction to Archaeological and Paleontological Resources***

Phase	Significance (Pre-mitigation) Site Layout 1	Significance (Pre-mitigation) Site Layout 2	Residual Impact Significance (Post-mitigation) Layout 2)
Construction - Palaeontology	MINOR (-VE)	MINOR (+VE)	MINOR (+VE)
Construction – Archaeology	MINOR (-VE)	MINOR (-VE)	MINOR (-VE)

12 SOCIO-ECONOMIC IMPACTS

12.1 BENEFITS FOR THE LOCAL ECONOMY

12.1.1 *Impact Description and Assessment*

The development of the proposed Olyven Kolk Farm 4 solar power plant will result in increased spending in South Africa thus having a positive impact on the national, regional and local economy to varying degrees. Direct impacts such as employment and procurement associated with the project will have the most significant impact when compared to other indirect and induced economic impacts. The direct impacts will be most significant during the construction phase of the project, and are likely to have the largest influence on the local economy.

Table 12.1 Impact Characteristics: Benefits for the Local Economy

Summary	Construction	Operation
Project Aspect/ activity	Employment and Procurement of local contractors/workers.	Employment and Procurement of local contractors/workers.
Impact Type	Direct, indirect and induced positive impact.	Direct, indirect and induced positive impact.
Stakeholders/ Receptors Affected	Local community, Local Municipality, suppliers throughout South Africa and Directly Affected Landowner.	Local community, Local Municipality, suppliers throughout South Africa and Directly Affected Landowner.

Construction Phase Impacts

Employment and training

The capital investment required for the 190 MW solar power plant is approximately R6.5 billion (if built to this capacity). The construction phase will be approximately six to eight months for every 10 MW. It is estimated that for the construction phase activities, an average of 60 site construction jobs will be created for a 10 MW block of the facility (thus approximately 300 jobs could be created for the facility as it is established over time). Of these jobs, approximately 20 to 30 percent of the jobs will require highly skilled personnel; the remainder will comprise semi-skilled and unskilled workers.

Unemployment is high (29 percent) in the Project Area and in Kenhardt. There is a high dependency by the community on government grants (approximately 95 percent). This is attributed to the general lack of employment opportunities and lack of public transportation services in the area. It is intended that Rotifield and its contractors will source the majority of the semi-skilled and unskilled workers from the local municipal area with the remainder being sourced regionally. The benefit to the local economy, however, will be for the short-term (i.e. for the duration of the construction phase).

During the site preparation phase, semi- skilled and unskilled persons will be employed from the local community. The jobs in this phase will include site security, manual labour, civil works, transportation of goods and services.

The construction phase will create opportunities for 'on-the-job' training for the local people. Rotifield plans to bring in a highly-skilled team of solar energy technicians from overseas who will be providing training to a number of potential employees, preferably from the regional area, thus increasing the general skills levels in the local area.

Procurement

During the construction phase the specialised industrial machinery and building construction sectors will derive the greatest benefits. Local procurement will primarily benefit the civil engineering, construction, hospitality and service industries. The highly specialised nature of the machinery required for the Project will require that the majority of the technical components be imported from specialist suppliers. The renewable energy sector is still developing in South Africa and as such the appropriate supplies and service providers are not available in the country; this may, however, change over time. The majority of the project spend will be on PV panels which will be imported, the balance of plant (buildings, substations etc) will be sourced in South Africa.

Indirect and induced benefits

The project will lead to increased spending in the local economy resulting from increased levels of disposable income and demand for additional services (e.g. retail shops and restaurants). This in turn will generate indirect and induced job opportunities.

Box 12.1 Construction Impact: Local Economy (including Procurement and Employment)

Nature: The benefit to the local economy will be **direct** via employment and procurement of services

Impact Magnitude – medium

- **Extent:** Employment and procurement of services will be created for South African's at a **local, provincial and national** level depending on skills and capacity availability.
- **Duration:** Employment and procurement will be generated during the construction phase and will therefore be **short-term**.
- **Intensity:** The intensity will be **medium** as the employment numbers at the site during the construction period are anticipated to be 60 per 10 MW and there will be some increase in procurement of goods and services in the local area during the construction phase.

Likelihood – This impact will **definitely** occur.

IMPACT SIGNIFICANCE (PRE-ENHANCEMENT) – MODERATE POSITIVE

Degree of Confidence: The degree of confidence is **medium** given that actual figures are not yet available due to the early stage of this project.

Operational Phase Impacts

Direct employment

Operation of the Solar Power Farm will largely be automated with routine scheduled services and maintenance. The operations team will comprise of between three to four full time jobs for every 10 MW (or between 24 and 30 jobs for a 75 MW facility). It is estimated that half of the operations team will be semi-skilled and unskilled labour and therefore potentially sourced locally. Approximately two of the staff for 10 MW (approximately 14 for the 75 MW) will be highly skilled; the majority of jobs will include security, groundskeeper, panel cleaners and infrastructure maintenance.

Much of the knowledge regarding operations and maintenance will be acquired 'on-the-job'. It is envisaged that operations personnel will be increasingly trained up and qualified to high levels over the operational period, consistent with demonstrated capability and ambition.

Direct procurement

Similar to the construction phase, the majority of goods and services will be highly specialised and technical in nature with the majority of operational expenditure being imported. Locally procured services will include maintenance work for balance of plant facilities, 24 hour security and cleaning resulting in an ongoing investment injection. Over time, as businesses develop locally to meet the needs of the renewables sector, levels of procurement may increase.

Indirect and induced benefits

Apart from the direct benefits resulting from the operational spend and direct jobs created, the spending of those employed directly would result in a positive indirect impact on the local and regional economy.

The potential for the proposed Project and other future projects to result in greater impacts on local economies and the South African economy as a whole is primarily dependent on economies of scale. Initially import content will be high. If the sector grows in size, however, it should provide opportunities for growth of the local supply chain and the additional benefits that would flow from this. The introduction of a large-scale renewable energy programme could provide local economic opportunities for component manufacturers. Rotifield will also look into establishing a community development fund from which the community will benefit.

Box 12.2 Operational Impact: Local Economy (including Procurement and Employment)

Nature: The benefit to the local economy will be **direct** via employment and procurement of services and **indirect** and induced via the spend in the local economy due to increased wages; local supply chain etc.

Impact Magnitude – Low
- **Extent:** Employment and procurement of service will be created for South African's at a **local, provincial and national** level depending on skills and capacity availability.
- **Duration:** Employment and procurement of services will be generated during the operational phase over a period of 20 years and will therefore be **long-term**.
- **Intensity:** The intensity will be **low** given the relatively small number of employees and procurement spend during the operation phase.

Likelihood – This impact will **definitely** occur.

IMPACT SIGNIFICANCE (PRE-ENHANCEMENT) – MINOR POSITIVE

Degree of Confidence: The degree of confidence is **medium** given that actual figures are not yet available due to the early stage of this project.

12.1.2 Enhancement Mitigation

The objective of enhancement is to optimise opportunities for employment and procurement of local labour and services, wherever possible, or alternatively that procurement at a regional or national level should take place.

<u>Employment and procurement</u>
It is important to recognise that the nature of the project dictates that large proportions of specialist materials and some specialist skills will have to come from outside of South Africa (and/or outside the province) with a high portion of international imports. However, the objective of enhancement is to optimise opportunities for employment/procurement of local people/suppliers or alternatively that employment and procurement opportunities are enhanced on a regional or national basis, where possible.

The following measures will be implemented to ensure that employment of local people is maximised and procurement of local, regional and national services are maximised:

- Rotifield will establish a recruitment and procurement policy which sets reasonable targets for the employment of South African and local residents/suppliers (originating from the local municipality) and promote the employment of women as a means of ensuring that gender equality is attained. Criteria will be set for prioritising, where possible, local (local municipal) residents/suppliers over regional or national people/suppliers. All contractors will be required to recruit and procure in terms of Rotifield's recruitment and procurement policy.

- Rotifieldwill work closely with relevant local authorities, community representatives and organisations to ensure that the use of local labour and procurement is maximised. This may include:
    - liaison with the local labour office (1) to advertise employment opportunities as part of the local recruitment drive;
    - sourcing and using available databases on skills/employment-seekers that local authorities may have;
    - advertising job opportunities and criteria for skills and experience needed through local and national media; and
    - conducting an assessment of capacity within the Local Municipality and South Africa to supply goods and services over the operational lifetime of the project.

- No employment will take place at the entrance to the site. Only formal channels for employment will be used.

- Advertise experience, quality and volume requirements for the supply chain needs.

- Rotifield to work closely with the suppliers to provide the requisite training to the workers. The training provided will focus on development of local skills.

- Ensure that the appointed project contractors and suppliers have access to Health, Safety, Environmental and Quality training as required by the Project. This will help to ensure that they have future opportunities to provide goods and services to the sector.

Community Development:

- Rotifield should explore ways to enhance local community benefits with a focus on broad-based BEE through mechanisms such as a community development fund. At this preliminary stage, and in accordance with the relevant BEE legislation and guidelines, up to four percent of after tax profit could be used for community development over and above that associated with expenditure in the area.

  The BEE Scorecard specifies the following contributions (totalling four percent):
    - enterprise development – max of 15 points for contribution of three percent of after tax profit or more; and
    - socio-economic development – max of 5 points for contribution of one percent of after tax profit or more.

(1) Labour Office: There is no labour office in the area; however, a satellite office comes to the area once a month to assist the local community with its employment related queries.

- Community investment activities will be identified in collaboration with the local Municipality and community representatives to ensure alignment with the key needs identified through the Integrated Development Planning process.

- All projects will be aligned with Rotifield's policies.

12.1.3 Residual Impact

The implementation of the above measures would ensure that the construction and operation impacts remain of minor positive significance. The pre- and post- enhancement impacts are compared in *Table 12.2*.

Table 12.2 Pre- and Post- Enhancement Significance: Local Economy (including Procurement and Employment)

Phase	**Significance (Pre-enhancement)**	**Residual Impact Significance**
Construction	**MODERATE positive**	**MODERATE positive**
Operation	**MINOR positive**	**MINOR positive**

12.2 INCREASED SOCIAL ILLS

12.2.1 Impact Description and Assessment

Table 12.3 Impact Characteristics: Increased Social Ills

Summary	**Construction**
Project Aspect/ activity	Temporary worker camp on site
Impact Type	Direct, negative impact
Stakeholders/ Receptors Affected	Specifically landowners of directly affected neighbouring farms.

Construction Phase Impacts

The Project area is located outside of town in an area predominantly characterised by agricultural activities. The population density of the immediate area is low; Kenhardt, the closest community, is located approximately 44 km from the site. Beside the distance, there is a general lack of public transportation services as well as a lack of accommodation in the town.

Rotifield will require accommodation for approximately 60 to 80 people per 10 MW and 200 for the entire project. The project is considering accommodating construction workers in Kenhardt and using shuttle buses transport workers to and from the site. An alternative option is to construct a temporary construction workers camp at the site. The worker camp will lead to a dramatic increase in the population of an area that has an extremely small population.

One of the four neighbouring landowner's resides on his farm; raised concerns about the presence of worker camps in the area. His main concern was based on the fact that livestock on these farms are generally left unattended. This may potentially lead to social ills, such as livestock theft and petty crimes may be increased if a construction camp is built on the site.

The two social ills that may occur as a result of the increased number of workers are described below.

- **Theft of livestock** is already problematic on farms located close to roads (R27) and in areas where construction work is taking place. It is likely that stock theft will continue and possibly increase during the construction phase.

- **Petty crimes** (e.g. theft of tools, household items and farm materials) on the project affected farm and neighbouring farms could occur.

Box 12.3 Construction Impact: Increased Social Ills

Nature: The social ills likely to accompany the Project would be regarded as an **indirect, negative** impact.

Impact Magnitude – Medium
- **Extent:** It is anticipated that the potential social ills will have impacts at the **local** scale.
- **Duration:** The worker camp will be on site for the duration of construction and it is expected to be **short-term**.
- **Intensity:** The intensity will be **low** as people should be able to adapt with relative ease.

Likelihood – This impact is **likely** to occur during the construction phase; one landowner has highlighted that stock theft already occurs and is likely to increase with the presence of a construction camp.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE NEGATIVE

Degree of Confidence: The degree of confidence is **medium.**

12.2.2 Mitigation

The objectives of mitigation are:

- to limit, where possible, social ills brought about by the construction and operation of the Solar Power Farm; and
- to ensure that Contractors manage their workers in such a way that the impacts on local communities are limited.

Specific measures include:

- Rotifield and the appointed contractors to develop an induction programme, including a Code of Conduct, for all workers (Rotifield and contractors including their workers) directly related to the project. A copy of the Code of Conduct to be presented to all workers and signed by each person.

- The Code of Conduct must address the following aspects:
    - respect for local residents;
    - respect for farm infrastructure and agricultural activities;
    - no hunting or unauthorised taking of products or livestock;
    - zero tolerance of illegal activities by construction personnel including: unlicensed prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting;
    - compliance with the Traffic Management Plan and all road regulations; and
    - description of disciplinary measures for infringement of the Code and company rules.

- If workers are found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, they will face disciplinary procedures that could result in dismissal. Stock theft should be noted as a dismissible offence.

- Rotifield will implement a grievance procedure that is easily accessible to neighbouring farmers and other stakeholders, through which complaints related to contractor or employee behaviour can be lodged and responded to. Rotifield will respond to all such complaints. Key steps of the grievance mechanism include:
    - circulation of contact details of 'grievance officer' or other key contact;
    - awareness raising among local communities (including all directly affected and neighbouring farmers) regarding the grievance procedure and how it works; and
    - establishment of a grievance register to be updated by Rotifield, including all responses and response times.

- The construction workers (from outside the area) should be allowed to return home over the weekends or on a regular basis to visit their families; the contractor should make the necessary arrangement to facilitate these visits.

12.2.3 Residual Impact

The implementation of the above mitigation measures would reduce the construction impacts from moderate to minor significance. The pre- and post-mitigation impacts are compared in *Table 12.4*.

Table 12.4 Pre- and Post- Mitigation Significance: Increased Social Ills

Phase	**Significance (Pre-mitigation)**	**Residual Impact Significance**
Construction	**MODERATE negative**	**MINOR negative**

12.3 LOSS OF AGRICULTURAL LAND

12.3.1 Impact Description and Assessment

Table 12.5 Impact Characteristics: Loss of Agricultural Land

Summary	Construction and Operation
Project Aspect/ activity	Land take for the construction and operation of facility.
Impact Type	Direct, negative impact.
Stakeholders/ Receptors Affected	Directly affected landowner, Local, Provincial and National Government.

Construction and Operation Phase Impacts

At present, there are three relevant pieces of legislation that apply to the change of land use; they are the Land Use and Planning Ordinance (1) (Ordinance 15 of 1985) (LUPO), the Northern Cape Planning and Development Act No 7 of 1998 and the Subdivision of Agricultural Land Act No 70 of 1970. The Department of Environmental Affairs and Development Planning has published amendments to LUPO. The proposed amendments provide that a consent use in Agriculture Zone 1 may be obtained for renewable energy structures. Numerous development parameters for renewable energy structures are included in the proposed amendments, making provision for height, setback, finishing and colour, lighting, advertising, noise and any associated noise pollution (2). The proposed amendments must be read with environmental legislation, including any laws relating to the rehabilitation of land, land clearing, soil erosion and habitat impact and provide for the restoration of land during the decommissioning process. The Department intends to finalise the amendments in September 2011 (3).

In addition to the amendments to LUPO, an intergovernmental meeting was held in October 2010 by the Department of Energy and National Department of Agriculture Forestry and Fisheries (DAFF) and the South African Wind Energy Association to discuss guidelines for the regulation of renewable energy farm's uptake of agricultural land (4). The new draft guidelines state that no renewable energy facility structures, footprint, service area, supporting infrastructure or access routes in any form or for any purpose will be allowed:

- On high potential or unique agricultural land as has been determined or identified by DAFF or the relevant provincial Department of Agriculture

(1) LUPO is used by three provinces Western Cape Northern Cape and Eastern Cape on Local Municipal level. On May 21st an updated Ordinance was published in the Western Cape Provincial Gazette for public comment.
(2) http://www.legalbrief.co.za/article.php?story=20110726104904758
(3) http://www.legalbrief.co.za/article.php?story=20110726104904758
(4) Comments received from Department of Agriculture in the Western Cape, 2010

through its existing or future developed spatial information data sets and/or through a detail agricultural potential survey.

- On areas currently being cultivated (cultivated fields/ production areas) or on fields that have been cultivated in the last ten years. This is relevant to cultivated land utilised for dry land production as well as land under any form of irrigation.

- To intervene with or impact negatively on existing or planned production areas (including grazing land) as well as agricultural infrastructure (silos, irrigation lines, pivot points, channels, feeding structures, dip tanks, grazing camps, animal housing, farm roads etc).

- To result in a degradation of the natural resource base of the farm or surrounding areas. This include, but are not limited to, the limit of soil degradation or soil loss through erosion or any manner of soil degradation, the degradation of water resources (both quality and quantity) and the degradation of vegetation (composition and condition of both natural or established vegetation.

The construction and operation of the proposed renewable energy facility will require that approximately 15 percent of the identified land parcel will be taken for the construction and operation of the renewable energy facility. Rotifield plans to buy the farm from the landowner for the development and its related infrastructure.

Even though agricultural land will be lost to the project, the area where the project site is located is regarded as an area of low quality soil and cannot sustain any agricultural activities beyond a low level of grazing. The carrying capacity of the entire site is about 200-250 goats/sheep as it is currently being used.

Box 12.4 Construction and Operation Impact: Loss of Agricultural Land

Nature: The impact on agricultural land is going to be experienced as a **direct, negative** impact.

Impact Magnitude – Low
- **Extent:** The impact on agricultural land resulting from the construction and operation activities will occur at the **local** level.
- **Duration:** This impact will occur for the duration of the construction and operation phases and will therefore be **long-term**.
- **Intensity:** The intensity will be **low** as limited agricultural land will be lost and the affected land is of low productive capacity.

Likelihood – This impact will **definitely** occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR NEGATIVE

Degree of Confidence: The degree of confidence is **high.**

12.3.2 *Mitigation*

The objective of mitigation is to minimise the loss of agricultural land resulting from project related activities during construction and operational phases.

Specific measures include:

- Rotifield to minimise the damage to farmland caused by construction activities by ensuring strict compliance with construction plans to minimise the development footprint and to implement a 'Code of Conduct' governing workers.

- Rotifield to design the infrastructure layout in a manner that limits the project footprint and allow for continued grazing on the land.

- Rotifield's Community Development Fund will seek to increase the extent of farming or the intensity of farming practice in order to counter the effects of agricultural land loss.

- Rotifield to minimise the damage caused by construction activities to the farmland by ensuring strict compliance with construction plans and worker 'Code of Conduct'.

- Any damage to vegetation will be rehabilitated in accordance with mitigation proposed for the rehabilitation of natural vegetation in *Chapter 8*.

12.3.3 *Residual Impact*

The implementation of the above mitigation measures would ensure that the construction and operation phase impacts are reduced from minor to negligible significance. The pre- and post-mitigation impacts are compared in *Table 12.6*.

Table 12.6 Pre- and Post- Mitigation Significance: Loss of Agricultural Land

Phase: Construction & Operation	**Significance (Pre-mitigation)**	**Residual Impact Significance**
Affected Landowner	**MINOR negative**	**NEGLIGIBLE**

12.4 *UNMET STAKEHOLDER EXPECTATIONS*

12.4.1 *Impact Description and Assessment*

Table 12.7 Impact Characteristics: Unmet Stakeholder Expectations

Summary	**Construction**	**Operation**
Project Aspect/ activity	Construction and operation of a PV project.	

Summary	Construction	Operation
Impact Type	Indirect, negative impact	
Stakeholders/ Receptors Affected	Local communities, local businesses and local government	

Construction and Operation Phase Impacts

During stakeholder consultation it was clear that there are high expectations around economic benefits (employment and procurement) and community development associated with the Project.

Many of the stakeholder expectations will be met through routine Project related activities (e.g. employment, procurement and skills development). Other expectations will be met through the community development fund. It is however possible that the expectations may exceed the benefits delivered.

There is likely to be disappointment and potential anger and resentment if these expectations are not met. Unmet expectations that are not actively managed by Rotifield could have a negative impact on stakeholder relations. As such all grievances raised need to be addressed as per the process outlined in the grievance mechanism.

13 OTHER IMPACTS

13.1 TRAFFIC

13.1.1 Impact Description and Assessment

This section considers the impacts to traffic and road users during the construction and operation of the Olyven Kolk Farm 4 solar power plant.

Table 1.1 Impact Characteristics: Traffic

Summary	Construction	Operation
Project Aspect/ activity	Delivery of PV components and construction equipment. Delivery of concrete. Construction personnel commuting to and from site.	Operational personnel commuting to and from site. Delivery of replacement PV components.
Impact Type	Direct negative	Direct negative
Stakeholders/ Receptors Affected	Road users. Affected landowners.	Road users. Affected landowners.

Construction Phase Impacts

During the construction phase of the solar power plant, there will be an increase in vehicle movement to and from the site. This has the potential to impact on traffic along the final transport route and on the site.

The increase in traffic could create noise, dust (1) and safety impacts for other road users and people living or working within close proximity to the roads on the selected transport route. In addition, the increased volume of traffic along the transport route will increase the wear and tear on these roads and possibly lead to deterioration in road conditions. As mentioned in *Chapter 4*, the PV, electrical and structure equipments will be procured in South Africa where available, or from an international manufacturer when sourcing from within the country is not possible. It is expected that these components will be delivered to site via road in small trucks (2), however the final route to be taken to transport these components to the Olyven Kolk Farm 4 will be dependent on the chosen manufacturer.

The construction phase of the project will take place in a phased approach, and as mentioned in *Chapter 4,* the approach is dependent on various factors. Installation of the full project could take up to 14 months to complete or more, with solar components arriving throughout the period.

(1) Impacts of dust are assessed separately below.
(2) Should abnormal loads be required, the relevant permits will be sought prior to transportation.

As the Sishen-Saldanha railway passes through the site, Rotifield will liaise with Transnet to take measures necessary to mitigate disturbance or impacts to the railway.

Box 1.1 ***Construction Impact: Traffic***

Nature: Construction activities that increase traffic would result in a **negative direct** impact on people who use the roads along the final transport route.

Impact Magnitude – Medium

- **Extent**: The extent of the impact is **regional** as the potential impact will extend along the selected transport route.
- **Duration**: The duration would be **short-term** for the duration of construction.
- **Intensity:** The intensity is likely to be **medium** given that the increase in traffic will temporary, but may create a nuisance and impact on the safety of other road users.

Likelihood – There is a **high** likelihood of increased traffic.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-VE)

Degree of Confidence: The degree of confidence is **medium**.

Operation Phase Impacts

A limited number of people will be employed permanently at the site during the operation phase of the solar power plant; these employees will reside in on site accommodation. Infrequent deliveries of replacement parts may be made during the lifespan of the solar power plant. Traffic impacts associated with the operation of the facility will be minimal and therefore traffic impacts associated with operation are not considered any further.

Similarly during the operational phase any disturbance or impacts to the railway will be mitigated to avoid impacts to the railway line.

13.1.2 Mitigation Measures

Construction

- During construction, arrangements and routes for abnormal loads (if required) must be agreed in advanced with the relevant authorities and the appropriate permit must be obtained for the use of public roads.
- A grievance procedure will be established whereby any complaints by neighbours or affected parties are recorded and responded to.
- Liaison with Transnet to mitigate or minimise disturbance or impacts to the Sishen-Saldanha railway.

Operation

- During operation, if abnormal loads are required for maintenance, the appropriate arrangements will be made to obtain the necessary transportation permits and the route agreed with the relevant authorities to minimise the impact of other road users.

- Liaison with Transnet to mitigate or minimise disturbance or impacts to the Sishen-Saldanha railway.

13.1.3 *Residual Impacts*

If mitigation measures are implemented, the overall significance will be reduced to minor negative for construction. Impacts will be negligible for the operational phase.

Table 1.2 Pre- and Post- Mitigation Significance: Traffic

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	**MODERATE (-VE)**	**MINOR (-VE)**
Operation	**NEGLIGIBLE**	**NEGLIGIBLE**

13.2 WASTE AND EFFLUENT

13.2.1 *Impact Description and Assessment*

Waste and effluent will be generated during the construction and operational phases of the Olyven Kolk Farm 4 solar power plant. The key types of waste generated and/or activities these arise from to be are set out below.

Table 13.3 Impact Characteristics: Waste and Effluent

Summary	Construction	Operation
Project Aspect/ activity	Construction activities including excavation/ trenching, unpacking of solar components, accommodation facilities on site (if required) and ablution facilities.	Maintenance activities, personnel and general office facilities.
Impact Type	Direct negative	Direct negative
Stakeholders/ Receptors Affected	Affect land owner. Surrounding habitat	Affect land owner. Surrounding habitat

Construction Phase Impacts

The construction of the solar power plant will produce a variety of waste products. The initial solid waste generated on site will be the cleared vegetation and soil overburden from levelling and grading of areas of the site. Some building rubble will be produced throughout the construction phase from activities such as the construction of temporary and permanent buildings and concrete pouring. Packaging material will be accumulated from unpacking of solar components. Packaging material (e.g. wooden pallets and cartons, cable rests etc) will be recycled as far as possible however, any waste that cannot be recycled or reused will be disposed of at a licensed disposal facility.

General waste will be produced by site personnel including wrapping from food, bottles and cans. Should a construction camp be required, quantities of waste generated may be high. It is anticipated that waste will be temporarily stored on site before it is removed by an appropriate contractor.

Effluent will be produced from toilet facilities. This wastewater is likely to be treated by temporary chemical toilets until a septic tank system is installed on site. There is potential for waste and effluent stored on site to leach into the soil and/ or groundwater, causing harm to the natural environment and potentially contaminating the soil and/ or groundwater.

Box 13.2 Construction Impact: Waste and Effluent

Nature: Construction activities that produce waste would result in a **negative direct** impact on the site.

Impact Magnitude – Medium

- **Extent**: The extent of the impact is **local** as impact would be restricted to the site.
- **Duration**: The duration would be **short-term** as impacts could persist after the construction of the solar power plant.
- **Intensity:** The intensity is likely to be **medium** as levels of waste volumes generated will be high based on the large workforce required onsite.

Likelihood – It is **unlikely** that waste and effluent generated on site will impact on the soil and/ or groundwater and other site users.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-VE)

Degree of Confidence: The degree of confidence is **high.**

Operation Phase Impacts

General waste, including office waste and effluent from onsite toilet facilities will be produced during the operation phase of the solar power plant by personnel working and or staying onsite. However, this will be limited as there is only likely to be up to 30 permanent personnel on site during the operational phase of the plant and a small team of personnel expected during maintenance activities. Waste produced during the operation phase will be minimal.

The PV panels will possibly be cleaned once or twice a year to remove dust accumulated on the surfaces of the modules during the operational phase of the project. The water used for cleaning will not contain any harmful chemicals or additives and will not be heated. Therefore the water is not regarded as wastewater and the water will be allowed to percolate onto the soil.

Box 13.3 Operation Impact: Waste and Effluent

Nature: Operation activities that produce waste would result in a **negative direct** impact on the site.

Impact Magnitude – Low

- **Extent**: The extent of the impact is **local** as impact would be restricted to the site.
- **Duration**: The duration would be **long-term** during the operation of the solar power plant.
- **Intensity:** The intensity is likely to be **low** owing to the small number of personnel present on site during the operation phase and few waste generating activities.

Likelihood – It is **unlikely** that large quantities of general waste will be generated on site.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR (-VE)

Degree of Confidence: The degree of confidence is **high.**

13.2.2 Mitigation Measures

The potential impacts associated with the generation of waste and effluent can be minimised through careful mitigation measure.

Design

- A suitable area for waste skips must be selected, away from drainage lines, and included in the final site layout plan with the approval by an ECO.

Construction

- All waste must be separated into skips for recycling, reuse and disposal. Recycled waste will be removed by an appropriate contractor, as per the EMP recommendations.

- Vegetative material will be kept on site and mulched after construction to be spread over the disturbed areas to enhance rehabilitation of the natural vegetation.

- Effluent from concrete washings etc will be contained within a bunded area.

- All hazardous and liquid waste materials e.g. fuel for generators, including any contaminated soils will be stored in a bunded area and disposed of by a licensed contractor.

- Effluent and stormwater run-off will be discharged away drainage lines.

- Materials that cannot be re-used or recycled will be placed in a skip and removed from site to a licensed disposal facility.

Operation

- General waste must be removed from site by a licensed contractor.

13.2.3 *Residual Impacts*

If mitigation measures given above and listed in the EMP are implemented, the overall significance will be minor during the construction phase and operation phases of the Olyven Kolk Farm 4 solar power plant.

Table 13.4 Pre- and Post- Mitigation Significance: Waste and Effluent

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	MODERATE (-VE)	MINOR (-VE)
Operation	MINOR (-VE)	NEGLIGIBLE

13.3 *AIR QUALITY*

This section considers the impacts to air quality during the construction and operation of the Olyven Kolk Farm 4 solar power plant. The two primary areas of interest are:

- dust generated during clearing of vegetation and earthmoving activities and by vehicles on site travelling along unpaved roads; and
- emissions from the exhaust of vehicles during construction.

Table 1.5 Impact Characteristics: Air Quality

Summary	Construction	Operation
Project Aspect/ activity	Soil disturbance and excavating. Vehicle movement on gravel roads. Emissions from construction vehicles and equipment.	Vehicle movement on gravel roads.
Impact Type	Direct negative	Direct negative
Stakeholders/ Receptors Affected	Affected landowners. Road users. Construction personnel.	Affected landowners.

Construction Phase Impacts

The presence of dust can be a nuisance to site users, including construction workers and other nearby receptors. Across the site there are large exposed areas of soil bearing little vegetation i.e. the *Rhigozum* thicket community shows a poorly developed grass layer. This is likely to be a result of heavy grazing and/or suppression of the grass layer by the dense *Rhigozum* stands. The levels of dust at the site are expected to be highly variable and dependent on the time of year, the intensity of the activity and the prevailing winds. During the construction phase, dust will be generated from increased vehicles movements from trucks driving on gravel roads and through activities that cause disturb of the soil.

Dust becomes airborne due to the action of winds on material stockpiles and other dusty surfaces, or when thrown up by mechanical action, for example the movement of tyres on a dusty road or activities such as excavating. The quantity of dust released during construction depends on a number of factors, including:

- the type of construction activities occurring;
- the area of exposed materials;
- the moisture and silt content of the materials;
- distances travelled on unpaved surfaces; and
- the mitigation measures employed.

Figure 1.1 Example of Trenching

Source: Rotifield

The key construction activities likely to result in increased dust levels are movement of trucks transporting solar infrastructure to and from the site, movement of construction vehicles along dusty roads, clearance of vegetation, trenching, burial of cables and screwing/ piling poles of solar structures into the ground. Dust emissions are exacerbated by dry weather and high wind speeds. The impact of dust also depends on the wind direction and the relative locations of dust sources and receptors.

Construction vehicles and other construction equipment will generate exhaust emissions. It is not anticipated that large volumes of exhaust emissions will be generated during the construction phase of the solar power plant.

Box 1.4 Construction Impact: Dust and Emissions

Nature: Construction activities that generate dust and emissions would result in a **negative direct** impact on receptors in the area.

Impact Magnitude – Low

- **Extent**: The extent of the impact is **local,** limited to within 200m of construction activities.
- **Duration**: The duration would be **short-term** for the duration of construction phase.
- **Intensity:** The site is very remote and dust generated or emissions released are therefore unlikely to impact any sensitive receptors, the intensity can be considered **low.**

Likelihood – There is a **definite** likelihood of dust and emissions generation.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR

Degree of Confidence: The degree of confidence is **high**.

Operation Phase Impacts

Minimal dust generation is expected to occur during the operational phase of the project by maintenance vehicles along the gravel access roads, which will be infrequent. Therefore, impact of dust generated during the operation phase is not considered any further.

13.3.2 Mitigation Measures

Given that the site is located in a water-scarce area, wetting of surfaces to minimise dust is not recommended.

Construction Phase

- Vehicles travelling on gravel roads will not exceed a speed of 40 km/hr.
- Stockpiles of dusty materials will be enclosed or covered by suitable shade cloth or netting to prevent escape of dust during loading and transfer from site.
- Vehicles are to be kept in good working order and serviced regularly to minimise emissions.
- Any directly affected individuals including neighbouring farmers will be able to lodge grievances with Rotifield using the Grievance Procedure (included in the EMP) regarding dust emissions that could be linked to the project.

Operation phase

- Vehicles travelling on gravel roads should not exceed a speed of 40 km/hr.

13.3.3 Residual Impacts

If mitigation measures are implemented, the overall significance will be negligible.

Table 1.6 Pre- and Post- Mitigation Significance: Dust and Emissions

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	**MINOR (-VE)**	**NEGLIGABLE**
Operation	**NEGLIGABLE**	**NEGLIGABLE**

14 CUMULATIVE IMPACTS

14.1 INTRODUCTION

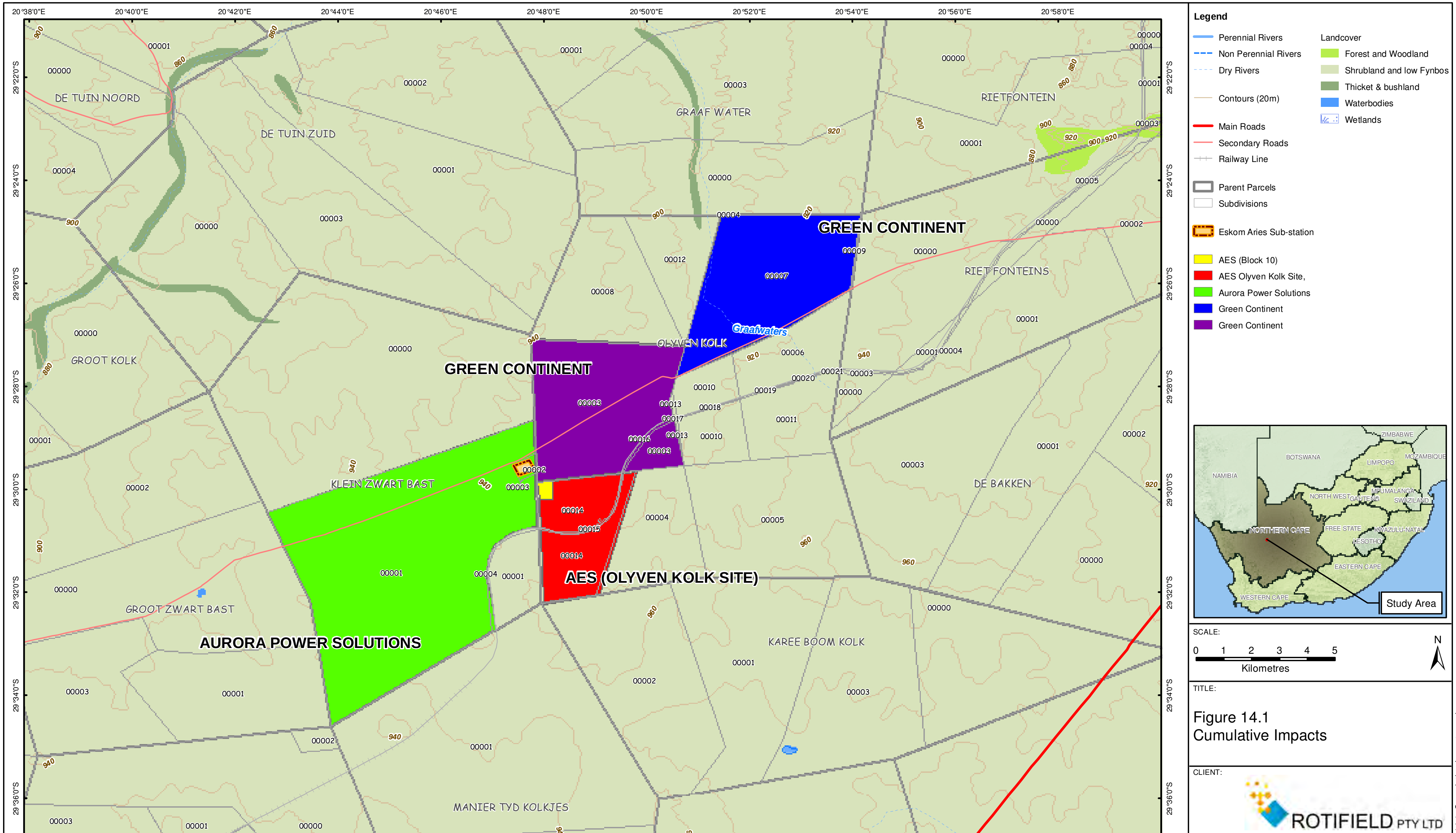
Cumulative impacts are impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the project under consideration (e.g. the combined effect of other similar projects in the general area). An impact to a resource in itself may not be considered significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse developments in the area.

There has been a substantial increase in renewable energy developments recently in South Africa as legislation is evolving to facilitate the introduction of Independent Power Producers (IPPs) and renewable energy into the electricity generation mix. The focus of the solar energy developments have largely been in the Northern Cape. It should however be noted, that not all the solar power plants presently under consideration will become operational because of the following reasons:

- There are limitations to the capacity of the existing Eskom grid;
- not all applications will receive positive environmental authorisation from the DEA;
- there are stringent requirements to be met by applicants in the competitive bidding process; and
- not all solar power plants will be successful in securing financial support.

The preceding impact assessment chapters have assessed the impacts associated with the Olyven Kolk Farm 4 solar power plant largely in isolation. It is important to, and there is a legislated requirement to, assess cumulative impacts associated with a proposed development. This chapter looks at whether the proposed project's potential impacts become more significant when considered in combination with the other exiting and proposed infrastructure including solar power projects within the area.

Figure 14.1 shows the proposed location of the Olyven Kolk Farm 4 solar power plant in relation to all other known commercials sized solar developments. It is important to note that the location and information available for each proposed development has been taken from the public domain and other developers.



TITLE:

Figure 14.1
Cumulative Impacts

CLIENT: ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 130 000

DRAWING: Fig14.1_Cumulative Impacts.mxd — REV: 2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

Projection: Geographic, Datum: WGS84
Chief Directorate National Geo-Spatial Information
Source: EnPat (2001) Demarcation Board (2011)
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig14.1_Cumulative Impacts.mxd

All reasonable effort has been made to review the current position with respect to other existing or proposed solar power plants and major infrastructure within a 10 km radius of the Olyven Kolk Farm 4 solar power plant. There are currently no existing commercial solar power plants within the Northern Cape and therefore this chapter focuses on any known proposed solar developments. These developments are listed in *Table 14.1* as well as the known status of each within their development cycle at the time of this assessment.

Table 14.1 Planned Solar Power Plants in the vicinity of the Olyven Kolk Farm 4

Wind Farm (Developer)	**Status of EIA**	**MW output**	**Distance (km)**
Aurora Power Solutions	Unknown	Unknown	2
Aurora Power Solutions(basic)	RoD	10	2
Green Continent (basic)	Final EIR	20	5
Green Continent (full)	EIA in process	Unknown	1
Rotifield Pty Ltd	Final BAR	10 MW	Adjacent to site
Rotifield Pty Ltd	EA Split	75	Adjacent to site
Rotifield Pty Ltd	EA Split	75	Adjacent to site

It is evident from *Table 14.1* that there are seven known proposed solar power plants in addition to the Olyven Kolk Farm 4 solar power plant in the 10 km study area all of which are looking to feed into the Eskom Aries Substation.

As there is uncertainty as to whether all the above mentioned developments will be implemented, it is difficult to quantitatively assess the potential cumulative impacts. It is however important to explore the potential cumulative impacts qualitatively to meet legislative requirements as well as to provide a better understanding of these impacts and the possible mitigation that may be required. The assessment and implementation of mitigation measures should be lead by Government in collaboration with the renewable energy sector and relevant NGO's. As these cumulative impacts are explored in more detail the trade-offs between promoting renewable energy (and the associated benefits in terms of reduction in CO_2 emissions) versus the local and regional environmental and social impacts and benefits (i.e. impacts on bird populations, landscape, tourism, flora, employment etc) will become evident. It is only when these trade-offs are fully understood, that the true benefits of renewable energy can be assessed.

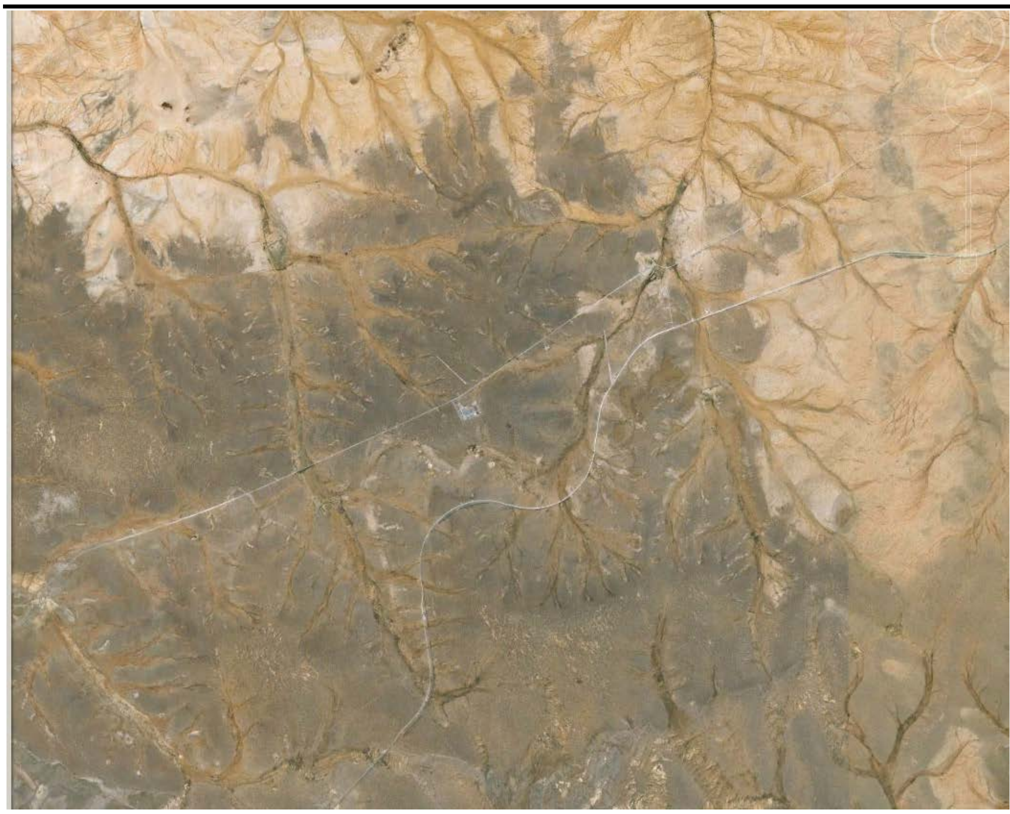
In the sections below the potential cumulative impacts of several developments within a 10km radius of the Olyven Kolk Farm 4 solar power plant are explored. The discussion and associated conclusions must be understood in the context of the uncertainty associated with the proposed and known developments and the qualitative nature of the assessment.

14.2 *GEOLOGY, SOILS, SURFACE AND GROUNDWATER*

When preparing sites for PV panels, some developers clear the entire site of vegetation, often leveling and grading the entire sites. The results are soil compaction, soil removal and erosion. As the proposed PV solar facilities occupy large sites impacts could be significant is not managed properly.

The proposed project sites are all located in areas have extensive dendretic drainage patterns as shown in *Figure 14.2*. These drainage lines convey stormwater and surface water run off. Should developers all take the appropriate mitigation measures to avoid disturbance to the drainage lines, cumulative impacts associated with the proposed solar facilities will be minimal.

Figure 14.2 Drainage Lines



Source: Google 2011

14.3 *ECOLOGY*

In addition to the number of proposed solar developments found within 10 km of the Olyven Kolk Farm 4 site, there are numerous solar energy projects of a commercial scale planned across the Northern Cape, some of which may also fall within Bushmanland Basin Shrubland, thereby contributing towards cumulative impact within the vegetation type. There is high uncertainly as to how many of these developments will go ahead nevertheless, the cumulative impacts of solar developments on this habitat type is considered to be low.

Bushmanland Basin Shrubland is one of the most extensive vegetation types within the country and has been little impacted by transformation. Therefore the potential of the proposed solar energy facilities to contribute towards the broad-scale fragmentation of habitat or to impinge on conservation targets for the associated vegetation types is considered low. Furthermore, the broad area has a low topographic diversity and as a result, broad-scale ecological processes are likely to operate in a diffuse manner and the site is therefore not likely to function as part of a movement or migration corridor for fauna and flora. The larger fauna which occurs in the area is typical of arid and semi-arid areas and constitutes species which are able to avoid human contact through mobility or their secretive behaviour. Such species will be able persist within the developed areas, or will be able to avoid them. In addition, the area is already relatively impacted due to the presence of the existing Sishen-Saldanha railway line as well as Eskom's Aries substation and associated transmission lines. The overall impact on the connectivity of the landscape and the further disruption of ecosystem processes is reduced by the proximity to a large amount of existing development.

14.4 BIRDS

The most significant potential impact on birds of any solar energy facility is the displacement or exclusion of threatened, rare, endemic or range-restricted species from critical areas of habitat. Given the considerable space requirements of commercially viable facilities (>50-100 ha), this effect could be regarded as significant in some instances when taking into consideration the various proposed solar energy facilities planned around the Aries substation and elsewhere in the Northern Cape. However, it is understood that it is likely that not all the proposed solar power plants will either not all become operational (see *Section 14.1*).

Lanner Falcons and Martial Eagle are known nest on the pylons within the site. The former species is known to occupy a breeding territory approximately centred on the Aries Substation, but has not generally been a productive territory, with breeding recorded only once in the period 2002-2006 (Jenkins *et al.* 2007). The additional proposed developments within close proximity to the site may cause increased pressure on these species unless appropriate mitigation and monitoring is undertaken.

14.5 LANDSCAPE AND VISUAL

Should many more of these types of solar energy development take place in close proximity to each other, there is a possibility that the area will exceed the carrying capacity created by the agricultural sense of place and that the sense of place will be defined by the solar energy facilities. However, due to the limited visual resources in the area and the limited number of receptors, any potential cumulative impact would be contained to the area and would not negatively impact on the tourism.

14.6 *SOCIO-ECONOMIC*

Benefits to the local, regional and national economy through employment and procurement of services could be substantial should all the renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the solar energy facilities to be manufactured in South Africa. Over time, as businesses develop locally to meet the needs of the solar energy sector, levels of procurement may increase.

The potential for the proposed Olyven Kolk Farm 4 solar power plant and other future projects to result in greater impacts on the local and national economy as a whole is primarily dependent on economies of scale. Initially import content will be high. However, if the sector grows in size it should provide opportunities for growth of the local supply chain and the additional benefits that would flow from this. The introduction of large numbers of PV plants could provide local economic opportunities for component manufacture, and with an appropriate industrial policy it would be possible to leverage South Africa's relatively cheap steel resources. The distance from other international manufacturers will also present a competitive advantage, especially for less-specialised large-scale components such as array support structures.

The cumulative impact in terms of loss of agricultural land could potentially be extensive due to the large land take required for PV plants and considering the number of plants planned in close proximity in the area of Aries. However, the agricultural potential of the land is classified as low (see *Chapter 6*) and therefore impacts are not considered to be significant. The sense of place value however would be threatened, but given the presence of the Aries Substation and its sheer size, the solar power plants will be insignificant in the landscape.

14.7 *CONCLUSIONS*

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of solar energy facilities in the Northern Cape. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant. Should impacts be management and proper monitoring put in place, impacts to environmental receptors are not considered to be significant.

15 DECOMMISSIONING

As mentioned in *Chapter 4*, the solar power plant would have a minimum lifespan of at least 20 years. Once the facility reaches the end of its lifespan the arrays may be refurbished or replaced to continue operating as a power generating facility or the facility could be closed and decommissioned. If decommissioned, all components would be removed and the site rehabilitated. The solar panels would be recycled as appropriate. The preferred panel manufacturer, *First Solar*, undertakes a module or panel collection and recycling programme in which the glass and encapsulated semiconductor material is processed into new modules or other products. The decommissioning and reinstatement of the site will involve many activities that may have some environmental and social impacts.

It is anticipated that the impacts associated with decommissioning will be similar to those encountered during construction. The generation of waste through the decommissioning activity is anticipated to be high although the choice of the preferred supplier was made to mitigate this impact since the supplier has an existing programme which would maximise the reuse and recycling of the panels therefore significantly decreasing the waste generation during decommissioning. The PV panels are piled or screwed into the ground and therefore the need to excavate panel foundations during decommissioning is avoided thus limiting the disturbance of vegetation.

The comprehensive decommissioning plan should be developed prior to the decommissioning of the facility to minimise potential negative impact and enhance positive impacts associated with decommissioning.

16 CONCLUSIONS AND RECOMMENDATIONS

16.1 INTRODUCTION

The aim of the EIA for the proposed Olyven Kolk Farm 4 solar power plant is to provide information to inform decision-making that will contribute to environmentally sound and sustainable development. This report is submitted to the DEA to provide it with information and an independent assessment thus enabling the DEA to make an informed decision regarding whether or not to grant an environmental authorisation for the proposed development in terms of NEMA. If granted, this report will also assist the DEA to define under what conditions the development should go ahead. In considering the development of renewable energy projects, it is inevitable that there will be some negative environmental impacts. However, there is also the need to encourage renewable energy in South Africa in order to move toward more sustainable energy practices and meet targets set by the government of sourcing 10,000 GWh from renewable energy projects by 2013 (1).

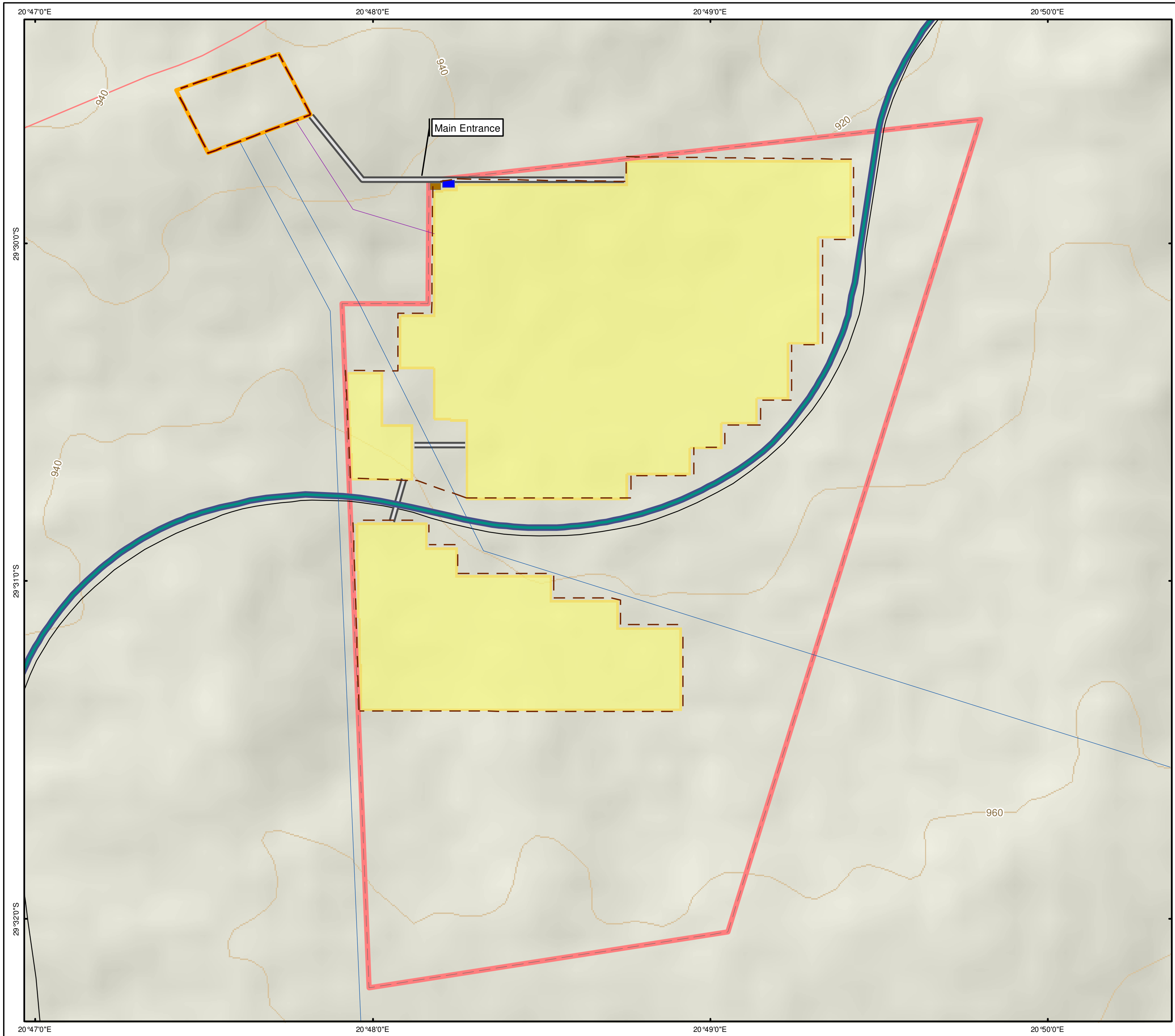
Through the EIA process which included various stakeholder and specialist input, ERM has identified and assessed a number of potential impacts relating to the development. This chapter provides an overview of the EIA findings and makes recommendations regarding key mitigation measures for the preferred and final layout (Alternative 2) which supersedes the original layout Alternative 1.

The final layout (Alternative 2) has been designed based on the sensitivity constraints of the site as established during the EIA process. *Figure 16.1* and *Figure 16.2* show the site layouts Alternative 1 and Alternative 2 (final layout), and illustrate how the site layout has been changed based on specialist feedback during the process. The final layout of the solar arrays has been based on the best available information but may require some minor alterations to the layout based on geo-technical studies. Any revisions of the design will however be within the allowable zones prescribed by this EIR and any amendments to the final layout will be submitted to DEA before construction with an indication of the extent of change and associated changes in significance ratings of impacts where applicable.

This EIA report provides a description of the EIA process followed to date.

The potential impacts associated with the development are summarised below and should be considered both in the context of the project rationale and the discussion of cumulative impacts in the previous chapter.

(1) National Energy Regulator of South Africa South Africa Renewable Energy Feed-In Tariff (2009) NERSA Publications.



Legend

- Secondary Roads
- Railway Line
- Proposed Access Roads
- Railway Service Road
- Fence
- Existing 400kV Transmission Lines
- Proposed Grid Interconnection
- Accommodation Block
- Control Building
- Eskom Aries Sub-station
- Solar Panel Arrays
- Olyven Kolk Site

SCALE:

0 250 500 750 1 000

Metres

N

TITLE:

Figure 16.1
Site Layout Alternative1 -
Project Infrastructure - 200 MW Plant

CLIENT:

ROTIFIELD PTY LTD

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING: Fig16.1_Site Layout Alternative 1-Infra_ 200MW_Rev2.mxd

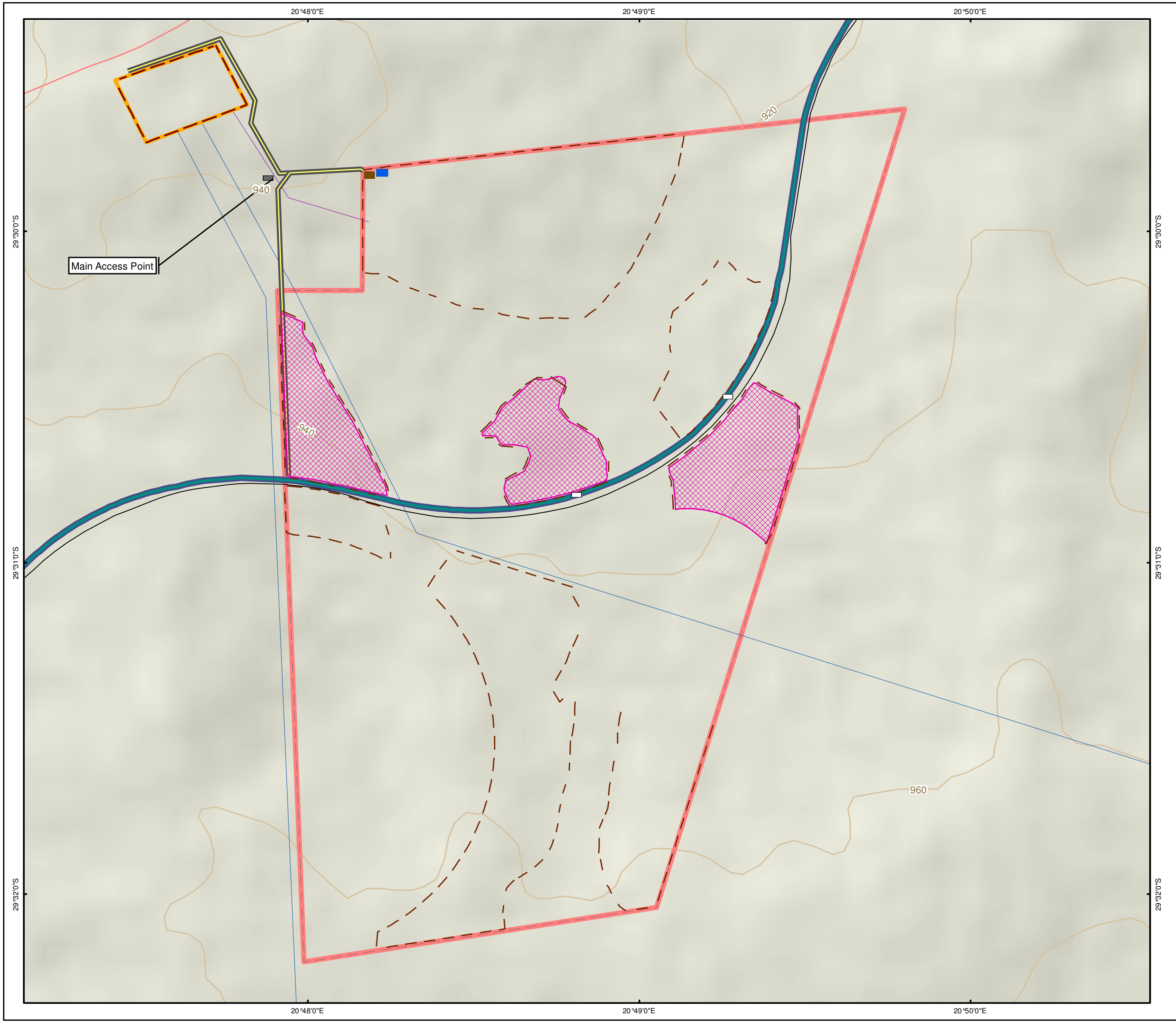
REV: 2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI)
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig16.1_Site Layout Alternative 1-Infra_200MW_Rev2.mxd



Legend

- Main Access Point
- Possible Site Access Points
- Secondary Roads
- Railway Line
- Proposed Access Roads
- Railway Service Road
- Fence
- Proposed Grid Interconnection
- Existing 400kV Transmission Lines
- Accommodation Block
- Control Building
- Eskom Aries Sub-station
- Farm 4
- Olyven Kolk Site

SCALE:
0 250 500 750 1 000
Metres
N

TITLE:

Figure 16.2
Farm 4, Site Layout Alternative 2, v2
Project Infrastructure - 40 MW Plant

CLIENT:

ROTIFIELD PTY LTD

DATE: Aug 2012	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING:
Fig16.2_Farm 4 Site Layout Alternative 2v2-Infra_190MW_Rev2.mxd

REV:
2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI)
Inset Map, Esri Data & Maps

SIZE:
A3

C:\0126393_AES\Mapping\MXD\October2011\Fig16.2_Farm 4 Site Layout Alternative 2v2-Infra_190MW_Rev2.mxd

16.2 *SUMMARY OF IMPACTS IDENTIFIED AND ASSESSED*

16.2.1 *Construction Phase Impacts*

The footprint of the Olyven Kolk Farm 4 solar arrays have reduced slightly from Layout Alternative 1 to revised Layout Alternative 2, 435 ha to 80 ha (1) respectively. The most significant consequence of the revised layout is that it avoids transgressing the drainage lines found on site and allows for a buffer around these drainage lines.

The loss of or damage/ disturbance to vegetation are predicted to be of minor to moderate negative residual significance during the construction period. Should the appropriate permits be obtained for the translocation of protected plant species, impacts to these will be of minor negative residual significance. Impacts to fauna are primarily likely to result from a loss of habitat and impacts are considered to be of minor negative residual significance.

Impacts to birds, in particular Martial Eagle and Lanner Falcon which are known to nest or have nested within the site will be minor negative residual significance should all suggested mitigation and monitoring take place.

Impacts of minor positive significance would be associated with finds of paleontological interest on the Olyven Kolk Farm 4 site such as fossils or bones as such finds, would add to the existing scientific data of the region.

The benefits to the local economy associated with the construction phase of the project warrants a moderate positive significance rating associated with the benefits from employment as well as local procurement.

A summary of the bio-physical and socio-economic impacts associated with the construction phase of the Olyven Kolk Farm 4 solar power plant including their pre-mitigation and residual impacts, are given in *Table 16.1*, below. All negative impacts associated with the proposed development have been mitigated to a level which is deemed appropriate for the construction phase to proceed.

(1) The areas include spacing between rows of arrays.

Table 16.1 *Summary of pre-mitigation significance during Construction Phase for Layout Alternative 1 and Layout Alternative 2 and residual impacts for final layout (Alternative 2)*

	Section	Impact	Pre-mitigation Significance (Based on Site Layout Alternative 1)	Pre-mitigation Significance (Based on Site Layout Alternative 2)	Residual Impact Significance (Based on mitigation and Site Layout Alternative 2)
Flora	8.1	Destruction and loss of natural vegetation	MODERATE –MAJOR (-VE)	MODERATE (-VE)	MINOR- MODERATE (-VE)
	8.2	Impact on protected plant species	MINOR- MODERATE (-VE)	MINOR- MODERATE (-VE)	MINOR (-VE)
Fauna	8.7	Loss of habitat for fauna	MODERATE (-VE)	MINOR - MODERATE (-VE)	MINOR (-VE)
	8.7	Direct faunal impacts	MODERATE (-VE)	MODERATE (-VE)	MINOR (-VE)
Bats	8.9	Habitat loss- destruction, disturbance and Displacement	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE
Birds	9.1	Habitat loss	MINOR -MODERATE (-VE)	MINOR(-VE)	MINOR(-VE)
	9.1	Disturbance	MODERATE- MAJOR (-VE)	MINOR -MODERATE (-VE)	MINOR (-VE)
Soils	7.1	Loss of topsoil, soil compaction and erosion	MODERATE (-VE)	MINOR(-VE)	MINOR(-VE)
Water	7.2	Impact on surface and groundwater	MODERATE (-VE)	MINOR (-VE)	MINOR (-VE)
Palaeontology	11.1	Destruction or disturbance	MINOR (-VE)	MINOR (+VE)	MINOR (+VE)
Archaeology	11.1	Destruction or disturbance	MINOR (-VE)	MINOR (-VE)	MINOR (-VE)
Visual	10.2	Impacts to landscapes and receptors	MAJOR (-VE)	MINOR (-VE)	MINOR (-VE)
Socio-economic*	12.1	Benefits to the local economy	N/A	MODERATE (+VE)	MODERATE (+VE)
	12.2	Increased social ills	N/A	MODERATE (-VE)	MINOR (-VE)
	12.3	Loss of agricultural land	N/A	MINOR (-VE)	NEGLIGIBLE
Other Impacts*	13.1	Traffic	N/A	MODERATE (-VE)	MINOR (-VE
	13.2	Waste and effluent	N/A	MODERATE (-VE)	MINOR (-VE)
	13.3	Air quality- dust and emissions	N/A	MINOR (-VE)	NEGLIGABLE

* *The socio-economic and other impacts impact assessments only assessed the preferred final layout, Site Layout Alternative 2*

16.2.2 *Operational Phase Impacts*

It is likely that the routine operational of the solar power plant may result in minor negative direct impacts on the vegetation, through alien plant invasion, erosion potential maintenance activities, however most disturbances would have occurred during the construction phase.

Avifauna may be impacted by disturbance associated with human activity, maintenance vehicles around the solar power plant and the additional power lines that may lead to collisions and electrocutions. The overall significance of the impact is considered to be minor negative should appropriate mitigation and monitoring be undertaken.

Increased sediment loads in drainage channels, spills and leaks during routine operational and maintenance activities and reduced groundwater recharge may result in a negative direct impact on surface- and groundwater. The residual significance is considered to be minor negative, and would remain so with the implementation of the proposed mitigation measures.

The construction of the solar power plant may alter the visual character of the landscape, however given that the area is not a pristine landscape and the sheer scale and size of the Eskom Aries substation and power lines within or in close proximity to the site and a railway line across the site, it is considered that impacts will be of minor significance.

The benefit to the local economy will be direct via employment and procurement of services and indirect via the money spent in the local economy due to increase in wages etc during the operational phase will of be minor positive significance. The loss of agricultural land is considered of negligible significance considering the extent of the land required for the 40 MW plant.

Impacts from traffic, dust and emissions and waste and effluent are predicted to be negligible during the operational phase.

A summary of the bio-physical and socio-economic impacts associated with the operational phase of the Olyven Kolk Farm 4 solar power plant including their pre-mitigation and residual impacts, are given in *Table 16.2*, below.

All negative impacts associated with the proposed development have been mitigated to a level which is deemed appropriate for the operational phase of the solar power plant to be sustainable.

Table 16.2 Summary of pre-mitigation significance during Operation Phase for Layout Alternative 1 and Layout Alternative 2 and residual impacts for final layout (Alternative 2)

	Section	Impact	**Pre-mitigation Significance** *(Based on Site Layout Alternative 1)* *	**Pre-mitigation Significance** *(Based on Site Layout Alternative 2)*	**Residual Impact Significance** *(Based on mitigation and Site Layout Alternative 2)*
Flora	8.3	Erosion potential	**MODERATE (-VE)**	**MINOR- MODERATE (-VE)**	**MINOR (-VE)**
	8.4	Alien plant invasion	**MINOR - MODERATE (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
	8.5	Maintenance impact on vegetation	**MINOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Fauna	8.7	Loss of landscape connectivity	**MODERATE (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Bats	8.9	Habitat loss- destruction, disturbance and displacement	**NEGLIGIBLE**	**NEGLIGIBLE**	**NEGLIGIBLE**
Birds	9.1	Habitat Loss	**MINOR -MODERATE (-VE)**	**MINOR(-VE)**	**MINOR(-VE)**
	9.1	Displacement	**MINOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
	9.2	Mortality – collisions and electrocution	**MODERATE (-VE)**	**MODERATE (-VE)**	**MINOR (-VE)**
Soils	7.1	Loss of topsoil, soil compaction and erosion	**MINOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Water	7.2	Impact on surface and groundwater	**MODERATE (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Visual	10.2	Impacts to landscape and receptors	**MAJOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Socio-economic*	12.1	Benefits to the local economy	**N/A**	**MINOR (+VE)**	**MINOR (+VE)**
	12.3	Loss of agricultural land	**N/A**	**MINOR (-VE)**	**NEGLIGIBLE**
Other Impacts*	13.1	Traffic	**N/A**	**NEGLIGIBLE**	**NEGLIGIBLE**
	13.2	Waste and effluent	**N/A**	**MINOR (-VE)**	**NEGLIGIBLE**
	13.3	Air quality- dust and emissions	**N/A**	**NEGLIGABLE**	**NEGLIGABLE**

* *The socio-economic and other impacts impact assessments only assessed the preferred final layout, Site Layout Alternative 2*

16.3 *RECOMMENDATIONS*

ERM feels confident that every effort has been made by Rotifield to accommodate the mitigation measures recommended during the EIA process to the extent that is practically possible, without compromising the economic viability of the proposed solar power plant. The implementation of the mitigation measures detailed in *Chapters 7* to *14* and listed in the Environmental Management Programme (EMP), including monitoring will provide a basis for ensuring that the potential positive and negative impacts associated with the establishment of the development are enhanced and mitigated to a level which is deemed adequate for the development to proceed.

In summary, based on the findings of this assessment, ERM finds no reason why the 40MW solar power plant proposed for the Olyven Kolk Farm 4 site should not be authorised contingent that the mitigations and monitoring for potential environmental and social impacts as outlined in the EIR and EMP are implemented.

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Annex A

Legislative Framework

CONTENTS

A1 LEGISLATIVE FRAMEWORK

A1.1 INTRODUCTION

This Annex provides a description of the institutional framework applied to the project, and the most relevant national and provincial legislation, policies and guidelines that have been taken into consideration. The content is as follows:

- Relevant South African government departments and regulators;
- South African law relevant to environmental and social standards deemed applicable to the project; and
- international conventions and standards to which South Africa is a signatory and with which the project must comply (relating to issues such as climate change and biodiversity).

A1.2 GOVERNMENT DEPARTMENTS AND REGULATORS

There are a number of Ministries and Departments that have an interest in and will take responsibility for ensuring that the proposed solar power plant project is implemented in an environmentally responsible manner. The concept of co-operative governance is becoming increasingly important in relation to the adjudication of Environmental Impact Assessment (EIAs) in South Africa and whenever an activity falls within the jurisdiction of more than one organ of state, there must be co-ordination and co-operation between those organs of state in the consideration of EIAs and decision-making.

A1.2.1 National

Department of Environmental Affairs (DEA)

The DEA falls under the Ministry of Water and Environmental Affairs and is responsible for all environmental affairs and decision making.

In terms of South Africa's Constitution, responsibility for the environment is shared between provincial and national government. Although decision-making on EIAs is, under most circumstances, a provincial competency, all renewable energy projects are being processed by the DEA, who is the national controlling authority based in Pretoria. This arrangement is set out in Section 4.1 of the 'Guideline in Environmental Impact Assessments for Facilities to be Included in the Electricity Response Plan', 25 November 2008, GN 162 of 2010. The DEA is, therefore, the competent authority for this proposed project and will be responsible for making a decision whether or not to authorise the project.

Department of Water Affairs (DWA)

The DWA falls within the Ministry of Water and Environmental Affairs and is the custodian of South Africa's water resources. While striving to ensure that all South Africans gain access to clean water and safe sanitation, the department also promotes effective and efficient water resources management to ensure sustainable economic and social development.

Unlike the DEA which has separate government departments in each province, DWA has regional offices in different areas. Should registration or a Water Use License be required for the proposed project (see discussion in *Section 0* below) application would be made to the regional offices of the DWA in Cape Town.

Department of Energy (formerly the DME)

The Department of Energy is responsible for policy relating to all forms of energy generation, including renewable energy. The Department commissioned an Integrated Energy Plan (IEP) in response to the requirements of the National Energy Policy in order to provide a framework by which specific energy policies, development decisions and energy supply trade-offs could be made on a project-by-project basis. The framework is intended to create a balance between energy demand and resource availability so as to provide low cost electricity for social and economic development, while taking into account health, safety and environmental parameters. Solar Energy is specifically considered in the White Paper for Renewable Energy, 2002.

National Energy Regulator of South Africa (NERSA)

NERSA is a regulatory authority established in terms of the National Energy Regulator Act, 2004 (Act No. 40 of 2004). Its role, among others, is to regulate the electricity industry in terms of the Electricity Regulation Act (Act 4 of 2006). This body will ultimately be the licensing authority for electricity generation from solar farm developments.

South African Heritage Resources Agency (SAHRA)

SAHRA is the national body responsible for policy development for heritage resources management. They are the controlling authority in terms of the National Heritage Resources Act (Act 25 of 1999). SAHRA administers heritage in the province particularly where archaeology and palaeontology are the dominant concerns. Heritage Northern Cape (Ngwao Boswa Kapa Bokoni) deals largely with built environment issues at this stage. Archaeology, including rock art, graves of victims of conflict and other graves not in formal cemeteries are administered by the national heritage authority, SAHRA.

A1.2.2 *Provincial*

Northern Cape Department of Environment and Nature Conservation (DENC)

DENC is the provincial department responsible for tourism, environmental affairs and conservation in the Northern Cape.

DENC's mission is to 'conserve and protect the natural environment for the benefit, enjoyment and welfare of present and future generations by integrating sustainable utilisation with socio-economic development'.
With regard to the EIA for the Olyven Kolk Solar Power Farm project, DENC are regarded as an important commenting authority and will provide comment on the EIA and input to the national Department's decision-making process.

Heritage Northern Cape (Cape (Ngwao Boswa Kapa Bokoni))

As explained above, Heritage Northern Cape (Ngwao Boswa Kapa Bokoni) deals largely with the built environment issues at this stage. Amongst other things Boswa administers:

- World Heritage Sites
- Provincial Heritage Sites
- Heritage Areas
- Register Sites
- 60 year old structures
- Public monuments & memorials

In terms of Section 28(8) of the Heritage Resources Act (Act 25 of 1999) and Regulation 3(3)(a) of PN 298 (29 August 2003) (as discussed below) an application will be made to SAHRA regarding the proposed project. HNC will provide comment on the proposed project.

Other

- Northern Cape Department of Transport, Safety and Liaison – will be responsible for the granting of exemption permits for the conveyance of abnormal loads on public roads.
- Department of Agriculture and Land Reform and Rural Development.

A1.2.3 *Municipal*

Certain Departments, such as the Planning and Roads Departments, from the Siyanda District Municipalities will also be involved as commenting authorities for the EIA. External to the EIA but also relevant to the project are land-use planning applications which are dealt with by the planning departments at a local government level

A1.3 LEGISLATIVE AND POLICY REQUIREMENTS

The proposed activity is subject to legislative and policy requirements at a national and provincial level. The most important of these are listed below.

National:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998), as amended;
- NEMA EIA Regulations (2006 and 2010);
- Environmental Conservation Act (No 73 of 1989 Amendment Notice No. R1183 of 1997);
- National Water Act (Act No. 36 of 1998);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004);
- National Forest Act (Act No. 84 of 1998);
- National Heritage Resources Act (Act No. 25 of 1999);
- Electricity Regulation Act (Act No. 4 of 2006) as amended;
- Occupational Health and Safety Act (Act No. 85 of 1993);
- Subdivision of Agricultural Land Act (Act No. 70 of 1970);
- Department of Environmental Affairs and Tourism (DEAT) Integrated Environmental Management Information Series No.2, Scoping, 2002;
- Noise Control Regulations, Environment Conservation Act (Act No. 73 of 1989) and SANS Code 10328, Methods for Environmental Noise Impact Assessments in Terms of NEMA; and
- Conservation of Agricultural Resources Act (Act 43 of 1983).

Provincial – Northern Cape:

- Northern Cape Planning and Development Act (Act 7 of 1998); and
- Northern Cape Nature Conservation (Act 9 of 2009).

A brief description of the requirements in the above listed Acts and Regulations is provided below.

A1.3.1 *National Environmental Management Act (Act 107 of 1998)*

Section 24 of the National Environmental Management Act (NEMA) as amended gives effect to the South African Constitution, which states that all South African citizens have a right to an environment that is not harmful to their health or well being.

Key principles of NEMA are described in **Chapter 1** of the Act and include the following:

- Development must be socially, environmentally and economically sustainable;
- Environmental management must be integrated;

- Decisions concerning the environment must take into account the needs, interests and values of all I&APs;
- Community well-being and empowerment must be promoted through environmental education and awareness, and the sharing of knowledge and experience;
- Decisions must be taken in an open and transparent manner; and
- Access to information must be provided in accordance with law.

Chapter 5 of NEMA deals with Integrated Environmental Management and focuses on promoting the use of appropriate environmental tools, such as Environmental Impact Assessment. Section 24 requires that activities be investigated that may have a potential impact on the environment, socio-economic conditions, and cultural heritage. The results of such investigations must be reported to the relevant authority. Procedures for the investigation and communication of the potential impact of activities are contained in Section 24 (4) of the Act, which requires that:

- The potential impact, including the cumulative effects of the activity and its alternatives must be investigated;
- The significance of the potential impact must be assessed;
- Mitigation measures which minimise adverse environmental impacts must be investigated;
- The option of not implementing the activity must be considered;
- There must be public participation, independent review and conflict resolution in all phases of the investigation and assessment of impacts; and
- Where an activity falls within the jurisdiction of more than one organ of state, there must be co-ordination and co-operation between those organs of state in the consideration of assessments.

Chapters 1 and 5 of NEMA provide a basis for consideration of potential impacts associated with a proposed development, by the competent authority.

These chapters provide the framework legislation for the more detailed EIA regulations (see *Section A1.3.2* below). These regulations form the basis of ERM's approach to the EIA.

Section 28 of the Act is specific regarding "duty of care" for the environment and remediation of environmental damage. Accordingly, every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring. The Act defines pollution broadly as any change in the environment caused by substances, radioactive or other waves, or emissions of noise, odours, dust or heat.

The environmental authorities may direct an individual or organisation to rectify or remedy a potential or actual pollution problem. If such a directive is not complied with, the authorities may undertake the work and recover the costs from the responsible party.

Section 28 would be relevant to the construction and operational phase of the proposed development. The proponent is obligated, in terms of NEMA, to implement measures and take actions to prevent any form of pollution to air, water or land.

A1.3.2 NEMA EIA Regulations

On 18 June 2010 revised EIA Regulations (Government Notice No R. 543, 544, 545 and 546) were promulgated in terms of Section 24(5) of NEMA. These regulations came into effect on 1 August 2010, replacing the regulations of 21 April 2006. A description of these regulations is provided below.

The Minister of Water and Environmental Affairs has in terms of Sections 24(2)(a) and (d) of NEMA, listed the activities which may have a detrimental effect on the environment in Government Notices GN544, 545 and 546. The regulations require that written authorisation is obtained from the Minister or his delegated authority, in this case the national Department of Environmental Affairs (DEA), in respect of which the investigation, assessment and communication of potential impacts of these activities must follow the procedure as described in Regulations 26 to 35 of the EIA Regulations. Such authorisation, which may be granted subject to conditions, will only be considered once the regulatory requirements have been met. Government Notice R543 sets out the procedures that need to be complied with.
The activities that would be relevant to the proposed project are listed in the Environmental Impact Assessment (EIA) Regulations. Activities from listings

GN544, GN545 and GN546 would be relevant. GN544 and GN 546 activities require a Basic Assessment process and GN545 activities require a more comprehensive Scoping and EIA process. Given the applicability of activities from all three listings, a Scoping and EIA process is being undertaken.
The EIA Regulations, June 2010 (Government Notice R544 and R545) identify activities which may have a detrimental effect on the environment and the listed activities which may be triggered by the proposed solar power plant include:

GN 544:

Activity 1 (i): *'The construction of facilities or infrastructure for the generation of electricity where: (i). the electricity output is more than 10 megawatts but less than 20 megawatts…'*

Activity 11: *'The construction of (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line'.*

Activity 24: *'The transformation of land bigger than 1000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, at the time of the coming into effect of this Schedule or thereafter such land was zoned open space, conservation or had an equivalent zoning'.*

GN 545:

Activity 1: *The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.*

Activity 8: *'The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex'.*

Activity 15: '*Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply'.*

GN 546:

Activity 14: *'The clearance of an area of 5 hectares or more of vegetation where 75% of the vegetative cover constitutes indigenous vegetation.*
(a) In the Northern Cape.
All areas outside urban areas.'

Activity 16 IV: *'The construction of infrastructure covering 10 square meters of more where such construction occurs within a watercourse of within 32 metres of a watercourse measured from the edge of the watercourse, excluding where such construction will occur behind the development setback line'.*

It is important to note that the above thresholds and activities also apply to phased developments "*where any phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.*"

A1.3.3 Environmental Conservation Act (No 73 of 1989 Amendment Notice No. R1183 of 1997)

This Act provides for the effective protection and controlled utilisation of the environment. This Act has been largely repealed by NEMA, but certain provisions remain, in particular provisions relating to environmental impact assessments. The ECA requires that developers must undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations.

A1.3.4 National Water Act (Act 36 of 1998)

The National Water Act (NWA) is the primary legislative instrument for the control and management of South Africa's water resources. In addition to ensuring equitable access to and use of water, a key function of the NWA is to ensure the protection of a national water resource from pollution. Many provisions in the NWA are similar to those in NEMA, but refer specifically to pollution of a water resource, whereas NEMA refers to any change in an environment (land, water, air). The definition of "water resource" includes surface water bodies, groundwater and aquifers.

Section 19 of the Act deals with the prevention and remediation effects of pollution. It is the responsibility of an owner of land, a person in control of land or a person who occupies or uses that land to take all reasonable measures to prevent pollution of a water resource from occurring, continuing or recurring. If these measures are not taken the authorities may do whatever is necessary to prevent the pollution or remedy its effects and may recover all reasonable costs. This Section includes pollution that may arise from contaminated stormwater.

Section 20 deals with the control of emergency incidents. In this Section, "incident" includes any incident or accident in which a substance –

- pollutes or has the potential to pollute a water resource; or
- has, or is likely to have, a detrimental effect on a water resource.

The onus is therefore on AES to ensure that storm water runoff is not contaminated, particularly during the construction phase.

The Act requires a person to obtain a Water Licence for 'water use', which in terms of Section 21 includes the following activities which may be relevant to the proposed project:

- taking water from a water resource;
- storing water;
- impeding or diverting the flow of water in a watercourse;
- disposing of waste in a manner which may detrimentally impact on a water resource; and
- altering the bed, banks. course or characteristics of a watercourse.

Generally a water use must be licensed unless it is listed in Schedule I of the Act, is an existing lawful use, is permissible under a general authorisation, or if a responsible authority waives the need for a licence. Section 39 of the Act allows the Minister to issue General Authorisations for certain activities which then do not require a water use licence. General Authorisation GNR 398, 26 March 2004, gives the landowner/occupier/lawful user permission to alter the bed, banks or characteristics of a water course (including for roads) without the requirement for a Water Use License, as long as the following conditions are met:

- The alteration:
    - o does not impact on a water resource or on another person's water use, property or land; and
    - o is not detrimental to the health and safety of the public in the vicinity of the activity
- The natural migration patterns of aquatic biota and the sustainable ecological functioning of the system are not interfered with;

- The alteration activity does not extend for more than 50 metres continuously or a cumulative distance of 100 metres on that property or land, measured along the watercourse;
- The volume of flow is not reduced except for natural evaporative losses;
- Strict erosion control measures are to be taken during and after construction to ensure no erosion of the bed and banks of the river takes place;
- The water quality is not detrimentally affected; and
- all necessary measures are taken to stabilize the structure and surrounding area. This will include:-
    - rehabilitation of the riparian habitat integrity by ensuring that during rehabilitation only indigenous shrubs and grasses are used in restoring the bio-diversity;
    - rehabilitation of disturbed and degraded riparian areas to restore and upgrade the riparian habitat integrity to sustain a bio-diverse riparian ecosystem;
    - removal of alien vegetation and all new alien vegetation recruitment must be controlled; and
    - annual habitat assessment must be carried out to monitor the sustainability of the diversion and compliance with the above conditions. Action must be taken to rectify any impacts
- Any structure built fully or partially in or across a watercourse does not exceed-
    - a height of 10 metres, measured from the natural level of the bed of the watercourse on the downstream face of the structure to the crest of the structure;
    - a width of 10 metres, measured at the widest part of the structure; or
    - a length of 50 metres, measured from one edge of the watercourse to the other; or
    - occur within a distance of 500 meters upstream or downstream of another structure that alters the bed, banks or characteristics of the same watercourse, measured along the watercourse.

AES must ensure that the water crossings meet the above requirements or alternatively a Water Use License may be required. Based on current information and understanding of the projects, the river crossings would meet these conditions. Section 2.8 (1) of the General Authorisation states that a person who uses water in terms of this authorisation must submit a registration form for the registration of the water use if the alteration involves mining related activities or occurs within a distance of 1 000 meters from any other alteration, measured along the watercourse.

A1.3.5 National Environmental Management: Biodiversity Act (Act 10 of 2004)

Amongst other objectives, the Biodiversity Act seeks to provide for the management and conservation of biological diversity and its components, the sustainable use of indigenous biological resources, and the fair and equitable sharing of benefits arising from bio-prospecting of indigenous biological resources. It further seeks to provide for co-operative governance in biodiversity management and conservation.

Chapter 1 provides that the Act give effect to conventions affecting biodiversity to which South Africa is a party. These would include the United Nations Convention on Biological Diversity (CBD), the Convention on Trade in Endangered Species (CITES), the Ramsar Convention and the Bonn Convention.

Significantly, the Act provides for the protection of ecosystems and species that are threatened or in need of protection and seeks to prevent the introduction and spread of alien or invasive species. As such, it controls and regulates:

- certain threatening activities occurring in identified ecosystems;
- certain activities which may negatively impact on the survival of identified threatened or protected species; and
- certain restricted activities involving alien or listed invasive species.

In accordance with the Biodiversity Act, an important function of the EIA and associated specialist studies is to ensure that sensitive vegetation is not detrimentally affected by the installation and construction activities associated with the establishment of the renewable energy facility and its associated infrastructure.

A1.3.6 National Forests Act (No. 84 of 1998):

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: "*no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated*".

Two protected tree species, Camelthorn *Acacia erioloba* and Kokerboom/Quiver Tree *Aloe dichotoma* occur in the district and potentially occur at the site. Neither of these species was observed at the site and as these are conspicuous species, it is safe to conclude that they do not occur within the study area.

A1.3.7 National Heritage Resources Act (Act 25 of 1999)

The protection and management of South Africa's heritage resources is controlled by the National Heritage Resources Act (NHRA), 1999 (Act No. 25 of 1999). The objective of the NHRA is to introduce an integrated system for the management of national heritage resources.

Archaeology, Palaeontology and Meteorites

According to Section 35 (Archaeology, Palaeontology and Meteorites) and Section 38 (Heritage Resources Management) of the South African National Heritage Resources Act (SAHRA), palaeontological heritage impact assessments (PIAs) and archaeological impact assessments (AIAs) are required by law in the case of developments in areas underlain by potentially fossiliferous (fossil-bearing) rocks, especially where substantial bedrock excavations are envisaged, and where human settlement is know to have occurred during prehistory and the historic period. Depending on the sensitivity of the fossil and archaeological heritage, and the scale of the development concerned, the palaeontological, and archaeological impact assessment required may take the form of (a) a stand-alone desktop study, or (b) a field scoping plus desktop study leading to a consolidated report. In some cases these studies may recommend further palaeontological and archaeological mitigation, usually at the construction phase. These recommendations would normally be endorsed by the responsible heritage management authority, Heritage Northern Cape (HNC), to whom the reports are submitted for review.

As part of the EIA, a Heritage Impact Assessment (including both archaeology and palaeontology) will be submitted to HNC to elicit comments. Comments received from HNC will be included in the Comments and Responses Report in *Annex C*.

Table 1.1 outlines when a permit is required depending on the sensitivity of the heritage resources.

Table 1.1 Permitting requirements for fossil, built environment and Stone Age archaeology

PERMIT APPLICATION SECTION 35 – FOSSILS, BUILT ENVIRONMENT FEATURES, SHIPWRECKS & STONE AGE ARCHAEOLOGY (Ref : NHRA 1999: 58):
(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite; (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite; (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite.

Burial Grounds and Graves

A Section 36 permit application is made to the South African Heritage Resources Agency (SAHRA) which protects burial grounds and graves that are older than 60 years, and must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make such arrangements for their conservation as it sees fit. SAHRA must also identify and record the graves of victims of conflict and any other graves which it deems to be of cultural significance and may erect memorials associated with these graves and must maintain such memorials. A permit is required under the conditions listed in *Table 1.2*.

Table 1.2 *Permitting requirements for burial grounds and graves older than 60 years to Heritage Northern Cape (HNC) and historic burials to the South African Heritage Resources Agency (SAHRA)*

PERMIT APPLICATION SECTION 36 – BURIAL GROUNDS & GRAVES (REF: NHRA 1999 : 60)
(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves (b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or (c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals (d) SAHRA or a provincial heritage resources authority may not issue a permit for The destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant

Table 1.3 *Permitting requirements for heritage resources management*

PERMIT APPLICATION SECTION 38 (Ref: NHRA 1999 : 62)
(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent; or (ii) involving three or more existing erven or subdivisions thereof; or (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority; (d) the re-zoning of a site exceeding 10 000 m^2 in extent; or (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

A1.3.8 Electricity Regulation Act and Regulations (Act 4 of 2006) as amended

The aims of the Electricity Regulation Act is to achieve efficient, effective and sustainable electricity supply, development and operation to ensure the needs of electricity users in South Africa are met and their interests safeguarded. This will be achieved through the facilitation of investment in the supply industry, access to electricity, promotion of use of diverse energy sources, promotion of competitiveness and a fair balance between the players in the industry and end users.

The Electricity Regulations on New Generation Capacity Government Notice R721 (August 2009), provides for the establishment and regulation of power purchase agreements with independent power producers (IPPs), guidelines governing procurement and renewable feed-in tariff (REFIT) programme.

The proposed solar plant facility will provide an additional electricity supply through renewable energy sources. AES, as the IPP, will be required to comply with guidelines governing the bid programme and REFIT.

A1.3.9 *Electricity Regulation on New Generation Capacity (Government Gazette No 32378 of 5 August 2009)*

The Electricity Regulations on New Generation Capacity (Government Gazette No 32378) were promulgated on 5 August 2009 by the Department of Energy in terms of the Electricity Regulation Act 2006 (see *Section A1.3.8*), and are applicable to:- (a) all types of generation technology including renewable generation and co-generation technology (i.e. landfill gas, small hydro (less than 10 MW), wind and concentrated solar power (with storage)) but excluding nuclear power generation technology; (b) base load, mid-merit and peak generation; and (c) take effect from the date of promulgation, unless otherwise indicated. The objectives of these regulations are:

- The regulation of entry by a buyer and an Independent Power Producer (IPP) into a power purchase agreement;
- The facilitation of fair treatment and the non-discrimination between IPP generators and the buyer;
- The facilitation of the full recovery by the buyer of all costs incurred by it under or in connection with the power purchase agreement and an appropriate return based on the risks assumed by the buyer there under and, for this purpose to ensure the transparency and cost reflectivity in the determination of electricity tariffs;
- The establishment of rules and guidelines that are applicable in the undertaking of an IPP bid programme and the procurement of an IPP for purposes of new generation capacity;
- The provision of a framework for the reimbursement by the regulator, of costs incurred by the buyer and the system operator in the power purchase agreement; and
- The regulation of the framework of approving the IPP bid programme, the procurement process, the Renewable Feed in Tariff (REFIT) programme, and the relevant agreements to be concluded.

The guidelines describe the basic structure of the REFIT programme, including the roles of various parties in the programme, namely the National Energy Regulator of South Africa (NERSA), Eskom and renewable energy generators. They specify that Eskom's "Single Buyer Office" is to be appointed as the Renewable Energy Purchasing Agency (REPA), the exclusive buyer of power under the REFIT programme. Power generators participating in the REFIT scheme are required to sell power generated by renewable technologies to Eskom (the REPA) under a Power Purchase Agreement (PPA), and are also entitled to receive regulated tariffs, based on the particular technology used for generation. NERSA is tasked with the administration of the REFIT programme, including setting the tariffs and verification of the fact that generation is genuinely from renewable energy sources.

The regulations deal generally with procurement under an IPP bid programme, this is defined to mean a bidding process for the procurement of new generation capacity and/or ancillary services from IPPs. They specify the use of a bidding process involving requests for prequalification, requests for proposals and negotiations with the preferred bidder. A special process for the procurement of renewable energy and cogeneration under the REFIT programme is described in Regulation 7. This Regulation states that NERSA is to, "*develop rules related to the criteria for the selection of renewable energy IPPs… that qualify for a licence*" and sets out a list of aspects that the NERSA prescribed criteria should take into account. These include:

- Compliance with the integrated resource plan and the preferred technologies;
- Acceptance by the IPP of a standardised power purchase agreement;
- Preference for a plant location that contributes to grid stabilisation and mitigates against transmission losses;
- Preference for plant technology and location that contributes to local economic development;
- Compliance with legislation in respect of the advancement of historically disadvantaged individuals;
- Preference for projects with viable network integration requirements;
- Preference for projects with advanced environmental approvals;
- Preference for projects demonstrating the ability to raise finance;
- Preference for small distributed generators over centralised generators; and
- Preference for generators that can be commissioned in the shortest time.

In order to establish the proposed Olyven Kolk Solar Power Farm, AES, as an independent power producer, will need to enter into a Power Purchase Agreement (PPA) with NERSA in order to sell the electricity generated.

A1.3.10 Occupational Health and Safety Act (Act 85 of 1993)

The purpose of the OHSA (Act 85 of 1993) is to provide for the health and safety of persons at work or in connection with the use of equipment and machinery. It also provides for the protection of people other than employees from hazards arising from or in connection with activities of persons at work. In this regard an employer is required to bring about and maintain, as far as reasonably practicable, a work environment that is safe and without risk to the health and well-being of workers. The Act is administered by the Department of Labour who have established provincial offices. Occupational health and safety inspectors from these provincial offices undertake inspections and investigations at workplaces to ensure compliance with OHSA.

The Act covers *inter alia*:

- General duties of employers to their employees;

- Electing of Health and Safety Representatives and establishment of Health and Safety Committees; and
- Reporting and investigation of incidents.

Health and safety aspects of the project, as well as employment and labour relations within the construction, operation and decommissioning phases of the project, will need to be undertaken in accordance with OHSA.

Subdivision of Agricultural Land Act (Act No. 70 of 1970)
AES will apply for an exemption (or departure) from applying for the subdivision of agricultural land in terms of the Subdivision of Agricultural Land Act (Act No. 70 of 1970) since agricultural activities will continue during operation of the facility.

A1.3.11 Conservation of Agricultural Resources Act (Act 43 of 1983)

The Conservation of Agricultural Resources Act provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. Regulation 15 of GNR 1048 of 1984 published under the Conservation of Agricultural Resources Act (CARA) classifies categories of weeds and invader plants and restrictions placed on where these weeds may occur. Regulation 15E details requirements and methods to implement control measures for alien and invasive plant species. While no permit requirements will arise from this regulation, AES will be required to ensure that no alien plants or weeds are introduced to the site due to the proposed activities.

A1.3.12 Integrated Environmental Management Information Series

The Department of Environmental Affairs and Tourism (DEAT) Information Series of 2002 consists of 20 documents. The documents were drafted as sources of information on the concepts and approaches to Integrated Environmental Management (IEM). IEM is a key instrument of NEMA and provides the overarching framework for the integration of environmental assessment and management principles into environmental decision-making. The aim of the information series is to provide general information on techniques, tools and processes for environmental assessment and management. ERM have referred to these various documents for information on the most suitable approach to the environmental assessment process for the proposed development.

The Information series on assessing impacts is particularly relevant to the EIR. This document outlines the approaches to and the objectives of assessing impacts.

A1.3.13 Northern Cape Nature Conservation (Act 9 of 2009)

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as

permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.
Manipulation of boundary fences

19. No Person may –

> *erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;*

A1.3.14 Municipal Bylaws

Certain activities related to the proposed development may, in addition to national legislation, be subject to control by municipal by-laws for aspects such as planning, dust, noise and roads, as well as the Siyanda District Municipality Integrated Development Plans (IDPs). Relevant by-laws that have been identified as part of the various specialist studies during the EIA Phase include:

<u>Kai! Garib Local Municipality IDP (2009</u>)

Potential internal economic drivers include:
- The development of niche tourism markets that capture full value out of the special attributes of the area.
- The exploitation of the climate of the area for energy generation (sunshine), i.e. solar farming in the adjacent Mier and //Khara Hais Municipalities

A1.3.15 International Guidelines

- IFC Performance Standards;
- Equator Principles; and
- Clean Development Mechanism (CDM).

The IFC applies Performance Standards (PS) to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing. The PS may also be applied by other financial institutions electing to apply them to projects in emerging markets. Together, the following eight PS establish standards that the client is to meet throughout the life of an investment by IFC or other relevant financial institution:

- PS 1: Social and Environmental Assessment and Management System;
- PS 2: Labor and Working Conditions;
- PS 3: Pollution Prevention and Abatement;
- PS 4: Community Health, Safety and Security;
- PS 5: Land Acquisition and Involuntary Resettlement (n/a);

- PS 6: Biodiversity Conservation and Sustainable Natural Resource Management;
- PS 7: Indigenous Peoples (n/a);
- PS 8: Cultural Heritage.

PS 1 establishes the importance of: (i) integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of social and environmental performance throughout the life of the project. PS 2 through 8 establish requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment, PS 2 through 8 describe potential social and environmental impacts that require particular attention in emerging markets. Where social or environmental impacts are anticipated, the client is required to manage them through its Social and Environmental Management System consistent with PS 1.

The Equator Principles (EPs) similarly are a credit risk management framework for determining, assessing and managing environmental and social risk in project finance transactions. Project finance is often used to fund the development and construction of major infrastructure and industrial projects. The EPs are adopted voluntarily by financial institutions and are applied where total project capital costs exceed US$10 million. The EPs are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making.

The EPs, based on the IFC's Performance Standards on social and environmental sustainability and on the World Bank Group Environmental Health and Safety Guidelines (EHS Guidelines), are intended to serve as a common baseline and framework for the implementation by each adopting institution of its own internal social and environmental policies, procedures and standards related to its project financing activities.

The relevant sections of the World Bank General Environment, Health and Safety Guidelines, as well as the industry specific Guideline on Solar Energy would also be applicable.

This EIA has been undertaken in accordance with the requirements of the EP and IFC Performance Standards. The EIA of course is only one step in the process of complying with the EP and IFC Performance standards and also would require the developer to keep to commitments made during the EIA process and to build on this by also meeting its commitments towards pre-construction and post construction monitoring, the conditions of approval that the DEA may impose, the EMP and an ongoing commitment towards environmental best practice. It is therefore recommended that the developer also commit to establishing and Environmental Management System against which the developer's ongoing performance can be monitored.

A1.4 INTERNATIONAL CONVENTIONS

A1.4.1 United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC is a framework convention which was adopted at the 1992 Rio Earth Summit. South Africa signed the UNFCCC in 1993 and ratified it in August 1997. The stated purpose of the UNFCCC is to, "*achieve….stabilisation of greenhouse gas concentrations in the atmosphere at concentrations at a level that would prevent dangerous anthropogenic interference with the climate system*", and to prevent human-induced climate change by reducing the production of greenhouse gases which are defined as, "*those gaseous constituents of the atmosphere both natural and anthropogenic, that absorb and re-emit infrared radiation*" (1).

The proposed solar farm project will contribute to a reduction in South Africa's greenhouse gases as it will provide an alternative to fossil-fuel based power generation.

A1.4.2 Kyoto Protocol

The Kyoto Protocol is a protocol to the UNFCCC which was initially adopted in 1997 in Kyoto, Japan, and which entered into force on 16 February 2005 (2) . The Kyoto Protocol is the chief instrument for tackling climate change. The main feature of the Protocol is that, *"it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions"*. These amount to an average of five per cent against 1990 levels, over the five-year period 2008-2011. The major distinction between the Protocol and the Convention is that, "*while the Convention encouraged industrialised countries to stabilize GHG emissions, the Protocol commits them to do so*" (3).

The Clean Development Mechanism (CDM) established under the Kyoto Protocol. The CDM allows developing countries such as South Africa to implement GHG emission reduction projects and generate carbon credits.

(1) UNFCCC website, 2010.
(2) *Ibid.*
(3) *Ibid.*

Annex B

Site Photographs

B1 SITE PHOTOGRAPHS

Figure 1.1 Looking into the Olyven Kolk Site from the North East Boundary

Figure 1.2 View of Topography to the East of the Sishen- Saldanha Railway Line

Figure 1.3 Typical Vegetation of the Site with Eskom's Aries Substation and Power Lines

Figure 1.4 Sishen- Saldanha Railway Line (Middle of Site where Railway Line Bends)

Figure 1.5 View of Sishen- Saldanha Railway Line and Service Road

Figure 1.6 Transnet Sishen- Saldanha Train

Figure 1.7 Railway Crossing Connecting Two Sections of Olyven Kolk Solar Power Plant Site

Figure 1.8 View of Low Lying Thorny Vegetation within Olyven Kolk Site

Figure 1.9 View of Flat Terrain and Little Vegetation within Olyven Kolk Sit

Figure 1.10 View of Existing Power Lines Transversing the Olyven Kolk Site

Figure 1.11 Exisiting Labourers Cottage on Olyven Kolk Site

Figure 1.12 View of Existing Borehole on Site

Figure 1.13 View of Derelict Labourers Cottage and Animal Pens

Figure 1.14 Site Entrance from Sishen- Saldanha Railway Line

Annex C

Public Participation Documentation

- Stakeholder database
- Proof of Advertisement of Release of Draft EIR
- Proof of Notification of Draft EIR (email and post)
- Proof of reminder request for comments on Draft EIR and email
- Comments received during EIA process
- Public Meeting Information

1 DATABASE OF STAKEHOLDERS

Name	Position	Organisation
Ms EJ Damon	*Library Manager*	Kenhardt Library
Mr K Lubbe (Kennett)		
Mr I Moolman	*Head of Office*	Kai! Garieb Head Office
Mr TC Ntamo (Chris)	*Director*	Relevent AmbitionTrading 102 cc
Mr F Ruppin (Frikkie)	*Environmental Department*	Siyanda District Municipality
Mr W de Bruin (Werner)		
Mr M Stoeltzing (Michael)	*Member*	Wimper Investments 6 CC
Mrs A Collett (Anneliza)	*Directorate: Land Use & Soil Management*	Department of Agriculture - Pretoria
Ms R de Kock (Rene)	*Statutory Control*	South African National Roads Agency Ltd
Prof R Levin (Richard)	*Director General*	National Government: Dept of Economic Development
Ms N Magubane (Nelisiwe)	*Director General*	National Government: Dept of Energy
Mr G Makaula (Gunyaziwe)	*Regional Manager*	South African National Roads Agency Ltd
Mr S Mokoena (Smunda)	*The Chief Executive Officer*	National Energy Regulator of South Africa (NERSA)
Mr DE Mthembu (Dumisane Emmanuel)	*Acting Chief Director: Environmental Impact Mgmt*	Department of Environmental Affairs
Ms N Ngele (Nobubele)	*Director General (Acting)*	National Gov Dept of Water Affairs
Adv S Nogxina (Sandile)	*The Director General*	National Government: Dept of Mineral Resources
Mr C van der Waldt (Cobus)		South African National Roads Agency Ltd
Mr S Vukela (Sam)	*Acting Director General*	National Government: Department of Public Works
Mr L Zitha (Langa)	*The Director General: Agriculture*	National Gvt Dept: Agriculture, Forestry&Fisheries
Ms SE Erasmus (Suzanne)	*NC Regional Chairperson*	Wildlife and Environment Society of SA (WESSA)
Dr M Galimberti (Mariagrazia)	*Archaeology, Palaeontology & Meteorite Unit*	South African Heritage Resources Agency (SAHRA)
Mr/Ms N Ndobochani (Nonofho)	*Manager: APM Division*	South African Heritage Resources Agency (SAHRA)
Ms D Van der Walt (Deirdre)		Agri South Africa
Ms N Wilson (Natasha)	*Land Programme Manager*	WWF South Africa
Mr A Abrahams (Abe)		Department of Water Affairs (DWA)
Mr A Hall (Andrew)	*Senior Manager*	Heritage Northern Cape
Mr J Mackay (Johny)	*Municipal Manager*	Kai Garib Local Municipality
Mr A Makaudi (At)	*Impact Management : EIA ADMIN*	NCape Prov Gvt: Environment & Nature Conservation
Mr WDV Mothibi (Viljoen)	*HOD: Agriculture*	NCape Prov Gov: Agriculture, Land Reform&Rural Dev
Mr J Mutyorauta (Julius)	*Director: Environment*	NCape Prov Gvt: Environment & Nature Conservation
Mr D Ngxanga (Dalixolo)	*Municipal Manager*	Siyanda District Municipality
Ms C Pienaar (Christine)	*Senior Nature Conservation Scientist: Ecologist*	NCape Prov Gvt: Environment & Nature Conservation
Mr T Rata (Timothy)	*Acting Provincial Manager - Northern Cape*	South African Heritage Resources Agency (SAHRA)

Name	Position	Organisation
Mr G Sahling (Graham)		NCape Prov Gov: Agriculture, Land Reform&Rural Dev
MJ Sinthumule	*Assistant Manager: Heritage Resources*	Heritage Northern Cape
Mr K Streuders		Department of Water Affairs (DWA)
()	*The Manager*	Sustainable Energy Society of Southern Africa
Ms C Ah Shene (Carolyn)		Birdlife South Africa
Dr M du Plessis (Morne)	*Chief Executive Officer*	World Wide Fund South Africa
Mr T Finnan (Tim)	*National Office Manager*	Wildlife & Environment Society of SA (WESSA)
Ms Y Friedmann (Yolan)	*CEO*	The Endangered Wildlife Trust
Mr J Grobler (Japie)	*President*	Agri South Africa
Mr SW Johnston (Shawn)		Sustainable Futures ZA
Mr Z Mokhine (Zini)	*Chairperson*	Earthlife Africa Johannesburg
Mr N Opperman (Nic)		Agri South Africa
Ms Z Rabaney (Zaitoon)		Botanical Society of SA
Ms A Roux (Anneke)		Agri South Africa
Mr T Taylor (Tristen)	*The Manager*	Earthlife Africa Johannesburg
Mrs J Thomas (Jo-Anne)		Savannah Environmental Consultants
Mr H van der Merwe (Hans)	*The Executive Director*	Agri South Africa
Professor RA Hasty		Emeritus Professor UNISA
Mr C Jooste (Charl)	*Planning Tools Applicator*	Eskom Holdings Ltd Distribution: Western Region
Mr H Landman (Henk)	*Senior Supervisor: Land & Rights*	Eskom Holdings Ltd Distribution: Western Region
Mr K Leask (Kevin)		Eskom - Johannesburg
Mr R Marais (Ronald)		Eskom - Johannesburg
Mr LW Ndou and Livhuwani Wilson	*Environmental Specialist*	Transnet Freight Rail
S Scheppers (Segomoco)	*System Planning Manager*	Eskom Transmission
A Van Gensen (Andrea)	*Environmental Management Practitioner*	Eskom Connections and Substations
Mr JT Benode		
Ms C Daniels (Charmaine)		
Ms N Feni (Ntombi)		Department of Water Affairs Northern Cape
Ms M Fourie (Maryna)	*Farm Owner*	
Ms A Hlengani (Alexia)	*Hydrology*	Department of Water Affairs Northern Cape
Mr WB Skei (William)		
Mr WW Speelman		
Mrs E Williams (Edith)		
Mr R Ally (Rory)		The Mayor
Mr PJ Buys		
Mr A Coetzee (Abrie)		
Mr/Ms S Jacob	*Speaker*	
Ms/Mr E Jordaan		Kenhardt CHC
Ms C Markgraaff (Christa)	*CDW*	Kai! Garieb Head Office
Cllr JG Styles (James)	*Councillor: Ward 9*	Kai Garib Local Municipality
Ms M Titus (Mary)	*Raadslid*	
Ms E Visser (Elbe)		

Potjiekoskompetisie by skougronde

26. TE LAAT VIR KLASSIFIKASIE

2 MONOSEM 2-ry lugdruk-planters te koop R25 000,00 en R27 000,00 onderskeidelik. Skakel 082 337 7560
---------------------- 0038692/28/10

KODE 14 Lanfafstand drywer met ondervinding van ten minste 3 jaar gesoek. Vorige werkverwysings moet aansoek vergesel. Geen kansvattres asb. Werkgewer doen koelvervoer vanaf Upington, semi afgetrede persone. Kan ook aansoek doen as hulpdrywers. Kontak 082 782 2334 vir 'n onderhoud.
------------------------------ ac/28/10

POWERFORCE hoëdruk spuit - R350. Flymo - Pushmower (grassnyer) - R280. USB Modem - R250. PS 2 games (Turmo 4 Fifa 07) R100 elk. Single view DStv decorder + skottel - R450. 072 3781 497
---------------------- 0038884/28/10

RIVER-VIEW Guest House. Rivier Oewer Gastehuis in Upington. Luukse kamers met badkamer/ lugreëling/swembad. Veilige sekerheids parkering. Bekostigbare tariewe. Teenaan rivier op rivierwal. Fanstastiese uitsig en natuuskoon. 082 773 5200 Mariana alle ure.
------------------------------ ac/28/10

RIVIER OEWER luukse woonstel te huur. Teenaan rivier op rivierwal. Aangrensende toegang na swembad met sondek. 1 Slaapkamer, kombuis met oopplan leef area. Uniek. Ten volle gemeubileerd, of beskikbaar sonder meubels. Krag en water ingesluit. Fantastiese uitsig en natuurskoon. R7 800 per maand.
------------------------------ ac/28/10

PAMGOLDING: Goedkoper sal jy nie kry nie: Een slk wstel te koop by Modesta (054) 332 7333; Anna - (083 561 5842); Filon - (082 493 5497); Dawid - (082 339 6805); Marina - (078 800 0210)
------------------------------ ac/28/10

UPINGTON: Oosterville Drankwinkel hou op 5 November 2011 hul 5de Potjiekoskompetisie by die skougronde op Upington.

Tydens die dag sal Mej. Upington Junior en Tiener gekies word en Upington se seksieste mamma word gekies.

Daar sal ook 'n DBV "Doggie Walk" aangebied word.

Hekke open 10h00 sodat elkeen sy stalletjie kan inrig, vure mag egter nie voor 13:00 aangesteek word nie.

Beoordeling van die potjiekos vind op die volgende tye plaas: Rooivleis rou beoordeling vanaf 13:30 by die stalletjies. Gaar beoordeling vanaf 16:30 tot 18:30 by die musiekpunt.

Die prysuitdeling is om 19:30 in die saal waarna daar gedans sal word tot laatnag.

Drie kunstenaars sorg vir "dans tot ounag" musiek met hoofsanger **Warren Elliot** van "Vuurwarm".

Die vermaak tydens die Potjiekos en dans sluit in: * Mnr Muscleman 8-13Jr * Waterwurm/ Springkasteel * DVD vir kinders onder toesig tydens die dans * Golf ... naaste aan die gat.

* Wipplank game, alleenlik vir volwassenes * Kabel loop vir jou en metgesel.

* Mej Upington Junior en Tiener, Upington se seksieste Mamma en DBV se "Doggie walk" vind vanaf 11:00 plaas in die Karakoelsaal.

Roandi van Staden, 17 jr, van Hoërskool Duineveld en deel van Chic Modelskool, is een van die inskrywings. Meisies in alle ouderdomsgroepe word uitgenooi om vir die verskillende afdelings in te skryf.

Mart-Mari van Zyl, 17 jaar oud en van Hoërskool Duineveld is ook een van die meisies wat ingeskryf het. Sy is ook deel van die Chic Modelskool.

26. TE LAAT VIR KLASSIFIKASIE

GORDONSBAAI: Luukse seefront vakansie woonstel op hoofstrand te huur. Slaap ses persone. Privaat sekerheids parkering. Ten volle toegerus. 4 Vlakke (verdiepings) met sondek, uniek. Sien webtuiste: www.gordonsbaybeachfront.co.za Huurdirek van eienaar. Kontak 082 782 2334
------------------------------ ac/28/10

VARS Sultana-en/of Merbine-druiwe per tonnemaat, 2012-oesseisoen. SMS/skakel 083 627 5776
--------------------------- 38814/28/10

KENNISGEWINGS

KENNISGEWING: In die Boedel van wyle Hector Nicholas Bergström, Identiteitsnommre 441126 5148 08 5, in lewe getroud, buite gemeenskap van goed, met Caroline Maria Bergström Identiteitsnommer 451023 0078 08 5 van Diamantstraat 579, Port Nolloth, wat op 7 Junie 2010 te Sierra Leone oorlede is. (Boedel Nr 329/2011). Skuldeisers moet hulle eise teen bogemelde Boedel indien en skuldenaars hulle skulde inbetaal by onderstaande adres binne 30 dae vanaf publikasie hiervan (28 Oktober 2011). Van Sitterts, Prokureurs vir Eksekuteur, Perlemoenstraat, Posbus 583, Port Nolloth 8280
-- K1/28/10

KENNISGEWING: In die boedel van Jacobus Johannes De Wet (Identiteitsnommer 271229 5023 08 7) van Vurkstraat 10, Die Rand, Upington. 8801 wie oorlede is op 25 Augustus 2011. (Boedelnommer 1775/2011). Krediteure en debiteure in bogenoemde boedel word hiermee versoek om binne 'n tydperk van 30 (Dertig) dae vanaf hierdie kennisgewing hul eise teen hierdie boedel in te stel en hul skulde aan die boedel te betaal. Du Toit van den Heever, Agente vir die Eksekuteur Testamentêr, Posbus 204, Upington, 8800
-- K2/28/10

KENNISGEWING: In die boedel van wyle Gert Johannes Kotze, Identiteits Nr 2202095028080 wie woonagtig was te Oranjehof Ouethuis, Du Plessisstraat No 2 Upington en wie oorlede is op 15/12/2010. No. 126/2011. Geliewe kennis te neem dat die Eerste en Finale Likwidasie en Distribusierekening in bogenoemde Boedel ter insae lê aan die Kantoor van die Meester van die Hooggeregshof te Kimberley en 'n afskrif daarvan aan die Kantoor van die Landdros te Upington vir 'n tydperk van 21 dae, gereken vanaf datum van publikasie hiervan. Lange, Carr & Wessels Ingelyf, Prokureurs vir die boedel, Oasis Protea Lodge Gebou, Schröderstraat 26, Posbus 6, Upington, 8800
-- K3/28/10

KENNISGEWING: Boedel wyle: Hendrik Johannes Myburgh. Identiteits No: 3906035010086. Van: Pionierpark Woonstel No 14, Du Plessisstraat No 2, Upington. Boedel No: 2792/2011. Alle persone wat eise teen bogemelde boedel het word versoek om sodanige eise by die eksekuteur in te dien by die ondervermelde adres binne 30 dae vanaf 2011/10/28 en enige persone wie gelde aan die boedel verskuldig is word versoek om sodanige gelde by die eksekuteur in te betaal binne die voormelde tydperk. Lange, Carr & Wessels Ingelyf, Posbus 6, Upington, 8800, Tel: (054) 337 5000
-- K4/28/10

URB Sellulêr is deel van die Net-Ex groep wat tegnologie met innovering integreer ten einde kliënte absolute gemoedsrus te gee rakende telekommunikasiedienste, rekenaars, netwerke en bekabeling, drukkers en CCTV-kameras en sellulêre dienste. URB Sellulêr, wat 14 winkels in die Noord- en Wes-Kaap bedryf, beskik oor die volgende uitdagende pos vir 'n analitiese en sistematiese persoon wat akkuraat kan werk

ADMINISTRATIEWE PERSOON
(UPINGTON)

Verantwoordelikhede behels hoofsaaklik die trek van verslae, analise van informasie, opstel van verslae op spreiblaaie en kontrole oor voorraad.

Verdere vereistes is Matriek, ondersteun deur 'n sterk syfer-oriëntasie en uitstekende kennis in die gebruik van MS Excel.

'n Onderhandelbare vergoedingspakket met byvoordele, onderhewig aan kwalifikasies en ondervinding, word aan die pos gekoppel.

Rig u aansoek en CV met verwysing JUS voor 4 November 2011 aan:

ORFFER & VAN DER MERWE
HUMAN RESOURCE PRACTITIONERS
E-mail: admin@ovdm.co.za
Fax: 054 331 3338

Indien u nie binne drie na die sluitingsdatum gekontak word nie, kan u aanvaar dat u aansoek onsuksesvol was.

Ons kliënt, 'n gevestigde tafeldruif uitvoermaatskappy, bied 'n uitdagende loopbaan geleentheid aan 'n dinamiese en energieke persoon in hul finansiële afdeling, as:

FINANSIëLE REKENMEESTER
Kakamas Omgewing

Die suksesvolle persoon moet goed georganiseerd, hardwerkend en presies wees met 'n natuurlike aanleg vir syfers, in besit van 'n relevante tersiêre kwalifikasie ondersteun deur minimum 3-5 jaar toepaslike ondervinding in 'n rekenmeester posisie met goeie kommunikasie vaardighede.
'n Voltooide B.COMM met koste en bestuursrek, voltooide "articles" of CIMA kwalifikasie sal as verdere aanbeveling dien.

Die suksesvolle persoon sal hoofsaaklik vir die volgende areas verantwoordelik wees:
- Algemene finansiële-en maatskappy administrasie
- Debiteure en krediteure bestuur, wat die ontvangs van uitvoer inkomste in buitelandse valuta en prosesseering van produ sente betalings insluit.
- Opstel van maand- en jaareinde opgawes en finansiële state.
- Begrotingsbestuur & Salaris-en-loonadministrasie
- SARS en ander maatskappy opgawes (BTW, LBS, WVF, Tantieme, Statutêre heffings, ens.)

Bykomend moet suksesvolle persoon oor die volgende vaardighede beskik:
- Bo-gemiddelde Pastel en gevorderde Excel vaardigheid
- Goeie tweetaligheid
- Positiewe gesindheid met hoë energievlakke
- Deeglike finansiële agtergrond en ondervinding
- Vorige ondervinding van QX uitvoerstelsel sal as aanbeveling dien

In ruil vir u dienste bied die maatskappy 'n aangename werksomgewing en 'n mededingende vergoedingspakket.

Stuur volledige CV, met verwysing MPFR, voor 07 November 2011 aan:

ORFFER & VAN DER MERWE
HUMAN RESOURCE PRACTITIONERS
E-mail: admin@ovdm.co.za
Fax: 054 331 3338

Indien u nie binne drie (3) weke na die sluitingsdatum gekontak word nie, kan u aanvaar dat u aansoek onsuksesvol was.

MUNISIPALITEIT //KHARA HAIS

KENNISGEWING K58/2011

DORPSAANLEGSKEMA : VOORGESTELDE HERSONERING EN OPHEFFING VAN BEPERKENDE VOORWAARDES EN AANSOEK OM AFWYKING OP ERF 953, UPINGTON

Kennis geskied dat die Munisipaliteit //Khara Hais van voorneme is om die volgende aksies met onroerende eiendom binne //Khara Hais Munisipale Regsgebied, ingevolge die bepalings van die Noord-Kaapse Wet op Ontwikkeling en Beplanning, 1998 (Wet 7 van 1998) te oorweeg.

1. ERF 953 UPINGTON

1.1 Voorgestelde hersonering

Beskrywing van Eiendom	:	Erf 953 Upington
Ligging	:	Schröderstraat 137, Upington
Oppervlakte	:	1166 m²,
Aansoeker	:	Macroplan Upington
Geregistreerde Eienaar	:	D Vollgraaff (Transportakte : T1022/2007)
Huidige Gebruiksaanwending	:	Residensiele Sone I
Voorgestelde Gebruiksaanwending	:	Residensiele Sone III
Doel van aansoek	:	Erf word hersoneer na Residensiele Sone III ten einde 'n gastehuis daarop te akkommodeer. Daar word ook aansoek gedoen om boulyn-verslapping van die suid-westelike syboulyn beperk vanaf 4.5m tot 3m op Erf 953, Upington.

1.2.1 **Opheffing van beperkende voorwaardes**
Aard van aansoek : Opheffing van beperkende titelvoorwaardes, soos vervat in Titelakte T1022/2007 Bl.3, paragraaf 5 en 6, segmente a – d, ten einde die hersonering op Erf 953, Upington te oorweeg.

Nadere besonderhede is verkrygbaar vanaf die Raad se Stadsbeplanner, Telefoon 054-3387372, gedurende normale kantoorure en besware teen die aansoek, indien enige, moet aldaar skriftelik by die Munisipale Bestuurder ingedien word om hom voor of op **Vrydag, 11 November 2011**, te bereik. Indien enige persoon wat kommentaar wil lewer/vertoë wil rig, nie kan skryf nie, kan sodanige persoon gedurende normale kantoorure voor of op **Vrydag, 11 November 2011** by
Mnr J du Plessis by die Bouafdeling Kamer 57 aanmeld, waar sodanige persoon se kommentaar/vertoë op skrif gestel sal word.

WJB ENGELBRECHT, MUNISIPALE BESTUURDER
Bugersentrum, Markstraat, Privaatsak X6003, UPINGTON, 8800

Erf 953, Upington

//KHARA HAIS MUNICIPALITY

NOTICE N58/2011

TOWN PLANNING SCHEME : PROPOSED REZONING, REMOVAL OF RESTRICTIONS AND DEPARTURE ON ERVEN 953, UPINGTON

Notice is given in terms of the provisions of the Northern Cape Planning and Development 1998, (Act 7 of 1998) and the applicable Scheme Regulations for //Khara Hais Municipality, that it is the intention of the Council to consider the undermentioned on immovable property:

1. ERF 953, UPINGTON

1.1 Proposed rezoning

Description of Property	:	Erf 953, Upington
Site	:	137 Schröder Street, Upington
Area	:	1166m²
Applicant	:	Macroplan Upington
Registered Owner	:	D Vollgraaff (Deeds of Transport : T1022/2007)
Present Utilisation	:	Residential Zone I
Proposed Utilisation	:	Residential Zone III
Purpose of application	:	The Erf will be rezoned in order to facilitate the erection of a Guest House. Application for Departure of the south western building line limited from 4.5m to 3m on Erf 953, Upington is also done.

1.2. **Removal of restrictions**
Nature of application: Removal of restrictive title conditions as enumerated in Title Deed T1022/2007 page.3, paragraph 5 and 6, segments a – d, to facilitate the rezoning of Erf 953, Upington.

Full particulars are obtainable from the Town Planner of the Council, Telephone 054-3387372, during normal office hours (Monday to Friday, 07:30 - 12:30 and 13:30 - 16:30) and objections against the application, if any, must be lodged in writing with the Municipal Manager before or on **Friday, 11 November 2011.** Any person with objections against the application, who is unable to write, can during normal office hours on or before **Friday, 11 November 2011**, report to Mr J du Plessis, Building Section, room 57 who will put such a persons objections in writing.

WJB ENGELBRECHT, MUNICIPAL MANAGER, Civic Centre Market Square, Private Bag X6003, UPINGTON, 8800

Erf 953, Upington

KENNISGEWING VAN OMGEWINGSINVLOEDBEPALING (OIB)
Voorgestelde Ontwikkeling van die Olyvenkolk Sonkrag Aanleg
DOS Verw 12/12/20/2170
ERM Verw: 0126393

Notice of Draft Environmental Impact Report

The Draft Environmental Impact Assessment (EIR) for the proposed solar power plant in Olyvenkolk farm in the Northern Cape is available for public comment. The report will be available for viewing on the project website http://www.erm.com/EIA-AES, and at Kenhardt Public Library from

Friday 28 October 2011.

The closing date for all comments is **5 December 2011**.

Kennisgewing van die Konsep Omgewingsimpak Verslag

Die Konsep Omgewingsimpak Verslag (OIV) vir die voorgestelde Sonkrag Aanleg aan Olyvenkolk plaas in die Noordkaap is beskikbaar op die projek webtuiste http://www.erm.com/EIA-AES en sal teen Vrydag 28 Oktober 2011 by Kenhardt Openbare Biblioteek beskikbaar wees.

Alle kommentaar moet ingedien word voor of op **5 Desember 2011.**

Please contact **Linda Slabber** or **Isobel Evans** if you would like to submit comments /
Om te kommentaar, kontak asseblief vir **Linda Slabber** of **Isobel Evans**.

Email / E-pos: aes.solarfarm@erm.com
Tel: 021 702 9100, Fax / Faks: 086 662 2228

Linda Slabber

From: Linda Slabber
Sent: 25 October 2011 17:59
To: Linda Slabber
Attachments: AES Draft EIR Notification Letter.pdf
Bcc: 'tonderai@apsolutions.co.za'; 'kenhardtlib@ncpg.gov.za'; 'kennett.lubbe@za.andress.com'; 'moolman@kaigarib.co.za'; 'chris.ntamo@gmail.com'; 'fpr@siyanda.gov.za'; 'werner.debruin@bm.pwc.com'; 'michael.stoeltzing@wineestatecapital.com'; 'dekockr@nra.co.za'; 'rlevin@economic.gov.za'; 'dineo.moraile@energy.gov.za'; 'makaulag@nra.co.za'; 'info@nersa.org.za'; 'lorrain.leburu@nersa.org.za'; 'dmthembu@deat.gov.za'; 'mabokoi@dwa.gov.za'; 'mwabisa.qwanyashe@dmr.gov.za'; 'mampuru.koma@dmr.gov.za'; 'waldtjc@nra.co.za'; 'sam.vukela@dpw.gov.za'; 'dg@daff.gov.za'; 'dodg@daff.gov.za'; 'pa.dg@daff.gov.za'; 'se@museumsnc.co.za'; 'wessanc@yahoo.com'; 'mgalimberti@sahra.org.za'; 'nndobochani@sahra.org.za'; 'Deirdre@agrisa.co.za'; 'nwilson@wwf.org.za'; 'abrahamsa@dwa.gov.za'; 'lefleurd@dwa.gov.za'; 'ahall@ncpg.gov.za'; 'mackayj@kaigarib.co.za'; 'cfortune@agri.ncape.gov.za'; 'enquiries@ncpg.gov.za'; 'judischoltz@ncpg.gov.za'; 'd.ngxanga@vodamail.co.za'; 'Christine.dtec@gmail.com'; 'info@sahra.org.za'; 'jsinthumule@ncpg.gov.za'; 'ahall@ncpg.gov.za'; 'streudersk@dwa.gov.za'; 'advocacy@birdlife.org.za'; 'info@birdlife.org.za'; 'mduplessis@wwf.org.za'; 'scharlton@wwf.org.za'; 'marketing@wessa.co.za'; 'yolanf@ewt.org.za'; 'agrisa@agriinfo.co.za'; 'swjohnston@mweb.co.za'; 'zini@earthlife.org.za'; 'mabule@ghouse.org.za'; 'nic@agrisa.co.za'; 'zaitoon@mweb.co.za'; 'anneke@agrisa.co.za'; 'tristen@earthlife.org.za'; 'joanne@savannahsa.com'; 'agrisa@agriinfo.co.za'; 'charmaine@agrisa.co.za'; 's.chymist@gmail.com'; 'joostecg@eskom.co.za'; 'henk.landman@eskom.co.za'; 'livhuwani.ndou@transnet.net'; 'segomoco.scheppers@eskom.co.za'; 'vGenseAL@eskom.co.za'; 'zeekoesteek@valeuitin.co.za'; 'feniN2@swa.gov.za'; 'Chrisf@yahoo.com'; 'hlengani@dwa.gov.za'; 'mayor@kaigarib.gov.za'; 'speaker@kaiGarib.gov.za'; 'omamiemie@gmail.com'

Dear Stakeholder,

The Draft Environmental Impact Report (DEIR) for the proposed Olyven Kolk Solar Power Plant is now available for comment. Please refer to the attached letter for further information about where you can view a copy of the report and for details regarding the comment period. The Non-Technical Summary is available in Afrikaans and English on request.

Kind regards,

Linda Slabber
ERM Southern Africa
Silverwood House,Block A
Silverwood Close,
Steenberg Office Park
Steenberg, 7945
Cape Town, South Africa
Tel: +27 21 702 9100
Fax: 086 662 2228
Mobile: +27 84 409 9641
linda.slabber@erm.com
www.erm.com

ERM Ref: 0126393
DEA Ref: 12/12/20/2170

Geagte Belanghebbende en Geaffekteerde Party,

Hierdie brief dien om u in te lig dat die Konsep Omgewingsimpak Verslag (OIV) vir die Olyven Kolk Sonkrag Plaas projek beskikbaar is vir kommentaar. 'n Kopie van die OIV sal teen Vrydag 28 Oktober beskikbaar wees by die Kenhardt Openbare Biblioteek en 'n elektroniese weergawe van die verslag kan nou op die volgende webtuiste besigtig word: http://www.erm.com/EIA-AES

Alle kommentaar op die OIV moet aan Isobel Evans of Linda Slabber by ERM geadresseer word en moet ingedien word voor of op 5 Desember 2011.

Die uwe

Isobel E

Isobel Evans
021 702 9100
AES.Solarfarm@erm.com

ERM Ref: 0126393
DEA Ref: 12/12/20/2170

Dear Interested and Affected Party,

This letter serves to inform you that the Draft Environmental Impact Report (EIR) for the Olyven Kolk Solar Power Plant is available for comment. A copy of the Draft EIR is available at the Klawer Public Library from Friday 28 October 2011 and an electronic version of the report and the NTS in English and Afrikaans can be accessed from today on the project website: http://www.erm.com/EIA-AES

All comments on the Draft EIR should be sent to Isobel Evans or Linda Slabber of ERM and must be submitted by the 5 December 2011.

Yours sincerely

Isobel E

Isobel Evans
021 702 9100
AES.Solarfarm@erm.com

Environmental Resources Management

Cape Town Office
Block A, Silverwood
Steenberg Office Park
Silverwood Close
Steenberg, 7945
Cape Town
South Africa
Tel: +27 (0) 21 702 9100
Fax:+27 (0) 21 701 7900
www.erm.com

Postal Address:
Postnet Suite 90
Private Bag X12
Tokai, 7966

24 October 2011

ERM ref: *0126393*
DEA ref: *12/12/20/2170*

Dear Sir/Madam,

Proposed Olyven Kolk Solar Power Plant - Draft Environmental Impact Report (EIR)

Please find enclosed the Draft Environment Impact Report (EIR) for the proposed AES Olyven Kolk Solar Power Plant for your comment.

Please do not hesitate to contact me should you have any queries.

Yours sincerely,

Isobel E

Isobel Evans
Consultant

AES.Solarfarm@erm.com

Project code - 0126393

PostNet: Postnet Tokai Address: Shop 7a, Tokai-on-Main S/C, Main Road, Tokai Tel No.: 021 715 5680.	**Barcode / Waybill No.** 5984880
Senders Name: Linda. Ref No.: E-mail Address: Tel No.: 021 7029100 Company Name: ERM Address: Postnet #90, Private Bag X12 Town: Tokai Code: 7966	Receivers Name: Mr Ishaam Abader Company Name: Acting Chief Director: Enviromental Address: Impact Mgnt. Dept. of Enviromental Affairs, Private Bag X447 Town: Pretoria Tel No.: Country: Code: 0001
Special Instructions:	**Domestic**: [X] Express (11h00) [ ] Budget/Next Day (Close of Business) [ ] Road (48-72hours) To: [X] Door [ ] Counter Other
Insurance Yes / No — **If yes, state value**	**International**: [ ] Documents [ ] Non-documents

No. of Parcels	Description	Length in cm	Breadth in cm	Height in cm	Mass in kg	Charges	Rands	Cents
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	(Draft EIR)					Surcharge		
	AES					Insurance		
						Packaging Sundries		
						VAT Amount		
	Total No. of Parcels / Total.Vol		Total Mass			Total Incl. VAT		

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Date: 25/10/2011 Time:	Date: 25/10/11 Time:	Date: Time:
Sign:	Sign:	Sign:

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Senders Name: Linda. Ref No.: E-mail Address: Tel No.: 021 7029100 Company Name: ERM Address: Postnet #90, Private Bag X12 Town: Tokai Code: 7966	Receivers Name: The Librarian Company Name: Kenhardt Library Address: Park Street Town: Kenhardt Tel No.: Country: Code: 8900.
Special Instructions:	**Domestic**: [X] Express (11h00) [ ] Budget/Next Day (Close of Business) [ ] Road (48-72hours) To: [X] Door [ ] Counter Other
Insurance Yes / No — **If yes, state value**	**International**: [ ] Documents [ ] Non-documents

No. of Parcels	Description	Length in cm	Breadth in cm	Height in cm	Mass in kg	Charges	Rands	Cents
1	Documents					Basic Tariff		
	(Draft EIR)					Surcharge		
	AES					Insurance		
						Packaging Sundries		
						VAT Amount		
	Total No. of Parcels / Total Vol		Total Mass			Total Incl. VAT		

SENDERS SIGNATURE | **ACCEPTED BY POSTNET** | **RECEIVED BY**

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Senders Signature	Accepted by PostNet	Received by
Name: Runeyda Daniels (PLEASE PRINT)	Name: F. ADAMS (PLEASE PRINT)	Name: (PLEASE PRINT)
Date: 25/10/2011 Time:	Date: 25/10/11 Time:	Date: Time:
Sign:	Sign:	Sign:

POSTNET Courier

Forms Control (011) 888-6007 Ref: 43327/8ss

Project Code: 0126393.

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						VAT Amount		
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Senders Name Linda Ref No. E-mail Address Tel No. 021 7029100 Company Name ERM Address Postnet #90 Private Bag X12 Town Tokai Code 7966	Receivers Name Mr A Mokaudi Company Name N Cape Prov Gvt Address Private Bag X 6102 Kimberley Town Tel No. Country Code 8300
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Ref No.:
E-mail Address:
Tel No.: 021 7029100
Company Name: ERM
Address: Postnet #90, Private Bag X12
Town: Tokai
Code: 7966

Receivers Name: Ms N Ngele
Company Name: National Gov Dept of Water Affairs
Address: Private Bag X313; Pretoria.
Town:
Tel No.:
Country: SA
Code: 0001

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Tel No.: 021 7029100
Company Name: ERM
Address: Postnet #90, Private Bag X12
Town: Tokai
Code: 7966

Receivers Name: MJ Sinthumule
Company Name: Heritage Northern Cape.
Address: Private Bag X5004. Kimberley
Town:
Tel No.:
Country:
Code: 8300

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E-mail Address:	Tel No.: 021 7029100
Company Name: ERM	
Address: Postnet #90, Private Bag X12	
Town: Tokai	Code: 7966

Receivers Name: Mr A. Makaudi	
Company Name: N Cape Prov Gvt: Enviroment	
Address: Private Bag X 6102, Kimberley	
Town:	Tel No.:
Country: S.A.	Code: 8300

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E-mail Address:	Tel No.: 021 7029100
Company Name: ERM	
Address: Postnet #90, Private Bag X12	
Town: Tokai	Code: 7966

Receivers Name: Mr L. Zitha.	
Company Name: National Gvt Dept: Agriculture	
Address: Private Bag X250. Pretoria.	
Town:	Tel No.:
Country:	Code: 0001

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ERM

AES Mailing
Notification DEIR. 0126342

Mr A Makaudi
Impact Management : EIA ADMIN
NCape Prov Gvt: Env Affairs &
Nature Conservation
Private Bag X6102,
Kimberley,
8300

Dr L Moorosi
Head of Department
Northern Cape Provincial
Department of Agriculture
Private Bag X02,
Bloemfontein,
9300

Mr G Sahling
NCape Prov Gvt: Agriculture, Land
Reform&Rural Dev
Private Bag X5018,
Kimberley,
8300

The Manager
Sustainable Energy Society of
Southern Africa
P O Box 152,
La Montagne,
0184

POSKANTOOR
2011 -10- 27

Mr J Grobler
President
AgriSA
P O Box X180,
Centurion,
0046

27/10/2011.
De'maine
5 X DL

25 October 2011

Environmental Resources Management

Cape Town Office
Block A, Silverwood
Steenberg Office Park
Silverwood Close
Steenberg, 7945
Cape Town
South Africa
Tel: +27 (0) 21 702 9100
Fax:+27 (0) 21 701 7900
www.erm.com

Postal Address:
Postnet Suite 90
Private Bag X12
Tokai, 7966

ERM

Dear Chief Librarian,

Draft Environmental Impact Assessments (EIA) for the Proposed Establishment of a Solar Power Plant at the Olyven Kolk Farm, Northern Cape

DEA Ref: E 12/12/20/2170, ERM Ref: 0126393

Please find enclosed, for public comment, a copy of the Draft Environmental Impact Report for proposed Olyven Kolk Solar Power Plant. Members of the public have been informed that the Draft EIR is available at the Library and that they are welcome to read it there.

I would like to request that the document should not be removed from the library until the 6th December 2011. Should the received copy be misplaced before this date, please inform us so that it can be replaced.

Thank you for your assistance in this regard. Should you have any queries please contact Isobel Evans of ERM on 021 702 9100 or via email: Isobel.evans@erm.com.

Yours sincerely,

Isobel E

Isobel Evans
Consultant

THE SOUTH AFRICAN NATIONAL
ROADS AGENCY LTD

Reg. No.1998/009584/06

SANRAL is an Agency of the Ministry of Transport

[redacted]

Western Region
Parc du Cap, Building 5, cor. Mispel Str & Willie van Schoor Avenue, Bellville, 7530
Private Bag X19, Bellville, South Africa, 7530
Tel +27 (0) 21 957 4600 Fax +27 (0) 21 946 1630
Head Office Tel +27 (0) 12 844 8000 Fax +27 (0) 12 844 8200
Offices in Menlyn - Pretoria, Pietermaritzburg, Port Elizabeth

Reference:	W11/2/3-R27/10-2	**Fax Number:**	+27 (0) 21 946 1630
Date:	14 July 2011	**Direct Line:**	+27 (0) 21 957 4600
Email:	dekockr@nra.co.za	**Website:**	www.sanral.co.za

Linda Slabber
ERM Southern Africa
Silverwood House, Block A
Silverwood Close
Steenberg Office Park
STEENBERG
7945

Creating wealth through infrastructure

Dear Ms Slabber

R27/10: PROPOSED 200MW OLYVEN KOLK SOLAR POWER PLANT, NORTHERN CAPE (12/12/20/2170)

Thank you for your email dated 13 June 2011.

The South African National Roads Agency Limited (SANRAL) has no objection to the proposed 200MW Olyven Kolk solar power plant, near Kenhardt in the Northern Cape.

If an existing access to a national road will be used as access to the solar power plant, details of the location, including the kilometre distance must be provided.

SANRAL requires detail plans, for approval produced by an ECSA registered consulting engineer, of alteration or upgrading measures that will be required at the access-intersection with the R27 national road.

All costs associated with alteration or upgrading measures will be for the applicant's account.

Yours faithfully

R de Kock
STATUTORY CONROL

Docs 436939

FOR ATTENTION: **PHRA**: **Northern Cape**

FOR OFFICIAL USE ONLY:
SAHRA File No: **9/2/048/0001**
Date Received: **26 August 2011 (AIA)**
25 October 2011 (AIA + PIA)
Date of Comment: **28 November 2011** ....
Sent to Peer Review: ....
Date to Peer Review: ....
SAHRA Contact Person: **Dr Mariagrazia Galimberti**

SOUTH AFRICAN HERITAGE RESOURCES AGENCY
111 HARRINGTON STREET, CAPE TOWN, 8001
PO BOX 4637, CAPE TOWN, 8000
TEL: 021 462 4502 FAX: 021 462 4509

REVIEW COMMENT ON ARCHAEOLOGICAL AND PALAEONTOLOGICAL IMPACT ASSESSMENTS

BY ARCHAEOLOGY, PALAEONTOLOGY AND METEORITES UNIT OF THE SOUTH AFRICAN HERITAGE RESOURCES AGENCY

South Africa has a unique and non-renewable archaeological and palaeontological heritage. Archaeological and palaeontological sites are protected in terms of the National Heritage Resources Act (Act No 25 of 1999) and may not be disturbed without a permit. Archaeological Impact Assessments (AIAs) and Palaeontological Impact Assessments (PIAs) identify and assess the significance of the sites, assess the potential impact of developments upon such sites, and make recommendations concerning mitigation and management of these sites. On the basis of satisfactory specialist reports SAHRA or the relevant heritage resources agency can assess whether or not it has objection to a development and indicate the conditions upon which such development might proceed and assess whether or not to issue permission to destroy such sites.
AIAs and PIAs often form part of the heritage component of an Environmental Impact Assessment or Environmental Management Plan. They may also form part of a Heritage Impact Assessment called for in terms of section 38 of the National Heritage Resources Act, Act No. 25, 1999. They may have other origins. In any event they should comply with basic minimum standards of reporting as indicated in SAHRA Regulations and Guidelines.
This form provides review comment from the Archaeologist of the relevant heritage resources authority for use by Heritage Managers, for example, when informing authorities that have applied to SAHRA for comment and for inclusion in documentation sent to environmental authorities. It may be used in conjunction with Form B, which provides relevant peer review comment.

A. PROVINCIAL HERITAGE RESOURCES AUTHORITY: **Northern Cape**......................

B. AUTHOR(S) OF REPORT: **Halkett, D. and J. Orton**

C. ARCHAEOLOGY CONTRACT GROUP: **ACO Associates**

D. CONTACT DETAILS: **8 Jacobs Ladder, St James, 7945**

E. TITLE OF THE REPORT: **AIA: proposed Olyven Kolk Solar Power Plant, Northern Cape Province**

F. DATE OF REPORT: **July 2011.**

B. AUTHOR(S) OF REPORT: **Halkett, D. and J. Orton**

C. ARCHAEOLOGY CONTRACT GROUP: **ACO Associates**

D. CONTACT DETAILS: **8 Jacobs Ladder, St James, 7945**

E. TITLE OF THE REPORT: **Archaeological, Heritage and Palaeontological Specialist Report**

F. DATE OF REPORT: **Augst 2011.** u

B. AUTHOR(S) OF REPORT: **Dr John Almond**

C. ARCHAEOLOGY CONTRACT GROUP: **Natura Viva**

D. CONTACT DETAILS: **PO Box 12410, Mill St, Cape Town, 8010, email: naturaviva@universe.co.za**

E. TITLE OF REPORT: **PIA Desktop Study. Proposed AES Solar Power Plant on the Farm Olyven Kolk 187 Near Kenhardt, Northern Cape Province**

F. DATE OF REPORT: **August 2011**

G. Please circle as relevant: Archaeological and Palaeontological components of EIA / EMP / HIA / CMP/ **Other** (Specify) **Basic Assessment Report** ....

H. REPORT COMMISSIONED BY (**CONSULTANT** OR DEVELOPER): **ERM Southern Africa**

I. CONTACT DETAILS: **Ms Linda Slabber, Silverwood House,Block A, Silverwood Close, Steenberg Office Park, Steenberg, 7945, Cape Town, Tel: +27 21 702 9100, Fax: 086 662 2228, Mobile: +27 84 409 9641**

J. COMMENTS: ....

Please see comment on next page ....

REVIEW COMMENT ON ARCHAEOLOGICAL AND PALAEONTOLOGICAL IMPACT ASSESSMENTS

Mr D. Halkett and Mr J. Orton
Dated: unknown, Received: August 2011

AIA: proposed Olyven Kolk Solar Power Plant, Northern Cape Province

Mr D. Halkett and Mr J. Orton
Dated: August 2011, Received: October 2011

Heritage Impact Assessment (Archaeology And Palaeontology): Proposed Olyven Kolk Solar Power Plant, Northern Cape Province

Dr J. Almond,
Dated: August 2011, Received: October 2011

PIA Desktop Study. Proposed AES Solar Power Plant on the Farm Olyven Kolk 187 Near Kenhardt, Northern Cape Province

INTRODUCTION

An Archaeological Impact Assessment was commissioned by ERM for the Basic Assessment Phase of the Environmental Impact Assessment process undertaken for the establishment of a 190MW solar power farm near Kenhardt.

During the Environmental Impact Report Phase, the Archaeological Impact Assessment was revised with the addition of further information available and a palaeontological study was also included, as requested by the National Heritage Resources Act.

The Solar Energy Facility will extend on an area of about 10km^2 with only a third of it being used for the solar panels. There will be in total about 190 units of solar panels, each of which with a generating capacity of 1MW. The maximum height of the solar panels from ground will be 2.5m. The solar farm will be divided in two portions, one above and one below the Sishen-Saldanha railway line which cuts the sites in two.

Amongst the necessary infrastructure for the establishment of the solar farm there will be underground cables, an inverter connected to step-up transformers, which will elevate the voltage to transmit the current to the Eskom Aries Substation via a new interconnection line with a maximum voltage of 400kV and a maximum length of about 700m. Access roads of maximum 3m width will also be necessary between the solar panels along with meteorological stations, a small site office and storage facility, site fencing and car parking, temporary construction camp (to house 60-80 people), permanent accommodation (for 4-5 people); and lay-down area for the temporary storage of materials during the construction activities (From the Environmental Impact Assessment Report).

The layout of the solar panel was decided after considering all sensitivity studies undertaken for the project and it is presented as Layout Alternative 2 in the report. Layout Alternative 1, which was included in the Basic Assessment Report and which is the one which was supplied to the archaeologists during their field survey, is not considered viable anymore.

DISCUSSION

From an archaeological perspective surface visibility of the site was very good and no impediment to the field survey were encountered by the two archaeologists. Looking at the walk paths, it is visible that while areas 0, 2, 4 and 5, as indicated in Alternative Layout 2, were extensively surveyed, areas 1, 3 and 7 had a minimal survey with zone 6 being unsurveyd. However, given the nature of the landscape, it is safe to assume that the type of material identified on the survey area may also be encountered in the unsurveyed section.

The most prominent archaeological evidence is represented by stone artefacts, made mostly of grey quartzite and less frequently by fine grained chert, dating from Early to Later Stone Age, with most of them belonging to the Middle Stone Age. One lower grindstone was also recorded on site. A representative sample of the material was recorded with GPS coordinates, photographed and described.

No graves were identified, whereas two structures, one shed with iron roof and a small brick cottage were recorded on site. According to the authors they have no heritage value.

The palaeontologist did not undertake a field survey, but a desktop study instead. The area on which the solar farm is proposed to be established is underlain by the Mbizane Formation of the Dwyka Group, which is overall considered of low sensitivity. The Mbizane Formation is overlain by calcretes and by deposits of the Gordonia Formation of the Kalahari Group, which has widely but sporadically occurring subfossils.

Considering the nature of the development and the geological background, the specialist recommends that it is not necessary to undertake any further palaeontological studies since it is expected that no palaeontological resources of significance will be affected by the development.

RECOMMENDATIONS AND CONCLUSION

As there is apparently no evidence of any significant archaeological material in this area, the SAHRA Archaeology, Palaeontology and Meteorites Unit has no objection to the development (in terms of the archaeological and palaeontological components of the heritage resources) on condition that, if any new evidence of archaeological sites or artefacts, palaeontological fossils, graves or other heritage resources are found during development or construction, SAHRA (Mariagrazia Galimberti/Colette Scheermeyer, Tel: 021 462 4502) and an archaeologist or a palaeontologist, according to the findings, must be alerted immediately.

Decisions on Built Environment (e.g. structures over 60 years) and Cultural Landscapes and associated Living Heritage (e.g. sacred sites) must be made by the Provincial Heritage Resources Authority of the Northern Cape (Mr. Joas Sinthumule, jsinthumule@ncpg.gov.za) to whom this Archaeological and Palaeontological Review Comment will be copied.

SIGNATURE OF ARCHAEOLOGIST PROCESSING REPORT: MGalimberti

EMAIL: mgalimberti@sahra.org.za

SIGNATURE OF SAHRA HEAD ARCHAEOLOGIST:

EMAIL: cscheermeyer@sahra.org.za

NAME OF HERITAGE RESOURCES AGENCY: SAHRA

PLEASE NOTE THAT THE COMMENT (ABOVE OR APPENDED) CONSTITUTES THE COMMENT OF THE HERITAGE RESOURCES AGENCY ARCHAEOLOGIST AND THAT ANY DEVELOPMENT THAT INVOLVES DESTRUCTION OF ANY ARCHAEOLOGICAL/PALAEONTOLOGICAL SITE IS STILL SUBJECT TO A PERMIT/PERMISSION FOR DESTRUCTION OF SUCH SITE GIVEN TO THE DEVELOPER BY THE RELEVANT HERITAGE RESOURCES AGENCY ARCHAEOLOGICAL AND PALAEONTOLOGICAL PERMIT COMMITTEE (THIS WILL BE SUBJECT TO APPROVAL OF THE PHASE 2 OR ARCHAEOLOGICAL/ PALAEONTOLOGICAL MITIGATION AS NECESSARY). THIS REPORT MAY BE TAKEN ONLY AS APPROVAL IN TERMS OF SECTION 35 OF THE NATIONAL HERITAGE RESOURCES ACT. THE PROVINCIAL MANAGER OF THE HERITAGE RESOURCES AUTHORITY MUST ADVISE AS TO APPROVAL IN TERMS OF HERITAGE ISSUES ENCOMPASSED BY OTHER ASPECTS OF THE LEGISLATION, SUCH AS ISSUES OF THE BUILT ENVIRONMENT (STRUCTURES (E.G. FARM HOUSES), OVER 60 YEARS), INDIGENOUS KNOWLEDGE SYSTEMS OR OF CULTURAL LANDSCAPES AS THIS IS NOT WITHIN THE SCOPE OF THE ARCHAEOLOGIST.

PLEASE NOTE THAT SAHRA IS NOW RESPONSIBLE FOR GRADE I HERITAGE RESOURCES (AND EXPORT) AND THE PROVINCIAL HERITAGE RESOURCES ARE RESPONSIBLE FOR GRADE II AND GRADE III HERITAGE RESOURCES, EXCEPT WHERE THERE IS AN AGENCY ARRANGEMENT WITH THE PROVINCIAL HERITAGE RESOURCES AUTHORITY.

ERM Ref: 0126393
DEA Ref: 12/12/20/2170

Geagte Belanghebbende en Geaffekteerde Party,

Hierdie brief dien om u in te lig dat die Konsep Omgewingsimpak Verslag (OIV) vir die Olyven Kolk Sonkrag Plaas projek nog beskikbaar is vir kommentaar. Die sluitingsdatum van die 40- dag kommentaar periode is volgende week Maandag 05 Desember 2011.

'n Kopie van die OIV is beskikbaar by die Kenhardt Openbare Biblioteek en 'n elektroniese weergawe van die verslag kan nou op die volgende webtuiste besigtig word: http://www.erm.com/EIA-AES.

Alle kommentaar op die OIV moet aan Isobel Evans of Linda Slabber by ERM geadresseer word of per epos AES.Solarfarm@erm.com gestuur word en moet ingedien word voor of op 5 Desember 2011. Indien u enige kommentaar oor die naamsverandering of oor die Finale OIV het, rig asseblief hierdie aan Thulisile Nyalunga; Epos: TNyalunga@environment.gov.za; Tel: 012 310 3249; Faks: 012 320 7539; of Private Bag X447 Pretoria 0001.

Die uwe

Isobel E

Isobel Evans
021 702 9100
AES.Solarfarm@erm.com

ERM Ref: 0126393
DEA Ref: 12/12/20/2170

Dear Interested and Affected Party,

In line with the Environmental Impact Assessment Regulations (as amended), the Draft Environmental Impact Report (EIR) for the Proposed Olyven Kolk Solar Power Plant, Northern Cape, was made available to you for comment. You are reminded that the 40-day comment period draws to a close next week on Monday 5 December 2011.

A copy of the Draft EIR is still available at the Klawer Public Library and an electronic version of the report and the NTS in English and Afrikaans can be accessed on the project website: http://www.erm.com/EIA-AES .

All comments on the Draft EIR should be sent to Isobel Evans or Linda Slabber of ERM at the following email address AES.Solarfarm@erm.com prior to Monday 5 December 2011. After this date, comments can be sent to the DEA Case Officer, Thulisile Nyalunga; Email: TNyalunga@environment.gov.za; Tel: 012 310 3249; Fax: 012 320 7539; or Private Bag X447 Pretoria 0001.

Yours sincerely

Isobel E

Isobel Evans
021 702 9100
AES.Solarfarm@erm.com

Linda Slabber

From: Linda Slabber
Sent: 30 November 2011 13:14
To: Linda Slabber
Subject: Draft Environmental Impact Report (EIR) for the Proposed Olyven Kolk Solar Power Plant, Northern Cape
Bcc: 'kenhardtlib@ncpg.gov.za'; 'kennett.lubbe@za.andress.com'; 'moolman@kaigarib.co.za'; 'chris.ntamo@gmail.com'; 'fpr@siyanda.gov.za'; 'werner.debruin@bm.pwc.com'; 'michael.stoeltzing@wineestatecapital.com'; 'annelizaC@nda.agric.za'; 'dekockr@nra.co.za'; 'rlevin@economic.gov.za'; 'dineo.moraile@energy.gov.za'; 'makaulag@nra.co.za'; 'info@nersa.org.za'; 'lorrain.leburu@nersa.org.za'; 'dmthembu@deat.gov.za'; 'mabokoi@dwa.gov.za'; 'mwabisa.qwanyashe@dmr.gov.za'; 'mampuru.koma@dmr.gov.za'; 'waldtjc@nra.co.za'; 'sam.vukela@dpw.gov.za'; 'dg@daff.gov.za'; 'dodg@daff.gov.za'; 'pa.dg@daff.gov.za'; 'se@museumsnc.co.za'; 'wessanc@yahoo.com'; 'mgalimberti@sahra.org.za'; 'nndobochani@sahra.org.za'; 'Deirdre@agrisa.co.za'; 'nwilson@wwf.org.za'; 'abrahamsa@dwa.gov.za'; 'lefleurd@dwa.gov.za'; 'ahall@ncpg.gov.za'; 'mackayj@kaigarib.co.za'; 'cfortune@agri.ncape.gov.za'; 'enquiries@ncpg.gov.za'; 'judischoltz@ncpg.gov.za'; 'd.ngxanga@vodamail.co.za'; 'Christine.dtec@gmail.com'; 'info@sahra.org.za'; 'jsinthumule@ncpg.gov.za'; 'ahall@ncpg.gov.za'; 'streudersk@dwa.gov.za'; 'advocacy@birdlife.org.za'; 'info@birdlife.org.za'; 'mduplessis@wwf.org.za'; 'scharlton@wwf.org.za'; 'marketing@wessa.co.za'; 'yolanf@ewt.org.za'; 'agrisa@agriinfo.co.za'; 'swjohnston@mweb.co.za'; 'zini@earthlife.org.za'; 'mabule@ghouse.org.za'; 'nic@agrisa.co.za'; 'zaitoon@mweb.co.za'; 'anneke@agrisa.co.za'; 'tristen@earthlife.org.za'; 'joanne@savannahsa.com'; 'agrisa@agriinfo.co.za'; 'charmaine@agrisa.co.za'; 's.chymist@gmail.com'; 'joostecg@eskom.co.za'; 'henk.landman@eskom.co.za'; 'livhuwani.ndou@transnet.net'; 'segomoco.scheppers@eskom.co.za'; 'vGenseAL@eskom.co.za'; 'zeekoesteek@valeuitin.co.za'; 'feniN2@swa.gov.za'; 'Chrisf@yahoo.com'; 'hlengani@dwa.gov.za'; 'mayor@kaigarib.gov.za'; 'speaker@kaiGarib.gov.za'; 'omamiemie@gmail.com'

ERM Ref: 0126393
DEA Ref: 12/12/20/2170

Geagte Belanghebbende en Geaffekteerde Party,

Hierdie brief dien om u in te lig dat die Konsep Omgewingsimpak Verslag (OIV) vir die Olyven Kolk Sonkrag Plaas projek nog beskikbaar is vir kommentaar. Die sluitingsdatum van die 40- dag kommentaar periode is volgende week Maandag 05 Desember 2011.

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Die uwe

Isobel Evans
021 702 9100
AES.Solarfarm@erm.com

ERM Ref: 0126393
DEA Ref: 12/12/20/2170

Dear Interested and Affected Party,

In line with the Environmental Impact Assessment Regulations (as amended), the Draft Environmental Impact Report (EIR) for the Proposed Olyven Kolk Solar Power Plant, Northern Cape, was made available to you for comment. You are reminded that the 40-day comment period draws to a close next week on Monday 5 December 2011.

A copy of the Draft EIR is still available at the Klawer Public Library and an electronic version of the report and the NTS in English and Afrikaans can be accessed on the project website: http://www.erm.com/EIA-AES .

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Yours sincerely

Isobel Evans
021 702 9100
AES.Solarfarm@erm.com

Isobel Evans

From: ERM Southern Africa EIA Mailbox
Sent: Monday, June 13, 2011 3:24 PM
To: Linda Slabber
Subject: AES: Notification of a Public Meeting for the Proposed Olyvenkolk Solar Power Plant
Attachments: Invitation to a Public Meeting.pdf
Bcc: s.chymist@gmail.com; se@museumsnc.co.za; Deirdre@agrisa.co.za; kenhardtlib@ncpg.gov.za; kennett.lubbe@za.andress.com; moolman@kaigarib.co.za; chris.ntamo@gmail.com; fpr@siyanda.gov.za; werner.debruin@bm.pwc.com; michael.stoeltzing@wineestatecapital.com; dekockr@nra.co.za; rlevin@economic.gov.za; dineo.moraile@energy.gov.za; makaulag@nra.co.za; info@nersa.org.za; lorrain.leburu@nersa.org.za; dmthembu@deat.gov.za; mabokoi@dwa.gov.za; mwabisa.qwanyashe@dmr.gov.za; dg@daff.gov.za; dodg@daff.gov.za; waldtjc@nra.co.za; sam.vukela@dpw.gov.za; abrahamsa@dwa.gov.za; lefleurd@dwa.gov.za; ahall@ncpg.gov.za; mackayj@kaigarib.co.za; judischoltz@ncpg.gov.za; dngxanga@vodamail.co.za; Christine.dtec@gmail.com; info@sahra.org.za; jsinthumule@ncpg.gov.za; ahall@ncpg.gov.za; streudersk@dwa.gov.za; advocacy@birdlife.org.za; mduplessis@wwf.org.za; scharlton@wwf.org.za; marketing@wessa.co.za; yolanf@ewt.org.za; swjohnston@mweb.co.za; zini@earthlife.org.za; mabule@ghouse.org.za; nic@agrisa.co.za; zaitoon@mweb.co.za; anneke@agrisa.co.za; tristen@earthlife.org.za; joanne@savannahsa.com; joostecg@eskom.co.za; henk.landman@eskom.co.za; livhuwani.ndou@transnet.net; segomoco.scheppers@eskom.co.za; vGenseAL@eskom.co.za

Dear Stakeholder,

Please find herewith attached an Invitation to a Public Meeting at the Kenhardt Hotel on the 28th June 2011.

Kind regards,
Linda Slabber

Done.
30/06/2011.

AES Public Meeting
28 June 2011

ATTENDANCE REGISTER

1-2

Title, First name & Surname	Organisation Name	Position in Organisation	Telephone / Cellphone Numbers	Fax Number	Email Address	Postal Address
send Draft scoping Ms N. Feni	Report. Dept of Water Affairs	Env. Off	054 3385800 0825101528	054 3340205 ~~087~~	feniN2@dwa.gov.za	Private Bag X5912 Water Affairs louisvaleweg 8800 ✓
Mev. Maryna Fourie	Farm owner		0832744 625	053 353 1440	chrisf@ yahoo.com	Posbus 152, Prieska, 8940 ✓
Mej. Edith Williams	—	—	0736439809	—	—	2387 Hillside Kenhardt 8900 ✓

AES Public Meeting
28 June 2011

ATTENDANCE REGISTER

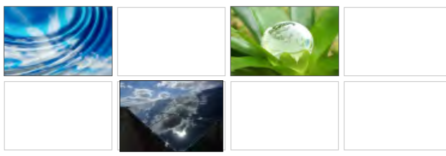
2-2

Title, First name & Surname	Organisation Name	Position in Organisation	Telephone / Cellphone Numbers	Fax Number	Email Address	Postal Address
Ms Hlengani Alexia PR.	DWA	Hydrolos	076 177 644 6	054 334 0205	hlenganiA@dwa.gov.za	P/b 5912 Loivale Rd 8800
MNR J.T. Benade	Privaat	afgevaardi	082 37 456 09	054 451 0293	zeekoesteek@ valentin.co.za	~~[illegible]~~ wildebees st. 76 Upington
Mnr WW Speelman	WAIDO		0789401960		~~[illegible]~~	~~[illegible]~~ 252
MNR. KILLIAN B. SKEI			0793154426	054 6510 116		NOORSSTR 1. KENHARDT 8900
Ms. CHARMAINE DANIËLS			072665 9806			Jakarandastr. 80 Kenhardt 8900

Olyven Kolk PV Solar

Environmental Impact Assessment (EIA)

June 2011



Agenda

- **Introduction** — **5 minutes**
- **EIA Process and Project Description** — **15 minutes**
- **Open Discussion** — **25 minutes**
  - Questions
  - Issues and concerns
- **Summary and Way Forward** — **5 minutes**

Principles for sharing

Please…

- **Mobile phones turned off or on silent**
- **All comments are welcome and will be recorded**
- **Raise a hand if you would like to ask a question**
- **Clearly introduce yourself**
- **Speak loudly so that everyone can hear**
- **Don't interrupt others**
- **Please allow for different opinions & different views**
- **Address all questions / remarks through the facilitator**
- **Show respect for all opinions and points of view**

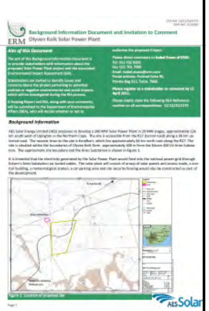
Omgewingsimpakbepalingsproses

Aansoek	Owerhede
Konsep-bepalingsverslag	
Openbare kommentaar	40 dae kommentaar
Finale Bepalingsverslag	
Besluitneming	30 dae
Konsep-OIB verslag	
Openbare kommentaar	40 dae kommentaar
Finale OIB verslag	
Besluitneming	90 dae
Appèl	10 + 30 dae

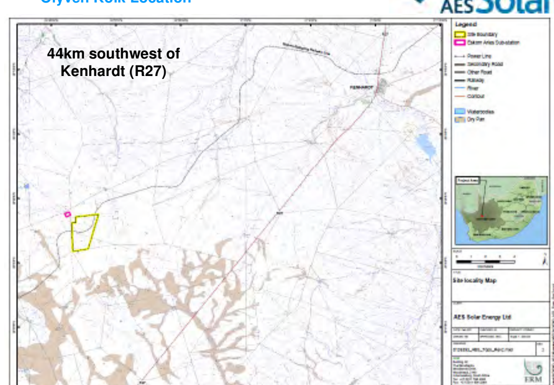
+/- 12 maande

Activities to Date

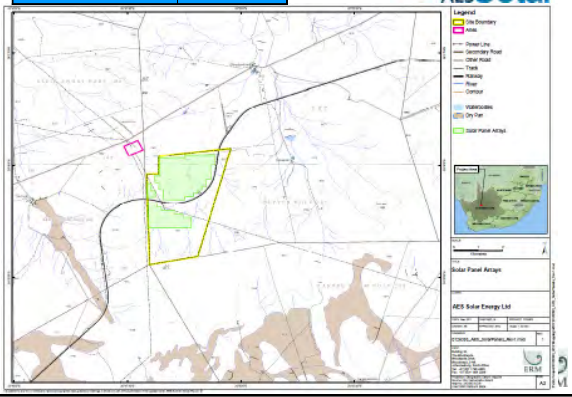
- **Submission of EIA Application to the National Department of Environmental Affairs (DEA)**
- **Initial stakeholder notification**
  - Background Information Document (BID)
  - Site notices and newspaper advertisements
  - Draft Scoping Report for comment
  - Public meeting (current)



Olyven Kolk Location



Electricity/Elektrisiteit	< 200MW
Area/Gebied	1,033ha



Project Description

- Photovoltaic (PV) arrays
- On-site access roads
- Electrical connections
- Temporary construction camp
- Electrical and control room, site office and storage facilities
- Inverter and transformer housing

Konstruksie

- Terrein voorbereiding
- Installasie van strukture
- Installasie van FV-rangskikkings
- Installasie van elektriese konneksies
- Konstruksie in fases

Specialist Studies

- Cultural Heritage and Archaeology
- Flora, fauna and habitats
- Birds
- Hydrology/ Drainage
- Visual and Landscape
- Socio-Economic

How Can You Be Involved?

- **Register as I&AP**
- **Provide comments**
- **Review Draft Scoping Report**
- **Participate at Scoping Public Meeting**
- **Comment on Scoping Report**
- **Stakeholder comment on draft EIR**
- **Notification of authority decision and opportunity to appeal**

ERM Southern Africa (Pty) Ltd
Linda Slabber / Isobel Evans
Postnet Suite 90,
Private Bag X12
Tokai, Cape Town,
7966
Tel: (021) 702 9100; Fax: (021) 701 7900
E-mail: aes.solarfarm@erm.com
website: http://www.erm.com/EIA-AES

Annex D

Comments and Responses Report

Table D1 Comments and Responses Report- From Scoping Phase

Issues/Comments Raised	Commentator(s)	Source	Response from Project Team
Site Location			
It is unclear where the site is in relation to the National Road (R27). Please send a map which shows the proposed location of the panels of the site.	René de Kock	Email response to BID and comment sheet	The site is approximately 15 km as the crow flies from the R27 and approximately 30 km by road. See in the figure below. *(A map was provided in the email)*
The South African National Roads Agency Limited (SANRAL) has no objection to the proposed 200 MW Olyven Kolk solar power plant, near Kenhardt in the Northern Cape. If an existing access to a national road will be used as access to the solar power plant, details of the locations including the kilometre distance must be provided. SANAL requires detail plans, for approval produced by an ECSA registers consulting engineer, of alteration or upgrading measures that will be required at the access-intersection with the R27 national road. All costs associated with alteration or upgrading measures will be for the applicants account.	René de Kock	Letter response to notification of Final Scoping Report	Comment welcomed and to be considered in the EIR.
Environmental Related Concerns			
Environmentally related concerns especially relating to resource usage (water, etc.) and waste disposal (solid and liquid).	R A Hasty	Email response to BID and comment sheet	The EIA will look to address all impacts on the environment and will consider water use requirements and waste disposal. At this stage it is considered that water requirements will be minimal for the operational phase of the development.
General Comments			

Issues/Comments Raised	Commentator(s)	Source	Response from Project Team
Please give me some more information on the above solar project.	Natasha Wilson	Response to invitation to Public Meeting	Thank you for getting in touch. I have attached the Background Information Document for the project. We will be finalising the Scoping report today and will send you a copy so that you can review. The commenting Period is now closed but if you have any comments, I will be happy to consider them in the Draft Environmental Impact Report (EIR).
Neutral at the moment. In general, I support the development of energy generation schemes which are developed with minimal impact on the environment.	R A Hasty	Email response to BID and comment sheet	Comment welcomed and noted.

Please note that no substantial comments on the Draft EIR were received.

Annex E

DEA Communications

Annex E (i)

DEA Acceptance of Final Scoping Report

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Private Bag X 447 · PRETORIA · 0001 · Fedsure Building · 315 Pretorius Street · PRETORIA
Tel (+ 27 12) 310 3911 · Fax (+ 2712) 322 2682

NEAS Reference: DEAT/EIA/0000217/2011
DEA Reference: 12/12/20/2170
Enquiries: Thulisile Nyalunga
Telephone: 012-310-3249**Fax:** 012-320-7539 **E-mail:** TNyalunga@environment.gov.za

Ms Tania Swanepoel
Environmental Resource Management
Private Bag X12
TOKAI
7966

Fax No: (021) 701 7900

PER FACSIMILE / MAIL

Dear Ms Swanepoel

APPLICATION FOR ENVIRONMENTAL AUTHORISATION: PROPOSED CONSTRUCTION OF A 200MW PHOTOVOLTAIC SOLAR POWER PLANT AT OLYVEN KOLK IN THE NORTHERN CAPE PROVINCE

The Final Scoping Report (FSR) and the Plan of Study for Environmental Impact Assessment (PoSEIA) dated July 2011 and received by the Department on 14 July 2011 refers.

The Department has evaluated the submitted FSR and the PoSEIA dated July 2011 and is satisfied that the documents comply with the minimum requirements of the Environmental Impact Assessment (EIA) Regulations, 2010. The FSR is hereby accepted by the Department in terms of regulation 30(1)(a) of the EIA Regulations, 2010.

You may proceed with the environmental impact assessment process in accordance with the tasks contemplated in the Plan of Study for Environmental Impact Assessment as required in terms of the EIA Regulations, 2010. In addition to the specialist studies to be conducted, a study must be done to determine the land use potential of the area especially with regard to the agricultural potential of the site and the impact of the proposed development on this potential.

Please ensure that comments from all relevant stakeholders are submitted to the Department with the Final Environmental Impact Report (EIR). This includes but is not limited to the Northern Cape Department of Environmental and Nature Conservation (DENC), Kheis Local Municipality, Department of Water Affairs (DWA), Department of Agriculture, Forestry and Fisheries (DAFF), and Eskom Holdings SOC Limited. In order to give effect to section 24O of the Act, the Draft EIR must be submitted with a letter with full contact details (i.e. postal address and fax/tel numbers) of any state Department. Proof of correspondence with the various stakeholders must be included in the Final EIR. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.

In addition, the following amendments and additional information are required for the EIR:

a) Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.

b) The total footprint of the proposed development should be indicated. Exact locations of the Olyven Kolk and associated infrastructure should be mapped at an appropriate scale.

c) Should a Water Use License be required, proof of application for a license need to be submitted.

d) Possible impacts and effects of the development on the vegetation ecology with regard to lowland-highland interface in the locality should be indicated.

e) The impacts of the proposed facility on avifauna and bats must be assessed in the EIA phase.

f) Possible impacts and effects of the development on the surrounding area.

g) The EIR should include information on the following:
   - Environmental costs vs benefits of the Olyven Kolk photovoltaic solar energy; and
   - Economic viability of the facility to the surrounding area and how the local community will benefit.

h) Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained?

i) A construction and operational phase EMP to include mitigation and monitoring measures.

j) Should blasting be required, appropriate mitigation measures should be provided.

The applicant is hereby reminded to comply with the requirements of regulation 67 with regard to the time period allowed for complying with the requirements of the Regulations, and regulations 56 and 57 with regard to the allowance of a comment period for interested and affected parties on all reports submitted to the competent authority for decision-making. The reports referred to are listed in regulation 56(3a-3h).

Please ensure that the Draft and Final EIR includes at least one A3 regional map of the area and the locality maps included in the final EIR illustrate the different proposed layouts. The maps must be of acceptable quality and as a minimum, have the following attributes:

- Maps are relatable to one another;
- Cardinal points;
- Co-ordinates;
- Legible legends;
- Indicate alternatives;
- Latest land cover;
- Vegetation types of the study area; and
- A3 size locality map.

Further, it must be reiterated that, should an application for Environmental Authorisation be subject to the provisions of Chapter II, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then this Department will not be able to make nor issue a decision in terms of your application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter II, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999.

You are requested to submit two (2) electronic copies (CD/DVD) and three (3) hard copies of the Environmental Impact Report (EIR) to the Department as per regulation 34(1)(b) of the EIA Regulations, 2010.

Please also find attached information that should be provided in the Environmental Impact Report. This will enable the Department to speedily review the EIAR and make a decision on the application.

You are hereby reminded that the activity may not commence prior to an environmental authorisation being granted by the Department.

Yours sincerely

Fatima Rawjee

Mr Ishaam Abader
Deputy Director-General: Environmental Quality and Protection
Department of Environmental Affairs
Letter signed by: Ms Fatima Rawjee
Designation: Director: Environmental Impact Evaluation (Acting)
Date: 15/09/2014.

CC:	Mr Su Lin Ong	AES Solar Energy Ltd	Fax: +44 2083329078
	Ms D Moleko	DENC	Fax: (053) 831 3530

Annex E (ii)

DEA Acknowledgment of Draft EIR

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Private Bag X 447· PRETORIA · 0001· Fedsure Building · 315 Pretorius Street · PRETORIA
Tel (+ 27 12) 310 3911 · Fax (+ 2712) 322 2682

Reference: 12/12/20/2170
Enquiries: Thulisisle Nyalunga
Telephone: 012 310 3249 **Fax:** 012 320 7539 **E-mail:** tnyalunga@environment.gov.za

Isobel Evans
Environmental Resources Management
Private Bag X12
TOKAI
7966

Fax: 021 701 7900

PER FACSIMILE / MAIL

Dear Sir/Madam

ACKNOWLEDGEMENT OF RECEIPT OF DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED OLYVEN KOLK SOLAR POWER PLANT, NORTHERN CAPE

The Department confirms having received the draft Environmental Impact Assessment Report dated October 2011 for the above-mentioned project on 31 October 2011.

Please note that the Department will start reviewing once the final Environmental Impact Assessment Report is received.

You are hereby reminded that the activity may not commence prior to an environmental authorisation being granted by the Department.

Yours sincerely

~~Mr Ishaam Abader~~
Deputy Director-General: Environmental Quality and Protection
Department of Environmental Affairs
Letter signed by: Ms Mmatlala Rabothata
Designation: PEO: Environmental Impact Evaluation
Date: 14/11/2011

Annex F

Ecological and Biodiversity Specialist Report

PROPOSED OLYVEN KOLK SOLAR POWER PLANT, NORTHERN CAPE:

BOTANICAL AND FAUNAL SPECIALIST ASSESSMENT

PREPARED BY

SIMON TODD CONSULTING

FOR

DEA Ref: 12/12/20/2170
AES Solar Energy Limited

OCTOBER 2011

Contents

Declaration of Independence

The author of this report, Simon Todd, does hereby declare that he is an independent consultant appointed by ERM for AES Solar and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of the specialist performing such work. All opinions expressed in this report are his own.

Simon Todd

October 2011

Summary of Expertise

Simon Todd:

- Graduated MSc Conservation Biology (Cum Laude) from University of Cape Town in 1997.
- Since 1997 I have been working in the ecological field as an independent contractor and consultant. I have worked extensively throughout the Western, Northern and Eastern Cape on a wide variety of ecological projects.
- Published numerous research reports as well as a large number of papers in leading scientific journals dealing largely with human impacts on the vegetation of these regions. Conducted a large number of specialist ecological assessments as an ecological consultant.
- Guest lecturer at two universities and have also served as an external examiner.
- Reviewed papers for more than 10 international ecological journals.
- Past committee member and current chairman of the Arid Zone Ecological Forum.

A selection of recent work is as follows:

Todd, S.W. 2006. Gradients in vegetation cover, structure and species richness of Nama-Karoo shrublands in relation to distance from livestock watering points. *Journal of Applied Ecology* 43: 293-304.

Todd, S.W. 2009. A fence-line in time demonstrates grazing-induced vegetation shifts and dynamics in the semi-arid Succulent Karoo. *Ecological Applications*, 19: 1897–1908.

Benito, G., Rohde, R., Seely, M., Külls, C., Dahan, O., Enzel, Y., **Todd, S**. Botero, B., Morin, E., Grodek, T., Roberts, C. 2010. Management of Alluvial Aquifers in Two Southern African Ephemeral Rivers: Implications for IWRM. *Water Resources Management*, 24:641–667.

Hahn, B.D., Richardson, F.D., Hoffman, M.T., Roberts, R., **Todd, S.W.** and Carrick, P.J. 2005. A simulation model of long-term climate, livestock and vegetation interactions on communal rangelands in the semi-arid Succulent Karoo, Namaqualand, South Africa. *Ecological Modelling* 183, 211–230.

Malgas, R.R., Potts, A.J., Oettlé, N.M., Koelle, B., **Todd, S.W.**, Verboom G.A. & Hoffman M.T.. 2010. Distribution, quantitative morphological variation and preliminary molecular analysis of different growth forms of wild rooibos (*Aspalathus linearis*) in the northern Cederberg and on the Bokkeveld Plateau. *South African Journal of Botany*, 76, 72-81.

Mills, A., Fey, M., Donaldson, J.D., **Todd, S.W**. & Theron, L.J. 2009. Soil infiltrability as a driver of plant cover and species richness in the semi-arid Karoo, South Africa. *Plant and Soil* 320: 321–332.

Rahlao, J.S., Hoffman M.T., **Todd, S.W**. & McGrath, K. 2008. Long-term vegetation change in the Succulent Karoo, South Africa following 67 years of rest from grazing. *Journal of Arid Environments*, 72, 808-819.

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Todd, S.W., Milton, S.J., Dean, W.R.J. Carrick, P.J. & Meyer, A. 2009. Ecological best Practice Guidelines for the Namakwa District. The Botanical Society of South Africa.

Todd, S.W. 2009. Field-Based Assessment of Degradation in the Namakwa District. Final Report. Mapping Degradation in the Arid Subregions of the BIOTA South Transect. SANBI.

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Todd, S.W. 2010. Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy at Konstabel, Western Cape Province. Specialist Report for Environmental Resources Management.

Todd, S.W. 2010. Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility at Perdekraal, Western Cape Province. Specialist Report for Environmental Resources Management.

Todd, S.W. 2010. Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility near Victoria West, Western and Northern Cape Provinces. Specialist Report for Environmental Resources Management.

Todd, S.W. 2010. Vegetation and Plant Communities Associated with the Tillite and Dolerite Renosterveld Types of the Avontuur Conservation Area, Nieuwoudtville, South Africa. DRYNET.

Todd, S.W. 2011. Klawer Wind Farm: Ecological and Biodiversity Assessment: Terrestrial Vertebrate Fauna & Botanical Specialist Study. Specialist Report for Environmental Resources Management.

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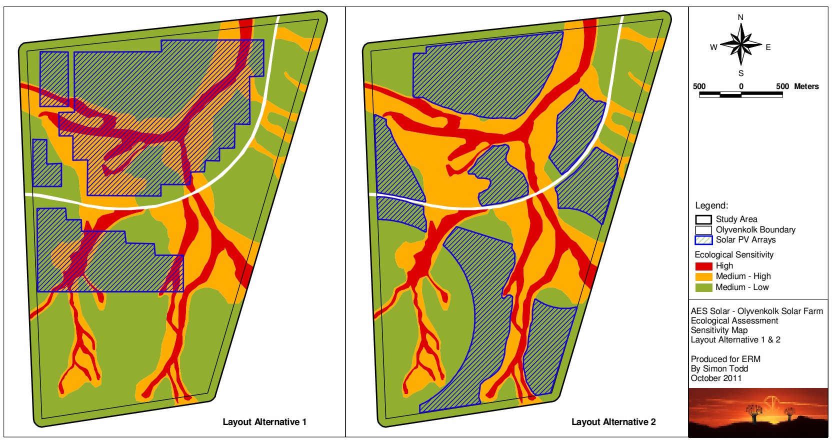
Todd, S.W. 2011. Lambert's Bay Wind Farm: Ecological and Biodiversity Assessment: Terrestrial Vertebrate Fauna & Botanical Specialist Study. Specialist Report for Environmental Resources Management.

Todd, S.W. 2011. Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility near Sutherland, Western and Northern Cape Provinces. Specialist Report for Environmental Resources Management.

Executive Summary

This report provides an ecological assessment of the proposed Olyven Kolk Solar Power Plant south of Kenhardt in the Northern Cape Province. Two different development alternatives are considered, Layout Alternative 1 consists of up to 415 ha of solar arrays producing up to 190 MW and Layout Alternative 2 consists of a similar output on 357 ha but with the solar PV arrays distributed in a different configuration across the site. The development would also comprise associated service roads, transmission infrastructure and housing for staff and equipment.

Ecological Sensitivity Map



The assessment revealed that the majority of the site can classified as Low to Medium Sensitivity, while approximately 11.5% of the site consists of areas that are considered High Sensitivity and which should not be developed. Higher sensitivity areas are associated with the drainage areas and low-lying areas within the site which are seen to be vulnerable to erosion and perform an important role as cover, habitat and movement corridors for larger fauna. Under the Layout Alternative 1, a significant proportion of the development lies within areas classified as High Sensitivity and this development option would thus be likely to result in significant local negative ecological impact. The alternative site layout was derived from various ecological and other constraints provided to the developer by the various specialists involved on the project, resulting in 'Layout Alternative 2', the preferred option. Layout Alternative 2 provides an alternative configuration which avoids the sensitive parts of the site and makes provision for important local ecological processes. Under Layout Alternative 2 and with the suggested mitigation measures implemented, the impact of the development would be of **minor** significance. The area is not deemed to be locally or regionally sensitive from a biodiversity or ecosystem function perspective. The development is not likely to result in any significant long-term ecological impacts beyond the direct loss of a small amount of habitat at a local level.

The major mitigation priorities associated with the development are seen to be:

- Preventing soil erosion
- Rehabilitation of disturbed areas
- Translocation of protected plant species (*Hoodia gordonii* and *Aloe claviflora*)
- Minimising human-related impacts during the construction phase (poaching & collecting of plants and animals)
- Finding acceptable ecologically-neutral solutions to the security fencing that will surround the site

In terms of the significance of the likely impacts that will accompany the project the following summary table is provided:

Phase	Impact	Alternative 1 Pre-mitigation	Alternative 2 Pre-mitigation	Alternative 2 Residual Impact (Post Mitigation)
Construction	Destruction & Loss of Vegetation	Moderate-Major	Moderate	Minor - Moderate
	Protected Plant Species	Minor-Moderate	Minor - Moderate	Minor
	Loss of habitat for fauna	Moderate	Minor -Moderate	Minor
	Direct faunal impacts	Moderate	Moderate	Minor
	Loss of landscape connectivity for fauna	Moderate	Minor	Minor
Operation	Erosion Potential	Moderate	Minor - Moderate	Minor
	Alien Plant Invasion	Minor-Moderate	Minor	Minor
	Maintenance impact on vegetation	Minor	Minor	Minor
Decommissioning	Inadequate rehabilitation	Minor-Moderate	Minor-Moderate	Minor

1. Introduction

Environmental Resources Management (ERM) has been commissioned by AES Solar Energy Limited (AES) to carry out an Environmental Impact Assessment (EIA) for a 190 MW solar power plant located approximately 126 km south of Upington in the Northern Cape. The site is situated within the boundaries of Olyven Kolk Farm, approximately 400 m from the Eskom 400 kV Aries Substation. The proposed development includes the installation and operation of solar panels with an initial proposed projected output of up to 190 MW. The solar panels would be photovoltaic (PV) arrays and would occupy up to 350 ha of the 1,033 ha site when the full 190 MW is installed. PV arrays would include rows of panels which would extend across the site and of the 350 ha occupied by the arrays, only about 40% would actually be under the arrays; the remainder would consist of the necessary space between the rows to avoid shading effects from one row to the next. The panels would be mounted on metal frames, supported by rammed pile foundations and they would face north in order to capture the maximum sunlight.

Simon Todd Consulting was appointed by ERM in April 2011, to conduct an ecological assessment of the study area as part of requirements of the EIA process. The terms of reference for this project are based on the guidelines and principles for biodiversity assessment as described by Brownlie (2005) and De Villiers et al. (2005). These include the following:

1. A description of the broad ecological characteristics of the site and its surrounds in terms of patchiness, patch size, relative isolation, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.
2. In terms of biodiversity pattern, the following will be identified and described where appropriate:

Community and ecosystem level:

- The main vegetation types, their aerial extent and interaction with neighbouring types, soils or landforms;
- The types of plant communities that occur on and in the vicinity of the site.
- Threatened or vulnerable ecosystems (With reference to Mucina and Rutherford (2006) and the NSBA (Driver *et al.* 2005).

Species level:

- Species of Conservation Concern (Red Data Book/RBD species) of both flora and fauna.
- The viability of and estimated population size of the RDB species that are present (including the degree of confidence in prediction based on availability of information and specialist knowledge (High=70-100% confidence, Medium 40-70% confidence, low 0-40% confidence).
- The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (including the degree of confidence).
- The condition of the site in terms of current or previous land uses.

3. In terms of biodiversity process, the following will be identified or described:
    - The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire and grazing.
    - Environmental gradients (e.g. upland-lowland), biome boundaries, soil interfaces or sand movement corridors on the site or in its vicinity.
    - Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
    - The condition and functioning of rivers and wetlands (if present) in terms of: possible changes to the channel, flow regime and naturally-occurring riparian vegetation.

In addition the study will include:

- A description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed facility.
- A description and evaluation of the environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified.
- The nature and the extent, of the impact.
- A statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts.
- "Red Flag" any sensitive or no-go areas within the broader study area which could influence the siting of the infra-structure.
- Ecological opportunities and constraints will be identified, which may include mitigation measures and offsets to reduce the ecological impact of the development.
- Recommendations for future management actions and monitoring.

2. Regulatory and Legislative Overview

National Environmental Management Act (NEMA) (Act No 107, 1998):

NEMA requires that measures are taken that ”prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.” In addition:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied:
- That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

Environmental Conservation Act (ECA) (No 73 of 1989 Amendment Notice No. R1183 of 1997)

This Act provides for the effective protection and controlled utilisation of the environment. This Act has been largely repealed by NEMA, but certain provisions remain, in particular provisions relating to environmental impact assessments. The ECA requires that developers must undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations.

National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004):

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009) has been gazetted for public comment. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the NSBA 2004. In terms of the EIA regulations, a basic assessment report is required for the transformation or removal of indigenous vegetation in a critically endangered or endangered ecosystem regardless of the extent of transformation that will occur. However, all of the vegetation types within and surrounding the Olyven Kolk study site are classified as Least Threatened.

NEMBA also deals with endangered, threatened and otherwise controlled species. The Act provides for listing of species as threatened or protected, under one of the following categories:

- **Critically Endangered:** any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered:** any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- **Vulnerable:** any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- **Protected species:** any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). *Hoodia gordonii* was observed at the site and is listed under NEMBA as a protected species.

Certain activities, known as Restricted Activities, are regulated by a set of permit regulations published under the Act. Those relevant to the current study are listed below.

Under the **Environmental Impact Assessment Regulations Listing Notice 1 of 2010** (No. R.544) the following activities are likely to be triggered:

Activity 1: The construction of facilities or infrastructure for the generation of electricity where:
i. the electricity output is more than 10 megawatts but less than 20 megawatts; or

ii. the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare.

Activity 11 (Xi): The construction of infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.

And, under **Environmental Impact Assessment Regulations Listing Notice 3** of 2010 (*R.546):*

Activity 14. The clearing of an area of 5 hectares or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation.

Activity 16 IV: The construction of infrastructure covering 10 square meters of more where such construction occurs within a watercourse of within 32 metres of a watercourse measured from the edge of the watercourse, excluding where such construction will occur behind the development setback line.

It is important to note that the above thresholds and activities also apply to phased developments "*where any phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold."*

Furthermore, it is also important to note that a number of additional listed activities would apply were the site classified as a Critical Biodiversity Area. However, a fine-scale conservation plan for the Siyanda District has not been conducted and therefore, these potential restrictions do not apply.

National Forests Act (No. 84 of 1998):

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: "*no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated".*

Two protected tree species, Camelthorn *Acacia erioloba* and Kokerboom/Quiver Tree *Aloe dichotoma* occur in the district and potentially occur at the site. Neither of these species was observed at the site and as these are conspicuous species, it is safe to conclude that they do not occur within the study area.

Conservation of Agricultural Resources Act (Act 43 of 1983):

The Conservation of Agricultural Resources Act provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. The Conservation of Agricultural Resources Act defines different categories of alien plants and those listed under Category 1 are prohibited and must be controlled while those listed under Category 2 must be grown within a demarcated area under permit.

Category 3 plants includes ornamental plants that may no longer be planted but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the floodline of water courses and wetlands.

Northern Cape Nature Conservation Act, No. 9 of 2009:

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.

Manipulation of boundary fences

19. No Person may –

(a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;

3. Methodology

Site Visit

The site was visited over two full days on the 13th and 14th of May 2011, during which time as much of the site as possible was investigated and assessed. All of the roads and tracks that could be located were driven in order to gain familiarity with the site and observe the broad-scale ecological gradients, patterns and processes likely to be operating at the site. Once familiar with the general ecological patterns apparent at the site, walk-through surveys were conducted at selected sites representative of the different vegetation and landscape units identified in the field as well as sites identified beforehand on satellite imagery of the site. Sampling was concentrated on areas that appeared to be ecologically significant or were likely to pose ecological issues in terms of the proposed development footprint.

At each location where a walk-through survey was conducted, 10 – 30 minutes were spent searching the area for both fauna and flora. The different plant species observed were identified and recorded and all terrestrial fauna directly or indirectly (scat, diggings, tracks etc) observed were also noted. Photographs for documentation purposes were taken of any species of conservation significance or which could not be positively identified in the field. Where important or rare habitats such as gravel patches or rocky outcrops were observed, these were specifically searched for species likely to be associated with these habitats. Sensitive areas identified in the field were mapped on satellite imagery of the site and specific features recorded on a GPS where necessary. The data collected during the site visit can be summarized as follows:

- A list of all plant species observed at the site

- A list of all mammals, reptiles and amphibians directly or indirectly (spoor, scat, etc) observed at the site
- Maps of sensitive areas identified in the field and delineated on satellite imagery of the site
- GPS coordinates of significant point-location biodiversity features
- Photographs of the different habitats, environments and biodiversity features present.
- Maps and notes regarding the different habitats and plant communities that could be discerned in the field at the site

Data Review & Sourcing

Following the site visit and the identification of the different ecological features of the site, lists of mammals, reptiles and amphibians which were observed at the site were augmented with species likely to occur at the site based on distribution records from the literature and various spatial databases (SANBI's SIBIS and BGIS databases). Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friendmann and Daly (2004) and Skinner and Chimimba (2005) for mammals. The lists provided are based on species which are known to occur in the broad geographical area as well as an assessment of the availability and quality of suitable habitat at the site. For each species, the likelihood that it occurs at the site was rated according to the following scale:

Low: The available habitat does not appear to be suitable for the species and it is unlikely that the species occurs at the site.
Medium: The habitat is broadly suitable or marginal and the species may occur at the site.
High: There is an abundance of suitable habitat at the site and it is highly probable that the species occurs there.
Definite: Species that were directly or indirectly (scat, characteristic diggings, burrows etc) observed at the site.

The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 3.1 (2010) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

Sensitivity Mapping & Assessment

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases as described above. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Units with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. This category is reserved specifically for areas where the natural vegetation has already been transformed, usually for intensive agricultural purposes such as cropping. Most types of development can proceed within these areas with little ecological impact. Since there were no transformed areas of this nature at the site, no areas of Low Sensitivity were ultimately mapped at the site.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas is highly undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided at all costs.

Sampling Limitations and Assumptions

The major potential limitation associated with the sampling approach is the narrow temporal window of sampling. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints and therefore, the representivity of the species sampled at the time of the site visit should be taken into account. It is however highly unlikely that a single visit has had a significant impact on the results. There was good rainfall in the period preceding the site visit and the vegetation at the time of sampling was in a near ideal condition for sampling as the grasses had seed heads and most shrubs were growing and could be identified. Although the area is not known for an abundance of geophytes, several geophyte species were observed, indicating that the majority of geophyte species likely to occur at the site were visible at the time of sampling. Few reptiles were observed during the site visit, probably because the weather was relatively cool at the time. Ideally, small mammal trapping would be conducted at the site, however, trap success in arid areas is extremely low and a very large sampling effort would be required to provide an adequate species list for the site. Furthermore, some species avoid traps and would not be represented under such an approach. The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach which takes account of the study limitations.

Relevant Aspects of the Development

A single site is being considered and alternative sites are not being assessed or compared to one another. The sensitivity assessment of the site therefore identifies the different ecological sensitivities apparent within a single site and the assessment, which is based on two alternative layouts, assesses the likely impact of each given the basic underlying ecological sensitivity. The first of the alternative layouts is an initial layout provided by AES. This does not take account of the ecological and other potential constraints at the site and is referred to as Layout Alternative 1. The second is a layout that was generated by AES following a mitigation workshop held in July 2011, where the different sensitivities provided by the various specialists involved in the project are taken into account as far as the client deemed possible from a technical perspective. This revised layout is referred to as Layout Alternative 2.

Layout Alternative 1 would produce up 200 MW and would consist of approximately 340 ha of Solar PV Arrays including spaces between rows, associated service roads and transmission infrastructure. Layout Alternative 2 retains a similar output, but the distribution of solar arrays has been fragmented and further distributed in order to avoid the sensitive parts of the site. Consequently, although the layouts occupy a similar total extent, Layout Alternative 2 is more dispersed across the site and consists of as many as eight different areas occupied by arrays and associated infrastructure.

Additional permanent infrastructure and temporary construction activities which will occur at the site will include:

- One or more permanent meteorological stations
- A small site office and storage facility, including security and ablution facilities
- Security system- closed circuit video-surveillance system
- Site fencing
- Car park
- Temporary construction camp (to house 60-80 people)
- Permanent accommodation (for 4-5 people)
- A lay-down area for the temporary storage of materials during the construction activities.

These will be located within or form part of the areas demarcated for the PV Arrays. The proposed grid connection will be approximately 1 km and will run from the north-western corner of the development to the Aries substation.

4. Description of the Affected Environment- Baseline

Broad-Scale Vegetation Patterns

According to Mucina & Rutherford (2006) the entire site falls within a single vegetation type, Bushmanland Basin Shrubland (Figure 1). This is not a threatened vegetation type, and the conservation status of this vegetation type is classified as Least Threatened and less than 1% has been transformed (Mucina & Rutherford 2006). The vegetation type is not protected as none falls within a formal protected area. It is however, important to note that the vegetation of the broad area (Bushmanland) has been mapped at a very coarse scale, and that the national vegetation map does not reflect the variation in vegetation composition present at the site. This is exemplified by the fact that despite being classified as a shrubland, a significant proportion of the site is in fact grassland with very little shrub cover. Several different habitats with characteristic plant communities can be discerned at the site. These can be differentiated in the field according to the stature of the vegetation and identity of the dominant species occurring within each. The different plant communities that could be discerned at the site are described and mapped in the section below.

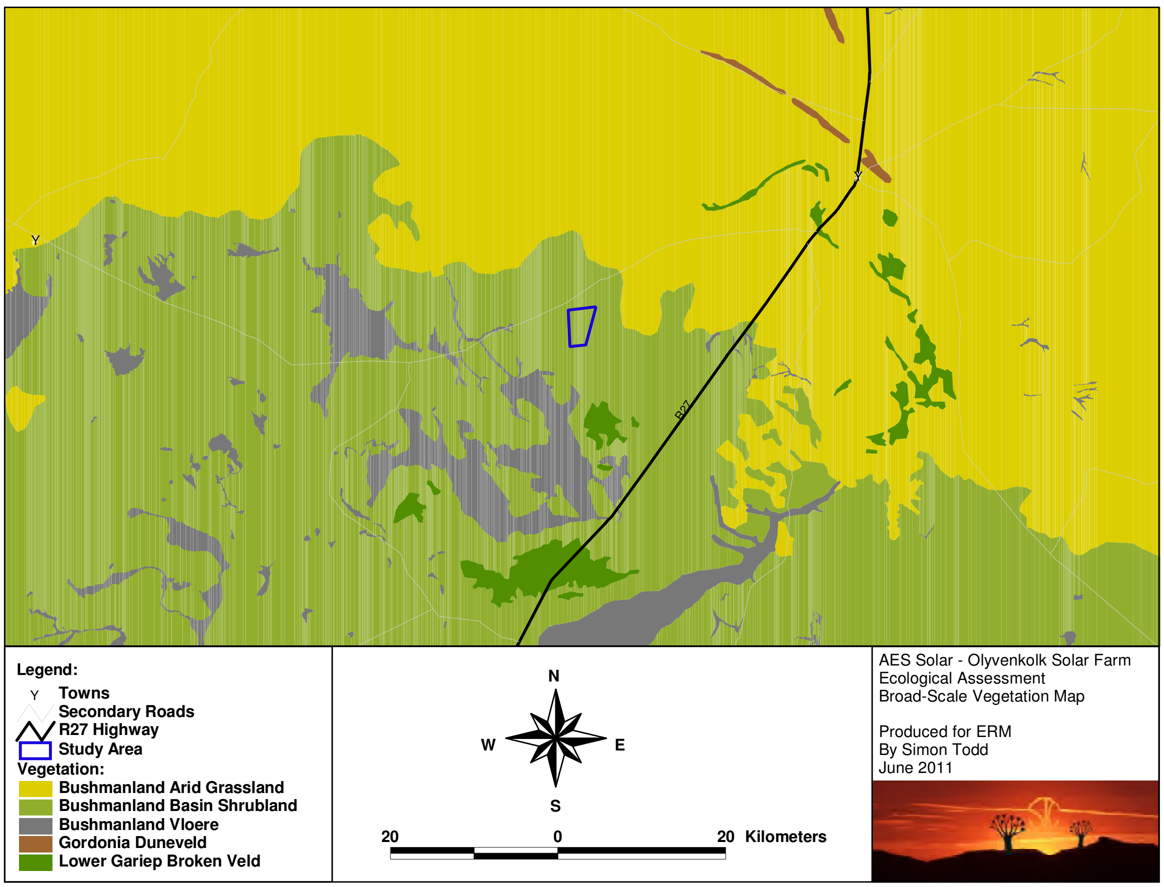


Figure 1. The national vegetation map (Mucina and Rutherford 2006) for the study area and broad surroundings, illustrating the site within the broader landscape context.

Fine-Scale Vegetation Patterns

Overall, the vegetation of the site is relatively homogenous and a large proportion of the species present are common to all the different communities which were observed at the site and are described below. It is only the relative abundance of the common species or the presence of certain subdominant species which differentiate the communities. The major driving variables of this differentiation are soil depth, substrate type and moisture availability which is usually related to landscape position. In order to map the different plant communities at the site, a fine-scale vegetation map of the site was derived from satellite imagery. The sites sampled in the field were used as reference sites in a supervised classification of the image and used to map similar areas across the site. The different plant communities that were identified on site during the site visit are:

- Calcareous Grassland;
- Mixed Rocky Shrubland;
- Drainage Lines and run-on areas which are characterized by Rhigozum & Lycium Thicket

These plant communities are described below and the vegetation map of these communities is also presented.

Calcareous Grassland

Areas of calcareous grassland occur scattered across the site, wherever the underlying calcrete is near to the surface or has been exposed. Plant cover is generally quite low and dominated by bushman grasses such as *Stipagrostis ciliata* and *S. obtusa*. Species richness in these areas is generally quite low as a result of the paucity of the shrub species present. An above average richness of geophytes was however observed. Since these areas usually occur in flat to very gently sloping areas, the risk or erosion or other detrimental disturbance effects is low and this community is considered to be of **Low** to **Moderate** Sensitivity. This is the shortest and most open vegetation type at the site, and apart from scattered shrubs, rarely exceeds 40 cm in stature.

Plate 1. Example of the Calcareous Grassland habitat at the site. The soil is usually very shallow with a lot of expose calcrete on the surface. The vegetation is low and open and dominated by *Stipagrostis* spp.

Mixed Rocky Shrubland

Rocky shrublands with a variably developed grass layer compose the largest proportion of the site and form the majority of those areas classified as **Moderate** Sensitivity within Figure 3. Cover varies from reasonably high to very low depending on the nature of the underlying substrate. Fairly extensive stony plains largely devoid of plant cover occur in many areas within this vegetation type. At the time of sampling the abundance of grasses was very high as a result of the above-average rainfall the area had experienced, but during drier periods the shrub layer would be more conspicuous. Typical species include shrubs such as *Eriocephalus spinescens*, *Pteronia sordida*, *Lycium cinereum* and the forb *Monsonia umbellata*. Typical grasses include *Stipagrostis ciliata*, *S.brevifolia*, *S.uniplumis* and *Aristida congesta*. This community contained the highest species richness relative to the other communities. This is also a generally open and fairly low vegetation type, with the average height of shrubs being in the order of 40-50 cm. The proportion of larger elements such as *Lycium* and *Rhigozum* is generally low but increases in areas with above-average moisture availability, such as those areas which receive run-off from adjacent slopes.

This community was also the only community observed to contain species of conservation concern such as *Hoodia gordonii* and *Aloe claviflora*. *Hoodia gordonii* is listed as a protected species under NEMBA (Act 10 of 2004) as well as provincial legislation while *Aloe claviflora* is protected in the Northern Cape Province in terms of the Northern Cape Nature Conservation Act, No. 9 of 2009. Although it was not possible to thoroughly search the entire development site for these species, the density of plants was observed to be quite low and based on the observed density, it likely that 5-20 individuals of each species would be affected, largely within the area to the south of the railway line. A permit obtainable from Department of Environment Northern Cape (DENC) is required for the removal, destruction or disturbance of these species. Any individuals of these species falling within areas that will need to be cleared for roads or PV arrays, should be located, marked and translocated within the site to an area outside the development footprint. Prior to commencement of construction activities, AES should apply with the consent of the landowner for such a permit and the translocation of plants should take place under the supervision of an ecologist or someone else with experience in this regard.

Plate 2. Example of the Mixed Rocky Shrubland community type. This is the dominant plant community across the majority of the site and is typically dominated by shrubs such as *Eriocephalus* and *Pteronia* with a grass component consisting largely of various *Stipagrostis* species as well as *Aristida congesta*.

Plate 3. Second example of the Mixed Rocky Shrubland plant community. An individual of *Hoodia gordonii* can be seen center-left.

Rhigozum & Lycium Thicket

The lower slopes and bottomlands of the site are the only areas which contain an appreciable amount of topsoil. These areas are dominated by taller shrubs such as *Rhigozum trichotomum*, *Lycium cinereum* and *Phaeoptilium spinosum* with an understorey of forbs and grasses. Common and dominant grasses within these areas included *Stipagrostis ciliata*, *Schmidtia kalahariensis* and *Eragrostis porosa*. The presence of this community is also indicative of the drainage areas of the site which are broad and diffuse as a result of the low overall slope of the area. The specific issues related to the presence of the drainage areas at the site are however dealt with separately below due to their potential significance. The *Rhigozum* and *Lycium* thicket community is the most impacted by livestock grazing as indicated by the high density of *Lycium* and *Rhigozum* which are known indicators of grazing pressure and degradation. The areas dominated by *Rhigozum* contain the lowest abundance of other plant species which can be ascribed to the negative effects of grazing as well as the suppression of the other plant species by *Rhigozum*.

No plant species of conservation concern were observed within this habitat. As such, this community is not considered sensitive from a purely botanical perspective, but the dense cover and greater stature of the vegetation is significant from a faunal and ecological function perspective. Due to the presence of topsoil and the lower slope position of this community it is also the most sensitive to erosion and other disturbance effects which impact plant cover. Based on these sensitivity indicators, this community is considered **Medium** to **High** Sensitivity. This community is conspicuous at the site in that the stature of the vegetation is significantly greater than that of the adjacent communities. Typically, the dominant woody shrub species in this community are around 1 m in height but may be as tall as 2 m indicating that at least the taller elements would probably need to be reduced in height to prevent shading of PV arrays should any arrays be constructed within this community.

Plate 4. Example of the *Rhigozum* thicket community which occurs on the deeper soils which occur in the low-lying and drainage areas of the site. The community is dominated by *Rhigozum trichotomum*, *Lycium* spp and *Phaeoptilium spinosum*.

Plate 5. Example of the *Rhigozum* thicket community with a poorly developed grass layer, which may be the result of heavy grazing and/or suppression of the grass layer by the dense *Rhigozum* stands.

"Drainage Lines"

Drainage lines at the site are not well developed as a result of the low slope and position of the site near the top of the catchment. Consequently, most drainage in the area occurs as sheetwash over a broad area and narrow, well defined drainage channels are not developed. As a result, defining drainage channels at the site is problematic as they are not well differentiated from the surrounding vegetation. The only valid and practical option is to define the *Rhigozum* and *Lycium* thicket community described above as a drainage-line community. However, since this community represents a widespread plant community which occurs on coarse sandy soils throughout Bushmanland, it is not broadly characteristic of drainage lines per se. This is an important issue since wetlands, drainage lines and riparian areas including the constituent vegetation are specifically protected under the National Water Act (Act 36 of 1998) as well as NEMA (ACT NO. 107 of 1998). In terms of the National Water Act, the presence of characteristic vegetation is a defining feature of riparian areas, quoting directly from the Act " '*riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas*"

This definition is not operational within many semi-arid areas as the development of characteristic waterlogged soils and specific vegetation along drainage lines frequently does not occur. Although the drainage line communities at the site are poorly developed, this is not a general phenomenon as well developed drainage lines with characteristic vegetation are common in the area. Typical species along such drainage lines includes *Zizyphus mucronata*, *Stipagrostis namaquensis*, *Diospyros lycoides* and *Acacia karoo*. These species are present even along relatively small drainage lines in the area, but were not observed at the study site.

As alluded to above, the poorly developed nature of the drainage areas at the site, can be ascribed to the position of the site at the very top of the catchment with little potential for runoff accumulation. Nevertheless, a cautious and conservative approach is warranted regarding the development potential of these areas. In order to maintain the connectivity of the site and differentiate those areas which receive the bulk of the run-off from the surrounding areas, those areas which receive the bulk of the run-off have been classified as **High** Sensitivity. These areas will be quite sensitive to disturbance and erosion due to the soil present and the large volumes of water that may be moving over the area following large storm events. This expected sensitivity is supported by the observation that some erosion had occurred at the site as a result of roads capturing overland storm flow which became channeled into the tracks, leading to some significant erosion. This indicates that sufficient water is present during such times to cause erosion and that erosion as a result of the development is a significant risk that will require mitigation.

Mapped Plant Communities

The vegetation map derived from the satellite imagery of the site is depicted in Figure 2, below. As can be seen from the map, the different vegetation units are not always clearly differentiated from one another and there is a lot of patchiness with many small patches of one plant community scattered within another. Although the vegetation map certainly aids in the identification of the drainage areas, those parts of the drainage areas that had not developed taller dense vegetation are mapped as Mixed Shrubland and ultimately, the drainage areas were mapped, for the purposes of the sensitivity analysis by hand based largely on the notes and observations from the site visit. In some areas of the site the vegetation appears to be spotted or banded, and this is a real phenomenon which commonly occurs in arid and semi-arid areas as a result of the manner in which the vegetation redistributes and controls and movement of water and soil down gentle slopes. The Calcareous Grassland and Mixed Rocky Shrubland, are not differentiated in terms of the sensitivity map due to their similar sensitivity and also because they form a complex mosaic that occurs at much finer scale than the footprint and scale of flexibility of the development.

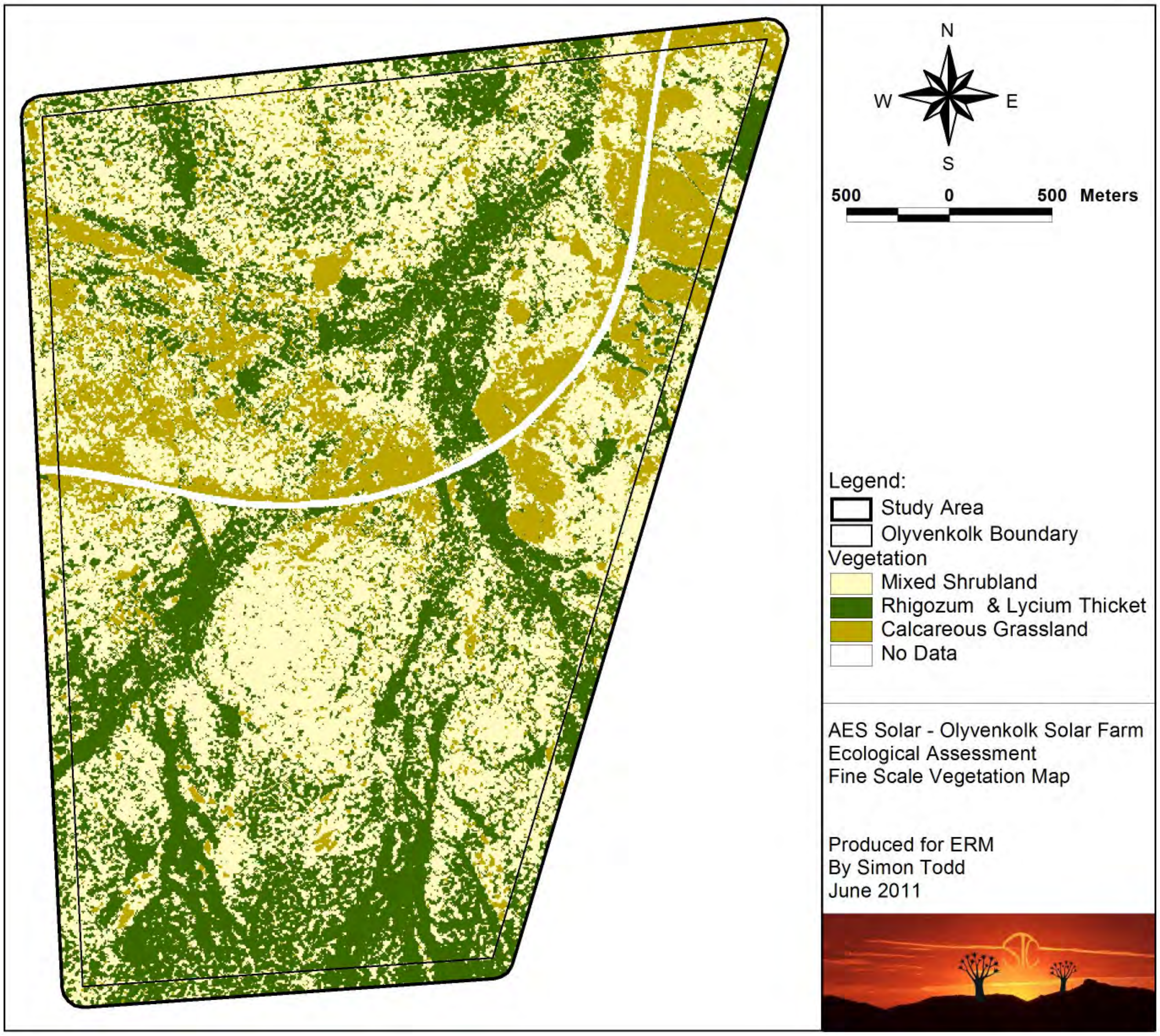


Figure 2. Fine-scale vegetation map of the study area derived from satellite imagery of the site.

Faunal Communities

Mammals

The site does not have a rich faunal community. This can be ascribed to the arid nature of the area and the low variety of different habitats present at the site. Although over 40 mammals have distribution ranges which may incorporate the site (Appendix 1), a large proportion of these are not likely to occur at the site due to the lack of suitable habitat. In particular, species associated with rocky outcrops are not likely to occur at the site. This includes a number of species such as Klipspringer, Rock Hyrax, Dassie Rat, Western Rock Elephant Shrew and Smith's Red Rock Rabbit. The only antelope which occur at the site are Steenbok *Raphicerus campestris* and Common Duiker *Sylvicapra grimmia*. Aardvark *Orycteropus afer*, Porcupine *Hystrix africaeaustralis* and Bat-Eared Fox *Otocyon megalotis* diggings and burrows were observed at the site, indicting the presence of these species in the area. Although they were not observed during the site visit, other medium sized mammals likely to occur at the site include Caracal *Caracal caracal*, Black-backed Jackal *Canis mesomelas*, Cape Fox *Vulpes chama* and Aardwolf *Proteles cristatus*. The medium to larger sized mammals which occur at the site all have home ranges which either exceed or are not likely to correspond to the boundaries of the study site. The erection of fencing which prevents the movement of such animals is therefore a concern regarding the development of the site and mitigation measures to reduce these impacts may be required.

The small mammal community at the site is likely to be dominated by widespread species such as the Four Striped Grass Mouse *Rhabdomys pumilio,* Namaqua Rock Mouse *Micaelamys namaquensis,* Cape Short-tailed Gerbil *Desmodillus auricularis* and Round-eared Elephant Shrew *Macroscelides proboscideus*. Species associated with sandy substrates such as Brants's Whistling Rat *Parotomys brantsii* and *Gerbillurus paeba* will be largely restricted to the low-lying areas dominated by *Rhigozum* and *Lycium*. The overall abundance of small mammals at the site is likely to fluctuate widely from year to year depending on rainfall which regulates small mammal abundance through its effects on plant cover and food availability. Some small mammals may benefit from the development, firstly since larger predators such as jackal and foxes may avoid the site and secondly because the solar arrays would probably shield and protect them from avian predators. This effect would include rodents and also the smaller predators such as mongoose. Although smaller mammals may benefit, this does not imply that this is a positive outcome of the development, but rather indicates that the development may alter the trophic dynamics of the site, which would either have a neutral or negative overall impact.

Reptiles

The site lies in or near the distribution range of at least 40 reptile species (Appendix 2). This indicates that the site has a relatively depauperate reptile assemblage. Based on distribution maps and habitat requirements, composition of the reptile fauna is likely to comprise 1 tortoise, 14 snakes, 16 lizards and skinks, 8 geckos and 1 chameleon. This suggests a reptile fauna which is low in tortoises and snakes, but relatively rich in lizards, skinks and geckos. This largely reflects the lack of vegetation cover and structure at the site and across bushmanland in general, which has favoured nocturnal and fast moving species adapted to open ground. Species associated large rocky outcrops such as Girdled Lizards (*Cordylus* spp) are not likely to be present at the site, while species which favour sandy, stony and open ground are likely to be dominant. Although no reptile species which occur at the site are listed as endangered, the Bushmanland Tent Tortoise is protected under provincial ordinance and is also listed under Appendix II of Cites which regulates trade in these species. While the development will impact the natural vegetative habitat of the site, the construction of the various infrastructural components such as the PV arrays and buildings will create additional habitat which will attract species which utilize such structures such as tubercled geckos (*Chondrodactylus* spp) and agamas (*Agama* spp). If artificial lighting will be provided at the site at night, this would attract insects which would in turn attract geckos and other night-feeding insectivores (such as bats and solifugids) to the vicinity of the lights. Species which may benefit from the development are however a small proportion of the overall fauna, and this effect is deemed to have a neutral impact. As with small mammals, the PV arrays will also likely provide some refuge for reptiles from aerial predators as well as alter soil temperatures which may impact the structure of the reptile community present.

Amphibians

The site lies within or near the range of as many as nine amphibian species. However several of these require more or less permanent water and are therefore extremely unlikely to occur at the site given the scarcity of water in the area. In practice, probably only toad species which are able to tolerate extended dry periods such as the Karoo Toad *Vandijkophrynus gariepensis* occur at the site. The only potential breeding habitats at the site appear to be man-made and include small earth dams, livestock watering troughs and temporary pools caused by the railway line preventing free flow of water across the site. Amphibians are not likely to be sensitive to the development of the site as there are no specialized natural amphibian habitats present such as wetlands which would be sensitive to impact due to the development.

Site Sensitivity Assessment

In terms of the distribution of the different ecological sensitivity categories at the site, those areas with deeper soils comprising the lower slopes and bottomlands of the site are classified as High Sensitivity. From a species richness perspective, these areas are not significant as plant diversity within these areas is low. Due to the deeper soils and landscape position of these areas, these areas would however be vulnerable to disturbance as this would render them susceptible to erosion. These areas are also important from a functional perspective because they provide cover for larger mammal species and would also serve as movement corridors. The presence of different vegetation units within an area is also ecologically important because each unit offers different resources and opportunities for the fauna at the site thereby contributing to the overall diversity of the area. Maintaining the connectivity within these areas and between these areas and the rest of the site should be an important objective of mitigation at the site. The middle and upper slopes of the site as well as those low-lying areas with a calcrete substrate are classified as Low to Medium Sensitivity. These areas would be more tolerant of disturbance as there is little soil cover that could be displaced and the risk of erosion would be low. Some of these areas do however contain the highest levels of plant diversity present at the site, including at least two protected species (*Hoodia gordonii* and *Aloe claviflora*). Development within these areas could proceed with minimal overall ecological impact, provided that due attention is paid to translocating individuals of the protected species and other standard mitigation measures are applied.

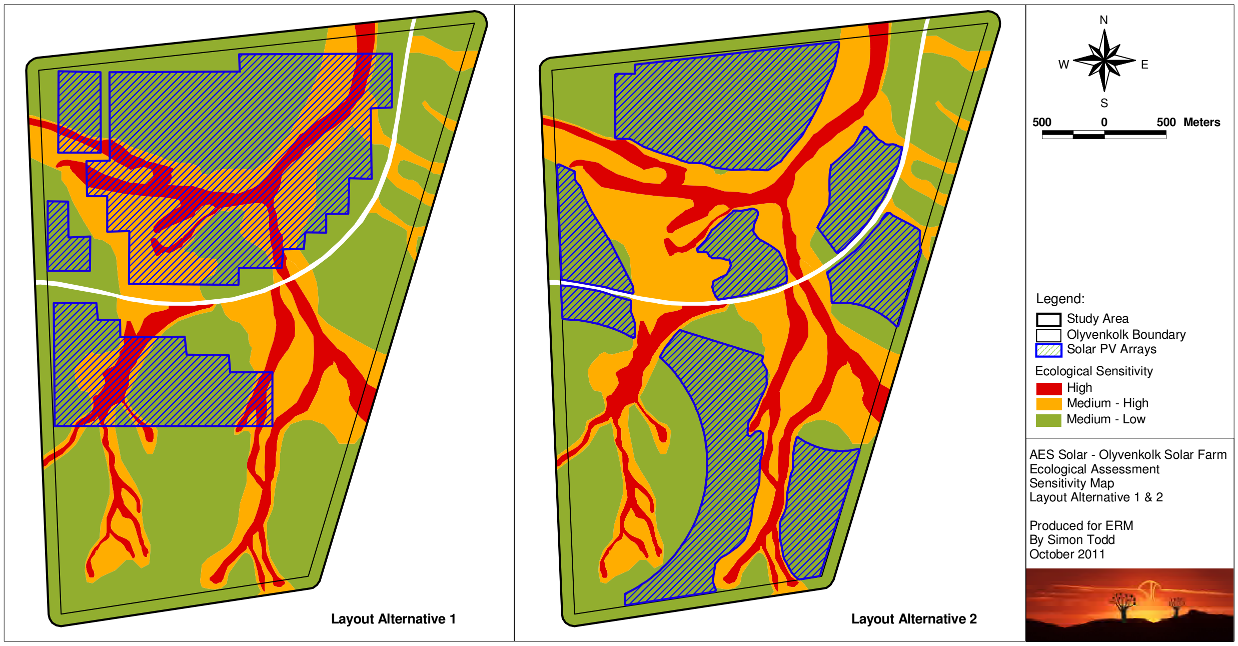


Figure 3. Ecological sensitivity map of the proposed Olyven Kolk Solar Power Plant, with the distribution of the proposed PV arrays under the two alternative layouts overlaid.

The extent of the different areas classified within each of the ecological sensitivity categories and the amounts falling within the development footprint under each development alternative is listed is Table 1. Almost two-thirds of the site is classified as Medium to Low Sensitivity, while around 10% is classified as High Sensitivity. Under Layout Alternative 1 a significant proportion of the development footprint lies within areas of High and Medium-High Sensitivity which is undesirable given the high risk of negative ecological impact that would be associated with development within these areas. As the PV arrays are constructed above the vegetation, and are compatible with the continued presence of low vegetation, and there are also spaces between the rows of arrays, probably less than half the vegetation within the areas earmarked for the PV arrays will actually be lost. The implications of the presence of the PV arrays for the different faunal and floral components at the site are discussed in the Impact Identification and Assessment section (Section 5) below.

While parts of the site have been classified as High Sensitivity, this is to a large extent relative to the other parts of the site. In absolute terms the site in general is low sensitivity when compared to high-biodiversity-value ecosystems with a high threat status or high levels of endemism. There are no threatened species which are known to occur at the site (or broader area) and the vegetation type (Bushmanland Basin Shrubland) occupies an area of 34 690 km^2, making it one of the most extensive vegetation types within South Africa. The loss of habitat resulting from the development is therefore insignificant when considered at the scale of the vegetation type. At a local level, a large proportion of the fauna which occurs in the area is sufficiently mobile to be able to avoid the area if they choose. There are also no habitats at the site which are not widely available in the area.

Although a fine-scale conservation plan and Critical Biodiversity Areas map for the Siyanda Municipality has not been produced, it is highly unlikely that the site would fall within an area that would be identified as a CBA or other significant conservation area. The site does not occur anywhere in the vicinity of any areas identified by the National Protected Areas Expansion Strategy as focus areas for protected area Expansion (NPAES 2009). The site is already to some extent impacted by human activity, since it is adjacent to the Sishen-Saldahna railway line as well as the Eskom Aries substation and there are two high-voltage Eskom transmission lines traversing the site. There are also few indications that the area is likely to act as a broad-scale movement corridor for fauna of flora as it is not within a significant biophysical gradient or corridor of any kind.

Table 1. Extent (Ha) of the different Ecological Sensitivity classes within the site as a whole and within the areas earmarked for the Solar PV Arrays under the two development alternatives. It is important to note that not the entire area under the arrays will be lost as approximately half the area under arrays comprises the spaces between the rows which will be left intact. The total calculated extent of the site below is slightly less than that provided by the client due to differences between the property title deeds and the actual fences on the ground, which are not exactly aligned.

Sensitivity	Site Total	Alternative 1	Alternative 2
High	126	64	0
Medium – High	271	123	0
Medium-Low	626	249	357
Total	1023	435	357

5. Impact Identification and Assessment

Introduction

Impact Identification

The likely impacts associated with the development of the Olyven Kolk Solar Power Plant are identified and assessed below according to the different phases of the project, namely construction, operation and decommissioning. The major potential risk factors associated with the current development can be summarized under the following areas:

- Erosion
- Alien Plant Invasion
- Loss of Habitat & Habitat Fragmentation
- Impacts on riparian/drainage areas
- Impacts on listed plant species

- Direct Faunal Impacts

These potential risks are caused by or related to the following activities:

- Vegetation Clearing
- Road, building and solar PV support construction
- Vehicle Activity
- Increased Human Activity

Mitigation

The objective of mitigation is to firstly avoid and minimise impacts where possible and where these cannot be completely avoided, to compensate for the negative impacts of the development on vegetation and animal habitats and to maximise re-vegetation and rehabilitation of disturbed areas. Mitigation should be focussed on ameliorating the major risk factors associated with the development as outlined above. Mitigation measures associated with each impact assessed are described following the assessment of each impact identified below.

Impact Assessment

The *nature* of the impacts under the two development alternative is similar given that construction methods and infrastructure under each scenario are similar. The distribution of solar PV arrays across the site however differs which has implications for the magnitude and significance of impact under the two scenarios. In order to ensure clarity in this regard, impacts are identified and assessed first with reference to Layout Alternative 1. Thereafter, since the nature of impacts under the two alternatives is similar, differences in the magnitude and significance of impacts under Layout Alternative 2 are discussed, and the impact significance of both alternatives presented in a table for comparative purposes.

All impacts assessed below are pre-mitigation level impacts and residual post-mitigation impacts are summarized in a table at the end of the section in the Summary Assessment section.

Construction Phase

The main impacts on the ecological characteristics and functioning of the site will occur during the construction phase of the project. These impacts will include the loss of natural vegetation and transformation and the general disturbance of natural ecosystems at the site. The presence of a sizeable construction workforce at the site also poses several risks, as does the operation and presence of construction machinery. In general, the key impacts associated with the construction phase of the project are;

- Destruction and loss of vegetation
- Direct impact on protected plant species
- Loss of faunal habitat
- Direct faunal impact

These are discussed and assessed in more detail below.

Prior to the commencement of construction activities at the Olyven Kolk site, the following mitigation measures should be taken to reduce the overall impact of the development.

- An Environmental Control Officer (ECO) should be appointed. The responsibilities of the ECO should include monitoring and reporting as well as ensuring that the development takes place within the guidelines provided in this and the other specialist reports.
- Compile a monitoring schedule for the site based on the monitoring recommendations of this and the other specialist reports.

Impact: Destruction & Loss of Vegetation

Nature: The construction phase will require the construction of access roads between the PV arrays as well as the clearing of vegetation for the arrays, buildings and lay-down areas. Although not all the vegetation between the arrays will be cleared, significant disturbance and loss is nevertheless likely to occur. Apart from the direct loss of vegetation, the disturbed areas will be vulnerable to erosion.

Impact Magnitude – **Medium-High**

- <u>Extent:</u> Local, the extent of the impact will be limited to the site and near surroundings. Erosion may however also affect adjacent and downstream areas.
- <u>Duration:</u> The duration of the impact will be long-term as the majority of impact will remain until the project is decommissioned.
- <u>Intensity:</u> Since this results in the total loss of vegetation within affected areas, the intensity is seen to be **High**.

Likelihood: There is a very high likelihood that this impact will occur across the majority of the development footprint.

Impact Significance: Moderate-Major (-ve)

Degree of Confidence: High. Based on the project description, this impact will occur to a greater or lesser extent.

Mitigation:

- Areas to be cleared should be clearly demarcated.
- Vegetation should only be cleared when and where absolutely necessary. If possible a vegetative cover should be left in place. It is preferable to mow the vegetation down to the required height than to use other more destructive clearing methods.

- Where construction vehicles must traverse the site, they must remain on demarcated roads or tracks. If vehicles must leave the road for construction purposes, they should utilize a single track and should not take multiple paths.
- Where construction does not require the clearing of the vegetation, for example for the solar array support structures, then vegetation that may obstruct construction activities or machinery should be brush cut to an acceptable level, rather than clearing the vegetation at soil level. Cut material should also be left in place or used as a cover to aid rehabilitation of cleared and disturbed areas.
- If topsoil must be removed, it should be replaced or used as soon as possible elsewhere as it will contain seed of local species which will aid the natural recovery of the vegetation.
- Appropriate erosion control and water diversion structures should be constructed at the same time as the vegetation is cleared so that the loosened soil is not left vulnerable to erosion.

Layout Alternative 2:

Given the similarities in construction and infrastructure of the alternatives, the impact of Alternative 2 is largely similar to that of Alternative 1. Since the more sensitive parts of the site are avoided under Alternative 2, a lower Impact Magnitude rating of **Medium** impact is justified. Overall, significance is however deemed to be **Moderate**.

Impact: Impact on Protected Plant Species

Nature: The construction phase will require the clearing of vegetation in areas which were observed to contain plant species protected under NEMBA and provincial legislation. The local populations of these species will therefore be impacted unless mitigation measures are implemented.

Impact Magnitude – Medium .

- Extent: Local, the extent of the impact will be limited to the site.
- Duration: The duration of the impact will be long-term as the habitat will be unavailable to these species until the project is decommissioned.
- Intensity: Although this would result in the destruction of listed plant species within the affected areas, the number of species and individuals affected is likely to low and so the intensity is seen to be **Low-Moderate**.

Likelihood: Protected plant species were observed within the development footprint indicating that this impact will occur.

Impact Significance: Minor-Moderate (-ve) .

Degree of Confidence: Definite, the listed species were observed to occur at the site.

Mitigation:

- Before construction commences the development footprint area should be searched for listed plant species (*Hoodia gordonii* and *Aloe claviflora*) by an ecologist or similarly qualified person. All individuals located should be marked and translocated to similar habitat outside the development footprint under the supervision of an ecologist or someone with experience in plant translocation. A permit will be required to relocate listed plant species, details of the application procedure have been provided in Section 2.
- Any individuals of protected species observed within the development footprint during construction, should be translocated under the supervision of the ECO.

Layout Alternative 2:

The listed plant species were observed to occur largely to the south of the railway line and there is little evidence to suggest that there is significant difference between the two layouts in terms of the number of plants that may be affected. As a result, no differences between the layouts are recognized in this regard and Layout Alternative 2 has a similar **Moderate** Impact Magnitude to Alternative 1.

Impact: Disturbance and loss of habitat for fauna

Nature: The construction phase will result in a lot of physical disturbance due to the operation of heavy machinery and construction activities at the site as well as habitat destruction for resident faunal species. This will result in direct mortality for smaller fauna unable to move away from the construction activities and a loss of faunal habitat in general. The human activity and noise generated by the construction will also frighten most medium and larger fauna such as antelope and smaller carnivores away from the area.

Impact Magnitude – Medium

- Extent: **Local**, the extent of the impact will be limited to the site and near surroundings.
- Duration: The duration of the impact will be **long-term** with regards to the habitat loss as the majority of impact will remain until the project is decommissioned. Noise and human disturbance associated with construction will be short term or as along as construction is underway if a phased approach is required.
- Intensity: The large amount of activity at the site and the associated habitat loss resulting from the clearing and leveling of the site will constitute a **High** disturbance intensity.

Likelihood: There is a very high likelihood that this impact will occur within the PV array areas as well as other areas of infrastructure construction.

Impact Significance: Moderate (-ve)

Degree of Confidence: Definite. Based on the project description, this impact will occur to a greater or lesser extent.

Mitigation:

- The large burrow systems of aardvark, porcupines and other similar medium-sized mammals should not be disturbed or leveled as the animals are likely to be retreated into the burrows during the day. If such burrows occur within areas that need to be cleared, then this should take place when it is certain that the animals are not within their burrows. The local conservation authorities may be able to assist the project on this front.
- Any slow-moving fauna, such as tortoises or snakes observed at the site during the construction phase should be removed to safety by the ECO.
- In order to reduce collisions of vehicles with fauna, speed limits should apply to all roads and vehicles using the site, a maximum of 30 km/h is recommended for heavy vehicles. Animals should have right of way.
- All cleared areas which do not need to remain clear of vegetation should be rehabilitated or seeded with local perennial grass species if natural recovery does not take place within a year of being cleared.

Layout Alternative 2:

Alternative 2 will result in somewhat less loss of habitat, but disturbance levels resulting from noise and human activity are likely to be of similar intensity. As a result of the reduced extent of habitat loss and the avoidance of ecologically sensitive areas, Impact Significance under Alternative 2 is rated as **Minor-Moderate**.

Impact: Direct faunal impacts due to poaching/hunting/illegal collection

Nature: A significant number of construction workers will be on site during the construction phase posing a risk to fauna as a result of poaching and hunting of fauna for food or other purpose. Vulnerable species would include the Bushmanland Tent Tortoise *Psammobates tentorius verroxii* as well as mammals such as Steenbok *Raphicerus campestris* and hares (*Lepus* spp).

Impact Magnitude – Medium.

- Extent: **Local**, the extent of the impact will be limited to the site and near surroundings.
- Duration: The duration of the impact will be short-term or as along as construction is underway if a phased approach is required.
- Intensity: As this impact will be concentrated on a few targeted species, the impact on these species could be of high intensity.

Likelihood: There is a high probability that this would occur in an unregulated situation.

Impact Significance: Moderate (-ve)

Degree of Confidence: High. This impact can be assessed with a high degree of certainty.

Mitigation:

- The staff accommodation should be fenced off and no personnel should be allowed to wander around at the site for any purpose after hours.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden.
- Fires should only be allowed within fire-safe demarcated areas.
- No fuelwood collection should be allowed on-site.
- No dogs should be allowed on site.
- As part of the EMP for the site, it should be mandatory for staff of both the developer as well as contractors to attend an environmental briefing and training session with respect to the guidelines outlined in this document and the EMP.

Layout Alternative 2:

As this impact is related to human presence at the site, the impact is not highly sensitive to the layout design and therefore impact significance is **Moderate** for both Alternatives.

Impact: Loss of landscape connectivity for fauna

Nature: The site will be contained within a security fence which will restrict animal movement onto and off the site unless suitably sized gaps are provided for animals to move through. The site is not sufficiently large to support populations or even individuals of most larger fauna, with the consequence that any such fauna trapped inside the development will not be to survive or meet other individuals for social or mating purposes. Tortoises are also vulnerable to electrocution from electric fences and so if the fence is to be electrified, then no electrified strands should occur within 30 cm of the ground.

Impact Magnitude – Medium

- Extent: **Local**, the extent of the impact will be limited to the site and surroundings.
- Duration: The duration of the impact will be **long-term** as the effect would persist as long as the fence was in place.

- Intensity: Since the presence of the fence would potentially prevent movement of a large proportion of the fauna at the site and could result in mortality of trapped animals, the effect is deemed to have a **high** intensity.

Likelihood: Depending on the construction of the fence, the effect would be highly likely under an unfavourable scenario and would not occur if the fence were constructed in manner which allowed the movement of fauna through the site.

Impact Significance: Moderate (-ve) under Alternative 1, as the extent of the site is not that large within the context of the local landscape.

Degree of Confidence: This effect can be assessed with a high degree of confidence, whether it would actually occur or not would however be dependent on the type of fencing that was used.

Mitigation:

- Any security or other fencing surrounding the site should allow the free movement of animals, especially during the construction phase when animals may need to leave the site. Strand fending is highly preferable to mesh fencing in this regard.
- Electrified fencing can cause high mortality of tortoises; therefore no electrified strands should be placed within 30 cm of the ground on any fence within or surrounding the site. Most other animals should be able creep or dig under the electrified strand if it is not less than 30 cm off the ground.

Layout Alternative 2:

Under Alternative 2, the PV arrays are more widely distributed across the site and the indicative layout provided indicates that each section of PV array will be individually fenced off. As a result, the disruption of connectivity should be significantly reduced and the drainage lines which are likely to be important faunal habitat will not be affected. Under Alternative 2, the loss of ecosystem connectivity at a landscape level would be of **minor** significance.

General Mitigation Measures

Other general mitigation measures recommended for the site during the construction phase include:

- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- The large number of people on site during the construction phase will require that an on-site ablution, sanitation, litter and waste management program is implemented.

Construction Phase- Residual Impacts (Post Mitigation)

A summary of the pre-mitigation significance ratings for the construction phase impacts identified above is provided below. The residual, post-mitigation impact significance is based on Layout Alternative 2 and the implementation of the various mitigation measures described above.

Phase	Impact	Alternative 1 Pre-mitigation	Alternative 2 Pre-mitigation	Alternative 2 Residual Impact (Post Mitigation)
Construction	Destruction & Loss of Vegetation	Moderate-Major	Moderate	Minor - Moderate
	Protected Plant Species	Minor-Moderate	Minor - Moderate	Minor
	Loss of habitat for fauna	Moderate	Minor -Moderate	Minor
	Direct faunal impacts	Moderate	Moderate	Minor
	Loss of landscape connectivity for fauna	Moderate	Minor	Minor

Operational Phase

During the operational phase, human activity and disturbance levels at the site should be relatively low given the low maintenance requirements of the solar arrays. Day to day facility operations will involve both regular on-site preventive and corrective maintenance tasks in order to keep the PV plant in optimal working order throughout the operational period. Intermittent cleaning of the panels will be carried out as necessary.

During this phase, potential impacts are likely to be related to maintenance activities and the likely sensitivity of the site to erosion and other disturbance effects. In particular, the site will remain vulnerable to erosion and alien plant invasion for some time following construction. The height of the vegetation in some areas may require vegetation management activities and the manner in which this is carried out will be an important aspect of mitigation during this phase of the project. Impacts associated with this phase of the project can be identified as follows:

- Post-construction vulnerability to erosion
- Post-construction vulnerability to alien plant invasion
- Direct impacts on vegetation resulting from maintenance activities

Impact: Erosion Potential

Nature: Post construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. Furthermore, compacted gravel tracks may capture overland flow, concentrating the water from a large area onto the tracks which may cause severe erosion. The panels themselves may also cause erosion as result of the run-off collected from the panels and the impact that the water falling from the lower edge of the panels is likely to make on the ground. It is therefore important that proper erosion control structures are built and maintained over the lifespan of the project.

Impact Magnitude – Moderate

- Extent: Local, the extent of the impact will be largely limited to the site, but downstream and adjacent areas may be affected.
- Duration: Should severe erosion occur then the duration of the impact will be long-term as such erosion is not easily remedied.
- Intensity: The intensity of the impact is likely to be moderate as there are no steep slopes at the site which would be vulnerable to extensive severe erosion.

Likelihood: Based on the large number of tracks that will be required at the site and the fact that they will probably not be built along the contour, there is a high likelihood that some erosion would occur under either Alternative.

Impact Significance: Moderate (-ve).

Degree of Confidence: There is a high degree of confidence in the assessment of this risk.

Mitigation:

- Regular monitoring of the site (minimum of twice annually) for erosion problems for the first 3-5 years of the operational phase is recommended, or until such time that the vegetation has sufficiently recovered that erosion problems are no longer occurring. Thereafter erosion control measures should be reactive and take place whenever erosion problems are observed to be developing.
- Any erosion problems observed should be rectified as soon as possible and monitored thereafter to ensure that they do not reoccur.
- All bare areas should be revegetated at least with a perennial grass layer of locally occurring species, to bind the soil and limit erosion potential.

Layout Alternative 2:

Alternative 2 poses a lower risk in this regard the site layout avoids the vulnerable drainage areas, as recommended during the mitigation workshop. Impact significance is therefore reduced to **Minor** for this Alternative.

Impact: Alien Plant Invasion

Nature: The areas of disturbed and bare ground that are likely to be present at the site after construction will leave the site vulnerable to alien plant invasion. The presence of alien plants may prevent the natural recovery of the natural vegetation, reduce plant and animal diversity at the site as well as result in various other negative ecosystem consequences. Furthermore, the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act. Alien invasion is likely to occur to some extent under either development alternative.

Impact Magnitude - Medium

- Extent: Local, the extent of the impact will be largely limited to disturbed areas of the site, but adjacent areas may also become affected in invasion is severe.
- Duration: Should alien plants become established this would be considered to have a long-term impact as these plants would probably persist at the site for years or decades.
- Intensity: The intensity of the impact is likely to be of low to moderate intensity as it is likely that the weedy grasses present at the site will colonise the disturbed areas and reduce the potential extent and severity of alien plant invasion.

Likelihood: Since the development of the site will result in a fairly extensive disturbance, it is highly likely that some alien plant invasion will occur.

Impact Significance: Minor to **Moderate** (-ve)

Degree of Confidence: There is a high degree of confidence in the assessment of this risk.

Mitigation:

- Regular monitoring for alien plants at the site should occur and could be conducted simultaneously with erosion monitoring.
- When alien plants are detected, these should be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur.
- Clearing methods should themselves aim to keep disturbance to a minimum.

Layout Alternative 2:

Layout Alternative 2 is deemed to pose a slightly lower risk than Alternative 1 in this regard as the drainage areas which are likely to be more vulnerable to invasion will be little impacted under layout Alternative 2. However, outside of the drainage areas, the vulnerability is likely to be the same. The impact significance under Alternative 2 is therefore deemed to be Minor.

Impact: Maintenance activity impact on vegetation

Nature: During the construction phase vegetation may need to be cleared from around the solar arrays. Mechanical means should be used for this purpose and vegetation should not be cleared lower than 30 cm above ground level.

Impact Magnitude - Low

- Extent: Local, the extent of the impact will be limited to the site.
- Duration: The duration of impact is assessed as medium term as it would persist as long as such maintenance activities are conducted during the operational phase.
- Intensity: The intensity of the impact is likely to be low

Likelihood: This impact is likely to occur some extent as it is likely that some vegetation will develop in areas that will need to be cleared

Impact Significance: Minor (-ve)

Degree of Confidence: There is a high degree of confidence in the assessment of this risk.

Mitigation:

- No herbicides to be used at the site
- Vegetation that needs to be reduced in height should be mowed or brush-cut to an acceptable height, and not to ground level except where necessary. Given that the lower end of the panels will be more than a meter off the ground, this should not be problem across the majority of the site, particularly under Alternative 2 and mechanical means should be more than adequate to control taller vegetation.

Layout Alternative 2:

This is a **minor** impact and will be restricted to the development footprint under both Alternatives.

Operation Phase- Residual Impacts (Post Mitigation)

A summary of the pre-mitigation significance ratings for the operational phase impacts identified above is provided below. The residual, post-mitigation impact significance is based on Layout Alternative 2 and the implementation of the various mitigation measures described above.

Phase	Impact	Alternative 1 Pre-mitigation	Alternative 2 Pre-mitigation	Alternative 2 Residual Impact (Post Mitigation)
Operation	Erosion Potential	Moderate	Minor	Minor
	Alien Plant Invasion	Minor-Moderate	Minor	Minor
	Maintenance impact on vegetation	Minor	Minor	Minor

Decommissioning

During the decommissioning phase the project is likely to face similar issues generated by the construction phase; that is negative impacts related to disturbance and human presence at the site. The decommissioning phase should attempt to rehabilitate the site with as little disturbance as possible. The key potential impact associated with the decommissioning phase would be that the site is not adequately restored to its previous potential and a degraded and disturbed ecosystem is left behind.

Impact: Inadequate rehabilitation of the site.

Nature: Decommissioning will involve a large amount of disturbance at the site as the majority of infrastructure will need to be removed and most roads will need to be rehabilitated. This will leave the site vulnerable to erosion and alien plant invasion. If the site is not adequately restored at decommissioning, a degraded ecosystem would persist at the site for decades.

Impact Magnitude - Moderate

- <u>Extent:</u> Local, the extent of the impact will be largely limited to disturbed areas of the site, but adjacent and downstream areas could also be affected in the case of erosion problems.
- <u>Duration:</u> Should erosion occur and alien plants become established this would be considered to have a long-term impact as the problems would probably persist at the site for years or decades.
- <u>Intensity:</u> The intensity of the impact is likely to be of low to moderate intensity as it is likely that the weedy grasses present at the site will colonise the disturbed areas and reduce the potential extent and severity of erosion and alien plant invasion.

Likelihood: Since the decommissioning of the site will result in a fairly extensive disturbance, it is highly likely that some erosion and alien plant invasion will occur if mitigation measures are not implemented.

Impact Significance: Minor to **Moderate** (-ve)

Degree of Confidence: There is a high degree of confidence in the assessment of this risk.

Mitigation:

- All disturbed areas should be rehabilitated with locally-sourced seed of indigenous species.
- The site should be monitored for a period of at least two years after the infrastructure has been removed to ensure that rehabilitation is successful and that areas that do not recover adequately can be identified and remedied.

Layout Alternative 2:

This problem is likely to be similar under both Alternatives, but Alternative 2 is likely to be less vulnerable to erosion-related problems as it avoids the most vulnerable parts of the site. Impact Significance is however also rated as **Minor** to **Moderate.**

Decommissioning Phase- Residual Impacts (Post Mitigation)

A summary of the pre-mitigation significance ratings for the impacts identified for the decommissioning phase is provided below. The residual, post-mitigation impact significance is based on Layout Alternative 2 and the implementation of the various mitigation measures described above.

Phase	Impact	Alternative 1 Pre-mitigation	Alternative 2 Pre-mitigation	Alternative 2 Residual Impact (Post Mitigation)
Decommissioning	Inadequate rehabilitation	Minor-Moderate	Minor-Moderate	Minor

Cumulative Impacts

Before the cumulative impacts of the current development can be adequately assessed, other developments that may occur or are currently being planned for the area need to be identified. At this stage and as far as can be ascertained, the only other planned development in the immediate area is another Solar PV facility on the adjacent property Kleinzwart Bast, which is directly east of this site. The current application (Basic Assessment) for the facility on Kleinzwart Bast lists the output of the facility at 10MVA and states that the entire facility will occupy less than 20 ha. However, in the long-term, the facility may be expanded to occupy the full 200 ha of feasible area that has been identified at the site. Although there are numerous solar energy projects planned across the Northern Cape, some of which may also fall within Bushmanland Basin Shrubland, thereby contributing towards cumulative impact within the vegetation type, how many of these planned projects will actually be built is not known and therefore cannot be reliably assessed. Nevertheless, the cumulative impacts of the development are likely to be low.

The potential of the development to contribute towards the broad-scale fragmentation of habitat or to impinge on conservation targets for the associated vegetation types is low, even when considered within the context of similar developments which may be planned for the area. Firstly, the site falls within Bushmanland Basin Shrubland, which has been little impacted by transformation and is one of the most extensive vegetation types within the country. Furthermore, the broad area has a low topographic diversity and as a result, broad-scale ecological processes are likely to operate in a diffuse manner and the site is therefore not likely to function as part of a regional movement or migration corridor for fauna and flora. The larger fauna which occurs in the area is typical of arid and semi-arid areas and constitutes species which are able to avoid human contact through mobility or their secretive behaviour. Such species will be able persist within the developed areas, or will be able to avoid them. Secondly, the area is already relatively impacted due to the presence of the railway line as well as the ESKOM substation and transmission lines. Therefore the additional transformation that will result as a consequence of the development of the site will compound the impacted nature of the local area, but the overall impact on the connectivity of the landscape and the further disruption of ecosystem processes is reduced by the proximity to a large amount of existing development.

Summary Assessment

Most of the impacts associated with the development can be mitigated to minor significance except for the destruction of the vegetation, which cannot be wholly mitigated as the development will occupy the space currently used by the fauna and flora within the affected areas. The residual impact for all other impacts would be **minor** once mitigation measures have been implemented. In terms of differences between the layout options, Alternative 2 is seen as the preferred option as it is likely to result in significantly less loss of landscape connectivity and would be less likely to result in significant soil erosion and alien plant invasion.

Table 2. Summary of pre and post mitigation impact significance ratings for the different impacts and risk factors identified for the different phases of the project.

Phase	Impact	Alternative 1 Pre-mitigation	Alternative 2 Pre-mitigation	Alternative 2 Residual Impact (Post Mitigation)
Construction	Destruction & Loss of Vegetation	Moderate-Major	Moderate	Minor - Moderate
	Protected Plant Species	Minor-Moderate	Minor - Moderate	Minor
	Loss of habitat for fauna	Moderate	Minor -Moderate	Minor
	Direct faunal impacts	Moderate	Moderate	Minor
	Loss of landscape connectivity for fauna	Moderate	Minor	Minor
Operation	Erosion Potential	Moderate	Minor	Minor
	Alien Plant Invasion	Minor-Moderate	Minor	Minor
	Maintenance impact on vegetation	Minor	Minor	Minor
Decommissioning	Inadequate rehabilitation	Minor-Moderate	Minor-Moderate	Minor

6. Information gaps, uncertainties and study limitations

The majority of impacts associated with the development of the site as a solar power plant can be assessed with a relatively high degree of confidence as the nature of the impact is readily identified and the ecological consequences well established. Areas of uncertainty include changes in soil temperatures, community composition and shifts in trophic dynamics. The solar arrays will shade the ground which will lower soil temperatures which will affect plant as well as faunal communities. The vegetation may become more dense or a shift in plant growth-forms may occur. How the faunal communities will respond to this effect is unclear, especially as the presence of the solar arrays would themselves have an effect through shielding small vertebrates from aerial predators. The presence of the solar arrays would probably deter larger predators away from the area, which may also lead to changes in the composition of smaller predators at the site, which would have consequences for trophic dynamics. In order to assess these potential impacts, some speculation as to the impacts of each effect would be necessary, however, these factors are all likely to interact with one another and the ultimate outcomes are not predictable. Nevertheless even if these effects occur, they would be largely restricted to the site and their impact would not be significant as they would form part of the anthopogenic landscape generated by the development of the site.

7. Conclusion and Recommendations

Overall, the Olyven Kolk site is a favourable location for the development of a solar power plant as the site is not sensitive locally or from a regional perspective. There are no highly sensitive ecosystems on the site, and there are no threatened plant or animal species which are known to occur in the area. Not all parts of the site are however equally sensitive and the low-lying and drainage areas are singled out as being of above-average sensitivity within the context of the site. Those areas associated with the core of the drainage areas are deemed to be of High ecological sensitivity and should not be developed so as to prevent the ecological degradation of the site as well as maintain the ecological connectivity of the site.

The exact amount of vegetation loss and transformation that will occur is to a large extent dependent on the exact construction methods that are ultimately used, but is potentially quite high at the site scale. Many of the impacts associated with the construction phase of the development are therefore potentially of a high intensity. However, the extent of these impacts will be largely restricted to the site, which is not very large when taken within context of the surrounding landscape. When the diversity and conservation value of the area is taken into account, the impacts of the development are largely of a low significance. Since a large proportion of the footprint under Layout Alternative 1 lies within areas classified as High Sensitivity, the significance of the impact of the development on the ecology of the site under Alternative 1 would potentially be of **Moderate** to **Major** Significance. However, Layout Alternative 2 has a significantly adapted footprint and is the preferred option as it avoids areas of high sensitivity with the consequence that the impact associated with Alternative 2 would potentially be of **Minor** Significance. Under, Alternative 2 and with the recommended mitigation measures implemented, the long-term impact of the development would be significantly reduced and would be of **minor** significance.

Therefore, there do not appear to be any valid ecological reasons to suggest that the development should not go ahead within the constraints as described in this report.

Areas of greatest potential impact that should form the focus of mitigation measures at the site can be summarized as follows:

- Preventing soil erosion
- Rehabilitation of disturbed areas
- Translocation of protected plant species
- Minimising human-related impacts during the construction phase (poaching & collecting of plants and animals)

- Finding acceptable ecologically-neutral solutions to the security fencing that will surround the site

Before construction commences a field survey for individuals of *Hoodia gordonii* and *Aloe claviflora* should be conducted. Two options are available:

1. Plants can be translocated to similar habitat on site but outside of the development footprint once the appropriate permits have been obtained.

or

2. Plants can mapped and the location of the infra-structure adjusted so as to avoid impacting individuals of these species. This may not be a practical course of action and the first option may be preferable especially if a significant number of individuals are located.

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Appendix 1. List of Mammals

List of mammals which were observed or may occur at the proposed Olyven Kolk Solar Power Plant. The likelihood that each species actually occurs at the site is listed based on the habitat requirements of the different species. The status refers to the conservation status of the different species according to the IUCN (2010). Habitat requirements are from Skinner and Chimimba (2005).

Scientific Name	Common Name	Status	Habitat	Likelihood
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	High
Elephantulus ruprestris	Western Rock Elephant Shrew	LC	Rocky koppies, rocky outcrops or piles of boulders where these offer sufficient holes and crannies for refuge.	Low
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	Definite
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	V.Low
Lagomorpha (Hares and Rabbits):				
Pronolagus rupestris	Smith's Red Rock Rabbit	LR/LC	Confined to areas of krantzes, rocky hillsides, boulder-strewn koppies and rocky ravines	V.Low
Lepus capensis	Cape Hare	LR/LC	Dry, open regions, with palatable bush and grass	High
Lepus saxatilis	Scrub Hare	LR/LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	High
Rodentia (Rodents):				
Cryptomys hottentotus	African Mole Rat	LC	Wide diversity of substrates, from sandy soils to heavier compact substrates such as decomposed schists and stony soils	Low
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Definite
Petromus typicus	Dassie Rat	LC	Mountainous regions and inselbergs, where they are confined to rocky outcrops and live in crevices or piles of boulders	V.Low

Pedetes capensis	Springhare	LC	Occur widely on open sandy ground or sandy scrub, on overgrazed grassland, on the fringes of vleis and dry river beds.	V.Low
Xerus inauris	South African Ground Squirrel	LC	Open terrain with a sparse bush cover and a hard substrate	High
Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	V.Low
Rhabdomys pumilio	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	High
Mus minutoides	Pygmy Mouse	LC	Wide habitat tolerance	High
Micaelamys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	High
Parotomys brantsii	Brants's Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
Parotomys littledalei	Littledale's Whistling Rat	LC	Riverine associations or associated with Lycium bushes or *Psilocaulon absimile*	High
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
Gerbillurus vallinus	Brush-tailed fairy-footed Gerbil	LC	Confined to areas with rainfall less than 150 mm	High
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	Medium
Primates:				
Papio hamadryas	Chacma Baboon	LR/LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Low
Eulipotyphla (Shrews):				
Crocidura cyanea	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
Carnivora:				
Proteles cristatus	Aardwolf	LR/LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	High

Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	High
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	High
Felis nigripes	Black-footed cat	LC	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	High
Genetta genetta	Small-spotted genet	LR/LC	Occur in open arid associations	High
Suricata suricatta	Meerkat	LR/LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	Definite
Cynictis penicillata	Yellow Mongoose	LR/LC	Semi-arid country on a sandy substrate	Definite
Galerella pulverulenta	Cape Grey Mongoose	LR/LC	Wide habitat tolerance	High
Vulpes chama	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	High
Canis mesomelas	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	High
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	High
Ictonyx striatus	Striped Polecat	LR/LC	Widely distributed throughout the sub-region	High
Mellivora capensis	Ratel/Honey Badger	LR/LC	Catholic habitat requirements	High
Rumanantia (Antelope):				
Sylvicapra grimmia	Common Duiker	LR/LC	Presence of bushes is essential	High
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	V.Low
Raphicerus campestris	Steenbok	LR/LC	Inhabits open country,	Definite
Oreotragus oreotragus	Klipspringer	LR/cd	Closely confined to rocky habitat.	V.Low
Chiroptera (Bats)				
Pipistrellus capensis	Cape Serotine Bat	LC	Wide habitat tolerances, but often found near open water	High
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	In arid areas. often associated with water sources	High
Nycteris thebaica	Egyptian Slit-faced Bat	LC	Wide habitat tolerance	High

Appendix 2. List of Reptiles

List of reptiles which may occur at the proposed Olyven Kolk Solar Power Plant. The status refers to the conservation status of the different species according to the IUCN (2010), however, the majority of species have not been assessed due to a lack of knowledge on the ecology and conservation status of these reptile species.

Scientific Name	Common Name	Distribution	Status	Habitat
Tortoises and Terrapins:				
Psammobates tentorius verroxii	Bushmanland Tent Tortoise	Endemic	Appendix II Protected	Varied: usually arid karroid areas or rocky sandveld
Snakes:				
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	Endemic	Data Deficient	Varied: semi-desert, coastal bush, fynbos & savannah
Rhinotyphlops schinzi	Beaked Blind Snake	Endemic	Data Deficient	Semi-deseet and arid savanna
Lamprophis fuliginosus	Brown House Snake	Widespread	Data Deficient	Common in highveld grassland & arid karroid regions, but found everywhere & tolerant of urban sprawl
Pseudaspis cana	Mole Snake	Widespread	Data Deficient	Sandy scrubland in SW Cape, highveld grassland & mountainous & desert regions
Dipsina multimaculata	Dwarf Beaked Snake	Endemic	Data Deficient	Rocky, sandy areas. Cape karroid areas.
Psammophis notostictus	Karoo Sand Snake Or Whip Snake	Widespread	Data Deficient	Arid scrubland & karroid regions
Psammophis leightoni	Fork-marked Sand Snake	Widespread	Data Deficient	Coastal fynbos, desert and semi-desert
Dasypeltis scabra	Common/Rhombic Egg Eater	Widespread	Data Deficient	Absent only from true desert & closed-canopy forest
Telescopus beetzii	Namib Tiger Snake	Endemic	Data Deficient	Rocky, arid regions
Aspidelaps lubricus	Coral Shield Cobra	Widespread	Data Deficient	Karroid & sandveld regions, entering dry valley plains in S and E Cape
Naja nivea	Cape Cobra	Endemic	Data Deficient	Arid karroid regions, particularly along river courses, entering well drained open areas along the southern coast
Naja nigricollis woodi	Black Spitting Cobra	Endemic	Data Deficient	Namibia to Citrusdal in karroid
Bitis arietans	Puff Adder	Widespread	Data Deficient	Absent only from desert & mnt tops
Bitis caudalis	Horned Adder	Widespread	Data Deficient	Sandy regions, throughout Karoo
Lizard and Skinks:				
Acontias lineatus	Striped Legless Skink	Endemic	Data Deficient	Sandy, arid soils
Mabuya capensis	Cape Skink	Widespread	Data Deficient	Very varied: arid karroid veld, moist coastal bush, montane grassland, etc
Mabuya occidentalis	Western Three-Striped Skink	Widespread	Data Deficient	Arid Savanna karroid veld and desert
Mabuya sulcata	Western Rock Skink	Widespread	Data Deficient	Karroid areas
Mabuya variegata	Variegated Skink	Widespread	Data Deficient	Extremely varied; desert, karroid veld, montane grassland, savanna, coastal bush & valley bushveld

Meroles suborbitalis	Spotted Desert Lizard	Endemic	Data Deficient	Varied, arid savanna to desert
Nucras tessellata tessellata	Striped Sandveld Lizard	Widespread	Data Deficient	Open arid savannah & karroid veld
Pedioplanis laticeps	Cape Sand Lizard	Endemic	Data Deficient	Coastal dunes and succulent karroid veld
Pedioplanis lineoocellata	Spotted Sand Lizard	Endemic	Data Deficient	Very varied: karroid veld, valley bushveld & arid & mesic savannah
Pedioplanis namaquensis	Namaqua Sand Lizard	Widespread	Data Deficient	Karroid veld
Pedioplanis undata inorata	Western Sand Lizard	Widespread	Data Deficient	Semi desert including rocky flats
Cordylus polyzonus	Karoo Girdled Lizard	Endemic	Appendix II Protected	Karroid regions
Varanus albigularis	Rock Monitor	Widespread	Data Deficient	Savanna and arid karroid areas
Agama aculeata	Ground Agama	Widespread	Data Deficient	Semi desert and savanna
Agama anchietae	Anchieta's Agama	Widespread	Data Deficient	Semi desert and arid savanna
Agama atra	Southern Rock Agama	Endemic	Data Deficient	Semi-desert to fynbos, from sea level to mountain tops
Chameleons:				
Chamaeleo namaquensis	Namaqua Chameleon	Widespread	Appendix II Protected	Sandy regions (incl coastal dunes) with scrub vegetation
Geckos:				
Chondrodactylus angulifer	Giant Ground Gecko	Endemic	Data Deficient	Gravel plains, interdune spaces & sandy flats
Chondrodactylus bibronii	Bibron's Tubercled Gecko	Endemic	Data Deficient	Rocky outcrops, cliffs and large trees
Pachydactylus capensis	Cape Gecko	Widespread	Data Deficient	Karroid veld, grassland and mesic savannah
Pachydactylus laevigatus	Button-scaled Gecko	Widespread	Data Deficient	Semi desert and arid savanna
Pachydactylus mariquensis	Marico Gecko	Endemic	Data Deficient	Flat sandy plains with sparse vegetation
Pachydactylus rugosus	Rough-scaled Gecko	Endemic	Data Deficient	Semi-desert and succulent karroid veld
Pachydactylus serval	Western Spotted Gecko	Endemic	Data Deficient	Semi desert and succulent karroid veld
Ptenopus garrulus	Common Barking Gecko	Endemic	Data Deficient	Desert and semi-desert on various soil types, preferring flat stable sandy soils with sparse vegetation cover

Appendix 3. List of Ampibians

List of amphibian species which may occur at the Olyven Kolk Solar Power Plant. Since there is no permanent water at the site, any species which require permanent water would be associated with man-made features such as livestock watering troughs.

Scientific Name	Common Name	Status	Habitat	Distribution	Likelihood
Vandijkophrynus gariepensis	Karoo Toad	Not Threatened	Karoo Scrub	Widespread	High
Poyntonophrynus vertebralis	Southern Pygmy Toad	Not Threatened	Nama karroo shrubland, grassland and dry savanna. Breeds in temporary shallow pans, pools or depressions containing rainwater, and rock pools along rivers.	Endemic	High
Pyxicephalus adspersus	Giant Bullfrog	Not Threatened	Breed in shallow margins of rain-filled depressions.	Widespread	Low
Xenopus laevis	Common Platanna	Not Threatened	Any more or less permanent water	Widespread	V. Low
Cacosternum boettgeri	Common Caco	Not Threatened	Marshy areas, vleis and shallow pans	Widespread	Low
Amietia angolensis	Common River Frog	Not Threatened	Slow flowing stream and other permanent bodies of water	Widespread	V. Low
Amietia fuscigula	Cape River Frog	Not Threatened	Large still bodies of water or permanent streams and rivers.	Widespread	V. Low
Tomopterna tandyi	Tandy's Sand Frog	Not Threatened	Nama karoo grassland and savanna	Widespread	Medium
Tomopterna cryptotis	Tremolo Sand Frog	Not Threatened	Widespread in savanna and grassland	Widespread	Low

Appendix 4. List of Plants

List of plant species that were observed at the Olyven Kolk site during the site visit. The conservation status of all species recorded is listed as *Least Concern*.

Family	Species
Acanthaceae	*Acanthopsis disperma*
Aizoaceae	*Galenia africana*
	Tetragonia arbuscula
Amaranthaceae	*Amaranthus praetermissus*
Amaryllidaceae	*Cf Brunsviggia sp.*
Apocynaceae	*Hoodia gordonii*
Asparagaceae	*Asparagus glaucus*
	Asparagus retrofractus
Asphodelaceae	*Aloe claviflora*
Asteraceae	*Berkheya pinnatifida subsp. pinnatifida*
	Dicoma capensis
	Eriocephalus pauperrimus
	Eriocephalus spinescens
	Felicia hyssopifolia subsp. hyssopifolia
	Kleinia longiflora
	Osteospermum armatum
	Pteronia leucoclada
	Pteronia sordida
	Rosenia glandulosa
	Geigeria filifolia
	Pentzia cf incana
Bignoniaceae	*Rhigozum trichotomum*
Capparaceae	*Cadaba aphylla*
Chenopodiaceae	*Salsola tuberculata*
Colchicaceae	*Ornithoglossum viride*
Cucurbitaceae	*Cucumis africanus*
Fabaceae	*Cullen tomentosum*
	Indigastrum argyraeum
	Lotononis marlothii
	Lotononis platycarpa
	Melolobium microphyllum
	Parkinsonia africana
	Prosopis glandulosa
	Sutherlandia frutescens

Geraniaceae	*Monsonia umbellata*
	Sarcocaulon patersonii
Gisekiaceae	*Gisekia pharnacioides var. pharnacioides*
Hyacinthaceae	*Ornithogalum unifolium var. unifolium*
	Ledebouria cf ovatifolia
Iridaceae	*Moraea speciosa*
Loranthaceae	*Septulina glauca*
Malvaceae	*Hermannia spinosa*
	Radyera urens
	Malva parviflora
Molluginaceae	*Limeum aethiopicum subsp. aethiopicum var. aethiopicum*
	Limeum africanum subsp. africanum
Nyctaginaceae	*Phaeoptilum spinosum*
Oxalidaceae	*Oxalis lawsonii*
	Oxalis cf beneprotecta
Pedalaceae	*Sesamum capense*
Poaceae	*Aristida congesta subsp. barbicollis*
	Cenchrus ciliaris
	Enneapogon desvauxii
	Enneapogon scaber
	Eragrostis biflora
	Eragrostis porosa
	Fingerhuthia africana
	Schmidtia kalahariensis
	Setaria verticillata
	Stipagrostis brevifolia
	Stipagrostis ciliata var. capensis
	Stipagrostis namaquensis
	Stipagrostis obtusa
	Stipagrostis uniplumis var. neesii
	Tragus berteronianus
	cf Hyperhennia sp.
	Sporobolus ioclados
Scrophulariaceae	*Aptosimum lineare var. lineare*
	Aptosimum procumbens
	Aptosimum spinescens
	Peliostomum leucorrhizum
	Selago pinguicula
Solanaceae	*Lycium cinereum*
	Lycium oxycarpum
	Solanum capense
Verbenaceae	*Chascanum garipense*

Verbenaceae	*Chascanum pumilum*
Zygophyllaceae	*Tribulus pterophorus*
	Tribulus terrestris
	Zygophyllum dregeanum

Annex G

Bird Specialist Report

OLYVEN KOLK PV SOLAR POWER PLANT

BIRD IMPACT ASSESSMENT

AVISENSE CONSULTING

EXECUTIVE SUMMARY

This study contains a review of the relevant literature on the impacts on avifauna of solar energy facilities and their associated electrical infrastructure, and identifies potential impacts of the proposed Olyven Kolk PV Solar Power Plant on the avifauna of the Kenhardt area. The expected impacts are: (i) habitat destruction by the construction of the facility itself and its associated power lines, tracks and roads, (ii) disturbance or displacement by construction, maintenance and decommissioning activities, and possibly by the operation of the facility, and (iii) mortality caused by collision with the associated power line network or with the PV arrays, and electrocution on power line and substation infrastructure. In addition, some birds may interfere with the efficient running of the proposed PV installation.

The broader impact zone of the proposed PV facility is contained within an extensive tract of flat, quite remote, grassy Karoo shrubland . The area is likely to support over 130 bird species, including 11 Red-listed species, 56 endemics, and four Red-listed endemics. The birds of greatest potential relevance and importance in terms of the possible impacts of the PV facility are likely to be breeding pairs of Martial Eagle *Polemaetus bellicosus* and Lanner Falcon *Falco biarmicus*, resident on existing power transmission pylons within the proposed development area. Large terrestrial birds (including Ludwig's Bustard *Neotis ludwigii* and Kori Bustard *Ardeotis kori*), local populations of endemic, and possibly Red-listed passerines (possibly including Red Lark *Calendulauda burra* and/or Sclater's Lark *Spizocorys sclateri*), and passing wetland birds on their way to distant resource areas, may also be affected. Pigeons, crows, weavers, sparrows and some raptor species may perch, roost, forage or even nest on or around the facility and cause pollution or fouling problems.

The proposed solar power plant would occupy a relatively small area of widespread habitat, and it is deemed unlikely to have any significant, long-term impact on the local avifauna, provided that recommended mitigation is applied. A revision of the site layout, and a reduction of the extent of the PV arrays, coincident with the first draft of this report, has already reduced possible impacts. Layout Alternative 2 will still require some limited mitigation, ideally including the relocation of the two Martial Eagle nest sites (one used by a pair of Lanner Falcons) to pylons 1 km further away from the development area than their current position. A comprehensive programme is put forward to fully monitor and research the actual impacts of the solar power plant on the broader avifauna of the area, from pre-construction and into the operational phase of the development.

1. *INTRODUCTION*

AES Solar Energy Ltd (AES) is planning to construct a PV Solar Power Plant (project name 'Olyven Kolk Solar Power Plant), south-west of the town of Kenhardt, in the Northern Cape Province, South Africa. Environmental Resources Management Southern Africa (Pty) Ltd was appointed to do the Environmental Impact Assessment study, and subsequently sub-contracted Dr Andrew Jenkins (*AVISENSE* Consulting cc) to conduct the specialist avifaunal assessment for this proposed development. Jenkins has a PhD in Zoology from the University of Cape Town, and is an experienced ornithologist, with over 20 years experience in avian research and impact assessment work. He has been involved in many power line, wind farm and solar plant EIA and EMP studies in South Africa, and also does research on raptors, bustards and cranes in various parts of the country.

1.1 *DECLARATION OF INDEPENDENCE*

Andrew Jenkins (*AVISENSE* Consulting) is an independent consultant to Environmental Resources Management Southern Africa (Pty) Ltd (ERM) and AES Solar Energy Ltd. He has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work.

1.2 *DEVELOPMENT PROPOSAL*

The proposed Olyven Kolk Solar Power Plant will be located on portion 14 (a portion of portion 4) of the farm Olyven Kolk 187. The proposed development will comprise about 500 ha of photovoltaic (PV) solar panels or arrays contained within a development area of about 1000 ha (Fig. 2.1). It should be noted that Development Phase 1 of this solar plant, which comprises 10 MW, is not directly considered in this report as it is covered by a separate EIA process. This study assesses the impact of the remainder of the development, 190 MW of solar panels and associated infrastructure. The development site is situated 44 km south-west of Kenhardt, in the Northern Cape Province, and is bisected by the Sishen-Saldanha railway line, and by Eskom's Aries-Kronos and Aries-Juno 400 kV transmission lines, which run south-east and south respectively from the Aries substation located on the north-west boundary of the development area (Fig. 1). The PV panels will be fitted on mountings, arranged in widely spaced arrays, and will be attended by various infrastructural components (underground and overhead power cabling, site office, a road network). Construction will require the use of lay-down areas for materials and equipment, and the establishment of temporary housing to accommodate 60-80 people.

Once the development is completed, day to day facility operations will involve both regular on site preventive and corrective maintenance tasks in order to keep the PV plant in optimal working order throughout the operational period. Intermittent cleaning of the panels will be carried out as necessary. Faulty components will be replaced as soon as problems are identified.

2.

3. METHODS

The required scope of the specialist avifaunal study included:

(i) A baseline description of the study area in terms of avian habitats and avifauna.

(ii) An assessment of potential impacts on birds associated with the development according to the impact assessment methodology specified by ERM.

(iii) A description of relevant and implementable mitigation measures to reduce, avoid, or minimise negative impacts and enhance positive impacts.

(iv) Listed recommendations, including possible monitoring studies.

(v) A comprehensive list of all referenced information sources.

The study included a review of the literature on bird:PV plant interactions, and collation of the data available on the avifauna of the area, including the compilation of a list of species likely to occur in and around the site, a site visit, and an on-site assessment of the avifauna and habitats present, and a resulting assessment of the nature of likely impacts of the development on the most important avifauna, with recommendations on mitigation. The latter stage included a second assessment of impacts and mitigation for a revised project layout, proposed in response to development constraints arising from the EIA process.

Information gleaned from the review of the available published and unpublished literature pertaining to bird interactions with PV solar plants and associated power infrastructure was integrated into the ultimate assessment of the impacts of the proposed facility. An inclusive, annotated list of the avifauna likely to occur within the impact zone of the proposed PV plant was compiled using a combination of the existing distributional data - listed below - and previous experience of the avian habitats and avifauna of the general area, and a short-list of priority bird species (defined in terms of conservation status and endemism) which could be impacted by the proposed PV plant was derived from this inclusive list. These priority species were subsequently considered as adequate surrogates for the local avifauna generally, and mitigation of impacts on these species was considered likely to accommodate any less important bird populations that may also potentially be affected.

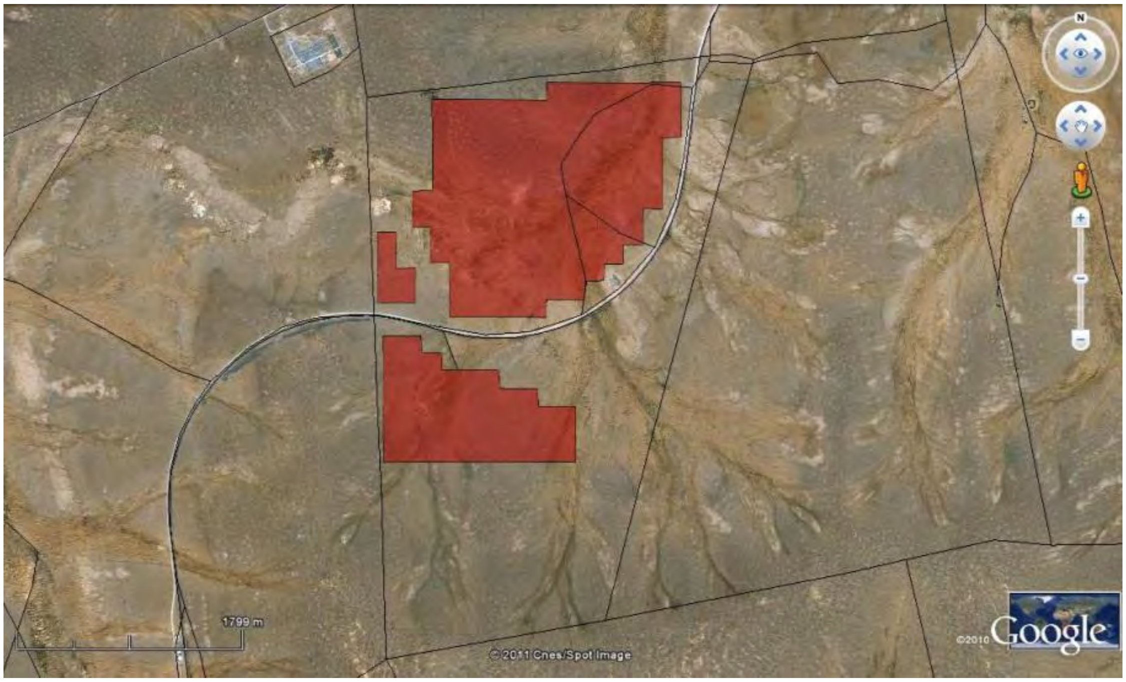

Figure 2.1a The two proposed layouts of roads and PV panels of the Olyven Kolk Solar Power Plant. Layout Alternative 1 comprises 190 MW of solar panels.

Figure 2.1b Layout Alternative 2 also comprises 190 MW of PV panels (brown shapes), but arranged to accommodate previously identified environmentally sensitive areas.

2.2 SITE VISIT

The proposed development area was visited on 30-31 May 2011 in order to:

(i) Ground-truth predicted habitats and birds present, mainly by visiting as much of the inclusive area of the proposed development as possible, with an emphasis on sampling the avifauna in all of the primary habitats available.

(ii) Compile Southern African Bird Atlas Project (SABAP) 2 atlas cards (bird lists) for all the pentads (5′ by 5′ squares) visited (http://sabap2.adu.org.za/index.php).

(iii) Search for large terrestrial species, raptors and endemic passerines within the study area to determine the relative importance and on-site distribution of local populations of these key taxa.

2.3 IMPACT ASSESSMENT

With the baseline information collected, the final assessment of impacts included:

(i) Identification of impacts and rating of significance in accordance with the impact assessment methodology provided by ERM for the initial proposal, Site Layout Alternative 1.

(ii) Identification of no-go zones and/or the least sensitive/lowest risk areas to locate solar panels within the broader study area. A mitigation workshop was held which resulted in changes of the site layout to accommodate for recommendations by the various specialists to avoid sensitive areas within the site. This resulted in Site Layout Alternative 2, the preferred and final site layout alternative.

(iii) Identification of impacts and rating of significance for Site Layout Alternative 2.

(iv) Recommendations on mitigation and monitoring where necessary.

2.4 DATA SOURCES USED

The following published and unpublished data sources were used:

(i) Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison *et al.* 1997) were obtained from the Animal Demography Unit website (http://sabap2.adu.org.za/index.php) for the SABAP 1 quarter-degree squares covering the proposed solar energy facility and its associated infrastructure (2920BD Grootriet – 16 cards submitted over the atlas period, and 2920DB Sonderhuis – seven cards submitted, Total = 23 cards for the area, note that the SABAP 1 data are now >15 years old), and for the relevant SABAP 2 pentads (2925_2045 and 2930_2045 – no cards submitted so far for this area combined). A composite list of species likely to occur in the impact zone of the PV plant was drawn up as a combination of these data and the information sources listed below, refined by a more specific assessment of the actual habitats affected and general knowledge of birds in the region (Appendix 1).

(ii) The conservation status and endemism of all species considered likely to occur in the area was determined from the national Red-list for birds (Barnes 2000), informed by a more recent revision for raptors (Jenkins 2009), the most recent iteration of the global list of threatened species (http://www.iucnredlist.org), and the most up to date and comprehensive summary of southern African bird biology (Hockey *et al.* 2005).

(iii) Coordinated Avifaunal Roadcount (CAR) data for large terrestrial birds and Black Harrier, and Coordinated Wetland Avifaunal Count (CWAC) data for wetland species (both available from the Animal Demography Unit, UCT - http://adu.org.za/), and relevant published references (Taylor *et al.* 1999, Young *et al.* 2003).

(iv) Information on nesting raptors on the nearby Eskom 400 kV transmission lines from the Eskom Electric Eagle Project (Jenkins *et al.* 2007).

4. THE AFFECTED ENVIRONMENT

3.1 THE NATURAL ENVIRONMENT

The area is situated in the Bushmanland Bioregion of the Nama Karoo Biome. The vegetation is dominated by Bushmanland Basin Shrubland (Mucina & Rutherford 2006), with open, flat topography, sandy soils, and mainly grassy vegetation interspersed with low, drought resistant shrubs. Altitude averages about 930 m above sea level and varies little across the site. The area receives about 70 mm of rain annually, most of which falls in autumn. Temperatures range from a mean minimum in winter of about 3°C overnight, to a mean maximum in summer of about 33°C in the middle of the day.

3.2 THE ALTERED ENVIRONMENT

The site is evidently used for small stock (sheep, goats) farming, and is fenced into camps, with a small number of well-points. Apart from the open Karoo vegetation, the only major avian habitat on site is provided artificially by the Eskom Aries-Kronos and Aries-Helios 400 kV transmission lines.

Figure 4.1a & b *Typical flat, open Karoo vegetation on the proposed development site, with the 400 kV transmission lines in the background.*

Figure 4.1c *Martial Eagle nest on the Aries-Helios 400 kV transmission line.*

3.3 AVIAN HABITATS

The habitat on site from an avian perspective is relatively uniform, dominated by open, flat, sandy Karoo veld (Fig. 4.1a & b), with thicker, woody growth along the main drainage lines. The lattice-type steel pylons which support the Eskom transmission power lines provide nesting habitat for birds that would normally nest in trees (e.g. passerines, corvids, raptors), and for birds that normally use nests built by these tree-nesting species (e.g. falcons).

3.4 THE AVIFAUNA

More than 130 bird species could possibly occur on the site (Appendix 1), including up to 11 red-listed species, 56 endemics or near-endemics, and four red-listed endemics (Ludwig's Bustard *Neotis ludwigii*, Black Harrier *Circus maurus*, Red Lark *Calendulauda burra* and Sclater's Lark *Spizocorys sclateri*). The site is not located close to any established Important Bird Areas (Barnes 1998). Red-listed species recorded in atlas data (Harrison et al. 1997, (http://sabap2.adu.org.za/index.php) for the area include Kori Bustard *Ardeotis kori*, Ludwig's Bustard *Neotis ludwigii*, Lanner Falcon *Falco biarmicus* and Sclater's Lark *Spizocory's sclateri*, and a number of localised endemics also occur there (e.g. Black-eared Sparrowlark *Eremopterix australis*). The site falls within the documented range of the red-listed endemic Red Lark *Certhilauda burra*, but does not feature the red sand dunes generally favoured by this species. The Rooiberg Dam, which apparently sometimes supports numbers of flamingo, is located about 40 km to the north-east of the proposed development site.

Only eighteen species were seen in the broader impact zone during the site visit (Appendix 1). Significant observations included an adult Martial Eagle *Polemaetus bellicosus* perched near a nest in a transmission pylon on the western boundary of the development area (Fig. 4.1c, 4.2), and a pair of Lanner Falcons at an old Martial Eagle nest on a pylon just to the east of the site (Fig. 4.2). The former species is known to occupy a breeding territory approximately centred on the Aries substation, but has not generally been a productive territory, with breeding recorded only once in the period 2002-2006 (Jenkins *et al.* 2007). The presence of an adult eagle near a well built-up nest structure, and some fresh droppings or whitewash accumulated under the nest pylon (Aries-Helios tower 11) suggests that the site may well be active in 2011. Lanner Falcons do not build their own nests, and when they nest in trees or equivalent man-made structures they usually use stick nests built by other birds as platforms for breeding. The pair seen on site were focused on a second Martial Eagle structure on the Aries-Kronos line, and their behaviour suggested that they may well breed on this nest later in the year. A Kori Bustard power line collision victim was found under the Aries-Helios Power line. Regional endemic species, such as Northern Black Korhaan *Eupodotis afraoides* Karoo Korhaan *Eupodotis vigorsii* , Rufous-eared Warbler *Malcorus pectoralis* probably occur commonly on the site, although only the latter species was seen during the site visit.

The birds most likely to proliferate and become active around the facility, possibly causing fowling problems, could include Speckled Pigeon *Columba guinea*, Greater Kestrel *Falco rupicolus*, Pale Chanting Goshawk, Cape Crow *Corvus capensis*, Pied Crow *Corvus albus*, Cape Sparrow *Passer melanurus*, House Sparrow *Passer domesticus* and Sociable Weaver *Philetairus socius*, and possibly variety of other perch-hunting hunting and insectivorous passerines.

On the basis of these observations, in combination with already documented information on the avifauna of the general area, nine priority species are recognized as key in the assessment of avian impacts of the proposed Olyven Kolk Solar Power Plant (Table 4.1). These are mostly nationally and/or globally threatened species which are known to occur, or could occur in relatively high numbers in the development area and which are likely to be, or could be, negatively affected by the PV solar power plant project. Five species – Martial Eagle, Secretarybird *Sagittarius serpentarius*, Greater Flamingo *Phoenicopterus ruber*, Lesser Flamingo *Phoenicopterus minor*, and Red Lark were included despite the fact that they were not recorded in either SABAP 1 or SABAP 2 data for the area, either because (a) they were seen on site, (b) the site is located within their respective distributions and the available habitat is possibly suitable, or (c) they may occasionally fly over the site *en route* between distant resource areas.

Figure 4.2 Distribution of raptor sites on Eskom transmission lines in relation to the broader development area for the proposed Olyven Kolk Solar Power Plant.

Table 3.1 Priority bird species considered central to the avian impact assessment process for the Olyven Kolk Solar Power Plant, selected mainly on the basis of South African (Barnes 2000) or global conservation status (www.iucnredlist.org or http://www.birdlife.org/datazone/species/), level of endemism, relative abundance on site (SABAP reporting rates, direct observation), and estimated conservation or ecological significance of the local population. Red-listed endemic species are shaded in grey.

Common name	**Scientific name**	**SA conservation status/ (Global conservation status)**	**Regional endemism**	**Average reporting rate[1] (n = 23 cards)**	**Estimated importance of local population**	**Preferred habitat**	**Risk posed by**		
							Collision	**Electro-cution**	**Disturbance / habitat loss**
Ludwig's Bustard	*Neotis ludwigii*	Vulnerable (Endangered)	Near-endemic	56.5	High	Open Karoo	High	-	Moderate
Kori Bustard	*Ardeotis kori*	Vulnerable	-	13.0	Moderate	Open Karoo	High	-	Moderate
Martial Eagle	*Polemaetus bellicosus*	Vulnerable (Near-threatened)	-	0.0	High	Open Karoo, power pylons	High	High	Moderate
Secretarybird	*Sagittarius serpentarius*	Near-threatened (Vulnerable)	-	0.0	Moderate	Open Karoo	High	-	Moderate
Lanner Falcon	*Falco biarmicus*	Near-threatened	-	8.7	Moderate	Open Karoo, power pylons	High	Moderate	-
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	-	0.0	Low	Wetlands, flying over	High	-	-
Lesser Flamingo	*Phoenicopterus minor*	Near-threatened	-	0.0	Low	Wetlands, flying over	High	-	-
Red Lark	*Calendulauda burra*	Vulnerable	Endemic	0.0	Low	Open Karoo	-	-	Moderate
Sclater's Lark	*Spizocorys sclateri*	Near-threatened	Endemic	4.3	Moderate	Open Karoo	-	-	Moderate

[1] Reporting rate calculated as the % of bird lists submitted for a given area which include each species.

5. IMPACT ASSESSMENT

4.1 IMPACT DESCRIPTION

4.1.1 Habitat loss – destruction, disturbance and displacement

Perhaps the most significant potential impact on birds of any solar energy generation facility is the displacement or exclusion of threatened, rare, endemic or range-restricted species from critical areas of habitat. Given the considerable space requirements of commercially viable facilities (>50-100 ha), this effect could be significant in some instances, particularly given the possibility that the initial footprint of successful facilities may be expanded over time, and the possible cumulative effects of multiple facilities in one area.

To a lesser extent, construction, ongoing maintenance and (if relevant) decommissioning activities are likely to cause some disturbance of birds in the general surrounds of a solar facility, and especially of shy and/or ground-nesting species resident in the area. Mitigation of such effects requires that generic best-practice principles be rigorously applied - sites are selected to avoid the destruction of key habitats, and construction and final footprints, as well as sources of disturbance of key species, must be kept to an absolute minimum.

4.1.2 Other effects

Any vertical, reflective surfaces may confuse approaching birds with the result that numbers are killed in collisions with such surfaces. If either of these sources of unnatural mortality are realistic expectations of a proposed solar power plant, efforts should be made to restrict access by birds into the relevant, hazardous areas of the facility.

Solar power plants generally feature large areas of reflective panelling. It is possible that nearby or overflying birds may be disorientated by any light reflected off the panels, and consequently be displaced from an area more extensive than just the developed footprint of the facility. Conversely, certain bird species may be attracted to the solar arrays, using the erected structures as prominent perches, sheltered roost sites or even nesting sites, and possibly foraging around the infrastructure in response to changes in the distribution of preferred foods (plants growing under the arrays, other animals attracted to the facility). Such scenarios might be associated with fouling of critical components of the solar infrastructure, bringing local bird populations into conflict with the facility operators. Under these circumstances, specialist advice should be sought in devising effective avian deterrents to minimize associated damage.

4.1.3 *Impacts of associated infrastructure*

Infrastructure commonly associated with wind energy facilities may also have detrimental effects on birds. The construction and maintenance power lines, servitudes and roadways causes both temporary and permanent habitat destruction and disturbance, and overhead power lines pose a collision and possibly an electrocution threat to certain species (Van Rooyen 2004a, Lehman *et al.* 2007, Jenkins *et al.* 2010).

4.1.4 *Construction and maintenance of power lines*

Some habitat destruction and alteration inevitably takes place during the construction of power lines and associated roadways. Also, power line service roads or servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, and to prevent vegetation from intruding into the legally prescribed clearance gaps between the ground and the conductors. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, and retention of cleared servitudes can have the effect of altering bird community structure along the length of any given power line (e.g. King & Byers 2002).

4.1.5 *Collision with power lines*

Power lines pose at least an equally significant collision risk to wind turbines, probably affecting the same suite of collision prone species (Bevanger 1994, 1995, 1998, Janss 2000b, Anderson 2001, van Rooyen 2004a, Drewitt & Langston 2008, Jenkins *et al.* 2010). Mitigation of this risk involves the informed selection of low impact alignments for new power lines relative to movements and concentrations of high risk species, and the use of either static or dynamic marking devices to make the lines, and in particular the earthwires, more conspicuous. While various marking devices have been used globally, many remain largely untested in terms of their efficacy in reducing collision incidence, and those that have been fully assessed have all been found to be only partially effective (Drewitt & Langston 2008, Jenkins *et al.* 2010).

4.1.6 *Electrocution on power infrastructure*

Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004b, Lehman *et al.* 2007). Electrocution risk is strongly influenced by the voltage and design of the power lines erected (generally occurring on lower voltage infrastructure where air gaps are relatively small), and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energized components. Mitigation of electrocution risk involves the use of bird-safe structures (ideally with critical air gaps >2 m), the physical exclusion of birds from high risk areas of live infrastructure, and comprehensive insulation of such areas (van Rooyen 2004b, Lehman *et al.* 2007).

4.2 IMPACTS OF THIS PROJECT

This proposal is for a medium-sized PV installation, sited in an area of homogeneous and not particularly bird-rich habitat (although levels of endemism are high), and distant from any established national Important Bird Area. The site is known to include at least two probable nesting sites of Red-listed species, and may (at least seasonally or sporadically) support numbers of other Red-listed species, and of a suite of localised endemics. The proposed solar power plant is likely to have a limited, detrimental effect on these birds, during both the construction and operational phases of the development, and to a lesser extent during decommissioning.

The taxa which are most likely to be affected are two raptor species (Martial Eagle and Lanner Falcon) which are resident and nesting on existing power transmission pylons within the proposed site. These birds (especially the eagles) will be significantly disturbed by the construction process, possibly to the extent of breeding failure or even territory abandonment. There will be very limited loss of habitat for threatened large terrestrial birds (Ludwig's Bustard, Kori Bustard), and an increased risk of collision for these birds on any new power lines installed. Ludwig's Bustard is prone to erratic influxes to areas of the Karoo, apparently in response to past rainfall, but these factors are not well understood (Allan 1994). Compounding this unpredictability, recent studies of power line collisions by this bird (Jenkins *et al.* 2009, Jenkins *et al.* 2011) have shown no detectable pattern in collisions in relation to landscape features. Hence, while bustards may well occur sporadically on the site in considerable numbers, it is not possible to predict when such influxes are most likely to happen, or where these birds will be most susceptible to collisions, precluding any useful input on where, and where not, to route new power lines.

Table 4.1 Impact characteristics: Olyven Kolk Solar Power Plant – Birds.

Summary	Construction	Operation	Decommissioning
Project Aspect/ activity	(i) Disturbance/displacement associated with noise and movement of construction equipment and personnel. (ii) Loss of vegetation and avian habitat through site clearance, road upgrade and establishment of the camp, lay-down and assembly areas.	(i) Loss of habitat to space occupied by solar panels and associated infrastructure, and disturbance / displacement associated with routine maintenance work. (ii) Mortality in collisions with solar panels and/or power lines, or by electrocution on new power infrastructure.	(i) Disturbance/displacement associated with noise and movement of decommissioning equipment and personnel.
Impact Type	Direct	Direct	Direct
Receptors Affected	(i) All birds on site; key species: Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics. (ii) Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics.	(iii) All birds on site; key species: Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics. (i) All birds on site; Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, overflying wetland birds.	(i) All birds on site; key species: Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics.

Hence, specific impacts of the proposed Olyven Kolk Solar Power Plant are most likely to be manifested in the following ways (summarised in Table 4.1):

(i) Disturbance and displacement of resident/breeding raptors (especially Martial Eagle and Lanner Falcon) from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the facility, and /or mortality of these species in collisions with new power lines or by electrocution when perched on power infrastructure.

(ii) Disturbance and displacement of seasonal influxes of large terrestrial birds (especially Ludwig's Bustard and Kori Bustard) from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the facility, and /or mortality of these species in collisions with new power lines while commuting between resource areas.

(iii) Disturbance and displacement of resident/breeding Karoo endemics – possibly including Black-eared Sparrowlark, Sclater's Lark and even Red Lark - by construction and/or operation and/or decommissioning of the facility.

(iv) Injury or mortality of wetland birds (especially flamingos) using possible flight lines in and out of resource areas in the broader vicinity, in collisions with the PV infrastructure or associated new power lines.

4.2 *IMPACT ASSESSMENT – ALTERNATIVE 1*

As already discussed, the initial project (Layout Alternative 1 – 190 MW, Fig. 2.1a) was subject to a provisional impact assessment in terms of the anticipated impacts referred to above. Significance ratings for these impacts are detailed in Boxes 4.1-4.3.

In light of initial suggestions to mitigate these impacts (see below), the client re-designed the project, and a revised proposal (Layout Alternative 2 – 190 MW – Fig. 2.2b) was submitted for further evaluation and assessment.

Box 4.1 *Construction Impact: Olyven Kolk Solar Power Plant – Birds (Layout Alternative 1)*

(A) Habitat loss

Nature: All construction activities would result in a **negative direct** impact on the avifauna of the Olyven Kolk site: loss of vegetation and habitat affecting Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics, through site clearance, road upgrade and establishment of the camp, lay-down and assembly areas..

Impact Magnitude – **Low-Medium**

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be **medium-term** as the ecology of the area would be altered beyond the completion of the project.
- **Intensity**: Loss of irreplaceable habitat for priority species will be minimal, so the magnitude of the change will be **low-medium**.

Likelihood – There is a **high** likelihood that some habitat will be lost.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR-MODERATE

Degree of Confidence: The degree of confidence is **high**.

(B) Disturbance

Nature: All construction activities would result in a **negative direct** impact on the avifauna of the Olyven Kolk site; disturbance associated with noise and movement of construction equipment and personnel, affecting Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics.

Impact Magnitude – **Medium-High**

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be **short-term** as this effect will not extend beyond the life of the project.
- **Intensity**: Some threatened species will be severely disturbed, so the magnitude of the change will be **medium-high**.

Likelihood – There is a **high** likelihood that birds will be disturbed.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE-MAJOR

Degree of Confidence: The degree of confidence is **high**.

Box 4.2 *Operation Impact: Olyven Kolk Solar Power Plant – Birds (Layout Alternative 1)*

(A) Habitat loss and disturbance

Nature: Operational activities would result in a **negative direct** impact on the avifauna of the Olyven Kolk site; loss of habitat for Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics, to space occupied by solar panels and associated infrastructure., and disturbance or displacement of these birds by routine maintenance activities.

Impact Magnitude – **Medium**

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be **long-term** as the ecology of the area would be affected until the project stops operating.
- **Intensity**: Some priority species may be displaced for the duration of the project, and there will be some loss of habitat, so the magnitude of the change will be **medium**.

Likelihood – There is a **high** likelihood that some priority species will be disturbed/displaced.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE

Degree of Confidence: The degree of confidence is **medium-high**.

(B) Mortality

Nature: Operational activities would result in a **negative direct** impact on the avifauna of the Olyven Kolk site; mortality of Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, overflying wetland birds in collisions with solar panels and/or power lines, or by electrocution on new power infrastructure.

Impact Magnitude – **Medium**

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be **long-term** as the ecology of the area would be affected at least until the project stops operating.
- **Intensity**: Some of individuals of threatened species may be killed in collision/electrocution incidents, so the intensity of change will be **medium-high**.

Likelihood – There is a **medium** likelihood that some individuals of priority species will be killed.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE

Degree of Confidence: The degree of confidence is **medium**.

Box 4.3 *Decommissioning Impact: Olyven Kolk Solar Power Plant – Birds (Layout Alternative 1)*

(A) Disturbance

Nature: All decommissioning activities would result in a **negative direct** impact on the avifauna of the Olyven Kolk site; disturbance associated with noise and movement of decommissioning equipment and personnel, affecting Martial Eagle, Lanner Falcon, Ludwig's Bustard, Kori Bustard, Karoo endemics.

Impact Magnitude – **Medium-High**

- **Extent**: The extent of the impact is **local**.
- **Duration**: The duration would be **short-term** as this effect will not extend beyond the life of the project.
- **Intensity**: Some threatened species will be severely disturbed, so the magnitude of the change will be **medium-high**.

Likelihood – There is a **high** likelihood that birds will be disturbed.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE-MAJOR

Degree of Confidence: The degree of confidence is **high**.

4.3 *PROPOSED MITIGATION*

Mitigation of impacts identified above will be best achieved in the following ways:

(i) Timing construction and decommissioning to avoid sensitive times (e.g. Martial Eagle pre-breeding, incubation and small nestling seasons from March/April to June/July).

(ii) Minimizing the disturbance impacts associated with the operation of the facility by scheduling maintenance activities to avoid disturbances at sensitive times (see above) or in sensitive areas (see below).

(iii) Excluding development from:

(a) Within a 1 km radius of the Martial Eagle nest site.

(b) Within a 500 m radius of the Lanner Falcon nest site.

Ideally, these areas should remain undisturbed and undeveloped. The radii referred to are working estimates, arrived at purely in terms of the author's experience of disturbance susceptibility of the two species concerned, and not in terms of any supporting empirical evidence.

(iv) Relocate both the eagle nest structures to more distant pylons (e.g. Jenkins *et al.* 2007) in order to put greater distance between those birds likely to use them and the disturbance sources of the development. This would have to be done outside of the eagle and falcon breeding seasons (i.e. between December/January and February/March, and would involve deconstructing both nests, re-building both in specially designed galvanized steel baskets, and positioning these in the 'waist' area of towers at least three spans (+/- 1 km) further away from the development area. Such an exercise would require the cooperation of Eskom, and the practical assistance of their live-line maintenance team and would require active supervision by an experienced avian specialist at all times. However, if successful it would greatly reduce the potential impact of the proposed solar development, and would have the added benefit of removing the two large eagle nest structures from locations above the conductors on VVV transmission towers (where they could cause streamer-related outages) to safe positions below the conductors. This would effectively improve Eskom's quality of supply to customers, and reduce associated maintenance costs (Jenkins *et al.* 2007). There is a good chance that both eagles and falcons will relocate to the new nest structures in the following breeding season, although this cannot be guaranteed.

(v) Minimizing the length of any new power lines installed, and ensuring that all new lines are marked with bird flight diverters – either static or dynamic markers, generally fitted to the upper, earth wire in most power line configurations (Jenkins *et al.* 2010), and that all new power infrastructure is adequately insulated and bird friendly in configuration (Lehman *et al.* 2007). Note that current understanding of power line collision risk in birds precludes any guarantee of successfully distinguishing high risk from medium or low risk sections of a new line (Jenkins *et al.* 2010). The relatively low cost of marking the entire length of a new line during construction, especially quite a short length of line in an area frequented by collision prone birds, more than offsets the risk of not marking the correct sections, causing unnecessary mortality of birds, and then incurring the much greater cost of retro-fitting the line post-construction. In situations where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line.

(vi) Carefully monitoring the local avifauna pre- and post-construction (see Section 6 below), and implementing appropriate additional mitigation as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the priority species listed in this report, or when collision or electrocution mortalities are recorded.

(vii) Ensuring that the results of pre-construction monitoring are applied to project-specific impact mitigation in a way that allows for the potential cumulative effects on the local/regional avifauna of any other solar energy projects proposed for this area. Viewed in isolation, each of these projects may pose only a limited threat to the avifauna of the area. However, in combination they may result in significant losses of habitat for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with new infrastructure.

4.4 FINAL IMPACT ASSESSMENT – LAYOUT ALTERNATIVE 2

Buffer or development exclusion zones for birds were partly accommodated in this new layout (with the nearest PV panels to either of the two nest sites extended to about 600-700 m - Fig. 4.1), which is effectively a partially mitigated version of Layout Alternative 1. While this allowance does not entirely rule out disturbance impacts on the birds at these nest sites, it is a meaningful step towards this end, substantially reducing the amount of construction and subsequent maintenance activity likely to occur close to either site.

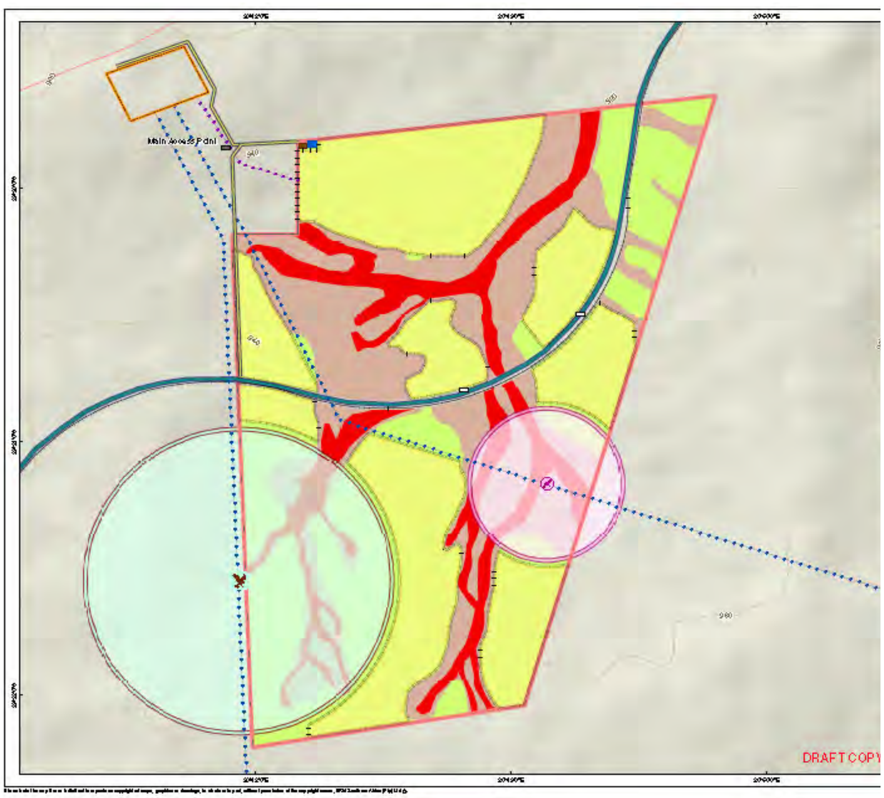

Figure 4.1 Constraints Map showing layout Alternative 2 for the Olyven Kolk Solar Power Plant, showing the four construction phases (including Phase 1 in pale blue, which is the subject of a separate EIA) and the allowances made for avian sensitivity buffers (above, red circles) and for all specialist inputs (below) delineated in an earlier draft of this report.

Figure 4.1 ***Constraints Map showing layout Alternative 2 for the Olyven Kolk Solar Power Plant, showing the allowances made for avian sensitivity buffers (circles) and for other specialist inputs delineated in an earlier draft of this report.***

Table 4.1 Pre- and Post- Mitigation Significance: Olyven Kolk Solar Power Plant - Birds, (Layout Alternatives 1 and 2 - also refer to Boxes 4.1-4.3).

Impact	**Layout 1**	**Layout 2**	
	Pre-mitigation	**Pre-mitigation**	**Residual (post-mitigation)**
Construction Phase			
Habitat loss	**MINOR-MODERATE**	**MINOR**	**MINOR**
Disturbance	**MODERATE-MAJOR**	**MINOR-MODERATE**	**MINOR**
Operation Phase			
Displacement & disturbance	**MODERATE**	**MINOR-MODERATE**	**MINOR**
Mortality	**MODERATE**	**MODERATE**	**MINOR**
Decommissioning Phase			
Disturbance	**MODERATE-MAJOR**	**MINOR-MODERATE**	**MINOR**

The redesign of Layout Alternative 1 lowered initial, pre-mitigation impacts from up to Moderate-Major to a maximum of Moderate. If the remaining mitigation recommendations are applied, including an attempt to relocate these two nest sites to nest platforms situated well away from the proposed development area, the residual impacts of Layout Alternative 2 will be reduced to Minor across all phases of the development (Table 5.2).

6. MONITORING

Given that solar energy development is new to South Africa, and its potential impacts on birds are generally not well understood, it is recommended that attention be given to improving this understanding by initiating quantitative studies of the avifauna at proposed sites both pre- and post-construction. The primary aims of this monitoring work would be to:

(i) Determine the densities of birds resident within the impact area of the solar power plant before construction of the plant, and afterwards, once the plant, or phases of the plant, become operational.

(ii) Document patterns of bird activity and movements in the vicinity of the proposed solar power plant before construction, and afterwards, once the plant is operational.

(iii) Register and as far as possible document the circumstances surrounding all avian mortalities associated with the solar power plant and its ancillary infrastructure for at least a full calendar year after the plant becomes operational.

(iv) Register and as far as possible document the circumstances surrounding all other avian interactions with the solar arrays of the solar power plant for at least a full calendar year after the plant becomes operational.

Bird density and activity monitoring should focus on rare and/or endemic, potentially disturbance or collision prone species, which occur with some regularity in the area (see Table 4.1). Ultimately, the study should provide much needed quantitative information on the effects of the solar power plant on the distribution and abundance of birds, and the actual risk it poses to the local avifauna, and serve to inform and improve mitigation measures to reduce this risk. It will also establish a precedent and a template for research and monitoring of avian impacts at possible, future solar power plant sites in the region.

Failing the institution of a structured and formalised general monitoring effort (as outlined above and detailed below), at the very least a specialist ornithologist should periodically monitor activities at both of the key raptor nests, immediately preceding, during and after construction.

Monitoring protocols: Avian densities before and after

A set of at least 10 walk-transect routes, each of at least 250 m in length, should be established in areas representative of all the avian habitats present within a 2 km radius of centre of the Olyven Kolk site. Each of these should be walked at least once every two months over the six months preceding construction, and at least once every two months over the same calendar period, at least six months after the PV plant is commissioned. The transects should be walked after 06h00 and before 09h00, and the species, number and perpendicular distance from the transect line of all birds seen should be recorded for subsequent analysis and comparison.

Monitoring protocols: Bird activity monitoring

Monitoring of bird activity in the vicinity of the solar power plant should be done over a single day at least every two months for the six months preceding construction, and at least once per quarter for a full calendar year starting at least six months after the solar power plant is commissioned. Each monitoring period should involve full-day counts of all species flying over or past the PV plant impact area (see passage rates below).

Monitoring protocols: Bird flight behavior and activities around solar arrays

Counts of bird traffic over and around the proposed/operational solar power plant should be conducted from suitable vantage points (selected and used to provide coverage of avian flights in relation to all areas of the PV plant). Once in position at the selected count station, the observer should record (preferably on a specially designed data sheet) the date, count number, start-time and conditions at start - extent of cloud cover, temperature, wind velocity and visibility – and proceed with the count. The counts should detail all individuals or flocks of the stipulated priority bird species, all raptors, and any additional species of particular interest or conservation concern, seen flying within 200 m of the envisaged or actual periphery of the solar power plant. Each record should include the following data: time, updated weather assessment, species, number, mode of flight (flapping, gliding, soaring), flight activity (commuting, hunting other), direction of flight and, for post construction monitoring, notes on any obvious evasive behaviour or flight path changes observed in response to the solar power plant. The time and weather conditions should again be noted at the end of each count. These observations should also detail (time, species, nature, location, duration) all direct interactions between birds and the solar panels (e.g. perching, hunting, displaying, nest-building).

Monitoring of avian collisions

Collision monitoring should have two components: (i) experimental assessment of search efficiency and scavenging rates of bird carcasses on the site, and (ii) regular searches of the vicinity of the solar power plant for collision casualties.

Monitoring of avian collisions: Assessing search efficiency and scavenging rates

The value of surveying the area for collision victims only holds if some measure of the accuracy of the survey method is developed (Morrison 2002). To do this, a sample of suitable bird carcasses (of similar size and colour to the priority species – e.g. Egyptian Goose *Alopochen aegyptiacus*, domestic waterfowl and pigeons) should be obtained and distributed randomly around the site without the knowledge of the surveyor, some time before the site is surveyed. This process should be repeated opportunistically (as and when suitable bird carcasses become available) for the first two months of the monitoring period, with the total number of carcasses not less than 10. The proportion of the carcasses located in surveys will indicate the relative efficiency of the survey method.

Simultaneous to this process, the condition and presence of all the carcasses positioned on the site should be monitored throughout the initial two-month period, to determine the rates at which carcassess are scavenged from the area, or decay to the point that they are no longer obvious to the surveyor. This should provide an indication of scavenge rate that should inform subsequent survey work for collision victims, particularly in terms of the frequency of surveys required to maximize survey efficiency and/or the extent to which estimates of collision frequency should be adjusted to account for scavenge rate (Osborn *et al.* 2000, Morrison 2002). Scavenger numbers and activity in the area may vary seasonally so, ideally, scavenge and decomposition rates should be measured twice during the monitoring year, once in winter and once in summer.

Monitoring of collisions: Collision victim surveys

The area within a radius of at least 20 m of each solar panel, the area on and under the panel itself, and the area within 5 m on either side of any new lengths of power line, should be checked regularly for bird casualties (Anderson *et al.* 1999, Morrison 2002). The frequency of these surveys should be informed by assessments of scavenge and decomposition rates conducted in the initial stages of the monitoring period (see above), but they should be done at least weekly for the first two months of the study. All suspected mortality incidents should be comprehensively documented, detailing the apparent cause of death, precise location (preferably a GPS reading), date and time at which the evidence was found, and the site of the find should be photographed with all the evidence *in situ*. All physical evidence should then be collected, bagged and carefully labeled, and refrigerated or frozen to await further examination. If any injured birds are recovered, each should be contained in a suitably-sized cardboard box, and the local conservation authority should be notified and requested to transport casualties to the nearest reputable veterinary clinic or wild animal/bird rehabilitation centre. These surveys should also include detailing (location, extent, size, number) of all bird products (e.g. faeces, pellets, nest structures etc) found on the solar panels.

7. *CONCLUSIONS*

Provided that there is good compliance with the mitigation stipulations listed above, and particularly if the suggested monitoring protocols are instituted, and any further mitigation requirements identified by that monitoring work are applied wherever possible post-construction, this development should be sustainable in terms of all anticipated impacts on avifauna.

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Appendix 1. Annotated list of the bird species considered likely to occur within the impact zone of the proposed Olyven Kolk PV plant (species in bold were seen during the April site visit).

Common name	Scientific name	Conservation status	Regional endemism	Habitat			Risk of		
				Karoo veld	Drainage lines	Dams & ephemeral waterbodies	Collision	Electro-cution	Disturbance / habitat loss
Egyptian Goose	*Alopochen aegyptiaca*	-	-			X	High	High	-
South African Shelduck	*Tadorna cana*	-	Endemic			X	High	-	-
Yellow-billed Duck	*Anas undulata*	-	-			X	Moderate	-	-
Acacia Pied Barbet	*Tricholaema leucomelas*	-	Near-endemic		X		-	-	Moderate
African Hoopoe	*Upupa africana*	-	-	X			-	-	Moderate
Common Scimitarbill	*Rhinopomastus cyanomelas*	-	-	X			-	-	Moderate
Swallow-tailed Bee-eater	*Merops hirundineus*	-	-	X	X	X	-	-	Moderate
European Bee-eater	*Merops apiaster*	-	-				-	-	-
White-backed Mousebird	*Colius colius*	-	Endemic		X		-	-	Moderate
Red-faced Mousebird	*Urocolius indicus*	-	-		X		-	-	Moderate
Alpine Swift	*Tachymarptis melba*	-	-				-	-	-
Common Swift	*Apus apus*	-	-				-	-	-

Common name	Scientific name	Conservation status	Regional endemism	Habitat			Risk of		
				Karoo veld	Drainage lines	Dams & ephemeral waterbodies	Collision	Electro-cution	Disturbance / habitat loss
Little Swift	*Apus affinis*	-	-				-	-	-
Bradfield's Swift	*Apus bradfieldi*	-	Near-endemic	X			-	-	-
White-rumped Swift	*Apus caffer*	-	-				-	-	-
Barn Owl	*Tyto alba*	-	-	X	X		-	Moderate	Moderate
Spotted Eagle-Owl	*Bubo africanus*	-	-	X	X		-	High	Moderate
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	-	-	X			-	-	Moderate
Rock Dove	*Columba livia*	-	-				-	-	Moderate
Speckled Pigeon	*Columba guinea*	-	-				-	-	Moderate
Laughing Dove	*Streptopelia senegalensis*	-	-		X		-	-	Moderate
Cape Turtle-Dove	*Streptopelia capicola*	-	-		X		-	-	Moderate
Namaqua Dove	*Oena capensis*	-	-	X	X		-	-	Moderate
Ludwig's Bustard	*Neotis ludwigii*	Vulnerable	Near-endemic	X			High	-	Moderate
Kori Bustard	*Ardeotis kori*	Vulnerable	-	X			High	-	Moderate
Northern Black Korhaan	*Afrotis afraoides*	-	Endemic	X			Moderate	-	Moderate
Karoo Korhaan	*Eupodotis vigorsii*	-	Endemic	X			Moderate	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat			Risk of		
				Karoo veld	Drainage lines	Dams & ephemeral waterbodies	Collision	Electro-cution	Disturbance / habitat loss
Red-knobbed Coot	*Fulica cristata*	-	-			X	-	-	-
Namaqua Sandgrouse	*Pterocles namaqua*	-	Near-endemic	X		X	-	-	-
Spotted Thick-knee	*Burhinus capensis*	-	-	X	X		-	-	-
Black-winged Stilt	*Himantopus himantopus*	-	-			X	-	-	-
Pied Avocet	*Recurvirostra avosetta*	-	-			X	-	-	-
Kittlitz's Plover	*Charadrius pecuarius*	-	-			X	-	-	-
Three-banded Plover	*Charadrius tricollaris*	-	-			X	-	-	-
Blacksmith Lapwing	*Vanellus armatus*	-	-			X	-	-	-
Crowned Lapwing	*Vanellus coronatus*	-	-	X			-	-	-
Double-banded Courser	*Rhinoptilus africanus*	-	-	X			-	-	-
Burchell's Courser	*Cursorius rufus*	-	Near-endemic	X			-	-	-
Black-shouldered Kite	*Elanus caeruleus*	-	-	X	X		-	-	Moderate
Black-chested Snake-Eagle	*Circaetus pectoralis*	-	-				-	Moderate	Moderate

Common name	**Scientific name**	**Conservation status**	**Regional endemism**	**Habitat**			**Risk of**		
				Karoo veld	**Drainage lines**	**Dams & ephemeral waterbodies**	**Collision**	**Electro-cution**	**Disturbance / habitat loss**
Black Harrier	*Circus maurus*	Near-threatened	Endemic	X		X	-	-	Moderate
Southern Pale Chanting Goshawk	*Melierax canorus*	-	Near-endemic	X	X		-	Moderate	Moderate
Steppe Buzzard	*Buteo vulpinus*	-	-	X			-	Moderate	Moderate
Jackal Buzzard	*Buteo rufofuscus*	-	Endemic	X			-	Moderate	Moderate
Verreaux's Eagle	*Aquila verreauxii*	-	-				Moderate	High	Moderate
Booted Eagle	*Aquila pennatus*	-	-				-	-	Moderate
Martial Eagle	***Polemaetus bellicosus***	**Vulnerable**	**-**				**Moderate**	**High**	**Moderate**
Secretarybird	*Sagittarius serpentarius*	Near-threatened	-	X			High	-	Moderate
Pygmy Falcon	*Polihierax semitorquatus*	-	-	X	X		-	-	Moderate
Lesser Kestrel	*Falco naumanni*	Vulnerable	-	X	X		Moderate	-	Moderate
Rock Kestrel	*Falco rupicolus*	-	-	X			-	-	Moderate
Greater Kestrel	***Falco rupicoloides***	**-**	**-**	**X**			**-**	**-**	**Moderate**
Lanner Falcon	***Falco biarmicus***	**Near-threatened**	**-**	**X**			**High**	**Moderate**	**-**
Little Grebe	*Tachybaptus ruficollis*	-	-			X	-	-	-
Reed Cormorant	*Phalacrocorax africanus*	-	-			X	-	-	-

Common name	Scientific name	Conservation status	Regional endemism	Habitat			Risk of		
				Karoo veld	Drainage lines	Dams & ephemeral waterbodies	Collision	Electro-cution	Disturbance / habitat loss
White-breasted Cormorant	*Phalacrocorax lucidus*	-	-			X	Moderate	-	-
Black-headed Heron	*Ardea melanocephala*	-	-	X		X	Moderate	Moderate	-
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	-				High	-	-
Lesser Flamingo	*Phoenicopterus minor*	Near-threatened	-				High	-	-
African Spoonbill	*Platalea alba*	-	-			X	Moderate	-	-
Bokmakierie	*Telophorus zeylonus*	-	Near-endemic		X		-	-	Moderate
Pririt Batis	*Batis pririt*	-	Near-endemic		X		-	-	Moderate
Cape Crow	*Corvus capensis*	-	-	X	X		-	-	Moderate
Pied Crow	***Corvus albus***	**-**	**-**	**X**	**X**		**-**	**-**	**Moderate**
Common Fiscal	***Lanius collaris***	**-**	**-**	**X**	**X**		**-**	**-**	**Moderate**
Cape Penduline-Tit	*Anthoscopus minutus*	-	Near-endemic	X			-	-	Moderate
Ashy Tit	*Parus cinerascens*	-	Near-endemic	X			-	-	Moderate
Brown-throated Martin	*Riparia paludicola*	-	-			X	-	-	Moderate
Barn Swallow	*Hirundo rustica*	-	-			X	-	-	Moderate
Greater Striped Swallow	*Hirundo cucullata*	-	-			X	-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat			Risk of		
				Karoo veld	Drainage lines	Dams & ephemeral waterbodies	Collision	Electro-cution	Disturbance / habitat loss
South African Cliff Swallow	*Hirundo spilodera*	-	Breeding endemic	X			-	-	Moderate
Rock Martin	***Hirundo fuligula***	**-**	**-**			**X**	**-**	**-**	**Moderate**
African Red-eyed Bulbul	*Pycnonotus nigricans*	-	Near-endemic		X		-	-	Moderate
Fairy Flycatcher	*Stenostira scita*	-	Endemic		X		-	-	Moderate
Long-billed Crombec	***Sylvietta rufescens***	**-**	**-**	**X**	**X**		**-**	**-**	**Moderate**
Yellow-bellied Eremomela	*Eremomela icteropygialis*	-	-	X	X		-	-	Moderate
Karoo Eremomela	*Eremomela gregalis*	-	Endemic	X			-	-	Moderate
Layard's Tit-Babbler	*Parisoma layardi*	-	Endemic	X	X		-	-	Moderate
Chestnut-vented Tit-Babbler	*Parisoma subcaeruleum*	-	Near-endemic		X		-	-	Moderate
Orange River White-eye	*Zosterops pallidus*	-	Endemic		X		-	-	Moderate
Grey-backed Cisticola	*Cisticola subruficapilla*	-	Near-endemic	X	X		-	-	Moderate
Desert Cisticola	*Cisticola aridulus*	-	-			X	-	-	Moderate
Black-chested Prinia	***Prinia flavicans***	**-**	**-**		**X**		**-**	**-**	**Moderate**

Common name	Scientific name	Conservation status	Regional endemism	Habitat			Risk of		
				Karoo veld	Drainage lines	Dams & ephemeral waterbodies	Collision	Electro-cution	Disturbance / habitat loss
Karoo Prinia	*Prinia maculosa*	-	Endemic	X	X		-	-	Moderate
Namaqua Warbler	*Phragmacia substriata*	-	Endemic		X		-	-	Moderate
Rufous-eared Warbler	***Malcorus pectoralis***	**-**	**Endemic**	**X**			**-**	**-**	**Moderate**
Eastern Clapper Lark	*Mirafra fasciolata*	-	Near-endemic	X			-	-	Moderate
Sabota Lark	***Calendulauda sabota***	**-**	**-**	**X**			**-**	**-**	**Moderate**
Red Lark	*Calendulauda burra*	Vulnerable	Endemic	X			-	-	Moderate
Spike-heeled Lark	*Chersomanes albofasciata*	-	-	X			-	-	Moderate
Karoo Long-billed Lark	*Certhilauda subcoronata*	-	Endemic	X			-	-	Moderate
Black-eared Sparrowlark	*Eremopterix australis*	-	Endemic	X			-	-	Moderate
Grey-backed Sparrowlark	*Eremopterix verticalis*	-	Near-endemic	X			-	-	Moderate
Red-capped Lark	*Calandrella cinerea*	-	-	X			-	-	Moderate
Stark's Lark	*Spizocorys starki*	-	Near-endemic	X			-	-	Moderate
Sclater's Lark	*Spizocorys sclateri*	Near-threatened	Endemic	X			-	-	Moderate
Large-billed Lark	***Galerida magnirostris***	**-**	**Endemic**	**X**			**-**	**-**	**Moderate**

Common name	Scientific name	Conservation status	Regional endemism	Habitat			Risk of		
				Karoo veld	Drainage lines	Dams & ephemeral waterbodies	Collision	Electro-cution	Disturbance / habitat loss
Chat Flycatcher	***Bradornis infuscatus***	**-**	**Near-endemic**	**X**			**-**	**-**	**Moderate**
Fiscal Flycatcher	*Sigelus silens*	-	Endemic		X		-	-	Moderate
Karoo Scrub-Robin	***Cercotrichas coryphoeus***	**-**	**Endemic**	**X**	**X**		**-**	**-**	**Moderate**
Mountain Wheatear	*Oenanthe monticola*	-	Near-endemic	X			-	-	Moderate
Capped Wheatear	*Oenanthe pileata*	-	-	X			-	-	Moderate
Sickle-winged Chat	*Cercomela sinuata*	-	Endemic	X			-	-	Moderate
Karoo Chat	*Cercomela schlegelii*	-	Near-endemic	X			-	-	Moderate
Tractrac Chat	*Cercomela tractrac*	-	Near-endemic	X			-	-	Moderate
Familiar Chat	***Cercomela familiaris***	**-**	**-**	**X**			**-**	**-**	**Moderate**
Ant-eating Chat	*Myrmecocichla formicivora*	-	Endemic	X			-	-	Moderate
Pale-winged Starling	*Onychognathus nabouroup*	-	Near-endemic				-	-	Moderate
Pied Starling	*Spreo bicolor*	-	Endemic				-	-	Moderate
Wattled Starling	*Creatophora cinerea*	-	-	X	X		-	-	Moderate
Southern Double-collared Sunbird	*Cinnyris chalybeus*	-	Endemic		X		-	-	Moderate

Common name	Scientific name	Conservation status	Regional endemism	Habitat			Risk of		
				Karoo veld	Drainage lines	Dams & ephemeral waterbodies	Collision	Electro-cution	Disturbance / habitat loss
Dusky Sunbird	*Cinnyris fuscus*	-	Near-endemic	X	X		-	-	Moderate
Scaly-feathered Finch	***Sporopipes squamifrons***	**-**	**Near-endemic**	**X**			**-**	**-**	**Moderate**
White-browed Sparrow-Weaver	*Plocepasser mahali*	-	-	X	X		-	-	Moderate
Sociable Weaver	*Philetairus socius*	-	Endemic	X			-	-	Moderate
Southern Masked-Weaver	*Ploceus velatus*	-	-		X	X	-	-	Moderate
Red-billed Quelea	*Quelea quelea*	-	-	X	X	X	-	-	Moderate
Southern Red Bishop	*Euplectes orix*	-	-			X	-	-	Moderate
African Quailfinch	*Ortygospiza atricollis*	-	-	X			-	-	Moderate
Red-headed Finch	*Amadina erythrocephala*	-	Near-endemic	X	X		-	-	Moderate
Common Waxbill	*Estrilda astrild*	-	-			X	-	-	Moderate
Pin-tailed Whydah	*Vidua macroura*	-	-		X		-	-	Moderate
House Sparrow	*Passer domesticus*	-	-	X	X		-	-	Moderate
Cape Sparrow	***Passer melanurus***	**-**	**Near-endemic**	**X**	**X**		**-**	**-**	**Moderate**

Common name	Scientific name	Conservation status	Regional endemism	Habitat			Risk of		
				Karoo veld	Drainage lines	Dams & ephemeral waterbodies	Collision	Electro-cution	Disturbance / habitat loss
Cape Wagtail	*Motacilla capensis*	-	-			X	-	-	Moderate
African Pipit	*Anthus cinnamomeus*	-	-				-	-	Moderate
Black-headed Canary	*Serinus alario*	-	Endemic	X			-	-	Moderate
Black-throated Canary	*Crithagra atrogularis*	-	-	X			-	-	Moderate
Yellow Canary	*Crithagra flaviventris*	-	Near-endemic	X			-	-	Moderate
White-throated Canary	***Crithagra albogularis***	**-**	**Near-endemic**	**X**			**-**	**-**	**Moderate**
Lark-like Bunting	***Emberiza impetuani***	**-**	**Near-endemic**	**X**			**-**	**-**	**Moderate**
Cape Bunting	*Emberiza capensis*	-	Near-endemic	X			-	-	Moderate

Annex H

Archaeological, Heritage and Paleontological Specialist Report

HERITAGE IMPACT ASSESSMENT (ARCHAEOLOGY AND PALAEONTOLOGY): PROPOSED OLYVEN KOLK SOLAR POWER PLANT, NORTHERN CAPE PROVINCE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act as part of an EIA.)

Prepared for:
ERM

On behalf of:
AES Solar Energy Limited

Prepared by:

David Halkett and Jayson Orton
ACO Associates
8 Jacobs Ladder
St James
7945

Email: ACOAssociates@gmail.com
Tel: 0731418606

EXECUTIVE SUMMARY

ACO Associates cc have been appointed by Environmental Resources Management Southern Africa (Pty) Ltd (ERM) on behalf of the proponent, AES Solar Energy Limited (AES), to undertake a Heritage Impact Assessment (archaeology and palaeontology), as part of the EIA process, for the establishment of a 190 MW solar power plant on the Olyven Kolk Farm located approximately 36km due south east of Kenhardt in the Northern Cape Province. Visual impact is assessed as a separate study.

The proposed areas that will be utilised for the solar arrays were examined for archaeology and built environment issues by way of fieldwork undertaken on the 4th and 5th June 2011. It involved a walk and drive survey of the proposed solar array sites within the overall farm boundary. Given the uniformity of the site, our observations can be projected more broadly. A desktop palaeontological study was also undertaken.

No significant limitations to conducting the survey were encountered.

Heritage Findings:

The Pre-colonial Archaeology:

- Archaeological sites are present in the form of stone artefact scatters from the Early stone age (ESA), Middle stone age (MSA) and Late stone age (LSA).
- Artefact scatters tend to be widespread rather than discrete and are found on extensive gravel pavements between scrub vegetation;
- The absence of associated organic material, and lack of discrete individual sites reduces the significance of the material overall;
- Further mitigation of sites is considered unnecessary in this case.

Palaeontology:

- The palaeontological sensitivity of the rock units within the study area is generally low.

The Built Environment:

- There are no buildings of heritage significance on the site.

Graves:

- No surface traces of graves were observed

Cultural Landscape:

- The proposed solar plant is isolated and will not be visible from any scenic route;
- The cultural landscape is agricultural in nature, exclusively stock farming; and
- The visual impact of the solar plant will be assessed by a separate Visual Impact Assessment.

Summary

The potential impacts resulting from the installation of a solar power plant (including solar panels, roads, power lines, operational facilities) on heritage resources are all considered to be of minor significance, and no mitigation is recommended.

1. INTRODUCTION

1.1 Overview and context

ACO Associates cc have been appointed by ERM on behalf of the proponent, AES, to undertake a Heritage Impact Assessment, as part of the EIA process, for the establishment of a solar power plant within the boundary including Portions 14 (a portion 4 of portion 4, and portion 15) of the farm Olyven Kolk 187, situated approximately 36 km due southwest of Kenhardt, in the Northern Cape Province (Figure 1).

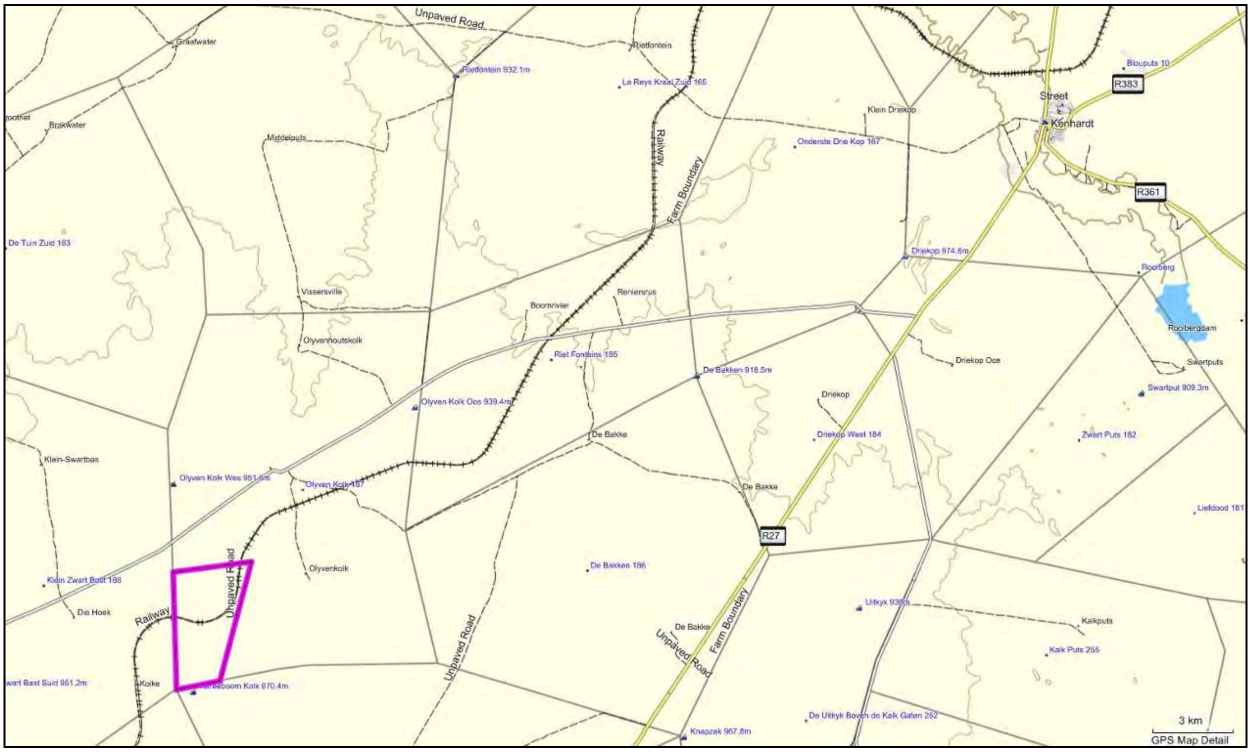

Figure 1: The location of the site (purple polygon) in regional context. Key features include the town of Kenhardt to the north east, and the Sishen-Saldanha railway which bisects the site. (Mapsource).

1.2 Development Proposals

The proposed development includes the installation and operation of solar panels with a projected output of up to 190 MW. Constraints and limitations on the site that were identified during the initial EIA studies, were used to inform the final layout of infrastructure (Figures 2,3) . The area of the proposed site overall is approximately 1010.47 ha (10.1 km^2) while the footprint of the solar panels will be around 357.73 ha (35.4 percent of the site, Figure 2A) when the full 190 MW is installed (Figure 3). PV arrays would include rows of panels which would extend across the site. Some space is necessary between rows of solar panels to minimise shadow effects from one row to the next, and will remain free from any construction or impact. Panels would be mounted on metal frames, supported by poles which will be screwed or piled into the ground, depending on the substrate type encountered and prevailing wind conditions. The panels will be north facing in order to capture the maximum sunlight.

Prior to construction, the site would be prepared as necessary, including removal of tall vegetation if present, and creating access roads, and foundations for single control and accommodation buildings. Each of the solar array areas will be fenced for security purposes rather than the whole site.

Once operational, the plant is expected to have a lifespan of some 25 years. At the end of this time the plant could be refurbished or decommissioned.

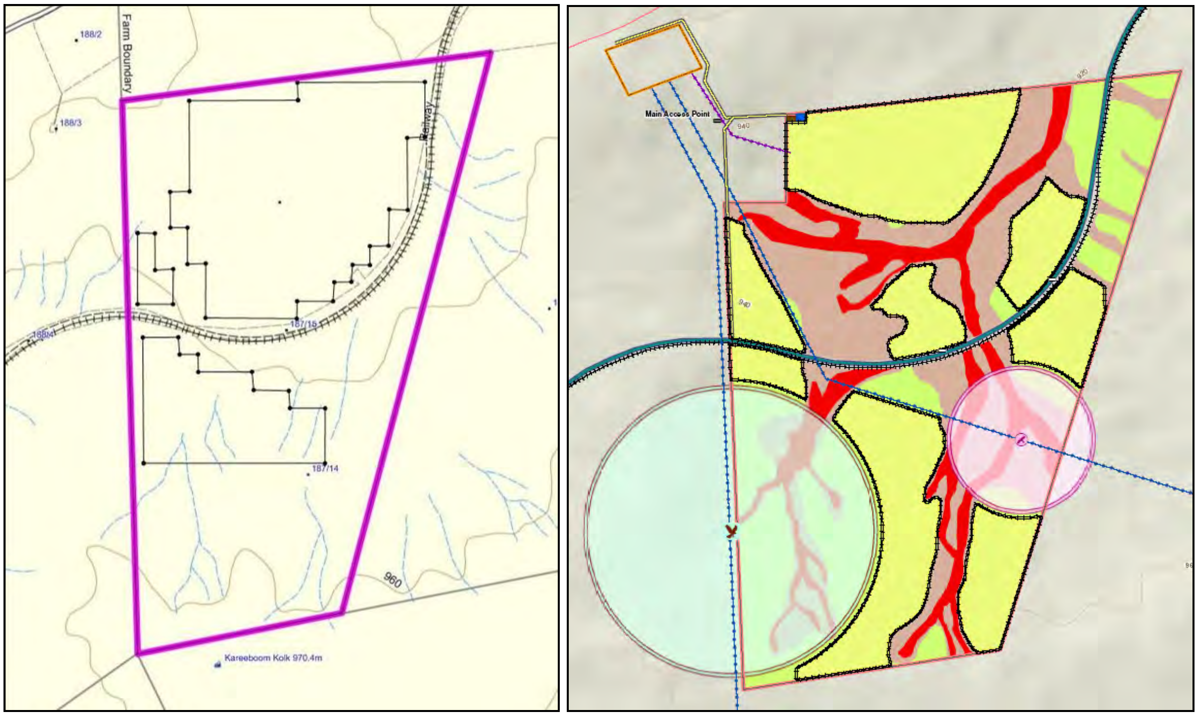

Figure 2: The original proposed Alternative Layout 1 (left), and Layout Alternative 2 (right) which has resulted from the specialist inputs on environmental sensitivity following a mitigation workshop. Yellow areas represent the areas for solar panels (see figure 3 for more detail and full key)

Figure 2A: Alternative 2 areas to be used for solar arrays with sizes indicated

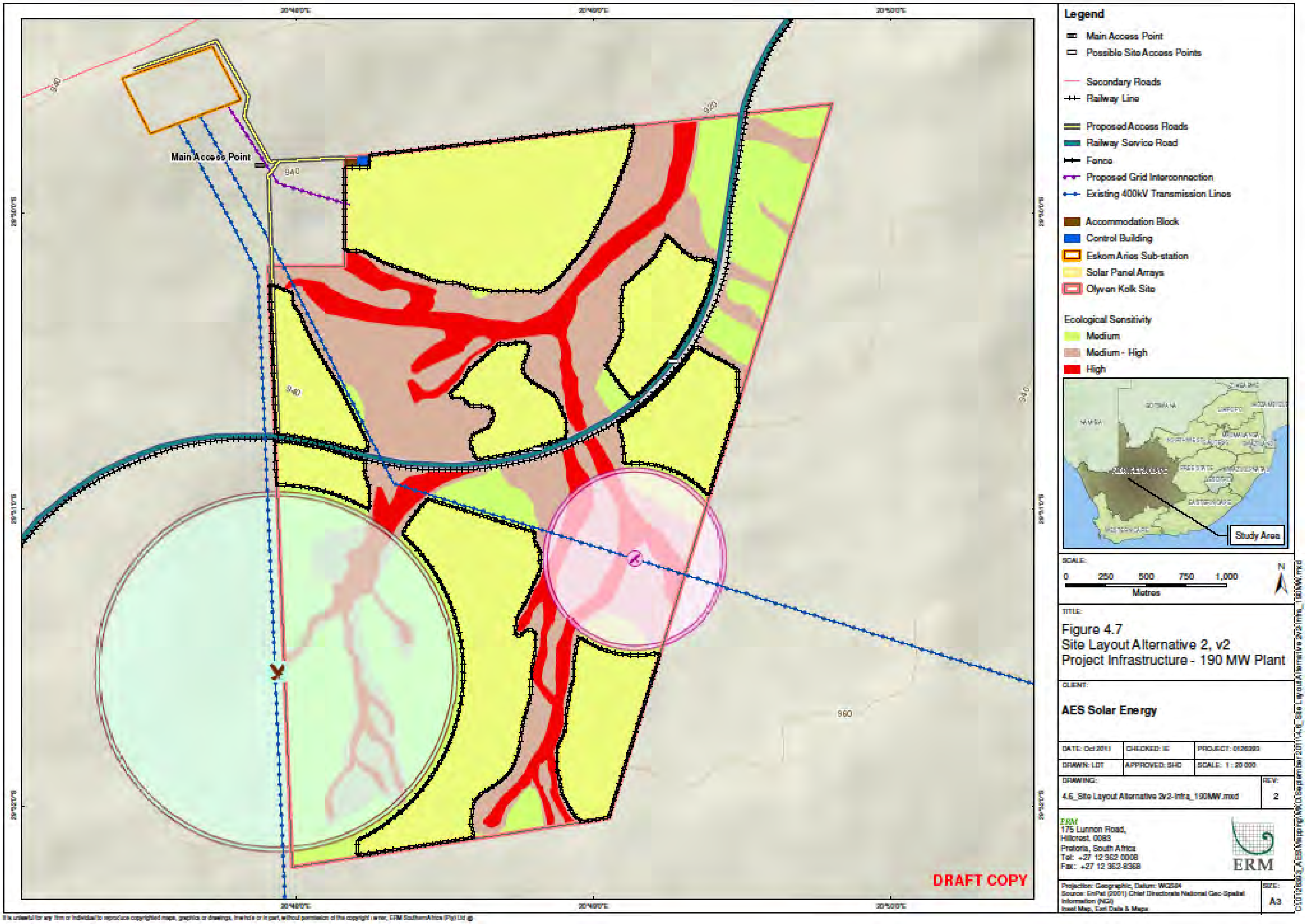

Figure 3: Proposed areas for PV arrays (yellow) within the property. Exclusion areas resulted from the initial specialist studies. (Figure used with permission of ERM).

1.3 Specialist team

David Halkett (BA, BA Hons, MA (UCT)) is an Archaeologist. and Member of the Association of Professional Archaeologists of Southern Africa accredited with Principal Investigator status. He has been working in heritage management for 23 years and has considerable experience in impact assessment with respect to a broad range of archaeological and heritage sites including those in the Northern Cape. He is a member of the Archaeology, Palaeontology and Meteorites Committee and the Impact Assessment Committee of the Heritage Western Cape (HWC), the Provincial Heritage Resources Authority.

Jayson Orton (BA, MA (UCT)) is an archaeologist with 7 years of working experience in heritage consultancy. He is a member of the Association of Professional Archaeologists of Southern Africa accredited with Principal Investigator status. He has worked on a number of impact assessment projects in the Northern Cape.

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA.

His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company Natura Viva cc. He is a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHAP (Association of Professional Heritage Assessment Practitioners - Western Cape).

1.4 Declaration of Independance

Mr David Halkett, Mr Jayson Orton and Dr John Almond are independent specialist consultants who are in no way connected, financially or otherwise, with the proponent, other than in the delivery of consulting services on the project.

2. REGULATORY AND LEGISLATIVE OVERVIEW

The basis for all heritage impact assessment is the National Heritage Resources Act 25 (NHRA) of 1999, which in turn prescribes the manner in which heritage is assessed and managed. The National Heritage Resources Act 25 of 1999 has defined certain kinds of heritage as being worthy of protection, by either specific or general protection mechanisms. In South Africa the law is directed towards the protection of human made heritage, although places and objects of scientific importance are covered. The National Heritage Resources Act also protects intangible heritage such as traditional activities, oral histories and places where significant events happened. Generally protected heritage which must be considered in any heritage assessment includes:

- Cultural landscapes (described below)
- Buildings and structures (greater than 60 years of age)
- Archaeological sites (greater than 100 years of age)
- Palaeontological sites and specimens
- Shipwrecks and aircraft wrecks
- Graves and grave yards.

Section 38 of the NHRA requires that Heritage Impact Assessments (HIA's) are required for certain kinds of development such as rezoning of land greater than 10 000 m2 in extent or exceeding 3 or more sub-divisions, or for any activity that will alter the character of a site greater than 5000 m^2. Only the Western Cape and Kwa-Zulu Natal have functioning Provincial Heritage Authorities, and consequently SAHRA administers heritage in the remaining provinces particularly where archaeology and palaeontology are the dominant concerns. Heritage Northern Cape (Ngwao Boswa Kapa Bokoni) deals largely with built environment issues at this stage. Amongst other things Boswa administers:

- World Heritage Sites
- Provincial Heritage Sites
- Heritage Areas
- Register Sites
- 60 year old structures
- Public monuments & memorials

Archaeology, including rock art, graves of victims of conflict and other graves not in formal cemeteries are administered by the national heritage authority, SAHRA. [1]

2.1 Cultural Landscapes

Section 3(3) of the NHRA, No 25 of 1999 defines the cultural significance of a place or objects with regard to the following criteria:

(a) its importance in the community or pattern of South Africa's history;
(b) its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
(c) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
(d) its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;

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[1] http://www.northern-cape.gov.za/index.php?option=com_content&view=article&id=321

(e) its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
(f) its importance in demonstrating a high degree of creative or technical achievement at a particular period;
(g) its strong or special association with a particular community or cultural group for social cultural or spiritual reasons;
(h) its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
(i) sites of significance relating to the history of slavery in South Africa.

2.2 Heritage Grading

Heritage resources are graded following the system established by Winter and Baumann (2005) in the guidelines for involving heritage practitioners in EIA's (Table 1).

Table 1: Grading of heritage resources (Source: Winter & Baumann 2005: Box 5).

Grade	Level of significance	Description
1	National	Of high intrinsic, associational and contextual heritage value within a national context, i.e. formally declared or potential Grade 1 heritage resources.
2	Provincial	Of high intrinsic, associational and contextual heritage value within a provincial context, i.e. formally declared or potential Grade 2 heritage resources.
3A	Local	Of high intrinsic, associational and contextual heritage value within a local context, i.e. formally declared or potential Grade 3A heritage resources.
3B	Local	Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources.
3C	Local	Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3C heritage resources.

3. METHODOLOGY

This study has been commissioned as the heritage component of an EIA. It assesses the identified range of impacts in terms of actual observations on site and in terms of accumulated knowledge of the area based on scientific or other heritage assessments related to archaeological and palaeontological work undertaken in the broader area. An on-site foot and drive survey of heritage resources (particularly the archaeology) has been conducted and sites have been identified and mapped. The locations of the proposed PV arrays were loaded onto handheld GPS receivers (set to the WGS84 datum) to facilitate the identification of the search area during field work undertaken on 4th & 5th June 2011. Walk paths and site locations were recorded with GPS and finds were photographed and described.

The archaeological study reported on here has been significantly reliant on a physical survey of the site, but we have established that some previous work done in the wider region provides a good basis for comparison with our observations (Pelser 2011, Beaumont et al 1995; Smith 1995).

Based on the low sensitivity of the site determined by its geological context, the palaeontological study was limited to a desktop study. In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area were determined from geological maps. The known fossil heritage within each rock unit was inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later during the compilation of the final report). This data was then used to assess the palaeontological sensitivity of each rock unit to development (Provisional tabulations of palaeontological sensitivity of all formations in the Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues; *e.g.* Almond & Pether 2008). The likely impact of the proposed development on local fossil heritage was then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature of the development itself, most notably the extent of fresh bedrock excavation envisaged.

An independent Visual Assessment forms part of the EIA.

3.1 Limitations

There were no significant physical limitations encountered when undertaking the field study and surface visibility was excellent. This part of the Northern Cape has not been intensively investigated for archaeology, but recently an assessment of material was undertaken for another proposed solar energy plant on the farm Klein Zwart Bast 188 immediately to the east of Olyven Kolk (Pelser 2011). Beaumont et al (1995) also describe making a collection of artefacts on Olyven Kolk but have not indicated where specifically that was from. We have made certain assumptions about the archaeology based on the specific landscape characteristics of the site, and knowledge of the broader archaeological issues. The lack of significant landscape features such as rock outcrops, caves, pans etc, greatly reduces the likelihood of finding significant sites.

From a palaeontological point of view, the lack of any natural exposures of bedrock on the site have meant that conclusions are broad, based on existing literature and observations elsewhere.

4. BASELINE DESCRIPTION OF THE AFFECTED ENVIRONMENT

The Study Area is located some 36 km southwest of Kenhardt in Bushmanland. It is a semi-arid region with summer rainfall mostly in the form of thunderstorms. The knee high bushy vegetation is sparse over the fairly flat site which lacks any major relief features (Plates 1 & 2). At the time of the survey, there was significant grass cover following good rains. Numerous bare gravel and rock covered pavements occur across the site on which we find most of the archaeological material. In places, the surface is covered by shallow orange wind blown sand which obscures the gravel pavement. There is some variation of surface caused by shallow drainage channels but these are scarcely visible in the field other than moderate increase in vegetation. The north western part of the site slopes up in the direction of the visually prominent Aries electrical substation. Occasional rock outcropping is noted to the north of the railway line while to the south, small outcrops were more common, though still very low to the ground and localised. The types of rock are variable but include grey quartzitic material in slabs often tilted vertically. Dolomite is also noted.

There are two major powerlines connecting into the sub-station (Eskom's Aries-Kronos and Aries-Juno 400 kV lines). One of these runs down the western edge of the site while the other crosses diagonally more or less through the middle of the site itself (Figure 3). Other prominent man-made elements include the Sishen-Saldanha railway line and its service road that loop through the site. There is one labourer's cottage and an associated informal structure on the site. Both appear to be recent in age and are probably associated with stock management. The usual stock fences and gates are present.

Despite the prominent human interventions at the site, it remains predominantly natural and moderately isolated, and typical of the area (Plates 1 and 2).

Plate 1: General view of the landscape looking towards the northwest from the railway service road, illustrating the flatness and sparse scrub and grass vegetation. The Aries sub-station is visible at left on the skyline.

Plate 2: Looking north towards the powerline that crosses the site. Aries sub-station visible on the skyline at left behind a pylon.

5. FINDINGS

The location of archaeological sites identified and walk paths undertaken during the archaeological field investigation are shown in Figure 4.

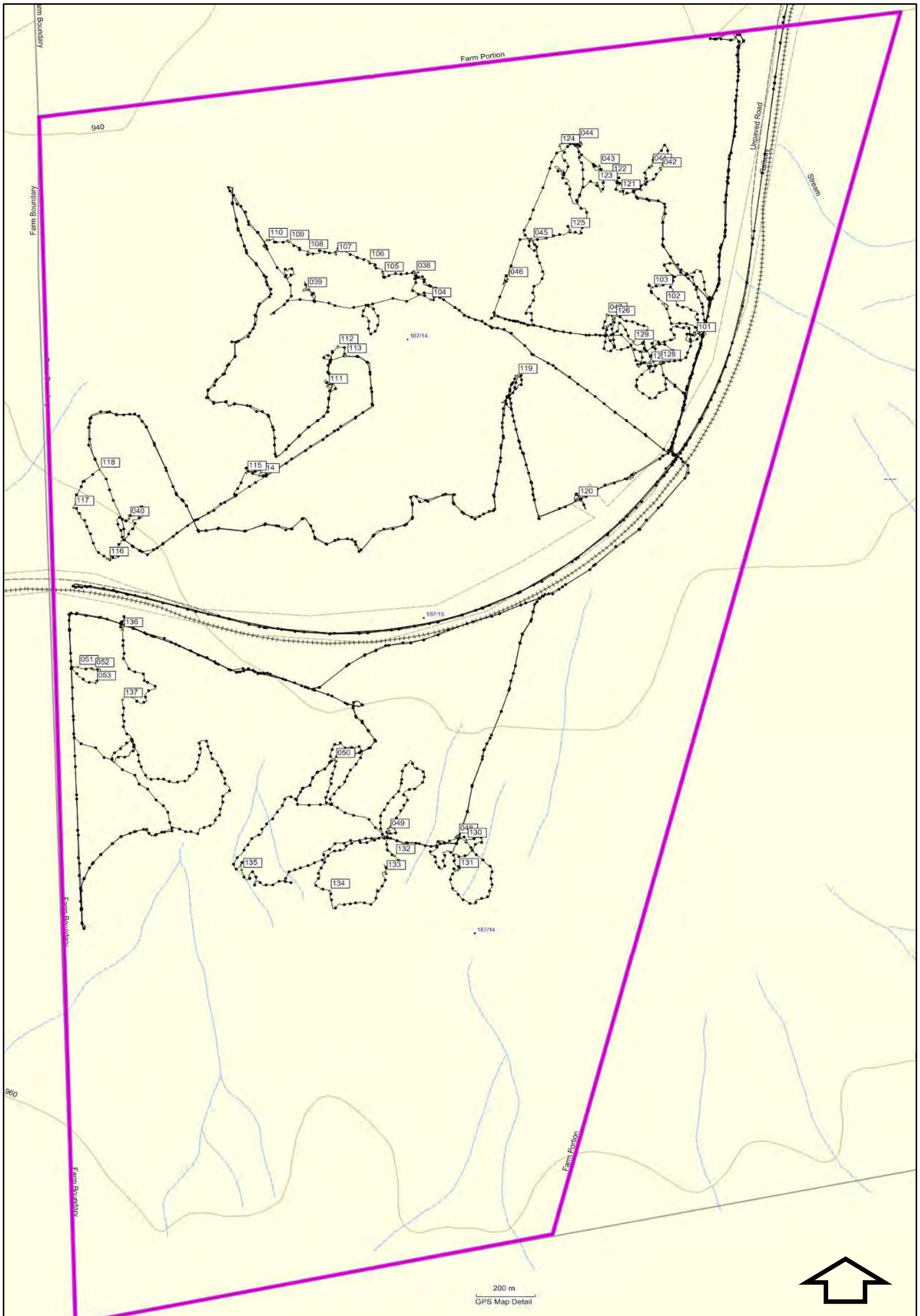

Figure 4: Site boundary (purple) archaeological sites (green dots labelled), and walk paths (black with dots)

5.1 Palaeontology

The detailed palaeontological report is presented in Appendix 2. Palaeontology is a specialist field and one of the components that must be considered as part of a broader Heritage Impact Assessment as required by the NHRA. In summary, the site of the proposed solar power plant is underlain by glacial-related sediments of the Permo-Carboniferous Dwyka Group (Mbizane Formation) that are generally of low palaeontological sensitivity. The main categories of fossils recorded from the Mbizane beds include a small range of interglacial trace fossils, petrified woods and other plant materials, palynomorphs and supposed stromatolites (the last possibly spurious). Quaternary aeolian sediments of the Gordonia Formation (Kalahari Group) as well as alluvial gravels, sands and calcretes of comparable age, all of low palaeontological sensitivity, are also represented within the study area. Fossils preserved within alluvial sediments will be largely safeguarded by the proposed final layout that avoids drainage areas.

5.2 Built Environment

There are two buildings on the site (Plates 3 & 4) situated close together. One is a shed built with corrugated iron , while the other is a small brick dwelling (labourer's cottage) with a metal sheet lean to. Neither of these constitutes significant heritage.


Plates 3 & 4: Two small structures on the site are of relatively recent construction

5.3 Pre-colonial Archaeology

Although our main observations were made on the northern two thirds of the site, it was absolutely clear that the these would apply to the site as a whole. Numerous stone artefacts were recorded across the surface of the northern area on extensive gravel pavements (Plate 5). In fact there were only few areas where surface traces were absent, largely due to the surface being obscured by windblown sand. In some areas density appeared higher but it would be difficult to define individual sites and scatters. All observations made are of the surface and there were no indicators that would suggest there would be deeply stratified material anywhere on the site (for example caves). No associated organic remains were noted with any of the stone scatters.

A few isolated large implements were recovered which resembled sub-classic bifaces (ESA) but the items were very weathered and observations remain equivocal (Plates 5 & 6). One clear biface of a size suggestive of Fauresmith type was recognised (Plate 7). Most of the material we observed can probably be ascribed to the Middle Stone Age (MSA) (Plates 8 & 9), and distinctive flakes were noted some of which were retouched (Plates 10 & 11). There were also 2 scatters of stone tools with a fresh appearance interpreted as Late Stone Age (LSA), although no distinctive formal LSA implements were recovered or noted (Plates 12 - 15). We found 3 typical lower grindstones in close association with these artefacts seeming to confirm our interpretation. No LSA ceramics were observed nor were any organic materials found in association.

The patination and sandblasting on many of the artefacts is consistent with significant vintage. Flakes, blades, chunks and cores make up the majority of the scatters, and retouch was present on some items. The most predominant raw material was grey quartzite with some fine grained chert also noted.

Plate5: Typical gravel pavement context where most stone artefacts are found

Plates 6-8: Bifaces are uncommon on the site and the leftmost two examples are adjudged to be sub-classic handaxes from the ESA period. The biface example at right is fresher in appearance and displays greater workmanship, possibly a Fauresmith type variant. This was the only clear example seen on the site (left J113, middle D049, right J118).

Plates 8& 9: Middle Stone Age artefacts made primarily on local quartzite (left J122, right J125).

Plates 10 & 11: Distinctive MSA flakes with retouch (left D043, right D048

Plates 12 & 13: A number of fresh flakes and cores in association with a lower grindstone at J127 are adjudged to be LSA artefacts.


Plates 14 & 15: A number of fresh flakes and cores in association with a lower grindstone at J128 are adjudged to be LSA artefacts. Younger material was deposited on older scatters

5.4 Graves

Due to the lack of any discernible historic settlements, coupled with the rocky nature of the site in general, it was considered unlikely that graves would be found on site. While there is considerable evidence for stone age use of the area, formal burials have never been found in South Africa that date to the MSA, and while graves from the LSA are found from time to time, these tend to be found in softer soils, as would also have been the case in the colonial period. No typical surface grave markers were observed and we consider it highly unlikely that any graves are present on the site.

5.5 Cultural Landscape

The affected portions of Olyven Kolk 187 represent very typical landscape characteristics for the area. Flat, featureless with scrubby low vegetation and bare patches of gravel pavement, the farm continues to be used for small stock farming. Man made features in the form of the Aries sub-station, two powerlines and the Sishen-Saldanha railway and service road are the most visible features located within the site or in close proximity. The non-industrial built environment on the farm is marginal. The cultural landscape of the solar plant site, as defined in Section 3.1 above, is therefore considered to be of low significance.

6. IMPACT IDENTIFICATION AND ASSESSMENT

6.1 Impact identification and mitigation

The activities likely to result in impacts to archaeology include: site preparation, creation of roads, construction of buildings and installation of cables. Installation of the solar panel frames will be secondary to the previous activities and so would the impacts would be minor. Drilling or screwing frames into place would however represent a possible threat to palaeontological resources if they existed on site.

There is little or no difference between the impacts of Alternate layout 1 or Alternate layout 2.

6.1.1 Palaeontology

The site of the proposed solar power plant is underlain by glacial-related sediments of the Permo-Carboniferous Dwyka Group (Mbizane Formation) that are generally of low palaeontological sensitivity. The main categories of fossils recorded from the Mbizane beds include a small range of interglacial trace fossils, petrified woods and other plant materials, palynomorphs and supposed stromatolites (the last possibly spurious). Quaternary aeolian sediments of the Gordonia Formation (Kalahari Group) as well as alluvial gravels, sands and calcretes of comparable age, all of low palaeontological sensitivity, are also represented within the study area.

Mitigation and management of impacts

Further specialist palaeontological mitigation of this project is not considered necessary. Should substantial fossil remains be exposed during construction however, these should be recorded (GPS, photos), safeguarded if possible in situ, and SAHRA should be notified by the ECO so that appropriate mitigation can be considered.

6.1.2 Archaeology

Extensive scatters of stone artefacts dating from the ESA and MSA and LSA will be impacted by the proposed activities.

Mitigation and management of impacts

The lack of stratified archaeological deposits and associated non-lithic materials limit its scientific value. We have photographed and recorded small collections of material across the solar plant site and believe that these are representative of the material as a whole. Further mitigation is unlikely to result in a greater understanding of the material and the various time periods, and as a result we do not believe further intervention from an archaeological point of view is necessary.

6.1.3 Graves

There is always a possibility of finding unmarked graves no matter how remote a site is. In this case however we consider it very unlikely due to the proximity of bedrock to the surface. The most likely areas would be in the softer deposits of drainage channels, which are in any event to be avoided for ecological reasons.

Mitigation and management of impacts

In the unlikely event that graves are found, (due to the proximity of bedrock to the surface), they should not be further exposed. The area should be cordoned off and the find reported to SAHRA. They would decide on the appropriate action which is likely to consist of exhumation.

The visual impacts will be addressed as a separate specialist study.

A mitigation workshop was held with all specialists (the palaeontologist was unable to attend) who presented their findings. Based on those presentations, a new Alternate Layout 2 was proposed, largely reflecting ecological concerns, where infrastructure would be placed in such a way so as to avoid drainage channels and bird nests. As there were no significant heritage issues, the new layout was acceptable to the heritage specialist.

6.2 Impact assessment

The impact assessment methodology used in the accompanying Tables was provided by ERM. Since there no real differences in the impacts on heritage resources of Alternative Layouts 1 or 2, these are both considered together.

6.2.1 Archaeology

Scatters of Stone Age artefacts were recognised, mainly on extensive gravel pavements. Some of the scatters (which lack discrete boundaries) will/may be impacted by construction and are likely to be disturbed. In general, the stone scatters are considered to be of minor significance. They are probably not in original context, and not associated with organic remains such as bone, which could provide valuable information on prehistoric lifeways.

Beaumont et al (1995:240) note that “thousands of square kilometres of Bushmanland are covered by a low density lithic scatter. The raw materials (mainly quartzite cobbles) are derived from the Dwyka till which is ubiquitous across this peneplain…” They indicate (1995:240) that systematic collection of material was undertaken on the broader Olyven Kolk Farm (indicated as site 13 on their distribution map), although a precise location for the collection is unknown at this time. In referring to the material from this and other collections in the region, they note that the material “separates out on the basis of abrasion state, into a fresh component, with advanced prepared cores, blades, and convergent points, that is ascribable to the Middle Stone Age, and a larger fraction of moderately to heavily weathered Early Stone Age. This is typified by the presence of long blades, Victoria West cores (mainly on dolerite) and an extremely low incidence of formal tools (handaxes and cleavers)…”. Our observations are largely consistent with these. LSA sites are known to be present in the area too, with perhaps the best studied being the site of Droëgrond, approximately 60 km to the northwest (Smith 1995). This site contained both lithic and organic remains in tight context. Our finding of LSA lithics is therefore not unexpected. The exposed nature of the LSA at Olyven Kolk is unlikely to have favoured the preservation of non lithic remains however.

Construction (surface clearing, cables, frames, operation facilities and laydown areas) will be limited to a relatively small area of the site and other areas will remain relatively undisturbed. It is our opinion that the impact of disturbance of stone age material in the affected zones will be minimal.

The visual and impacts will be addressed as separate specialist study.

Table 1: Alternative 2: Archaeology - Construction Impacts on the pre-colonial archaeology of the study area

	Pre- Mitigation	**Post- Mitigation**
Magnitude	On-site	On-site
Impact Nature/Type	Negative	Negative
Duration	Permanent	Permanent
Intensity	Negligible	Negligible
Likelihood	Definite	Definite
Significance	Minor	Minor
Mitigation: Although some archaeological material will be impacted, the impact is considered **minor**. No mitigation has been suggested as this material is abundant and preserved extensively elsewhere. Lack of associated organic remains or discrete site boundaries reduces scientific value greatly. In the unlikely event that unmarked graves are present and found during the construction phase (proximity of bedrock), work at that location must be halted, the feature should be cordoned off and the heritage authority (SAHRA) notified. They are likely to suggest mitigation in the form of exhumation.		
Operational Phase: n/a		
Decommissioning Phase: n/a		

Table 2: Alternative 2: Palaeontology- construction impacts of on the palaeontology of the study area

	Pre- Mitigation	**Post- Mitigation**
Magnitude	On-site	On-site
Impact Nature/Type	Negative	Negative
Duration	Permanent	Permanent
Intensity	Negligible	Negligible
Likelihood	Unlikely	Unlikely
Significance	Negligible	Negligible
Mitigation: Since the palaeontological sensitivity of the rock units within the entire study area is generally minor, the development footprint is relatively small, and extensive bedrock excavations are not envisaged, the impact significance as far as fossil heritage is concerned is likely to be **negligible**. Fossils preserved within alluvial sediments will be largely safeguarded by the proposed final layout that avoids drainage areas. Therefore further specialist palaeontological studies or mitigation for this project are not considered necessary. Should substantial fossil remains be exposed during construction, however, these should be recorded (GPS, photos) and safeguarded, if possible *in situ*, by the ECO who should also notify SAHRA so that appropriate palaeontological mitigation can be considered.		
Operational Phase: n/a		
Decommissioning Phase: n/a		

The following table summarises the pre- and post-mitigation impact ratings of the original layout (Alternative 1) and the layout established after scoping (Alternative 2). Since the impacts on heritage resources are minor/negligible, no mitigation has been recommended. There will however still be an impact on archaeological resources from the proposed activities.

Table 3: Summary impact ratings for layout alternatives 1 and 2 for archaeology and palaeontology

Impact	**Layout Alt1 Pre-mitigation**	**Layout Alt2 Pre-mitigation**	**Layout Alt2 Residual Impact (post mitigation)**
Construction Phase			
Archaeology	minor	minor	minor
Palaeontology	negligible	negligible	negligible
Operational Phase			
Archaeology	minor	minor	minor
Palaeontology	negligible	negligible	negligible

7. CONCLUSION AND RECOMMENDATIONS

Having considered the heritage sensitivities at the site, the proposed development will have impacts of negligible to minor significance (the magnitude of the proposed development is sufficiently small, latest planning and re-design has taken into account initial concerns, and the heritage resources are considered to be of limited scientific value) on the heritage components of the site.

Heritage	**Anticipated/identified resources**	**Unanticipated Subsurface resources**
Palaeontology	Further specialist palaeontological studies or mitigation for this project are not considered necessary.	Action: Should substantial fossil remains be exposed during construction, however, these should be recorded (GPS, photos) and safeguarded, if possible *in situ*, by the ECO who should also notify SAHRA so that appropriate palaeontological mitigation can be considered.
Archaeology	Samples of artefacts photographed and described. No further mitigation required.	Action: Work at that location to cease and remains to be cordoned off. Report the find to SAHRA.
Graves	No graves identified from surface evidence.	Action: Should any graves or human remains be identified during construction, work at that location to cease and remains to be cordoned off. Report the find to SAHRA. If avoidance is not an option, it is likely that exhumation would be suggested as mitigation.

8. LIST OF DEFINITIONS AND ABBREVIATIONS

Palaeontology: *'Palaeontological'' means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trance;*

Archaeology: *Remains resulting from human activity which is in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.*

Early Stone Age: *The archaeology of the Stone Age between 700 000 and 2500 000 years ago*.

Fossil: *Mineralised bones of animals, shellfish, plants and marine animals.*

Heritage: *That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).*

Holocene: *The most recent geological time period which commenced 10 000 years ago.*

Late Stone Age: *The archaeology of the last 20 000 years associated with fully modern people.*

Middle Stone Age: *The archaeology of the Stone Age between 20-300 000 years ago associated with early modern humans.*

National Estate: *The collective heritage assets of the Nation.*

Palaeontology: *Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.*

SAHRA: *South African Heritage Resources Agency – the compliance authority which protects national heritage.*

Structure (historic): *Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.*

Trace fossil: *The track or footprint of a fossil animal that is preserved in stone or consolidated sediment.*

Acronyms

BP	Before the Present
DEA	Department of Environmental Affairs
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
LSA	Late Stone Age
MSA	Middle Stone Age
NHRA	National Heritage Resources Act, No 25 of 1999
SAHRA	South African Heritage Resources Agency

9. REFERENCE LIST

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Beaumont, P.B., Smith A.B. and Vogel J.C. 1995. Before the Einiqua: The archaeology of the frontier zone. In Smith A.B. ed. Einiqualand: Studies of the Orange River frontier. UCT Press: 236-264.

Pelser, A.J. 2011 A report on an archaeological impact assessment (aia) for the proposed solar energy plant on Klein Zwart Bast 188, Kenhardt district, northern Cape. Unpublished report AE1104 prepared for Robert De Jong & Associates. Archaetnos.

Smith A.B. Archaeological observations along the Orange River and its hinterland. In Smith A.B. ed. Einiqualand: Studies of the Orange River frontier. UCT Press: 265-300.

(see Dr Almond's report in the Appendix 2 for palaeontological references)

Appendix 1: List of heritage sites recorded during the survey

SITE	LAT S (dec deg)	LONG E (dec deg)	DESCRIPTION	GRADING
D038	29.50236100	20.81140500	gravel pavement, low density artefact scatter esa/msa	ungraded
D039	29.50289800	20.80738600	gravel pavement, low density artefact scatter esa/msa gravel pavement, possible biface	ungraded
D040	29.51037100	20.80081100	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D041	29.49887000	20.82015400	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D042	29.49899500	20.82051200	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D043	29.49888100	20.81822500	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D044	29.49805100	20.81743900	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D045	29.50129300	20.81574400	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D046	29.50256500	20.81483200	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D047	29.50371500	20.81850900	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D048	29.52068500	20.81297900	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D049	29.52052100	20.81044000	gravel pavement, low density artefact scatter esa/msa gravel pavement, possible biface	ungraded
D050	29.51822400	20.80843400	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D051	29.51519600	20.79892300	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D052	29.51528100	20.79950900	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
D053	29.51571200	20.79957600	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J101	29.50435730	20.82178400	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J102	29.50335690	20.82064720	gravel pavement, low density artefact scatter esa/msa gravel pavement, several small, fresh quartzite flakes here.	ungraded
J103	29.50282120	20.82019620	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J104	29.50322850	20.81198470	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J105	29.50239120	20.81022580	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J106	29.50198070	20.80968750	gravel pavement, low density artefact scatter esa/msa gravel pavement, ESA radial core.	ungraded
J107	29.50175370	20.80848120	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J108	29.50166260	20.80743190	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J109	29.50135290	20.80672560	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J110	29.50128900	20.80593350	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J111	29.50603920	20.80816000	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J112	29.50474800	20.80854790	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J113	29.50504830	20.80885260	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J114	29.50894470	20.80563360	gravel pavement, artefact scatter esa/msa gravel pavement quite a dense patch	ungraded
J115	29.50886150	20.80514860	gravel pavement, artefact scatter esa/msa gravel pavement quite a dense patch	ungraded
J116	29.51167260	20.80004320	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J117	29.51001720	20.79876410	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J118	29.50876080	20.79972240	gravel pavement, low density artefact scatter esa/msa gravel pavement, small biface (hand-axe) (115 x 60 x 32 mm) Fauresmith?	ungraded
J119	29.50570760	20.81518000	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J120	29.50972090	20.81741370	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J121	29.49970780	20.81899290	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J122	29.49921910	20.81866140	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J123	29.49942790	20.81814300	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J124	29.49823640	20.81675410	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J125	29.50096310	20.81712620	gravel pavement, artefact scatter esa/msa gravel pavement, very dense area	ungraded
J126	29.50382810	20.81879450	gravel pavement, artefact scatter esa/msa gravel pavement fairly dense area	ungraded
J127	29.50530750	20.82010670	usual scatter but including a proper LSA site with an upside down lower grindstone and quartz and quartzite artefacts.	3c
J128	29.50525230	20.82048270	as above but with quite a bit of CCS included. Lower grindstone found right way up	3c
J129	29.50460460	20.81948390	double-sided lower grindstone with best side found facing up. GS flaked all round the edges. Also a hammer stone/upper grindstone	ungraded
J130	29.52082200	20.81330460	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J131	29.52180190	20.81299730	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J132	29.52135060	20.81065350	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J133	29.52186920	20.81030460	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J134	29.52247870	20.80823710	concentrated scatter of pale quartzite flakes and cores in a very small area.	ungraded
J135	29.52180060	20.80498890	artefacts extremely sparse in this whole area.	ungraded
J136	29.51397710	20.80057450	gravel pavement, low density artefact scatter esa/msa gravel pavement	ungraded
J137	29.51626460	20.80057040	outcrop of fine pale quartzite that has been flaked in situ – quarry site. Only one flake in vicinity so rest were carried away.	ungraded

Appendix 2: Palaeontological report

PROPOSED AES SOLAR POWER PLANT ON THE FARM OLYVEN KOLK 187 NEAR KENHARDT, NORTHERN CAPE PROVINCE

PALAEONTOLOGICAL ASSESSMENT: DESKTOP STUDY

John E. Almond PhD (Cantab.)

Natura Viva **cc,**

PO Box 12410 Mill Street,
Cape Town 8010, RSA

naturaviva@universe.co.za

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1. SUMMARY

AES Solar Energy Ltd is proposing to develop a photovoltaic (PV) solar power plant of 190 MW capacity on the farm Olyven Kolk 187, situated some 37 km southwest of the town of Kenhardt, Siyanda District Municipality and KAI!GARIB! Municipality, Northern Cape Province, RSA. The site of the proposed solar power plant is underlain by glacial-related sediments of the Permo-Carboniferous Dwyka Group (Mzibane Formation) that are generally of low palaeontological sensitivity. The main categories of fossils recorded from the Mbizane beds include a small range of interglacial trace fossils, petrified woods and other plant materials, palynomorphs and supposed stromatolites (the last possibly spurious). Quaternary aeolian sediments of the Gordonia Formation (Kalahari Group) as well as alluvial gravels, sands and calcretes of comparable age, all of low palaeontological sensitivity, are also represented within the study area. Fossils preserved within alluvial sediments will be largely safeguarded by the proposed final layout that avoids drainage areas.

Since the palaeontological sensitivity of the rock units within the entire study area is generally low, the development footprint is relatively small, and extensive bedrock excavations are not envisaged, the impact significance of the proposed 190 MW solar power plant as far as fossil heritage is concerned is likely to be **MINOR**. Therefore further specialist palaeontological studies or mitigation for this project are not considered necessary. Should substantial fossil remains be exposed during construction, however, these should be recorded (GPS, photos) and safeguarded, if possible *in situ*, by the ECO who should also notify SAHRA so that appropriate palaeontological mitigation can be considered.

2. INTRODUCTION & BRIEF

AES Solar Energy Limited (AES) is proposing to develop a PV solar power plant of 190 MW capacity adjacent to the Aries electrical substation on the farm Olyven Kolk 187. The study site is situated some 37 km southwest of the town of Kenhardt, Siyanda District Municipality and KAI!GARIB! Municipality, Northern Cape Province. The site lies to the northwest of the R27 tar road between Kenhardt and Brandvlei and is bisected by the Sishen-Saldanha railway line (Figs. 1, 2, 3). A palaeontological assessment for the proposed (120 MW) Solar Cape Photovoltaic Electricity Generation Facility also on the same farm has been provided by Almond (2011).

The proposed AES solar power plant development comprises the following major components:

- Solar panels with a projected output of up to 190 MW. These panels would be PV arrays and would include rows of panels extending across the site. The panels would be mounted on metal frames which will be screwed or piled into the ground, depending on the substrate type encountered and prevailing wind conditions. The arrays would face north in order to capture the maximum sunlight;
- New access roads;
- Power line;
- Underground power cables (where feasible);
- A control building and small ancillary buildings.

The 70 MW development would be built in phases. The final layout has been designed to minimise impact on drainage areas and other sensitive features identified within the site by various specialist studies in particular birds and terrestrial ecology studies. Once the facility is operational it is expected that the facility would have a lifespan of around 25 years.

The proposed development area overlies potentially fossiliferous bedrock of the Palaeozoic Dwyka Group as well as Quaternary sands of the Kalahari Group. A palaeontological impact assessment for the project is therefore necessary in compliance with the requirements of the National Heritage Resources Act, 1999. This desktop palaeontological assessment has accordingly been commissioned by the Archaeology Contracts Office, University of Cape Town on behalf of Environmental Resources Management (ERM) as a contribution to an Environmental Impact Assessment (EIA) for the proposed 75 MW solar power plant.

Contact details for ACO are: Tim Hart / Dave Halkett
ACO Associates cc
8 Jacobs Ladder
St James 7945
Cell 0731418606

2.1. National Heritage Resources Act

The extent of the proposed development (over 5000 m^2) falls within the requirements for a Heritage Impact Assessment (HIA) as required by Section 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999). The various categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance
- palaeontological sites
- palaeontological objects and material, meteorites and rare geological specimens

Minimum standards for the palaeontological component of heritage impact assessment reports are currently being developed by SAHRA. The latest version of the SAHRA guidelines is dated May 2007.

2.2. General approach used for palaeontological impact desktop studies

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to the proposed development (Provisional tabulations of palaeontological sensitivity of all formations in the Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues; *e.g.* Almond & Pether 2008). The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature of the development itself, most notably the extent of fresh bedrock excavation envisaged.

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a Phase 1 palaeontological field assessment by a professional palaeontologist is usually warranted. Most detrimental impacts on palaeontological heritage occur during the construction phase when fossils may be disturbed, destroyed or permanently sealed-in during excavations and subsequent construction activity. Where Phase 2 specialist palaeontological mitigation is recommended, this may take place before construction starts or, most effectively, during the construction phase while fresh, potentially fossiliferous bedrock is still exposed for study. Mitigation usually involves the judicious sampling, collection and recording of fossils as well as of relevant contextual data concerning the surrounding sedimentary matrix. It should be emphasised that, *provided* appropriate mitigation is carried out, many developments involving bedrock excavation actually have a *positive* impact on our understanding of local palaeontological heritage. Constructive collaboration between palaeontologists and developers should therefore be the expected norm.

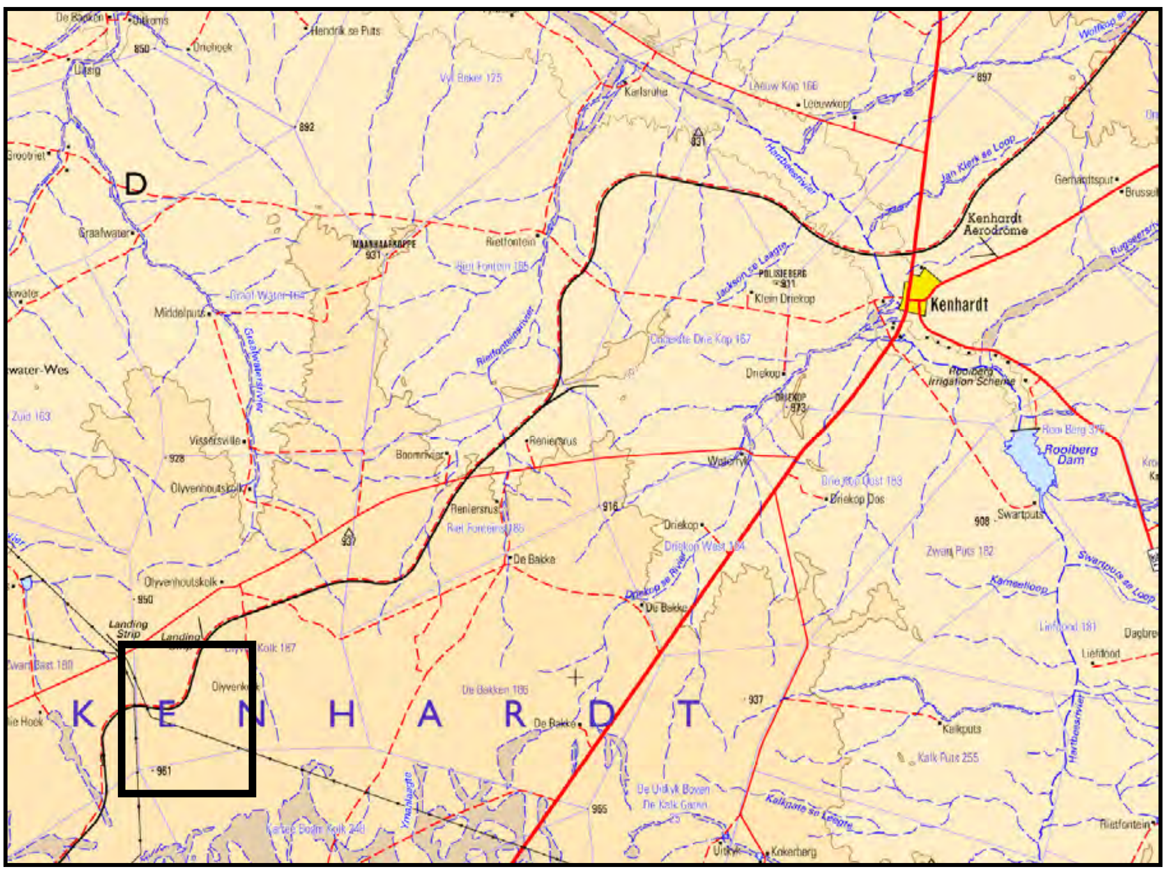

Figure 1. Extract from 1: 250 000 topographical sheet 2920 Kenhardt showing *approximate* location of the Olyven Kolk solar power plant study area (black rectangle) *c*. 37 km southwest of Kenhardt, Northern Cape Province (Courtesy of the Chief Directorate of Surveys and Mapping, Mowbray).

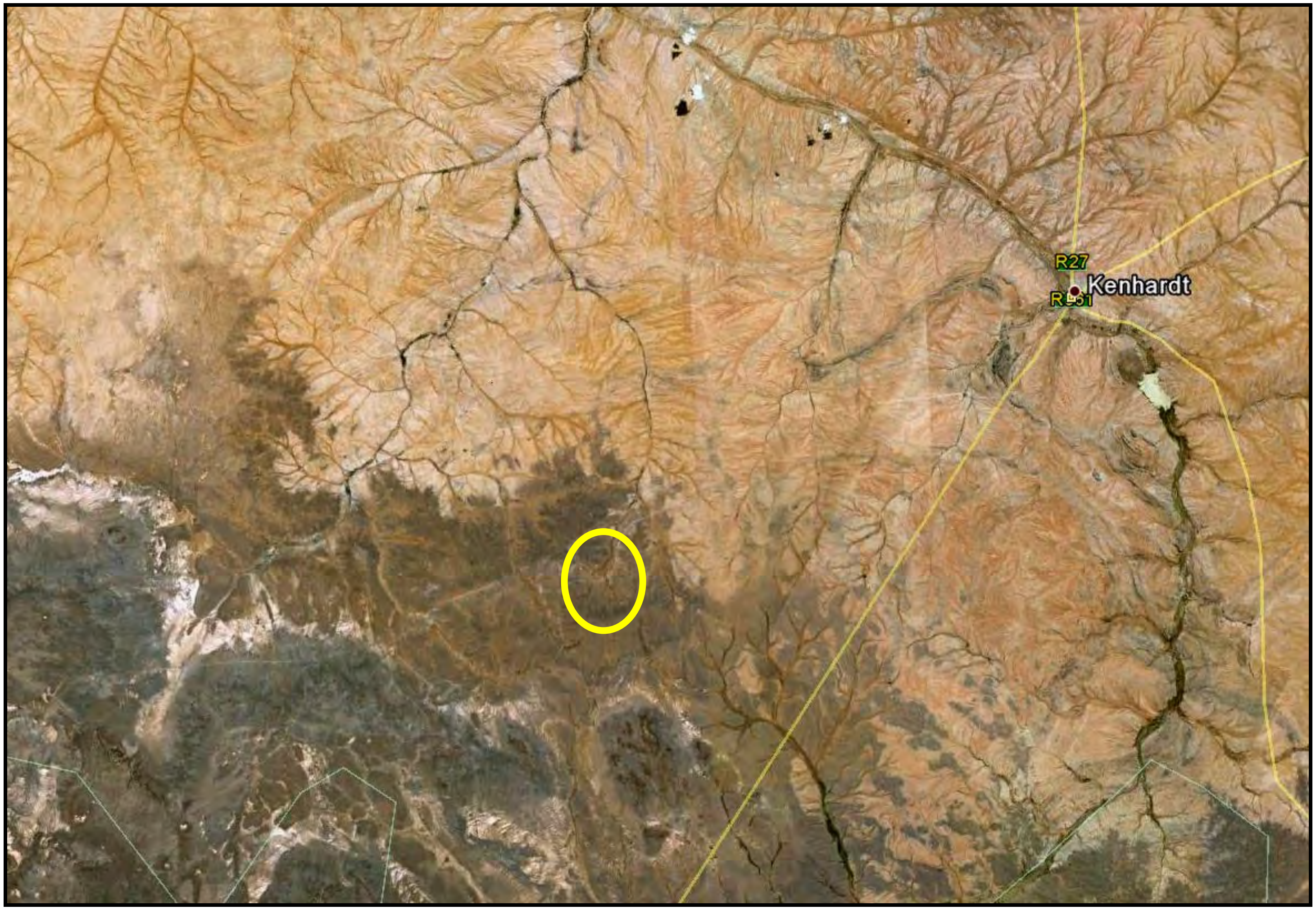

Figure 2. *Google Earth* satellite image showing the location (yellow oval) of the proposed AES solar power plant *c*. 37 km southwest of Kenhardt, Northern Cape Province. The dark grey area in the south western part of the image is underlain by glacially-related sediments of the Dwyka Group. The pale buff area to the northeast is underlain by Precambrian basement rocks mantled with Quaternary aeolian sands of the Kalahari Group (Compare geological map in Fig. 4). Note extensive erosional dissection of the landscape in this region by tributaries of the Hartbeesrivier.

3. GEOLOGICAL BACKGROUND

The Olyven Kolk study area some 37 km southwest of Kenhardt is situated in a topographically subdued, semi-arid part of eastern Bushmanland at an elevation of 915 to 960m amsl. The site is bisected by the Sishen-Saldanha railway line and lies just to the south of a dust road between Kenhardt and Pofadder. As is clear from satellite imagery (Figs. 2, 3) the region is dissected by a dendritic system of small tributaries of the Graafwater River that flows northwards into the Hartbeesrivier and thence into the Orange River. These images show a greyish background representing glacial rocks of the Dwyka Group that are locally overlain by pale buff aeolian (wind-blown) sands and darker alluvial deposits within drainage channels (*N.B.* these are both mapped as wind-blown sand at 1: 250 000 scale; Fig. 4).

Figure 3. Detailed *Google Earth* satellite image of the Olyven Kolk study area (approximately outlined by yellow polygon) straddling the Sishen – Saldanha railway line (white line) and just southeast of the Aries electrical substation. Note dendritic array of tributary streams of the Harbeesrivier drainage system, pale buff wind-blown sands, darker brown alluvium and background greyish outcrop area of the Dwyka Group.

The geology of the study area is outlined on the 1: 250 000 geology map 2920 Kenhardt (Council for Geoscience, Pretoria; Fig. 4 herein). An explanation to the Kenhardt geological map has been published by Slabbert *et al.* (1999). Several of the relevant rock units are also treated in the explanations for the adjacent 1: 250 000 sheets such as the Britstown sheet to the southeast (Prinsloo 1989), the Pofadder sheet to the west (Agenbacht 2007) and the Sakrivier sheet to the south (Siebrits 1989).

According to the Kenhardt 1: 250 000 geology map (Fig. 4) the Olyven Kolk site is underlain by the Permocarboniferous **Dwyka Group** (Karoo Supergroup, **C-Pd**). Dwyka sediments underlie most of the western portion of farm Olyven Kolk 187, with Quaternary to Recent alluvium lining the major water courses. Quaternary to Recent aeolian (wind-blown) sands and associated fluvial sediments and pedocretes of the **Gordonia Formation** (Kalahari Group, **Q**) are also mainly associated with the water courses. Unconsolidated sands here are alternately reworked by stream and aeolian processes and the two units are often conflated at 1: 250 000 scale.

3.2. Dwyka Group

Permocarboniferous glacially-related sediments of the **Dwyka Group** (**C-Pd** in Fig. 4) underlie the thin, superficial cover of Gordonia sands, calcrete and Late Caenozoic alluvium both north and south of the Orange River and crop out at surface within the study area southwest of Kenhardt. The geology of the Dwyka Group has been summarized by Visser (1989), Visser *et al.* (1990) and Johnson *et al.* (2006), among others. The geology of the Dwyka Group along the north-western margin of the Main Karoo Basin as far east as Prieska has been reviewed by Visser (1985). Other studies on the Dwyka in or near the Prieska Basin include those by Visser *et al.* (1977-78; summarized by Zawada 1992) and Visser (1982). Fairly detailed observations by Prinsloo (1989) on the Dwyka beds on the northern edge of the Britstown 1: 250 000 geology sheet are in part relevant to the more proximal (near-source) outcrops at Kenhardt. Massive tillites at the base of the Dwyka succession (**Elandsvlei Formation**) were deposited by dry-based ice sheets in deeper basement valleys. Later climatic amelioration led to melting, marine transgression and the retreat of the icesheets onto the continental highlands in the north. The valleys were then occupied by marine inlets within which drifting glaciers deposited dropstones onto the muddy sea bed ("boulder shales"). The upper Dwyka beds (**Mbizane Formation**) are typically heterolithic, with shales, siltstones and fine-grained sandstones of deltaic and / or turbiditic origin. These upper successions are typically upwards-coarsening and show extensive soft-sediment deformation (loading and slumping). Varved (rhythmically laminated) mudrocks with gritty to fine gravely dropstones indicate the onset of highly seasonal climates, with warmer intervals leading occasionally even to limestone precipitation.

According to maps in Visser *et al.* (1990) and Von Brunn and Visser (1999; Fig. 5 herein) the Dwyka rocks in the Kenhardt area close to the northern edge of the Main Karoo Basin belong to the **Mbizane Formation**. This is equivalent to the "Northern (valley and inlet) Facies" of Visser *et al*. (1990). The Mbizane Formation, up to 190m thick, is recognized across the entire northern margin of the Main Karoo Basin where it may variously form the whole or only the *upper* part of the Dwyka succession. It is characterized by its extremely heterolithic nature, with marked vertical and horizontal facies variation (Von Brunn & Visser 1999). The proportion of diamictite and mudrock is often low, the former often confined to basement depressions. Orange-tinted sandstones (often structureless or displaying extensive soft-sediment deformation, amalgamation and mass flow processes) may dominate the succession. The Mbizane-type heterolithic successions characterize the thicker Dwyka of the ancient palaeovalleys cutting back into the northern basement rocks. The key Reference Stratotype C section for the valley fill facies of the Mbizane Formation is located a few kilometres west of Douglas on the northern side of the Vaal River (Von Brunn & Visser 1999). The composite section, which overlies glacially-striated Precambrian bedrock, is some 25-30m thick. The lower part of the section consists of massive diamictites with subordinate conglomerates and siltstones. The upper half is dominated by laminated mudrocks with thin diamictites, lonestones (dropstones) and calcareous concretions.

The section is conformably overlain by mudrocks of the Prince Albert Formation (Ecca Group) which is not represented in the study area.

For details of the Dwyka Group rocks in the Kenhardt area the reader is referred to the accounts of Visser (1985) and Slabbert *et al.* (1999). The study area southwest of Kenhardt lies close to the eastern edge of the Sout River palaeovalley identified by Visser (1985, fig. 12 therein). The Dwyka succession in this area comprises both massive, muddy diamictites ("boulder shales") as well as heterolithic intervals dominated by interbedded reddish-brown, pebbly sandstones, conglomerates, and diamictite (ibid., figs. 2, 4). Slabbert *et al.* (1999, p. 107) report that the uppermost Dwyka beds contain stromatolites, oolites and calcareous concretions.

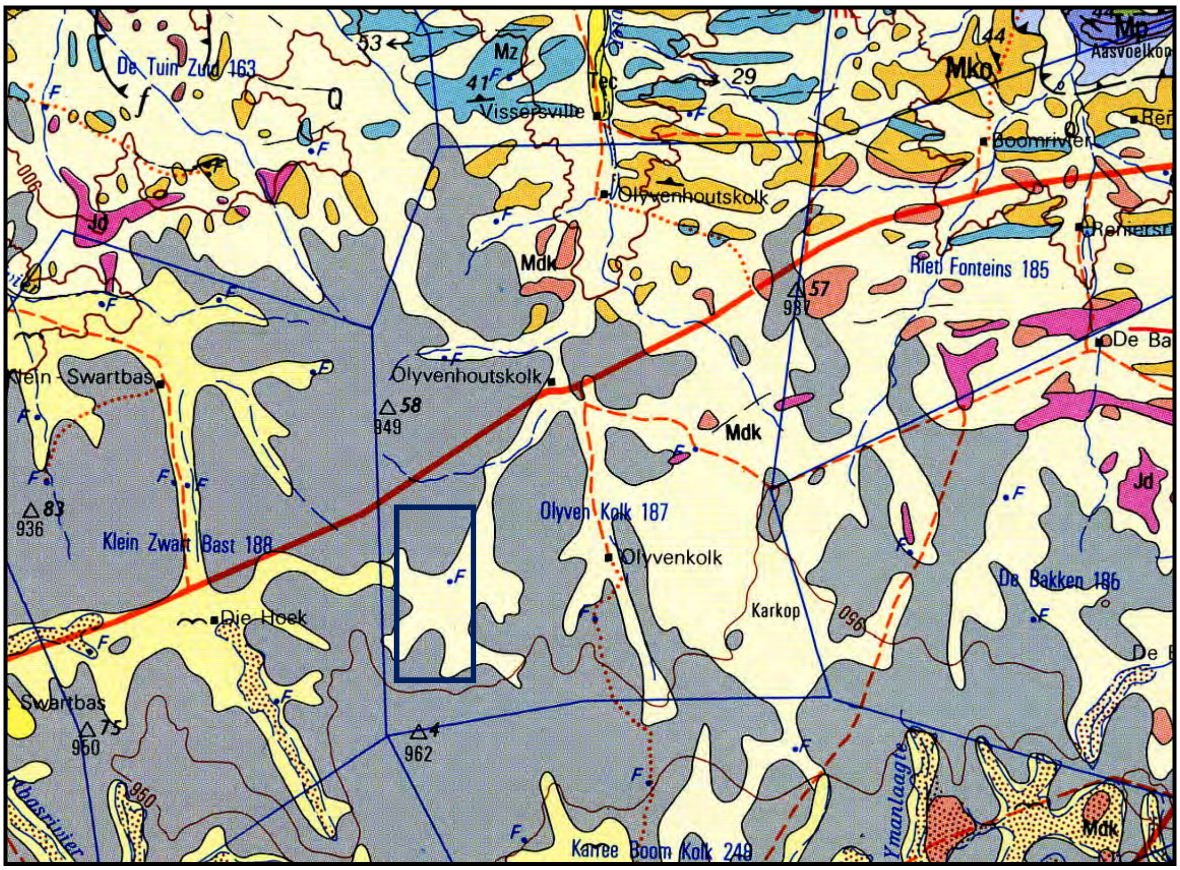

Figure 4. Extract from 1: 250 000 geological map 2920 Kenhardt (Council for Geoscience, Pretoria) showing the approximate location of proposed AES solar power plant study area on the northern part of farm Olyven Kolk 187 (dark blue rectangle). The area is underlain by Dwyka Group glacial deposits (grey) as well as Quaternary to Recent alluvium and wind-blown sand (pale yellow) that are mainly associated with shallow drainage courses.

MAIN GEOLOGICAL UNITS:
Grey (C-Pd) = Mbizane Formation (Permo-Carboniferous Dwyka Group, Karoo Supergroup)
Pale yellow (Q) = Quaternary to Recent sands and sandy soil of the Gordonia Formation (Kalahari Group)
Middle Yellow with "flying bird" symbol = Quaternary to Recent alluvium

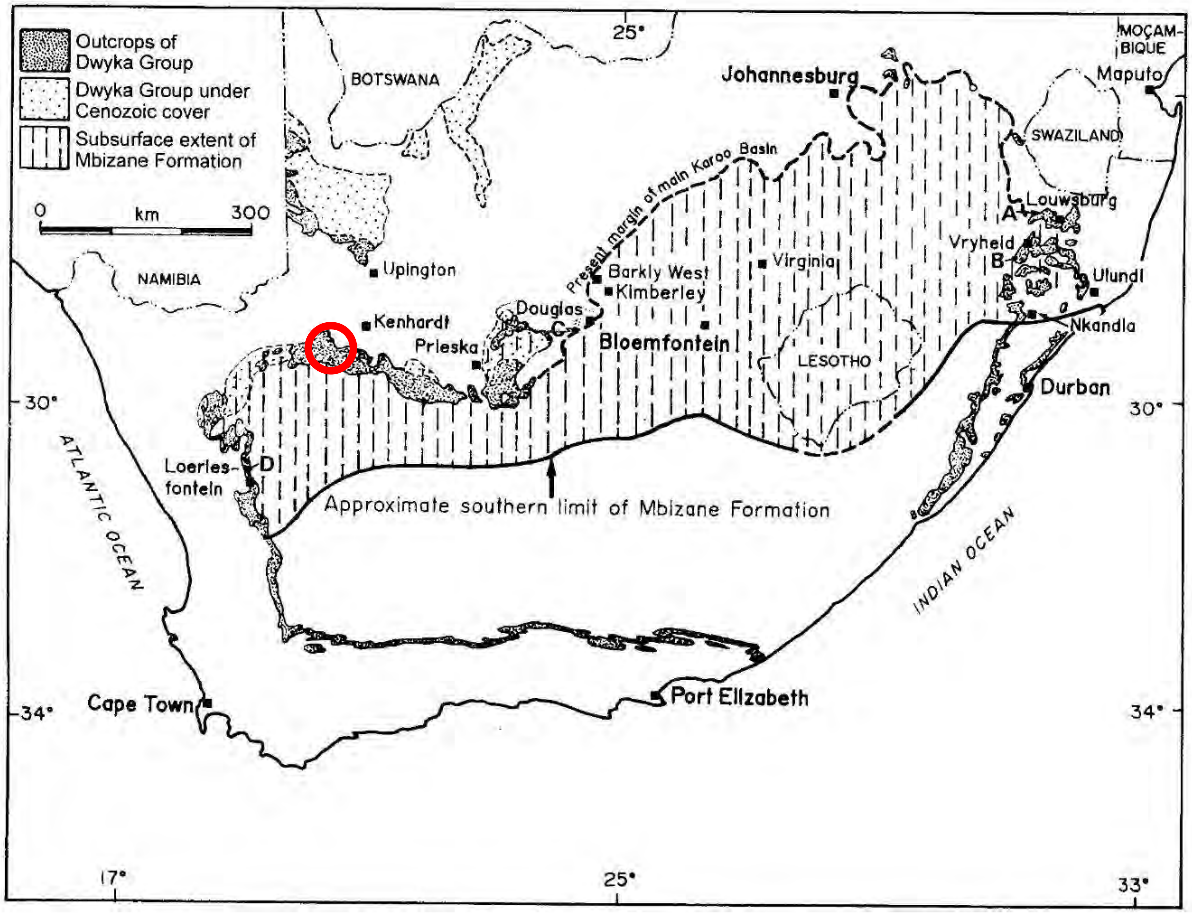

Figure 5. Outcrop map of the Dwyka Group within the Main Karoo Basin of South Africa. Exposures in the study area southwest of Kenhardt (red circle) are assigned to the outcrop area of the Mbizane Formation (From Von Brunn & Visser 1999).

3.2. Superficial deposits: Kalahari Group sands, calcretes, alluvial gravels

Unconsolidated, reddish-brown aeolian (*i.e.* wind-blown) sands of the Quaternary **Gordonia Formation** (**Kalahari Group**) (**Q** in Fig. 4) blanket large areas of the landscape in the Kenhardt area (Slabbert *et al.* 1999). The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas *et al.* (1988), Thomas & Shaw 1991, Haddon (2000) and Partridge *et al.* (2006). The Gordonia dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Later Stone Age stone tools (Dingle *et al*., 1983, p. 291). Note that the recent extension of the Pliocene - Pleistocene boundary from 1.8Ma back to 2.588 Ma would place the Gordonia Formation almost entirely within the Pleistocene Epoch.

According to Slabbert *et al.* (1999, p. 109) Gordonia wind-blown sands in the Kenhardt area, far to the south of the main Kalahari Basin, are thin, rarely preserve longitudinal dune bedforms (these are seen along the Hartbeesrivier near Kenhardt but not further west), and are probably of Holocene age. In the study area the thin superficial blanket of sandy sediments is admixed with local weathering products of the Karoo and other bedrocks. According to these geological survey authors, the sands capping the plains west of the Hartbeesrivier might not in fact be correlated with the Gordonia Formation proper, although they are at least in part derived from the Kalahari Basin.

Late Caenozoic **alluvial deposits** of the Hartbeesrivier tributaries are not described or discussed in detail by Slabbert *et al.* (1999). In addition to finer-grained silts and sands, in the study area they probably include an admixture of coarser gravels derived from weathering of the Karoo rocks (*e.g.* polymict, bouldery erratics and pebbles from diamictites and conglomerates of the Dwyka Group). De Wit (1999) discusses the post-Gondwana evolution of the drainage systems in the Bushmanland region, including pans between Kenhardt and Brandvlei that fed floodwaters from the region *via* the Sakrivier and Hartbees Rivers into the Orange from at least the Plio-Pleistocene times (Ibid., fig. 13. See also De Wit *et al.* 2000).

4. BASELINE-PALAEONTOLOGICAL HERITAGE

The fossil heritage recorded within each of the main sedimentary rock successions occurring within the study region near Kenhardt is outlined here (See also summary provided in Table 1 below).

4.1. Fossils in the Dwyka Group

The generally poor fossil record of the Dwyka Group (McLachlan & Anderson 1973, Anderson & McLachlan 1976, Visser 1989, Visser *et al*., 1990, Von Brunn & Visser 1999, Visser 2003, Almond & Pether 2008) is hardly surprising given the glacial climates that prevailed during much of the Late Carboniferous to Permian Periods in southern Africa. However, most Dwyka sediments were deposited during periods of glacial retreat associated with climatic amelioration. Sparse, low diversity fossil biotas from the Mbizane Formation in particular mainly consist of arthropod trackways associated with interglacial to post-glacial dropstone laminites and sporadic vascular plant remains (drifted wood and leaves of the *Glossopteris* Flora), while palynomorphs (organic-walled microfossils) are also likely to be present within finer-grained mudrock facies. Glacial diamictites (tillites or "boulder mudstones") are normally unfossiliferous but do occasionally contain fragmentary transported plant material as well as palynomorphs in the fine-grained matrix. There are interesting records of limestone glacial erratics from tillites along the southern margins of the Great Karoo (Elandsvlei Formation) that contain Cambrian eodiscid trilobites as well as archaeocyathid sponges. Such derived fossils provide important data for reconstructing the movement of Gondwana ice sheets (Cooper & Oosthuizen 1974, Stone & Thompson 2005).

A limited range of marine fossils are associated with the later phases of several of the four main Dwyka deglaciation cycles (DSI to DSIV). These are especially well known in the Kalahari Basin of southern Namibia but also occur sporadically within the Main Karoo Basin in South Africa (Oelofsen 1986, Visser 1989, 1997, Visser *et al*. 1997, Bangert *et al*. 1999 & 2000, Stolhoffen *et al*. 2000, Almond 2008a, b). These deglaciation sequences are estimated to have lasted five to seven million years on average (Bangert *et al*. 1999). A range of stenohaline (*i.e.* exclusively salt water) invertebrate fossils indicates that fully marine salinities prevailed at the end of each sequence, at least in the western outcrop area (Namibia, Northern Cape). These invertebrates include echinoderms (starfish, crinoids, echinoids), cephalopods (nautiloids, goniatites), articulate brachiopods, bryozoans, foraminiferans, and conulariids, among others. Primitive bony fish (palaeoniscoids), spiral "coprolites" attributable to sharks or eurypterids, as well as wood and trace fossils are also recorded from mudrock facies at the tops of DSII (Ganikobis Shale Member), DS III (Hardap Member) and DSIV (Nossob Shale Member), as well as base of the Prince Albert Formation (Ecca Group) in southern Namibia and, in the last case at least, in the Northern Cape near Douglas (McLachlan and Anderson 1973, Veevers *et al*. 1994, Grill 1997, Bangert *et al*. 1999, Pickford & Senut 2002, Evans 2005). The Ganikobis (DSII) fauna has been radiometrically dated to *c*. 300 Ma, or end-Carboniferous (Gzhelian), while the Hardap fauna (DSIII) is correlated with the *Eurydesma* transgression of earliest Permian age (Asselian) that can be widely picked up across Gondwana (Dickens 1961, 1984, Bangert *et al*. 1999, Stolhoffen *et al*. 2000). The distinctive thick-shelled bivalve *Eurydesma*, well known from the Dwyka of southern Namibia, has not yet been recorded from the main Karoo Basin, however (McLachlan and Anderson 1973). The upper part of DSIV, just above the Dwyka / Ecca boundary in the western Karoo Basin (*i.e.* situated within the basal Prince Albert Formation), has been radiometrically dated to 290-288 Ma (Stolhoffen *et al*. 2000).

Low diversity ichnoassemblages dominated by non-marine arthropod trackways are widely associated with cold water periglacial mudrocks, including dropstone laminites, within the Mbizane Formation in the Main Karoo Basin (Von Brunn & Visser, 1999, Savage 1970, 1971, Anderson 1974, 1975, 1976, 1981, Almond 2008a, 2009). They are assigned to the non-marine / lacustrine *Mermia* ichnofacies that has been extensively recorded from post-glacial epicontinental seas and large lakes of Permian age across southern Gondwana (Buatois & Mangano 1995, 2004). These Dwyka ichnoassemblages include the arthropod trackways *Maculichna*, *Umfolozia* and *Isopodichnus*, the possible crustacean resting trace *Gluckstadtella*, sinuous fish-fin traces (*Undichna*) as well as various unnamed horizontal burrows. The association of these interglacial or post-glacial ichnoassemblages with rhythmites (interpreted as varvites generated by seasonal ice melt), the absence of stenohaline marine invertebrate remains, and their low diversity suggest a restricted, fresh- or brackish water environment. Herbert and Compton (2007) also inferred a freshwater depositional environment for the Dwyka / Ecca contact beds in the SW Cape based on geochemical analyses of calcareous and phosphatic diagenetic nodules within the upper Elandsvlei and Prince Albert Formations respectively. Well-developed U-shaped burrows of the ichnogenus *Rhizocorallium* are recorded from sandstones interbedded with varved mudrocks within the upper Dwyka Group (Mbizane facies) on the Britstown sheet (Prinsloo 1989). Similar *Rhizocorallium* traces also described from the Dwyka Group of Namibia (*e.g.* the Hardap Shale Member, Miller 2008). References to occurrences of the complex helical spreiten burrow *Zoophycos* in the Dwyka of the Britstown sheet and elsewhere (*e.g.* Prinsloo 1989) are probably in error, since in Palaeozoic times this was predominantly a shallow marine to estuarine ichnogenus (Seilacher 2007).

Scattered records of fossil vascular plants within the Dwyka Group of the Main Karoo Basin record the early phase of the colonisation of SW Gondwana by members of the *Glossopteris* Flora in the Late Carboniferous (Plumstead 1969, Anderson & McLachlan 1976, Anderson & Anderson 1985 and earlier refs. therein). These records include fragmentary carbonized stems and leaves of the seed ferns *Glossopteris* / *Gamgamopteris* and several gymnospermous genera (*e.g. Noeggerathiopsis, Ginkgophyllum*) that are even found within glacial tillites. More "primitive" plant taxa include lycopods (club mosses) and true mosses such as *Dwykea*. It should be noted that the depositional setting (*e.g.* fluvial *versus* glacial) and stratigraphic position of some of these records are contested (*cf* Anderson & McLachlan 1976). Petrified woods with well-developed seasonal growth rings are recorded from the upper Dwyka Group (Mbizane Formation) of the northern Karoo Basin (*e.g.* Prinsloo 1989) as well as from the latest Carboniferous of southern Namibia. The more abundant

Namibian material (*e.g. Megaporoxylon*) has recently received systematic attention (Bangert & Bamford 2001, Bamford 2000, 2004) and is clearly gymnospermous (pycnoxylic, *i.e.* dense woods with narrow rays) but most woods cannot be assigned to any particular gymnosperm order.

Borehole cores through Dwyka mudrocks have yielded moderately diverse palynomorph assemblages (organic-walled spores, acanthomorph acritarchs) as well as plant cuticles. These mudrocks are interbedded with diamictites in the southern Karoo as well as within Dwyka valley infills along the northern margin of the Main Karoo Basin (McLachlan & Anderson 1973, Anderson 1977, Stapleton 1977, Visser 1989, Anderson & Anderson 1985). Thirty one Dwyka palynomorph species are mentioned by the last authors, for example. Anderson's (1977) Late Carboniferous to Early Permian Biozone 1 based on Dwyka palynomorph assemblages is characterized by abundant *Microbaculispora*, monosaccate pollens (*e.g. Vestigisporites*) and nontaeniate bisaccate pollens (*e.g. Pityosporites*) (Stephenson 2008). Prinsloo (1989) mentions stromatolitic limestone lenses within the uppermost Dwyka Group in the Britstown sheet area while stromatolites are also recorded within the uppermost Dwyka beds in the Kenhardt area (Slabbert *et al.* 1999). These may be comparable to interglacial microbial mats and mounds described from the Ganikobis Shale Member (DSII) of southern Namibia by Grill (1997) and Bangert *et al.* (2000). However, it should be noted that abiogenic cone-in-cone structures developed within ferruginous diagenetic carbonate nodules have also been frequently mistaken for stromatolites in the past. Some of these Karoo stromatolite records may therefore in fact refer to pseudofossils.

Although a wide range of fossils are now known from the Dwyka Group, most sediments assigned to this succession are unfossiliferous (with the possible exception of microfossils). The overall palaeontological sensitivity of the Dwyka Group is therefore rated as low (Almond & Pether 2008). Any interglacial mudrocks and heterolithic successions (*i.e.* interbedded sandstones and mudrocks) are worth investigating for fossils, however, and the more proximal Mbizane Formation may be considered to be of moderate palaeontological sensitivity.

4.2. Fossils within the superficial deposits

The fossil record of the **Kalahari Group** is generally sparse and low in diversity. The **Gordonia Formation** dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying Dwyka Group may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*) and shells of land snails (*e.g. Trigonephrus*) (Almond 2008a, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands (Du Toit 1954, Dingle *et al*., 1983). These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying **calcretes** might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways.

Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be expected occasionally expected within Kalahari Group sediments and calcretes, as well as in associated ancient alluvial gravels. A brief review of fossil biotas within Neogene alluvial deposits of the Loeriesfontein / Bushmanland region has been given by Almond (2008a; see also papers by Cooke 1949, Wells 1964, Butzer *et al.* 1973, Helgren 1977, Klein 1984, Macrae 1999). They include remains of fish, reptiles, mammals, freshwater molluscs, petrified wood and trace fossils (*e.g.* De Wit 1990, 1993, De Wit & Bamford 1993, Bamford 2000, Bamford & De Wit 1993, Senut *et al.* 1996). It is noted that the final layout of the 75 MW solar power plant is designed to minimise impacts on the drainage areas and so any fossil heritage preserved within alluvial deposits will be largely safeguarded.

5. IMPACT ASSESSMENT

Impacts of solar power plant developments on palaeontological heritage generally occur only in the construction phase. They stem from the disturbance, destruction or sealing-in of fossil material preserved at or beneath the ground surface.

The significance of the proposed AES solar power plant as far as fossil heritage is concerned is summarised in Table 2 in the HIA. The impact is considered to be NEGLIGIBLE given:

(a) the low palaeontological sensitivity of the Palaeozoic bedrocks as well as the superficial sediments (alluvium, wind-blown sands) within the development footprint;

(b) the minor excavations of potentially fossiliferous bedrocks involved (*e.g.* foundations for ancillary buildings, trenches for buried cables);

(c) Fossils preserved within alluvial sediments will be largely safeguarded by the proposed final layout that avoids drainage areas.

MITIGATION

Since the palaeontological sensitivity of the rock units within the study area is generally low, the development footprint is fairly small, and extensive bedrock excavations are not envisaged, the impact significance of the proposed solar power plant as far as fossil heritage is concerned is likely to be very small. Therefore further specialist palaeontological studies or mitigation of this project are not considered necessary.

6. CONCLUSIONS & RECOMMENDATIONS

The site of the proposed Olyven Kolk solar power plant is largely underlain by Permocarboniferous glacial-related sediments of the Dwyka Group (Mzibane Formation) that are generally of low palaeontological sensitivity. Quaternary to Recent aeolian sediments of the Gordonia Formation (Kalahari Group) as well as similar-aged alluvial gravels and calcretes, both of low palaeontological sensitivity, may also be encountered near-surface in the study area, especially along drainage lines, but these units are largely safeguarded by the proposed layout for the plant.

Should substantial fossil remains be exposed during construction, however, these should be recorded (GPS, photos) by the responsible ECO and safeguarded, if possible *in situ*. SAHRA should be notified by the ECO so that appropriate specialist mitigation can be considered.

7. ACKNOWLEDGEMENTS

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GEOLOGICAL UNIT	ROCK TYPES & AGE	FOSSIL HERITAGE	PALAEONTOLOGICAL SENSITIVITY	RECOMMENDED MITIGATION
Quaternary alluvium	sands, silts, gravels	sparse remains of fish, reptiles, mammals, freshwater molluscs, petrified wood and trace fossils	**LOW**	none recommended any substantial fossil finds to be reported by ECO to SAHRA
Gordonia Formation KALAHARI GROUP plus SURFACE CALCRETE	mainly aeolian sands plus minor fluvial gravels, freshwater pan deposits, calcretes PLEISTOCENE to RECENT	calcretised rhizoliths & termitaria, ostrich egg shells, land snail shells, rare mammalian and reptile (e.g. tortoise) bones, teeth freshwater units associated with diatoms, molluscs, stromatolites etc	**LOW**	none recommended any substantial fossil finds to be reported by ECO to SAHRA
Mbizane Formation DWYKA GROUP	tillites, interglacial mudrocks, deltaic & turbiditic sandstones, minor thin limestones LATE CARBONIFEROUS – EARLY PERMIAN	sparse petrified wood & other plant remains, palynomorphs, trace fossils (e.g. arthropod trackways, fish trails, U-burrows) possible stromatolites in limestones	**LOW TO MODERATE**	none recommended any substantial fossil finds to be reported by ECO to SAHRA

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QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company *Natura Viva* cc. He is a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHAP (Association of Professional Heritage Assessment Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that i am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which i was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. there are no circumstances that compromise the objectivity of my performing such work.

John E. Almond

Dr John E. Almond
Palaeontologist
Natura Viva cc

Annex I

Visual Specialist Report

FINAL

VISUAL IMPACT ASSESSMENT

PROPOSED OLYVEN KOLK SOLAR POWER PLANT

Revised 13 October 2011

Prepared for:
ERM Southern Africa
Silverwood House, Block A
Steenberg Office Park
Steenberg, 7945
Cape Town

Visual Resource Management Africa cc
P O Box 7233, George, 6531
Tel/Fax: 044-876 0020
Cell: 083 560 9911
E-Mail: info@vrma.co.za
Web: www.vrma.co.za

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ACRONYMS

BPEO	Best Practicable Environmental Option
BLM	Bureau of Land Management (United States Department of Internal Affairs)
DTM	Digital terrain model
EIA	Environmental impact assessment
EMP	Environmental Management Plan
GIS	Geographic information system
I&AP	Interested and Affected Party
IEMA	Institute of Environmental Management and Assessment (UK)
KOP	Key Observation Point
PLM	Proposed Landscape Modification
PRU	Physiographic Rating Unit
VAC	Visual absorption capacity
VE	Visual Envelope
VIA	Visual impact assessment
VRM	Visual resource management
WRD	Waste Rock Dump
ZVI	Zone of Visual Influence

GLOSSARY

Alternatives
A possible course of action, in place of another, that would meet the same purpose and need defined by the development proposal. Alternatives considered in the EIA process can include location and/or routing alternatives, layout alternatives, process and/or design alternatives, scheduling alternatives or input alternatives.

Best practicable environmental option
This is the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.

Cumulative Impact
The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.' [1]

Environmental impact assessment
A public process that is used to identify, predict and assess the potential positive and negative social, economic and biophysical impacts of a proposed development. EIA includes an evaluation of alternatives, appropriate management actions and monitoring programmes.

Impact (visual)
A description of the effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space

Issue (visual)
Issues are concerns related to the proposed development, generally phrased as questions, taking the form "what will the impact of some activity be on some element of the visual, aesthetic or scenic environment?"

Key Observation Points (KOP)
Receptors refer to the people located in the most critical locations or Key Observation Points (KOPs) surrounding the landscape modification who make consistent use of the views associated with the site where the landscape modifications are proposed. KOPs can either be a single point of view that an observer/evaluator uses to rate an area or panorama, or a linear view along a roadway, trail, or river corridor. [2]

Landscape integrity
The relative intactness of the existing landscape or townscape, whether natural, rural or urban, and with an absence of intrusions or discordant structures

Management actions
Actions that enhance benefits of a proposed development, or avoid, mitigate, restore or compensate for negative impacts.

Physiographic Rating Units (PRU)
PRU which are defined as areas within the proposed sites which have physical as well as graphic similarities.

Pre-application planning
The process of identifying environmental opportunities and constraints, potential fatal flaws and negative impacts, as well as alternatives and management actions in the early stage of the project design, prior to application for environmental authorization.

Receptors
Individuals, groups or communities who will be subject to the visual influence of a particular project.

Scenarios
A description of plausible future environmental states that could influence the nature, extent, duration, magnitude/intensity, probability and significance of the impact occurring

Sense of place
The unique quality or character of a place, whether natural, rural or urban.

Scenic corridor
A linear geographic area that contains scenic resources, usually, but not necessarily, defined by a route. See also *view corridor.*

Scoping
The process of determining the key issues, and the space and time boundaries to be addressed in an environmental assessment.

Viewshed
The outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed.

Zone of Visual Influence
The ZVI is defined as the 'area within which a proposed development may have an influence or effect on visual amenity.'[3]

1 EXECUTIVE SUMMARY

The proposed solar power plant is located on the remaining portion of 14 (a portion of portion 4) of Olyven Kolk Farm, No. 187 which is situated in the Siyanda District of the Northern Cape. The project has two layout alternatives to be assessed:

- Site Layout Alternative 1: (Plate 3) This option consists of 160 panels in three sections over a footprint of 160ha with a total power of 200 MW
- Site Layout Alternative 2: (Plate 4) This alternative has a total power of 190MW and is derived out of the constraints and mitigations put forward by specialists in their assessment of Alternative 1.

Planning and Guidelines Key Findings:

- Tourism is an existing important economic driver for the region
- Solar farming is seen as an important future economic driver for the region
- The Siyanda District in the Northern Cape has been identified as the top solar resource in the country which ranks with some of the best solar statistics in the world. A solar power station in this area would therefore provide steady power generation with low CO^2 emissions and water consumptions.

Site Landscape Character Key Findings:

The site is mostly flat with some slight undulation in the drainage areas. The landuse is currently agricultural sheep farming and as such existing man made modifications are limited. Located on the site are two 400 kV Eskom transmission lines which feed into the Aries Sub-station located just to the north of the site. The following broad brush landscapes were defined within the 2km Zone of Visual Influence (ZVI) of the proposed solar power project:

- Biodiversity
  - Bushmanland Basin Shrubland
  - Natural drainage lines /dry river beds
- Modified
  - Railway Line and access road
  - Aries Sub station
  - Powerlines crossing site and adjacent to site
- Agricultural Grazing land

Viewshed Key Findings:

The viewshed is described as **localised** in extent. Based on the viewshed and the findings of the site visit, the following receptors and landscape features were identified as being included in the viewshed of the proposed component landscape modifications:

- Agricultural Farmstead 1
- Gravel District Road (Eastbound)
- Gravel District Road (Westbound)
- Aries Substation
- Agricultural Farmstead 2

Exposure Key Findings:

The following communities were identified as having **High and Moderate** Exposure to the proposed landscape modifications. It is recommended that the receptors are assessed in terms of sensitivity to proposed landscape modification:

- High exposure:
  - District Farm Road receptors east and westbound
  - Aries Substation
- Moderate exposure:
  - Agricultural Dwelling receptors as indicated by GPS points 017 & 020.

The overall visual exposure of the proposed landscape modification would be **Moderate.**

Receptor Sensitivity Key Findings:

PHYSIOGRAPHIC RATING UNITS	TYPE OF USERS	AMOUNT OF USE	PUBLIC INTEREST	ADJACENT USERS	SPECIAL AREAS	TOTAL
Dry river beds/ drainage lines	L	L	H	L	H	H
Arid Nama Karoo biome	L	L	L	L	L	L

Source: Bureau of Land Management, U.S. Department of Interior. 2004.
Visual Resource Management Manual 8400
(L = Low, M = Moderate, H = High, N = No. Y = Yes)

The overall sensitivity of the receptors would be **Low** due to the limited use of the views of the project site and the strong visual associations of the Aries Substation and transmission lines.

KOP Key Findings:

The following communities were identified as significant in terms of their proximity to the proposed landscape modifications and would require assessment of the visual impacts as seen from these locations:

- Agricultural Farm buildings (GPS 020)
- District Farm Road (GPS 013 & GPS 015)
- Agricultural Farmstead (west of site) (GPS 017)

Scenic Quality Key Findings:

- The overall scenic quality was defined as **Moderate to Low** due to the uniformity of the landscape. Adjacent scenic value is Low due to the presence of the Aries substation and the powerlines which cut through the property. The scarcity value of the dry river beds / drainage lines is due to the High and Medium to High ecological ratings for these areas from the Ecology Impact assessment (Simon Todd Consulting)

VRM Sensitivity Mapping Key Findings:

- No Class I type landscapes were defined within the area.
- The Dry river beds/ drainage lines were defined as having a Class II status where the visual objective is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low and should not attract the attention of the casual observer.
- The Arid Nama Karoo biome was defined as having a Class III status where the visual objective is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate and may attract attention but should not dominate the view of the casual observer.

Cumulative Impacts

There are a number of known proposed solar energy facilities (approximately ten) planned in the Northern Cape. Three of these are located in close proximity to the proposed Olyven Kolk solar power plant, including one which will also be located on another portion of the Olyven Kolk Farm.[4] The proposed BioTherm Energy Kleinzwart Bast Photovoltaic Solar Power Plant is situated in the Kenhardt District, alongside the Aries substation. See Appendix for background details.

Should many more of these types of solar energy development take place in close proximity to each other, there is a possibility that the area will exceed the carrying capacity created by the agricultural sense of place and that the sense of place will be defined by the solar energy facilities. However, due to the limited visual resources in the area and the limited number of receptors, any potential cumulative impact would be contained to the area and would not negatively impact on the tourism.

Summary Impacts Rating

Impact	**Layout Alternative 1** Pre- mitigation	**Layout Alternative 2** Pre- mitigation	**Layout Alternative 2** Residual Impact (post mitigation)
Construction Phase			
Visual Impact	Major -ve	Minor -ve	Minor -ve
Operational Phase			
Visual Impact	Major -ve	Minor -ve	Minor -ve

Conclusion

The site is remote and located in a flat and arid environment typical of the Northern Cape. The area is not associated with any established heritage sites or scenic routes. The main landuse in the area is agricultural sheep farming. The area is not a pristine landscape and other landscape modifications define the context, specifically the Eskom Aeries Substation (which generates high levels of visual contrast), the powerlines, the telecommunication mast and the Sishen Iron Ore railway line.

The Site Layout Alternative 2 of 190 MW photovoltaic (PV) solar panels avoids areas highlighted as ecologically sensitive and as such is the preferred development alternative. The low 2.5m height of the proposed PV panels does limit the visibility to the surrounding mainly flat terrain. As such, the viewshed is located mainly in the 2km high exposure area but does also extend in some parts to the 5km Foreground / Middle ground. However, it must be noted that the viewshed does not extend outside of the existing Aries Substation located adjacent the site to the north. This existing feature dominates the landscape context, and as such it is very likely that the visual intrusion would not be perceived as significant by the receptors.

2 INTRODUCTION

Visual impact is defined as 'The effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.' [5] As identified in this definition, 'landscapes are considerably more than just the visual perception of a combination of landform, vegetation cover and buildings as they embody the history, landuse, human culture, wildlife and seasonal changes to an area.' [6] These elements combine to produce distinctive local character that will affect the way in which the landscape is valued and perceived.

VRM Africa's objective is to provide I&AP's and decision makers with sufficient information to take "early opportunities for avoidance of negative visual effects." This is based on the U.K Institute of Environmental Management and Assessment's (IEMA) and Western Cape Department of Environmental Affairs and Development Planning Guidelines (South Africa):

- "The ideal strategy for each identifiable negative effect is one of avoidance. If this is not possible, alternative strategies of reduction, remediation and compensation may be explored. If the consideration of mitigatory measures is left to the later stages of scheme design, this can result in increased mitigation costs, because early opportunities for avoidance of negative visual effects are missed." [7]
- "In order to retain the visual quality and landscape character, management actions must become an essential part of the guidelines throughout construction, and operation.... Proper management actions ensure that the lowest possible impact is created by the project...
- On-going monitoring programmes with regard to the control of aesthetic aspects for all stages of the project are a vital component ensuring that the long term visual management objectives will be met."[8]

2.1 TERMS OF REFERENCE

VRM Africa was appointed by Environmental Resources Management (Southern Africa) Pty Ltd (ERM) to undertake a Landscape and Visual Impact Assessment (VIA) for the proposed Olyven Kolk Solar Power Plant. The proposed Olyven Kolk Solar Power Project lies on Portion 14 (a portion of portion 4) of Olyven Kolk Farm, No. 187 which is situated 126 km south west of Upington in the Kai !Garib Municipal Area under the Siyanda District Municipality, Northern Cape. The nearest town is Kenhardt, which lies 44 km north east along the R27. (See Regional Locality Map in Plate 1)

The intention of this report is to:

- identify the visual resources of the area which define the landscape character;
- identify the main potential receptors or Key Observation Points (KOP);
- identify potential visual impacts;
- identify potential mitigations.

Other solar energy projects that VRM Africa has been involved in are:

- Kathu CSP
- Sasol CSP
- Beaufort West PV (in progress)

2.2 VRM AFRICA DECLARATION OF INDEPENDENCE

ERM appointed *VRM AFRICA CC* as an independent professional visual impact practitioner to facilitate the Visual Impact Assessment (VIA). Stephen Stead is the director and owner of VRM Africa, a GIS and visual impact assessment consultancy. He studied Psychology and Geography at Pietermaritzburg University in KwaZulu – Natal and then undertook an Honours degree in Human Geography. He has 12 years experience in the field of GIS mapping and 3D modelling through his work as a GIS consultant and visual impact practitioner. His experience in visual impact assessment was obtained by working in association with ILASA and SACLAP registered landscape architect Liesel Stokes (B.L. Pr L.Arch (ML) (Pret)). Together they have assessed over 100 major landscape modifications throughout Southern Africa. The contract services of Liesel Stokes were utilised in this project for review and design related work. VRM Africa has been operating for eight years and has successfully established and retained a large client base throughout Southern Africa.

I, Stephen Stead, author of the Visual Impact specialist report, hereby declare that I am an independent consultant appointed by ERM to provide specialist input on the proposed Olyven Kolk Solar Power Plant. I hereby confirm that I have no business, financial, personal or other interest in the activity, application or appeal in respect of which I have been appointed other than fair remuneration for work performed in connection with the activity and application. All opinions expressed in this specialist report are my own.

____

Stephen Stead
B.A (Hons) Human Geography
University of KwaZulu-Natal, Pietermaritzburg

VRM Africa is indemnified from any damages that may result from publication. Any comments on the draft copy of the VIA need to be put in writing. This report or electronic copies thereof must not be altered or added to without the prior consent of the author. Any recommendations, statements or conclusions drawn from or based upon this report must make reference to it. Within the main report, this report must be included in its entirety as an appendix or separate section.

2.3 LIMITATIONS AND ASSUMPTIONS

- This report is limited to the assessment of the visual impact of the proposed Olyven Kolk Solar Power Plant.
- The information for the terrain on which the visibility analysis is based was generated from the Chief Directorate: Surveys and Mapping 1:50 000 aerial photograph map series using the 20m contours.
- The viewshed mapping is approximate and may not represent an exact visibility incidence.
- A limitation in terms of understanding the cumulative impacts of the project is that there are other proposed solar power projects located around the Olyven Kolk site which this study could not address. It is recommended that the suitability of solar power projects needs to be addressed at a strategic level which would allow for a better understanding of the visual impacts taking all the solar power projects proposed for the area into consideration. (See Annexure 2)
- A Visual Impact Assessment is subjective as it is well documented that 'determining a visual resource in absolute terms is not achievable' (Lange 1994). [9]
- A visualisation exercise was undertaken but with moderate accuracy due to the 2.5 kilometre distance from the site to the proposed landscape modifications and the limited base modelling of the site. As such the images are for illustrative purposes only. Images of the 3D model are provided in the document I order to allow the relevant authority more of an understanding into the nature of the landscape modification.

2.4 SUMMARY OF METHODOLOGY

The impact assessment methodology that VRM Africa uses is based on the Visual Resource Management system[10] which is a systematic process developed by the Bureau of Land Management (BLM) from the United States Department of Internal Affairs to evaluate potential visual impacts associated with landscape modifications. The method is based on the premise that the degree to which a management activity affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape. [11] The objective of this methodology is to:

- Provide a way of identifying and evaluating scenic values to determine the appropriate levels of management.

- Provide a way to analyse potential visual impacts and apply visual design techniques to ensure that surface-disturbing activities are in harmony with their surroundings.
- Using multi criteria mapped based methods increases objectivity in decision making.[12]

A: FIELD STUDY

- Relevant Planning
- Site information
- Project description and mapping
- Visual envelope/viewsheds verification
- Exposure verification
- Landscape Character
- Receptor Identification

B: INVENTORY STAGE (Baseline): The inventory stage during which field study and site sampling is undertaken**,** involves the identification of the visual resources of the area where the proposed landscape modification will influence landscape character.

- Identify Areas visual resources:
    - Landscape units
    - Scenic qualities
    - Receptor Sensitivities
    - Distance zone analysis
    - Class I, II, III and IV categorisation and objectives
    - Identify Key Observation Points
    - VRM Sensitivity mapping
    - Preliminary recommendations and mitigations (if any)

C: CONTRAST RATING STAGE (Impacts): The contrast rating or impacts assessment phase is undertaken after the inventory process has been completed. The suitability of the landscape modification is assessed by measuring the degree of contrast of the proposed landscape modification to the existing contrast created by the existing landscape. As a component in this contrast rating process, visual representation such as photo montages are vital in large scale modifications, as this serves to inform I&APs and decision making authorities of the nature and extent of the impact associated with the proposed project/development.

- Visualisation (Photo montages from KOPs if any)
- Suitability assessed by contrast rating from KOPs
- Mitigations if objectives not met.
- Impacts
- Final recommendations
- Final mitigations

For further details please refer to Annexure 1: Methodology

3

4 PROPOSED PROJECT COMPONENTS

Photovoltaic power generation employs solar panels composed of a number of cells containing a photovoltaic material. The panels are separate entities optimally angled toward the sun. The proposed project will be completed in a number of phases and will be made up of 200 Photovoltaic (PV) solar panels.

The proposed Solar Power Project is situated in the Northern Cape Province as seen in the Regional Locality Map in Plate 1. The site is located approximately 44km south-west from the town of Kenhardt which is approximately 127 km south of Upington. Stellenbosch University's Centre for Renewable and Sustainable Energy Studies data studies found that the Northern Cape has been identified as an area with exceptionally high solar irradiance.' [13] The South African government has developed a policy framework on Renewable Energy and set a target of sourcing 10,000 GWh from renewable energy projects by 2013, approximately 4 percent of South Africa's total estimated energy demand by 2013.[14]

The proposed solar power plant is located on the remaining portion of 14 (a portion of portion 4) of Olyven Kolk Farm, No. 187 which is situated in the Siyanda District of the Northern Cape. The site is accessible from the R27 along the Sishen -Saldanha railway line service road. The proposed site is approximately 400 m from the Eskom 400 kV Aries Substation.

The area of the proposed site is approximately 1,010.47 ha (10.10 km^2). The proposed photovoltaic (PV) panels will be 1.2 m in length and 0.6 m in width. These will be connected in strings and arrays to form units with a total power of 1MW each (around12,500 panels/MW). The panels will be mounted on fixed structures, approximately 2.5 m in height from the ground. The distance or spacing between rows will be around 3 m. The panels will face north in order to capture maximum sunlight.[15]

The project has two layout alternatives to be assessed:

Site Layout Alternative 1: (Plate 3)

- This option consisted of 160 panels in three sections over a footprint of 160ha with a total power of 200 MW as seen in the layout plan on Plate 3.
- Site Layout Alternative 1 consists of two stages. However the first stage of 10MW is not included in the assessed in this document.
- Input on environmental sensitivity of Alternative 1 was received from specialists following a mitigation workshop undertaken in July 2011 which informed the layout of Alternative 2.

Site Layout Alternative 2: (Plate 4)
This alternative has a total power of 190MW and is derived out of the constraints and mitigations put forward by specialists in their assessment of Alternative 1. The areas of each section can be seen in the diagram and table on the following page. A layout plan overlaid onto a Google Earth Locality Map can be seen in Plate 4. Solar arrays will cover 35.4% of the site.

Sections	Area in ha
0	11.83
1	25.38
2	23.65
3	113.01
4	32.17
5	28.76
6	36.27
7	86.67
	357.73

The break down of stages would be:

- Site Preparation and Construction
  - Site Preparation - Vegetation clearance, levelling, fence, construction camp, access roads and tracks
  - Construction - PV panels, inverter and transformer foundations, cables, electrical and control room, office, storage etc
- Operation (25 years): Cleaning, replacement of faulty components
- Decommissioning: Refurbished or replaced

List of visually relevant project components

- PV panels
- Power lines
- one or more permanent meteorological stations
- a small site office and storage facility, including security and ablution facilities
- temporary construction camp (60-80 people); permanent accommodation (for 4-5 people)
- temporary storage of materials during the construction activities and site fencing car park

5 RELEVANT PLANNING POLICY

In order to comply with the VRM requirements it is necessary to clarify which planning policies govern the property area to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area. The proposed landscape modifications must be viewed in the context of the planning policies from the following:

- National Environmental Management Act (No. 107 of 1998) as amended by Act 56 of 2002 and Act 8 of 2004
- Northern Cape Department of Environment and Nature Conservation. Strategic Plan 2010/11-2014/15
- Siyanda District Municipality Integrated Development Plan (IDP) 2007/8 – 2011/12
- Kai !Gariep Municipality IDP 2009
- Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1. Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning, Cape Town. (Oberholzer, B. 2005) [16]

5.1 NORTHERN CAPE DEPT OF ENVIRONMENT & NATURE STRATEGIC PLAN 2010-15

Strategic Objective: Biodiversity Enforcement and Compliance Monitoring. Ensure sustainable use of resources for the protection of the environment and biodiversity through compliance monitoring and enforcement activities. … Stopping environmental harm before it occurs is less expensive, in terms of damage to human health and total economic costs to the community than cleaning up after the act. (Pg 33/34)[17]

5.2 SIYANDA DISTRICT MUNICIPALITY

Developmental goals and objectives:

- Siyanda District Municipality must deliver a positive contribution to the sustainable growth and development within its boundaries and the rest of the Northern Cape.
- The creation of a environmentally friendly environment within and outside of the Councils district boundaries
- The promotion of a safe and tourism friendly environment should be furthered in order to promote tourism and investor interest in the region. *(Page 35)*

5.3 KAI !GARIEP MUNICIPALITY IDP 2009

Potential internal economic drivers include:

- The development of niche tourism markets that capture full value out of the special attributes of the area.
- The exploitation of the climate of the area for energy generation (sunshine), i.e. solar farming in the adjacent Mier and //Khara Hais Municipalities *(Page 12)*

5.4 DEA&DP GUIDELINE FOR INVOLVING VISUAL AND AESTHETIC SPECIALISTS

The Western Cape DEA&DP Guideline for involving visual and aesthetic specialists in EIA processes is used in the absence of a specific Northern Cape Visual Guideline. The BPEO (Best Practicable Environmental Option) should address the following:

- Ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area. The BPEO must also ensure that development must be located to prevent structures from being a visual intrusion (i.e. to retain open views and vistas).
- ‘Long term protection of important scenic resources and heritage sites;
- Minimisation of visual intrusion in scenic areas;
- Retention of wilderness or special areas intact as far as possible;
- Responsiveness to the area's uniqueness, or sense of place.’[18]

Planning and Guidelines Key Findings:

- Tourism is an existing important economic driver for the region
- Solar farming is seen as an important future economic driver for the region
- The Siyanda District in the Northern Cape has been identified as the top solar resource in the country which ranks with some of the best solar statistics in the world. A solar power station in this area would therefore provide steady power generation with low CO^2 emissions and water consumptions.

6 LANDSCAPE CHARACTER

Landscape character is defined by the U.K Institute of Environmental Management and Assessment (IEMA) as the 'distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, landuse and human settlement.' It creates the specific sense of place or essential character and 'spirit of the place'. [19] The aim of this section is to identify the key elements that define the greater landscape character within the proposed area.

The vegetation is characteristic of a typical Nama Karoo biome where 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.[20] The general landuse of the area is for agricultural purposes and Kenhardt is considered the heart of the Dorper sheep-farming area.[21]. Hills to the south of Kenhardt contain the Quiver Tree Forest National Monument which is made up of 4000 – 5000 Quiver Trees.

The topography is characteristically flat to slightly undulating plains. Sporadic hills to the south of Kenhardt create some topographical relief. There is a large flat salt pan (Verneukpan) to the south and granite metamorphic outcrops in the area. 'The Bushmanland Basin, which the site falls into, forms an environment for a number of ephemeral pans and extensive systems of intermittent river channels. Approximately 4 kilometres to the south of the Olyven Kolk site there are a number of large ephemeral waterbodies (pans) which may hold water at certain times of the year, during and immediately after the rains.'[22] A photograph of the different landscapes in the area can be seen in Plate 7 to Plate 11.

The following broad brush landscapes were defined within the greater Kenhardt district:

- Non perennial rivers and drainage lines
- Disturbed context. E.g. Eskom Aries Substation
- Railway line and access road
- Arid agricultural grazing landscape

6.1 SITE

The site is currently used for agricultural grazing and is crossed by intermittent tracks and fences. It covers an area of 1033 hectares and is currently zoned as Agricultural. To the north of the property is a gravel district farm road connecting the R27 with the R358 to Pofadder. There are some isolated farmsteads on this road as well as the Eskom Aries Substation. The different components of modified landscape found in the vicinity of the site are: a gravel airstrip, a railway line and service road, an Eskom substation including its associated power lines and a lattice communication tower. The site sense of place can be seen in the photographs on the following page.

As can be seen in the Slopes Analysis Map on Plate 12 the landscape of the site and surrounds is relatively flat with shallow drainage lines running in a south to north direction. The area to the east of the Sishen- Saldanha railway is more undulating. The slope across the site is shallow with topographical elevations across the site ranging from approximately 960 to 930m amsl.

An ecological survey was undertaken by Simon Todd Consulting (August 2010) and an Ecological Sensitivity Map was generated (See Plate 13) The map shows the high ecologically sensitive areas along the drainage lines as they are often considered as important habitats for a range of species, with moderate sensitivity areas buffering the drainage areas.

The site visit (31 May 2011) showed sporadic existing landscape modifications in the area which reflects previous and existing agricultural activities, including farm labourers cottages, disused dwellings, farm tracks, as well as railway lines, existing overhead power lines, sub-station and lattice mast.

The photographs below depict the compass point views taken on the site.


Panoramic view south to south east showing existing vertical nature of the power line modifications to the landscape *(GPS 024, Plate 25:GPS Point Map)*


Panoramic view west depicting the flat landscape with existing high voltage power lines in the background *(GPS 024, Plate 25)*


Panoramic view north to north east depicting the different grasses and woody vegetation found more in the drainage lines. *(GPS 024, Plate 25)*


Panoramic view south east to south west of the railway line and power lines in the background. *(GPS 027, Plate 25)*

Site Landscape Character Key Findings:

The site is mostly flat with some slight undulation in the drainage areas. The landuse is currently agricultural and as such the man made modifications are limited. Located on the site are two Eskom transmission lines which feed into the Aries Sub-station located just to the north of the site. The following broad brush landscapes were defined within the 2km Zone of Visual Influence (ZVI) of the proposed solar power project:

- Biodiversity
  - Bushmanland Basin Shrubland
  - Natural drainage lines /dry river beds
- Modified
  - Railway Line and access road
  - Aries Sub station
  - Powerlines crossing site and adjacent to site
- Agricultural Grazing land

7 VIEWSHEDS

A viewshed is 'the outer boundary defining a view catchment area, usually along crests and ridgelines'.[23] This reflects the area or extent where the landscape modification would probably be seen. However, visibility tends to diminish exponentially with distance which is well recognised in visual analysis literature. [24] Therefore the views of a landscape modification would not necessarily influence the landscape character within all areas of the viewshed. However, it is important to assess the extent to which the proposed landscape modifications are visible in the surrounding landscape as a point of departure for defining the shared landscape context and to identify the receptors making use of the common views.

A viewshed analysis was undertaken for both of the Alternatives taking 3 metres as the proposed height of the PV structure. As depicted on Plate 14 and Plate 15, the viewshed for both alternatives is mostly the same. The viewshed is fairly widely dispersed within the two km high visibility buffer area excepting for the southern extent where views will be contained by slightly elevated terrain. Within the 5 km foreground / Middle Ground zone the viewshed is broadly linear in spatial distribution aligning to a NE to SW direction. In both instances the Viewshed could be rated Medium in extent.

Viewshed Key Findings:
The viewshed is described as localised in extent. Based on the viewshed and the findings of the site visit, the following receptors and landscape features were identified as being included in the viewshed of the proposed component landscape modifications:

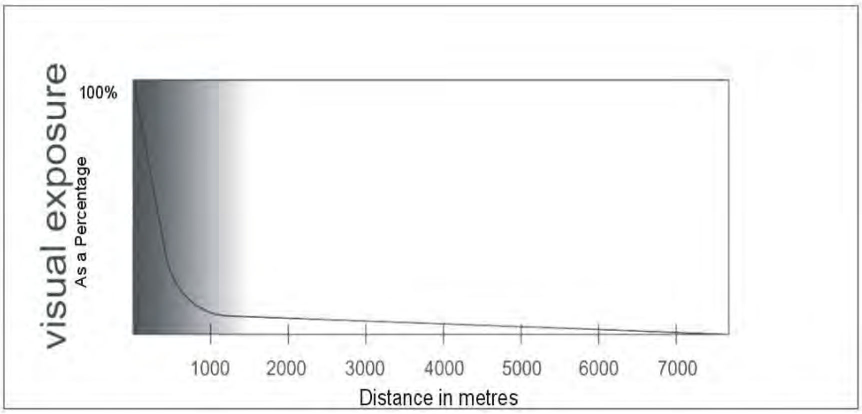
- Agricultural Farmstead 1
- Gravel District Road (Eastbound)
- Gravel District Road (Westbound)
- Aries Substation
- Agricultural Farmstead 2

8 VISUAL EXPOSURE

As defined by the DEA&DP Visual and Aesthetic Guidelines exposure is based on distance from the project to selected viewpoints. Exposure or visual impact tends to diminish exponentially with distance.[25]

The area where a landscape modification starts to influence the landscape character is termed the Zone of Visual Influence (ZVI) and is defined by the U.K Institute of Environmental Management and Assessment (IEMA), *'Guidelines for Landscape and Visual Impact Assessment'* as the 'area within which a proposed development may have an influence or effect on visual amenity (of the surrounding areas).'

The inverse relationship of distance and visual impact is well recognised in visual analysis literature.[26] According to Hull and Bishop, exposure or visual impact tends to diminish exponentially with distance. The areas where most landscape modifications would be visible are located within 2km from the site of the landscape modification. Thus the potential visual impact of an object diminishes at an exponential rate as the distance between the observer and the object increases, due to atmospheric conditions prevalent at the location which causes the air to appear greyer, diminishing detail. For example, at 1000 metres from the property would be 25% of the impact as viewed from 500 metres from the property. At 2000 metres it would be 10% of the impact at 500 metres. The relationship is indicated in the following graph generated by Hull and Bishop.



The VRM methodology also takes distance from the landscape modification into consideration in terms of understanding visual resource. Three distance categories are defined by the Bureau of Land Management (United States Department of Interior):[27] The distance zones are:

- Foreground / Middle ground, up to approximately 6km, which is where there is potential for the sense of place to change.
- Background areas, from 6km to 24km, where there is some potential for change in the sense of place but would only take place with very large landscape modifications.
- Seldom seen areas which fall within the Foreground / Middle ground area but as a result of no receptors they are not viewed or seldom viewed.

In order to determine the level of exposure to receptors, the following criteria were utilised and the receptor located within each distance zone were identified:

RECEPTOR COMMUNITIES	SOLAR PANELS		POWER LINES	
	APPROX DIST (km)	RATING	APPROX DIST (km)	RATING
Agricultural Farm buildings	3.5 km	M	5.5 km	M
Gravel District Road (Eastbound)	1.8 km	H	1 km	H
Gravel District Road (Westbound)	1.7 km	H	1 km	H
Agricultural Farmstead to the west of the site	4.3 km	M	4.3 km	M
Aries Substation	0.1 km	H	0.1 km	H

Visual Exposure Rating Criteria[28]

- High: Dominant or clearly noticeable (<2km)
- Moderate: Recognisable to the viewer (2 – 6km)
- Low: Minimally visible areas in the landscape (>6km)

Exposure Key Findings:

The following communities were identified as having **High and Moderate** Exposure to the proposed landscape modifications. It is recommended that the receptors are assessed in terms of their sensitivity to the proposed landscape modification:

- High exposure:
  - District Farm Road receptors east and westbound
  - Aries Substation

- Moderate exposure:
  - Agricultural Dwelling receptors as indicated by GPS points 017 & 020 (Plate 25)

The overall visual exposure of the proposed landscape modification would be **Moderate.**

9 PHYSIOGRAPHIC RATING UNITS

During the study, the following criteria were used to undertake a broad brush landscape characterisation exercise to identify the dominant landscapes as well as to define the physiographic units within the area. These are land parcels within the property which have physical as well as graphic similarities.' [29] The assessment criteria are:

- Similar visual patterns, texture, colour, variety (vegetation)
- Like geographic character
- Similar impacts from man-made modifications (landuse)
- Areas of high prominence.
- Topography

In order to understand the landscape character, the major landscapes physiographic rating units (PRU) affecting the visual context within the zone of visual influence (ZVI) were identified.

PHYSIOGRAPHIC RATING UNIT	LANDSCAPE CHARACTER	SUMMARY DESCRIPTION
Dry river beds/ drainage lines	HIGH	The landscape of the site and surrounds is relatively flat with shallow drainage lines running in a south to north direction. Drainage lines feature taller, woody vegetation.[30]
Arid Nama Karoo biome	MEDIUM	The Nama-Karoo Biome (Mucina & Rutherford, 2006) is not particularly rich in plant diversity with only one natural vegetation type, Bushman Basin Shrubland. This habitat features slightly irregular plains with dwarf shrubland dominated by a mixture of low sturdy and spiny (and sometime succulent) shrubs [31]

Each PRU was evaluated and rated in terms of the VRM scenic quality rating criteria, the sensitivity of the property and the distance between the property and receptor areas in the VRM class rating table on page 25. It must be noted that these classes should rather be used as a guide to ensure that every attempt is made to minimise potential visual impacts.

10 RECEPTOR SENSITIVITY

Sensitivity levels are a measure of public concern for scenic quality. Public lands are assigned high, medium, or low sensitivity levels by analysing the various indicators of public concern. The following criteria were used to assess each the sensitivity of each of the communities:

- **Public Interest.** The visual quality of an area may be of concern to local, State, or National groups. Indicators of this concern are usually expressed in public meetings, letters, newspaper or magazine articles, newsletters, land-use plans, etc. Public controversy created in response to proposed activities that would change the landscape character should also be considered
- **Special Areas.** Management objectives for special areas such as Natural Areas, Wilderness Areas or Wilderness Study Areas, Wild and Scenic Rivers, Scenic Areas, Scenic Roads or Trails, and Areas of Critical Environmental Concern (ACEC), frequently require special consideration for the protection of the visual values. This does not necessarily mean that these areas are scenic, but rather that one of the management objectives may be to preserve the natural landscape setting. The management objectives for these areas may be used as a basis for assigning sensitivity levels.
- **Adjacent Land Uses.** The interrelationship with land uses in adjacent lands can effect the visual sensitivity of an area. For example, an area within the viewshed of a residential area may be very sensitive, whereas an area surrounded by commercially developed lands may not be visually sensitive
- **Type of User.** Visual sensitivity will vary with the type of users. Recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change
- **Amount of Use.** Areas seen and used by large numbers of people are potentially more sensitive. Protection of visual values usually becomes more important as the number of viewers increase.[32]

Based on the viewshed and the findings of the site visit, the following receptor communities were identified as being included in the viewshed of the proposed component landscape modifications.

- Agricultural Farmstead (east of site)
- District Farm Road
- Agricultural Farmstead (west of site)

<u>Receptor Community 1: Agricultural Farm buildings (GPS 020)</u>

As seen in Plate 17 (GPS 020) the view from the receptor is taken from the entrance to the receptor dwelling in a SSE direction. Aries Substation is visible in the distance on the right and the full extent of the site is shown. The site is 3.5 km away.

Receptor Community 2: District Farm Road (Westbound) (GPS 013)

As seen in Plate 18 the photograph shows the view south to south east towards the site from the gravel road travelling west (Aries Substation to the right). The site is 1.8 km away.

Receptor Community 3: District Farm Road (Eastbound) (GPS 015)

Plate 19 shows the panoramic view south-east towards site as seen from the gravel road receptors travelling east. Aries substation indicated on the left. The site is 1.7 km away.

Receptor Community 4: Agricultural Farmstead (west of site) (GPS 017)

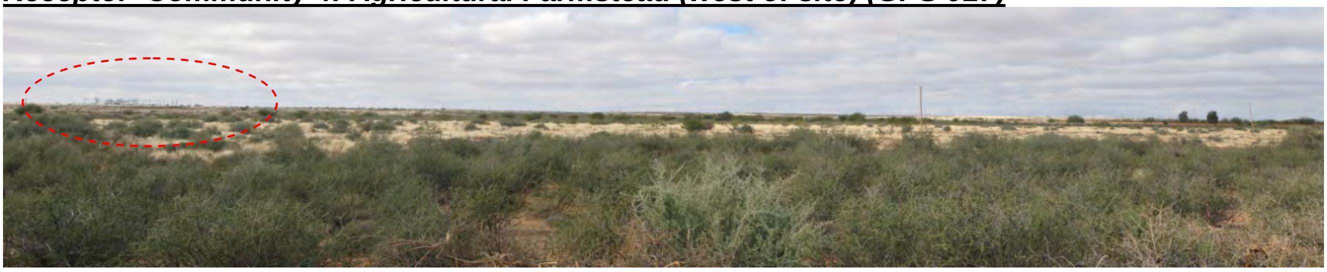


Plate 20 shows the panoramic view north east to east towards site from the Farmstead west of the site. Aries substation indicated on the left. The site is 4.3 km away.

Receptor Sensitivity Key Findings:

PHYSIOGRAPHIC RATING UNITS	TYPE OF USERS	AMOUNT OF USE	PUBLIC INTEREST	ADJACENT USERS	SPECIAL AREAS	TOTAL
Dry river beds/ drainage lines	L	L	H	L	H	H
Arid Nama Karoo biome	L	L	L	L	L	L

Source: Bureau of Land Management, U.S. Department of Interior. 2004. Visual Resource Management Manual 8400

(L = Low, M = Moderate, H = High, N = No. Y = Yes)

The overall sensitivity of the receptors would be **Low** due to the limited use of the views of the project site and the strong existing visual associations of the Aries Substation and transmission lines.

10.1 KEY OBSERVATION POINTS

Key Observation Points are defined by the BLM Visual Resource Management as the people located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology as it requires that the degree of contrast that the proposed landscape modifications will make to the existing landscape is measured from these most critical locations within the zone of visual influence. [33] (See Plate 25)

KOP Key Findings:

The following communities were identified as significant in terms of their proximity to the proposed landscape modifications and would require assessment of the visual impacts as seen from these locations:

- Agricultural Farm buildings (GPS 020)
- District Farm Road (GPS 013 & GPS 015)
- Agricultural Farmstead (west of site) (GPS 017)

11 SCENIC QUALITY

In the VRM methodology, the scenic quality is a measure of the visual appeal of a tract of land. In the visual resource inventory process, public lands are given a rating based on the apparent scenic quality which is determined using seven key factors. During the rating process, each of these factors are ranked on a comparative basis with similar features in the region. [34] These 7 elements are:

- **Landform:** Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured.
- **Vegetation:** Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular. Consider also smaller scale vegetation features which add striking and intriguing detail elements to the lands.
- **Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.
- **Colour:** Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.
- **Scarcity:** This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique or rare within one physiographic region.
- **Adjacent Landuse:** Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range, depending upon the characteristics of the topography, the vegetative cover, and other such factors.
- **Cultural Modifications:** Cultural modifications in the landform/water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit. Rate accordingly

These landscapes are then rated from 1 – 5 with the higher values being the most valued. Three categories of scenic quality are provided based on the apparent scenic quality.

VRM SCENIC QUALITY RATING CRITERA	
A - High	19 or more
B - Medium	12 - 18
C - Low	11 or less

LANDSCAPE AREAS (PRU)	LANDFORM	VEGETATION	WATER	COLOUR	ADJACENT SCENERY	SCARCITY	CULTURAL MODIFICATION	TOTAL	SCENIC QUALITY RATING
Dry river beds/ drainage lines	1	4	3	3	2	4	0	17	B
Arid Nama Karoo biome	1	1	0	2	3	1	0	9	C

Table 1: Table of Landscape types

(A= score of ≥19; B = score of 12 – 18, C= score of ≤11)

<u>Scenic Quality Key Findings:</u>

The overall scenic quality was defined as **Moderate to Low** due to the uniformity of the landscape. Adjacent scenic value is Low due to the presence of the Aries substation and the powerlines which cut through the property. The scarcity value of the dry river beds / drainage lines is due to the High and Medium to High ecological ratings for these areas from the Ecology Impact assessment (Simon Todd Consulting)

12 VRM ASSESSMENT

The degree of contrast the proposed landscape modifications will make to the existing landscape is measured from locations surrounding the property. The selection criterion for these receptors is their location within the defined viewshed where they have a clear view of the property (Key Observations Points (KOP)). View corridors within the viewshed are also taken into account. View corridors are linear geographic areas that contain scenic resources, usually, but not necessarily, defined by a route. Five steps are involved in the visual resource management (VRM) classification process. These are:

1. Outlining and numerical evaluation of scenic quality;
2. Outlining of visual sensitivity levels;
3. Delineating distance zones;
4. Overlaying the scenic quality, sensitivity levels and distance zones using a matrix to develop visual resource inventory classes;
5. Adjusting the inventory to meet the landscape goals and designating VRM management classes with objectives for each class through the planning process.[35]

Class I is assigned to those areas where a ***management or specialist decision*** has been made to maintain a natural landscape. The **Class I** objective is to preserve the existing character of the landscape where the level of change to the characteristic landscape should be very low and must not attract attention. It must be noted that these classes are ***informative in nature*** and would have to be modified to take into consideration a management decision. For this study area, no Class I type landscapes were defined a within the area.

Classes II, III & IV are assigned to the physiographic regions by cross referencing scenic quality, distance zones and sensitivity combined values, making use of the table below developed by the Bureau of Land Affairs, USA.

- The **Class II** objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low but should not attract the attention of the casual observer.
- The **Class III** objective is to partially retain the existing character of the landscape where the level of change to the characteristic landscape should be moderate and may attract attention but should not dominate the view of the casual observer.
- The **Class IV** objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high.

Bureau of Land Affairs, USA developed the VRM Matrix table below in order to cross reference scenic quality, distance zones and sensitivity values that are defined using criteria and scenic quality and sensitivity questionnaires.

			VISUAL SENSITIVITY LEVELS								
			HIGH			MEDIUM			LOW		
19 or more	SCENIC QUALITY	A	II	II	II	II	II	II	II	II	II
12 - 18		B	II	III	III/ IV *	III	IV	IV	IV	IV	IV
11 or less		C	III	IV	IV	IV	IV	IV	IV	IV	IV
	DISTANCE ZONES		fore/middle ground	background	seldom seen	fore/middle ground	background	seldom seen	fore/middle ground	background	seldom seen

* If adjacent areas are **Class III** or lower assign **Class III**, if higher assign **Class IV**

PHYSIOGRAPHIC RATING UNIT	SCENIC	RECEPTOR SENSITIVITY	DISTANCE	VRM CLASS
Dry river beds/ drainage lines	B	H	FG	II
Arid Nama Karoo biome	C	L	FG	III

(A= score of ≥19; B = score of 12 – 18, C= score of ≤11,
L = Low, M = Moderate, H=High, FG = Foreground)

VRM Sensitivity Mapping Key Findings:

- No Class I type landscapes were defined within the area. See Plate 21.
- The Dry river beds/ drainage lines were defined as having a Class II status where the visual objective is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low and should not attract the attention of the casual observer.
- The Arid Nama Karoo biome was defined as having a Class III status where the visual objective is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate and may attract attention but should not dominate the view of the casual observer.

12.1 VISUAL REPRESENTATION

As a component in this contrast rating process, visual representation using 3D Google Earth modelling for context was used. Some kind of visual representation is vital in large scale modifications as this serves to inform I&APs and decision making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003).[36] (See Annexure for further details)

This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes; providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information
- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity
- Interest

The Photo Montages using 3D modelling can be seen in the attached Colour Plates in Plate 23 and Plate 24 .**These are an approximation and for illustrative purposes only.**

13 VRM CONTRAST RATING

The contrast rating or impacts assessment phase is undertaken after the inventory process has been completed. The suitability of landscape modification is assessed by measuring the degree of contrast of the proposed landscape modification with the existing landscape. This is done by evaluating the level of change to the existing landscape in terms of the line, colour, texture and form in relation the visual objectives defined for the area. The following criteria are utilised in defining the degree of contrast:

The following steps will be carried out in the Contrast Rating Process.

1. Obtain a detailed project description.
2. Define the site landscape character
3. Identify the Viewshed for the proposed landscape modification and significant receptors that fall within this area.
4. Define the VRM Classes for the site and identify VRM Class Objectives. This would involve the measuring of the Degree of Contrast that the proposed landscape modifications would create to the existing landscape and would include a motivation. (See Methodology in Annexure 1 for further details)
5. Identify whether or not the VRM Objectives were met.
6. Describe the Impacts and the Nature of the impacts.
7. Make recommendations and mitigations.

VRM Contrast Rating Criteria for assessment of visual intrusion:

- **None -** The element contrast is not visible or perceived.
- **Weak -** The element contrast can be seen but does not attract attention.
- **Moderate -** The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong -** The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

13.1 SUMMARY TABLE OF VRM CONTRAST RATING FOR ALT 1

IMPACT SUMMARY SHEET		VRM				VRM OBJECTIVES MET		
KOP	PRU AREA	SCENIC QUALITY	SENSITIVITY	VRM CLASS OBJECTIVE	DEGREE OF CONTRAST	YES	NO	WITH MITIGATION
1	Dry river beds/ drainage lines	**B**	H	II	M		✓	
	Arid Nama Karoo biome	**C**	L	III	W	✓		
2	Dry river beds/ drainage lines	**B**	H	II	M		✓	
	Arid Nama Karoo biome	**C**	L	III	W	✓		
3	Dry river beds/ drainage lines	**B**	H	II	M		✓	
	Arid Nama Karoo biome	**C**	L	III	W	✓		

There are limited views of the site, however from an aesthetic perspective there is merit in design which takes the landscape into consideration. The landscape character of the site is defined by the topography with the washes and dry river beds being important ecological areas. As such it is recommended that development within these would **not meet the Class II visual objectives** to retain the existing character of the landscape. The level of change to the characteristic landscape would not be low.

13.2 SUMMARY TABLE OF VRM CONTRAST RATING FOR ALT 2

IMPACT SUMMARY SHEET		VRM				VRM OBJECTIVES MET		
KOP	**PRU AREA**	**SCENIC QUALITY**	**SENSITIVITY**	**VRM CLASS OBJECTIVE**	**DEGREE OF CONTRAST**	**YES**	**NO**	**WITH MITIGATION**
1	Dry river beds/ drainage lines	**B**	H	II	M			✓
	Arid Nama Karoo biome	**C**	L	III	W			✓
2	Dry river beds/ drainage lines	**B**	H	II	M			✓
	Arid Nama Karoo biome	**C**	L	III	W			✓
3	Dry river beds/ drainage lines	**B**	H	II	M			✓
	Arid Nama Karoo biome	**C**	L	III	W			✓

This mitigated layout does take the dry river bed areas into consideration and the development is located within the **Class III** areas. As such the Class III objectives are met with mitigation (dust control) as the proposed landscape modifications would partially retain the existing character of the landscape where the level of change to the characteristic landscape would be moderate. Given that the surrounding landscape context is strongly associated with the Aries substation and associated transmission lines, it is likely that the development may attract attention but would not dominate the view of the casual observer.

14 RISK ASSESSMENT

The following criteria for the Risk Assessment were provided by ERM to assess the project impacts: *(See Annexure for details of ERM Impact Assessment Methodology)*

1. Nature of the Impact
2. Magnitude of the Impact
    a. Extent
    b. Duration
    c. Intensity
3. Likelihood of Impact
4. Impact Significance
5. Degree of Confidence

Two layout alternatives were assessed for the impact assessment:

- Layout Alternative 1: Initial layout plan (200MW) (See Plate 21)
- Layout Alternative 2: This alternative is based on specialist input on environmental sensitivity (190MW) (See Plate 22)

14.1 SITE LAYOUT ALTERNATIVE 1

Table of impacts	
Nature:	**Direct negative** impact with a potential for cumulative impacts from other similar projects which would be located around the Aries substation.
Impact Magnitude:	**High**
• Extent:	The extent is **Local** as the zone of visual influence would extend approximately two kilometres around the site. There is potential for further cumulative impacts associated with development in dry river bed areas.
• Duration:	The visual impacts would be **Long term** and continue for the life of the project but would cease should the project be decommissioned and the area rehabilitated back to agricultural land use.
• Intensity:	The intensity of the direct impacts on the Biophysical Environment would be High as development would take place in the dry river beds which are identified as having a high ecological sensitivity. The intensity of the indirect visual impacts on the surrounding receptors is Low as the surrounding communities would be able to adapt with relative ease and maintain pre-impact livelihoods. Due to the low levels of scenic quality of the area as a result of the Aries substation and associated power lines, in conjunction with the limited visual resource drivers, there are no tourism related activities in the area. The overall intensity would be **Medium to High**.
Likelihood:	As the impact would be to the aesthetics of the area associated with the direct impact on the biodiversity of the dry river areas, the impact will be **Definite**.
Impact Significance (Pre-mitigation):	**Major**
Degree of Confidence:	**High**

Recommendations

- Redesign the proposed site footprint to ensure that the footprint does not intrude into Class 2 areas which have been highlighted as sensitive.

14.2 SITE LAYOUT ALTERNATIVE 2

Table of Construction and Operation impacts	
Nature:	Neutral
Impact Magnitude:	**Low**
• Extent	The extent is **Local** as the zone of visual influence would extend approximately two kilometres around the site. There is potential for further cumulative impacts associated with development in dry river bed areas.
• Duration	The visual impacts would be **Long term** and continue for the life of the project but would cease should the project be decommissioned and the area rehabilitated back to agricultural land use.
• Intensity	The intensity of the direct impacts on the Biophysical Environment would be Moderate as development would not take place in the dry river beds which are identified as having a high ecological sensitivity. The intensity of the indirect visual impacts on the surrounding receptors is Low as the surrounding communities would be able to adapt with relative ease and maintain pre-impact livelihoods. Due to the low levels of scenic quality of the area as a result of the Aries substation and associated power lines, in conjunction with the limited visual resource drivers, there are no tourism related activities in the area. The overall intensity would be **Medium to Low**.
Likelihood	The impact would be **Likely** to occur under most conditions.
Impact Significance (Pre-mitigation):	**Minor**
Degree of Confidence:	**High**

Construction Residual Impact: Mitigations

- The clearing of vegetation should as much as possible be limited so as to reduce dust.
- On the areas that are cleared, dust prevention measures need to be implemented during construction to reduce visual impacts associated with dust.
- Fencing needs to be limited to only surrounding the specific sites where the PV panels are to be located and not constructed around the whole property.
- Agricultural land use should be retained on the remaining property so as to retain the agricultural sense of place.
- The construction camp should be located on an area that will eventually be constructed.
- A litter fence needs to be erected around the construction fence to reduce windblown litter.
- Littering needs to be a punishable offence.
- The structures need to be simple in design and form in order to blend with the surrounding agricultural setting.

Operation Residual Impact: Mitigations

- As much as possible, natural vegetation needs to be retained between the PV panel rows to reduce the effects of windblown dust.
- Littering needs to be a punishable offence.

14.2.1 *RESIDUAL IMPACT PRE AND POST- MITIGATION SIGNIFICANCE OF ALTERNATIVE 2*

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	Minor	Minor

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Operation	Minor	Minor

14.3 SUMMARY IMPACT RATINGS

Impact	Layout Alternative 1 Pre- mitigation	Layout Alternative 2 Pre- mitigation	Layout Alternative 2 Residual Impact (post mitigation)
Construction Phase			
Visual Impact	Major -ve	Minor -ve	Minor -ve
Operational Phase			
Visual Impact	Major -ve	Minor -ve	Minor -ve

14.4 CUMULATIVE IMPACTS

There are a number of known proposed solar energy facilities (approximately ten) planned in the Northern Cape. Three of these are located in close proximity to the proposed AES Olyven Kolk solar power plant, including one which will also be located on another portion of the Olyven Kolk Farm.[37] The proposed BioTherm Energy Kleinzwart Bast Photovoltaic Solar Power Plant is situated in the Kenhardt District, alongside the Aries substation. See Appendix for background details.

Should many more of these types of development take place in close proximity to each other, there is a possibility that the area will exceed the carrying capacity created by the agricultural sense of place and that the sense of place will be defined by the solar energy facilities. However, due to the limited visual resources in the area and the limited number of receptors, any potential cumulative impact be contained.

15 CONCLUSION

The site is remote and located in a flat and arid environment typical of the Northern Cape. The area is not associated with any established heritage sites or scenic routes. The main landuse in the area is agricultural sheep farming. The area is not a pristine landscape and other landscape modifications define the context, specifically the Eskom Aeries Substation (which generates high levels of visual contrast), the powerlines, the telecommunication mast and the Sishen Iron Ore railway line.

The Site Layout Alternative 2 of 190 MW photovoltaic (PV) solar panels avoids areas highlighted as ecologically sensitive and as such is the preferred development alternative. The low 2.5m height of the proposed PV panels does limit the visibility to the surrounding mainly flat terrain. As such, the viewshed is located mainly in the 2km high exposure area but does also extend in some parts to the 5km Foreground / Middle ground. However, it must be noted that the viewshed does not extend outside of the existing Aries Substation located adjacent the site to the north. This existing feature dominates the landscape context, and as such it is very likely that the visual intrusion would not be perceived as significant by the receptors.

16 ANNEXURE 1: METHODOLOGY

Determining how an area should be managed first requires an assessment of the area's scenic values as different levels of scenic value require different levels of management. The impact assessment methodology that VRM Africa uses is based on the Visual Resource Management system[38] which is a systematic process developed by the Bureau of Land Management (BLM) from the United States Department of Internal Affairs to evaluate potential visual impacts associated with landscape modifications. The method is based on the premise that the degree to which a management activity affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape. [39] The objective of this methodology is to:

- Provide a way of identifying and evaluating scenic values to determine the appropriate levels of management.
- Provide a way to analyse potential visual impacts and apply visual design techniques to ensure that surface-disturbing activities are in harmony with their surroundings.
- Using multi criteria mapped based methods increases objectivity in decision making.[40]

The VRM system consists of two stages:

- **Inventory** stage which is part of the baseline study: The inventory stage during which field study and site sampling is undertaken**,** involves the identification of the visual resources of the area where the proposed landscape modification will influence landscape character.
- **Contrast Rating** stage which forms part of the impact assessment study: The contrast rating or impacts assessment phase is undertaking after the inventory process has been completed. The suitability of landscape modification is assessed by measuring the degree of contrast of the proposed landscape modification to the existing contrast created by the existing landscape. As a component in this contrast rating process, visual representation such as photo montages are vital in large scale modifications as this serves to inform I&APs and decision making authorities of the nature and extent of the impact associated with the proposed project/development.

16.1 INVENTORY STAGE

The inventory stage during which field study and site sampling is undertaken**,** involves the identification of the visual resources of the area where the proposed landscape modification will influence landscape character. The following factors are defined during the inventory stage:

- Delineation of broad brush landscape units which have physical as well as graphic similarities.
- Identify and evaluate scenic qualities of each of the landscapes.
- Identification and evaluation of receptor sensitivities within the defined landscape areas;
- Distance Zone Analysis to determine the exposure of the surrounding landscapes and receptors to the proposed / existing landscape modifications.

Through the inventory process, landscapes are categorised into 4 different classes which reflect the inherent value of each of the landscapes. Each of the 4 classes has a management objective which is used to assess the suitability of the proposed landscape modification. It must be noted that this VRM technique is used as guideline. These Classes are not intended to be the only means of resolving these impacts but should rather be used as a guide.

<u>Class I</u> is assigned to those areas where a *specialist decision* has been made to maintain a natural landscape. Class I is not rated in terms of scenic quality, distance zones and sensitivity values. The Class I objective is to preserve the existing character of the landscape where the level of change to the characteristic landscape should be very low and must not attract attention.

<u>Classes II, III & IV</u> are assigned to the landscape areas by cross referencing scenic quality, distance zones and sensitivity values, making use of the VRM Matrix table below which was developed by the Bureau of Land Affairs, USA.

			VISUAL SENSITIVITY LEVELS								
			HIGH			MEDIUM			LOW		
19 or more		A	II	II	II	II	II	II	II	II	II
12 - 18	SCENIC QUALITY	B	II	III	III/ IV *	III	IV	IV	IV	IV	IV
11 or less		C	III	IV	IV	IV	IV	IV	IV	IV	IV
	DISTANCE ZONES		fore/middle ground	background	seldom seen	fore/middle ground	background	seldom seen	fore/middle ground	background	seldom seen

o If adjacent areas are **Class III** or lower assign **Class III**, if higher assign **Class IV**

The Class II objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.

The Class III objective is to partially retain the existing character of the landscape where the level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

The Class IV objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high and these management activities may dominate the view and be the major focus of the viewer attention.

16.2 CONTRAST RATING STAGE

The contrast rating or impacts assessment phase is undertaking after the inventory process has been completed. The suitability of landscape modification is assessed by measuring the degree of contrast of the proposed landscape modification to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape in terms of the line, colour, texture and form in relation the visual objectives defined for the area. The following criteria are utilised in defining the degree of contrast:

- **None -** The element contrast is not visible or perceived.
- **Weak -** The element contrast can be seen but does not attract attention.
- **Moderate -** The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong -** The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

As an example, in a Class I area, the visual objective is to preserve the existing character of the landscape and the resultant contrast to the existing landscape should not be notable to the casual observer and cannot attract attention. In the Class IV area example, the objective is to provide for management activities which require major modifications of the existing character of the landscape. Based on whether the VRM Objectives are met, mitigations, if required, are defined to avoid, reduce or mitigate the proposed landscape modifications so that the visual impact does not detract from the surrounding landscape sense of place.

16.3 VISUALISATION

As a component in this contrast rating process, visual representation such as photo montages are vital in large scale modifications as this serves to inform I&APs and decision making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003).[41] This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes; providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information
- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity
- Interest

The Code of Ethical Conduct states that the presenter should:

- Demonstrate an appropriate level of qualifications and experience.
- Use visualisation tools and media that are appropriate to the purpose.
- Choose the appropriate level of realism.
- Identify, collect and document supporting visual data available for or used in the visualisation process; conduct an on-site visual analysis to determine important issues and views.
- Seek community input on viewpoints and landscape issues to address in the visualisations.
- Provide the viewer with a reasonable choice of viewpoints, view directions, view angles, viewing conditions and time frames appropriate to the area being visualised.
- Estimate and disclose the expected degree of and uncertainty, indicating areas and possible visual consequences of the uncertainties.
- Use more than one appropriate presentation mode and means of access for the affected public.
- Present important non-visual information at the same time as the visual presentation, using a neutral delivery.
- Avoid the use or the appearance of ‘sales’ techniques or special effects.
- Avoid seeking a particular response from the audience.
- Provide information describing how the visualisation process was conducted and key decisions taken.[42]

As part of the process of providing I&APs and decision makers with information about the proposed landscape modifications, VRM Africa places a strong emphasis on the colour plates and on 3D modelling.

16.4 VRM CRITERIA

16.4.1 *SCENIC QUALITY RATING QUESTIONNAIRE*[1]

KEY FACTORS	RATING CRITERIA AND SCORE		
SCORE	**5**	**3**	**1**
Landform	High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops, or severe surface variation or highly eroded formations including or dune systems: or detail features dominating and exceptionally striking and intriguing.	Steep sided river valleys, or interesting erosion patterns or variety in size and shape of landforms; or detail features that are interesting though not dominant or exceptional.	Low rolling hills, foothills or flat valley bottoms; few or no interesting landscape features.
Vegetation	A variety of vegetative types as expressed in interesting forms, textures and patterns.	Some variety of vegetation, but only one or two major types.	Little or no variety or contrast in vegetation.
Water	Clear and clean appearing, still or cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent, or present, but not noticeable.
Colour	Rich colour combinations, variety or vivid colour: or pleasing contrasts in the soil, rock, vegetation, water.	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element.	Subtle colour variations contrast or interest: generally mute tones.
Adjacent Scenery	Adjacent scenery greatly enhances visual quality.	Adjacent scenery moderately enhances overall visual quality.	Adjacent scenery has little or no influence on overall visual quality.
Scarcity	One of a kind: unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing etc…	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.
SCORE	**2**	**0**	**-4**
Cultural Modification	Modifications add favourably to visual variety while promoting visual harmony.	Modifications add little or no visual variety to the area, and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.

[1] Bureau of Land Management, U.S. Department of Interior. 2004. Visual Resource Management Manual 8400

16.4.2 *SENSITIVITY LEVEL RATING QUESTIONNAIRE*

The following VRM questionnaire was completed.

FACTORS	QUESTIONS	
Type of Users	**Maintenance of visual quality is:**	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Amount of use	**Maintenance of visual quality becomes more important as the level of use increases:**	
	A high level of use	High
	Moderately level of use	Moderate
	Low level of use	Low
Public interest	**Maintenance of visual quality:**	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Adjacent land Users	**Maintenance of visual quality to sustain adjacent land use objectives is:**	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low
Special Areas	**Maintenance of visual quality to sustain Special Area management objectives:**	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low

16.4.3 *DISTANCE ZONES*

Landscapes are subdivided into 4 distance zones based on relative visibility from travel routes or observation points. The 4 zones are:

DISTANCE ZONES	DISTANCE ZONES DEFINITION
Foreground	The foreground (fig) zone includes areas seen from highways, rivers, or other viewing locations that are less than 1 kilometres away.
Middle ground	The middle ground (mg) zone includes areas seen from highways, rivers, or other viewing locations that are greater than 1 kilometre but less than 2 kilometres away.
Background	Seen areas beyond the foreground-middle ground zone greater than 2 kilometres away are in the background (big) zone.
Seldom seen	Areas not seen as foreground-middle ground or background (i.e. hidden from view) are in the seldom-seen (sis) zone

16.5 VISUALISATION

As a component in this contrast rating process, visual representation such as photo montages are vital in large scale modifications as this serves to inform I&APs and decision making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003).[43] This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes; providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information
- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity
- Interest

The Code of Ethical Conduct states that the presenter should:

- Demonstrate an appropriate level of qualifications and experience.
- Use visualisation tools and media that are appropriate to the purpose.
- Choose the appropriate level of realism.
- Identify, collect and document supporting visual data available for or used in the visualisation process; conduct an on-site visual analysis to determine important issues and views.
- Seek community input on viewpoints and landscape issues to address in the visualisations.
- Provide the viewer with a reasonable choice of viewpoints, view directions, view angles, viewing conditions and time frames appropriate to the area being visualised.
- Estimate and disclose the expected degree of and uncertainty, indicating areas and possible visual consequences of the uncertainties.
- Use more than one appropriate presentation mode and means of access for the affected public.
- Present important non-visual information at the same time as the visual presentation, using a neutral delivery.
- Avoid the use or the appearance of ‘sales’ techniques or special effects.
- Avoid seeking a particular response from the audience.
- Provide information describing how the visualisation process was conducted and key decisions taken.[44]

As part of the process of providing I&APs and decision makers with information about the proposed landscape modifications, VRM Africa places a strong emphasis on the Colour plates and 3D modelling.

16.6 ERM IMPACT METHODOLOGY

1.1 IMPACT ASSESSMENT METHODOLOGY

The adequate assessment and evaluation of the potential impacts and benefits that will be associated with the proposed project necessitates the development of a scientific methodology that will reduce the subjectivity involved in making such evaluations. A clearly defined methodology is used in order to accurately determine the significance of the predicted impact on, or benefit to, the surrounding natural and/or social environment. For this the proposed project must be considered in the context of the area and the people that will be affected.

Nonetheless, an impact assessment will always contain a degree of subjectivity, as it is based on the value judgment of various specialists and EIA practitioners. The evaluation of significance is thus contingent upon values, professional judgement, and dependent upon the environmental and community context. Ultimately, impact significance involves a process of determining the acceptability of a predicted impact to society.

The purpose of impact assessment is to identify and evaluate the likely significance of the potential impacts on identified receptors and resources according to defined assessment criteria, to develop and describe measures that will be taken to avoid, minimize, reduce or compensate for any potential adverse environmental effects, and to report the significance of the residual impacts that remain following mitigation.

There are a number of ways that impacts may be described and quantified. An impact is essentially any change to a resource or receptor brought about by the presence of the proposed project component or by the execution of a proposed project related activity.

The nature of the project may determine whether one needs to assess both routine and non-routine impacts. Non-routine impacts generally relate to accidents and could include oil/chemical/fuel spills, emergency venting of noxious gases, etc. In most cases, it would be sensible to have separate chapters for the assessment of routine and non-routine impacts.

The types of impacts and terminology to be used in the assessment are outlined in *Table1.1*.

Table 1.1 Defining the Nature of the Impact

Term	Definition
Impact nature	
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.

Term	Definition
Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (eg. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (eg. in-migration for employment placing a demand on resources).
Cumulative impact (1)	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

1.1.1 *Assessing Significance*

There is no single accepted definition of *significance* and its determination is , therefore, somewhat subjective. However, it is generally accepted that significance is a function of the **magnitude** of the impact and the **likelihood** of the impact occurring. It is widely accepted that Impact Magnitude (or Severity) is a function of the extent, duration and intensity of the impact.

The criteria used to determine significance are summarised in *Table1.2*. These criteria (specifically Extent and Duration) should be customised to suit individual projects.

Table 1.2 Significance Criteria

Impact magnitude – the degree of change brought about in the environment	
Extent	**On-site** impacts that are limited to the site boundaries. **Local** impacts that affect an area in a radius of XX km around the site. **Regional** impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem. **National** impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences. **Transboundary/International** impacts that affect internationally important resources such as areas protected by international conventions.
Duration	**Temporary** impacts are predicted to be of short duration and intermittent/occasional. **Short-term** impacts that are predicted to last only for the duration of the construction period. **Long-term** impacts that will continue for the life of the Project, but ceases when the Project stops operating. **Permanent** impacts that cause a permanent change in the affected receptor or resource (eg. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.

Intensity (1)	BIOPHYSICAL ENVIRONMENT: *Intensity can be considered in terms of the sensitivity of the biodiversity receptor (ie. habitats, specie communities).* **Negligible** the impact on the environment is not detectable. **Low** the impact affects the environment in such a way that natural functions and processes are not affected. **Medium** where the affected environment is altered but natural functions and processes continue, albeit in a modified way. **High** where natural functions or processes are altered to the extent that it will temporarily or permanently cease. ***Where appropriate, national and/or international standards are to be used as a measure of the impact.*** *Specialist studies should attempt to quantify the magnitude of impacts and outline the rationa used.*
	SOCIO-ECONOMIC ENVIRONMENT: *Intensity can be considered in terms of the ability of project affected people/communities to adap changes brought about by the Project* **Negligible** there is no perceptible change to peoples livelihood **Low** - People/communities are able to adapt with relative ease and maintain pre-impact livelihoods. **Medium** - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support. **High** - Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.
Impact likelihood – the likelihood that an impact will occur	
Unlikely	The impact is unlikely to occur.
Likely	The impact is likely to occur under most conditions.
Definite	The impact will occur.

Once a rating is determined for magnitude and likelihood, the matrix in *Table 1.3* can be used to determine the impact significance.

Table 1.3 Example of Significance Rating Matrix for Positive and Negative Impacts

SIGNIFICANCE RATING				
	LIKELIHOOD	**Unlikely**	**Likely**	**Definite**
	Negligible	Negligible	Negligible	Minor
	Low	Negligible	Minor	Minor
	Medium	Minor	Moderate	Moderate
MA G	High	Moderate	Major	Major

A colour scale for negative and positive ratings is given in *Table1.4*

Table 1.4 *Colour Scale for Ratings*

Negative ratings	Positive ratings
Negligible	Negligible
Minor	Minor
Moderate	Moderate
Major	Major

Table 1.5 outlines the various definitions for significance of an impact and is based on the significance rating matrix.

Table 1.5 *Significance Definitions*

Significance definitions	
Negligible significance	*An impact of negligible significance is where the magnitude is negligible, low or medium and the likelihood of the impact occurring is unlikely or likely.* An impact of negligible significance is where a resource or receptor will not be affected in any way by a particular activity, or the predicted effect is deemed to be imperceptible or is indistinguishable from natural background levels.
Minor significance	*An impact of minor significance is where the magnitude of the impact is low but the likelihood is high or where the magnitude is high but the likelihood of occurrence is unlikely or likely.* An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small and well within accepted standards, and/or the receptor is of low sensitivity/value.
Moderate significance	*An impact of moderate significance is where the magnitude is medium to high and likelihood of the impact occurring is likely or definite* An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that moderate impacts have to be reduced to minor impacts, but that moderate impacts are being managed effectively and efficiently.
Major significance	*An impact of major significance is where the magnitude of the impact is medium to high and the likelihood of the impact occurring is also likely or definite* An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a development. It is then the function of regulators and stakeholders to weigh such negative factors against the positive factors, such as employment, in coming to a decision on the Project.

Once the significance of the impact has been determined, it is important to qualify the **degree of confidence** in the assessment. Confidence in the prediction is associated with any uncertainties, for example, where information is insufficient to assess the impact. Degree of confidence can be expressed as low, medium or high.

1.2 MITIGATION POTENTIAL AND RESIDUAL IMPACTS

It is expected that for the identified significant impacts, the project team will work with the client in identifying suitable and practical mitigation measures that are implementable. Mitigation that can be incorporated into the Project design in order to avoid or reduce the negative impacts or enhance the positive impacts will be developed. A description of these mitigation measures should also be included within the Framework ESMP.

Residual impacts are those impacts which remain once the mitigation measures have been designed and applied. Once the mitigation is applied, each impact is re-evaluated (assuming that the mitigation measure is effectively applied) and any remaining impact is rated once again using the process outlined above. The result is a significance rating for the residual impact.

The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in *Box 1.1*.

Box 1.1 Mitigation Hierarchy

THE MITIGATION HIERARCHY FOR PLANNED PROJECT ACTIVITIES

Avoid at Source; Reduce at Source

Avoiding or reducing at source is essentially 'designing' the project so that a feature causi an impact is designed out (eg a waste stream is eliminated) or altered (eg reduced waste volume). Often called minimisation.

Abate on Site

This involves adding something to the basic design to abate the impactpollution controls fall within this category. Often called 'end-of-pipe'.

Abate at Receptor

If an impact cannot be abated onsite then measures can be implemented offsite - an example of this would be to use the standby vessel to help control the level of interference with fishing activity.

Repair or Remedy

Some impacts involve unavoidable damage to a resource, eg land disturbance. Repair essentially involves restoration and reinstatement type measures, such as base camp closure

Compensate in Kind

Where other mitigation approaches are not possible or fully effective, then compensation, in some measure, for loss, damage and general intrusion might be appropriate.

17 ANNEXURE 2: PROPOSED KLEINZWART BAST PHOTOVOLTAIC PLANT BAR

Extract from BioTherm Energy Basic Assessment Report for Photovoltaic Solar Power Plants, Northern Cape: *(DEA Reference: 12/12/20/2098/1, 2 & 3. February 2011)*

- Site 1: Konkoonsies (Pofadder District)
- Site 2: Kleinzwart Bast (Kenhardt District)

1. ACTIVITY DESCRIPTION

Describe the activity, which is being applied for in detail (A1):

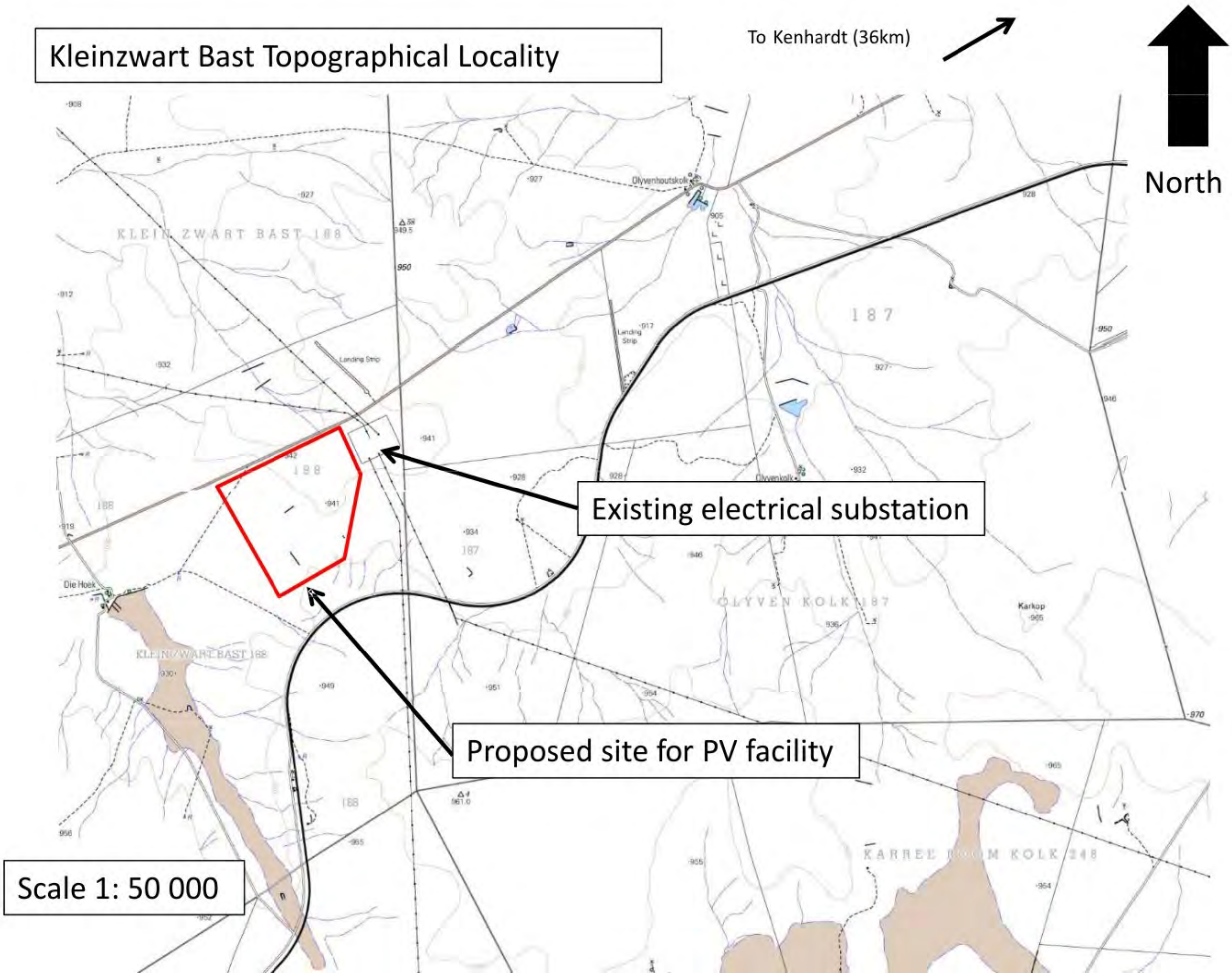
S1a and S1b will be described throughput the Basic Assessment Report. As described in the application form, the two applications that were originally made were requested to be consolidated, and this was accepted by the National Department of Environmental Affairs. As such, this Basic Assessment will deal with the assessment of two feasible areas (sites), NOT as potential alternatives, but as feasible and realistic developments. The two feasible areas for development that will be assessed include:

1. Konkoonsies (referred to as S1a, AKA: Paulputs Solar), and
2. Kleinzwart Bast (referred to as S1b, AKA: Aries Solar)

Photovoltaic's (PVs) are arrays of cells containing a solar photovoltaic material that converts solar radiation into direct current electricity.

The PV plant is expected to have a power generating capacity of 10MVA (electrical, peak). The plant and all associated infrastructure will be less than 20 Ha in extent. The plant and associated infrastructure is made of up the following broad components:

· PV panel array
· Wiring to central inverters
· Connection to grid
· Balance of plant (incl. control rooms, regulators, etc…)



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DRAFT VISUAL IMPACT ASSESSMENT

PROPOSED OLYVEN KOLK SOLAR POWER PLANT

COLOUR PLATES

Revised 13 October 2011

Prepared for:
ERM Southern Africa
Silverwood House, Block A
Steenberg Office Park
Steenberg, 7945
Cape Town

Visual Resource Management Africa cc
P O Box 7233, George, 6531
Tel/Fax: 044-876 0020
Cell: 083 560 9911
E-Mail: info@vrma.co.za
Web: www.vrma.co.za

TABLE OF COLOUR PLATES

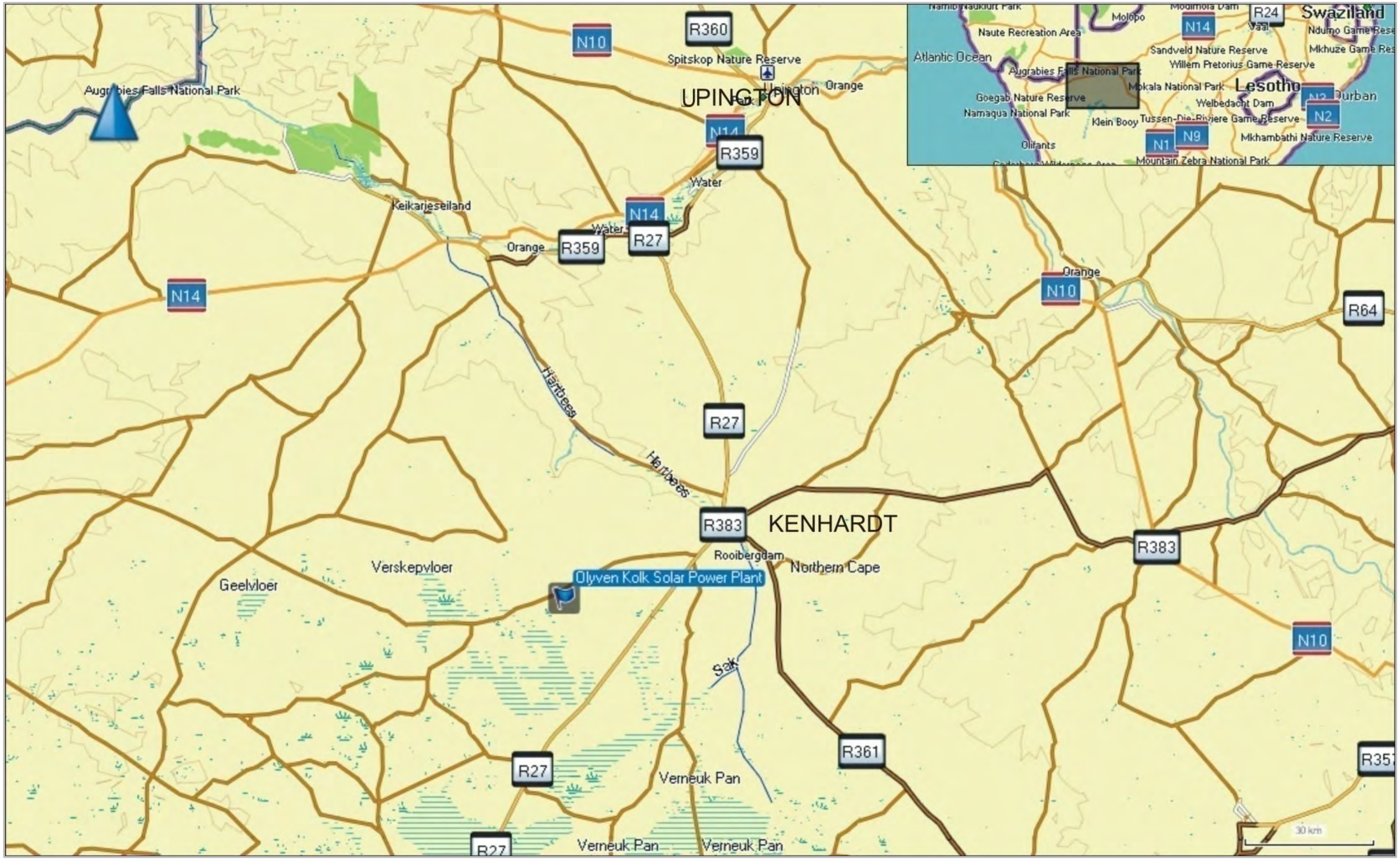


PLATE 1: REGIONAL LOCALITY MAP

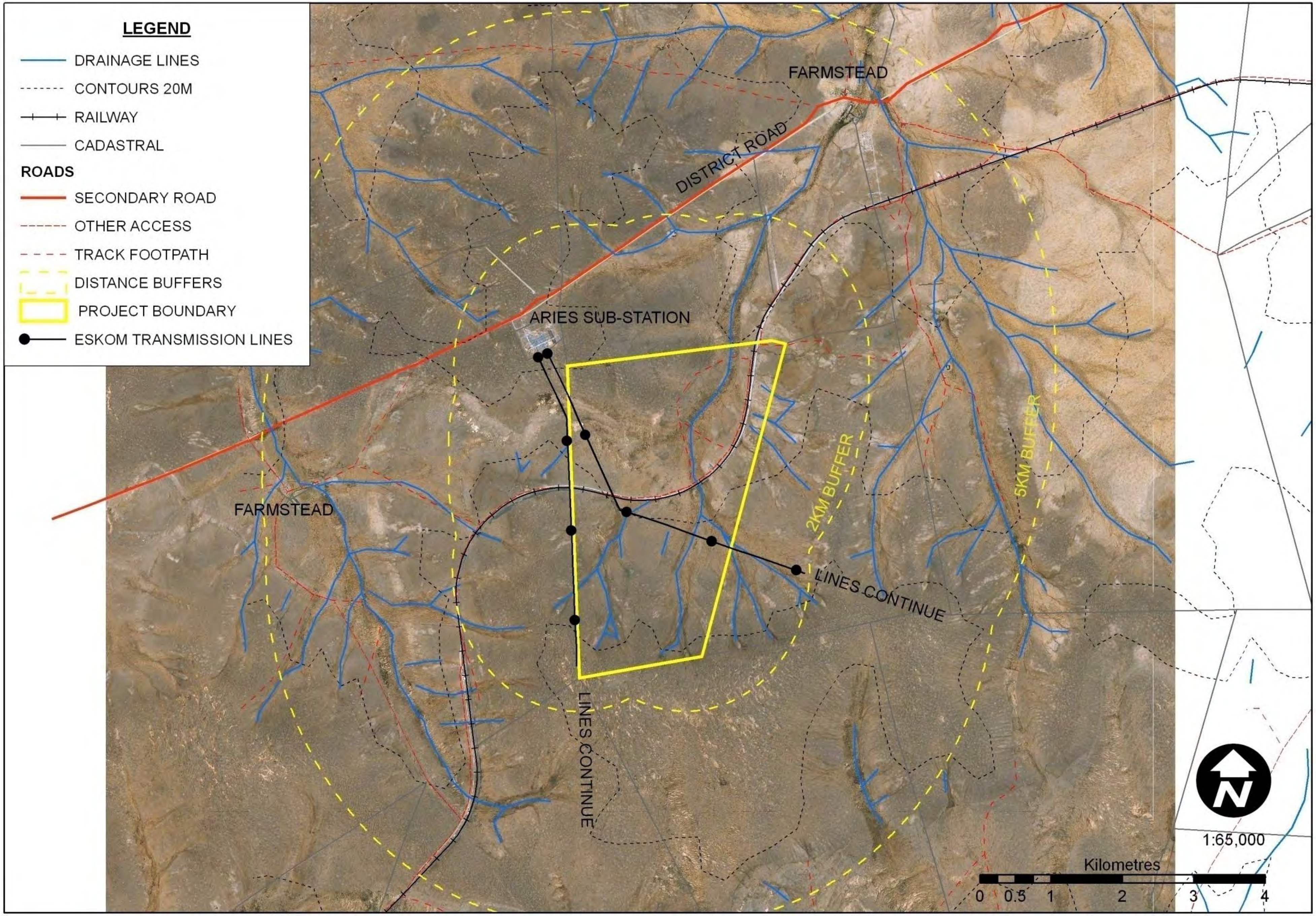


PLATE 2: SITE LOCALITY MAP

PLATE 3: PROJECT DESCRIPTION: PROPOSED SITE LAYOUT ALTERNATIVE 1

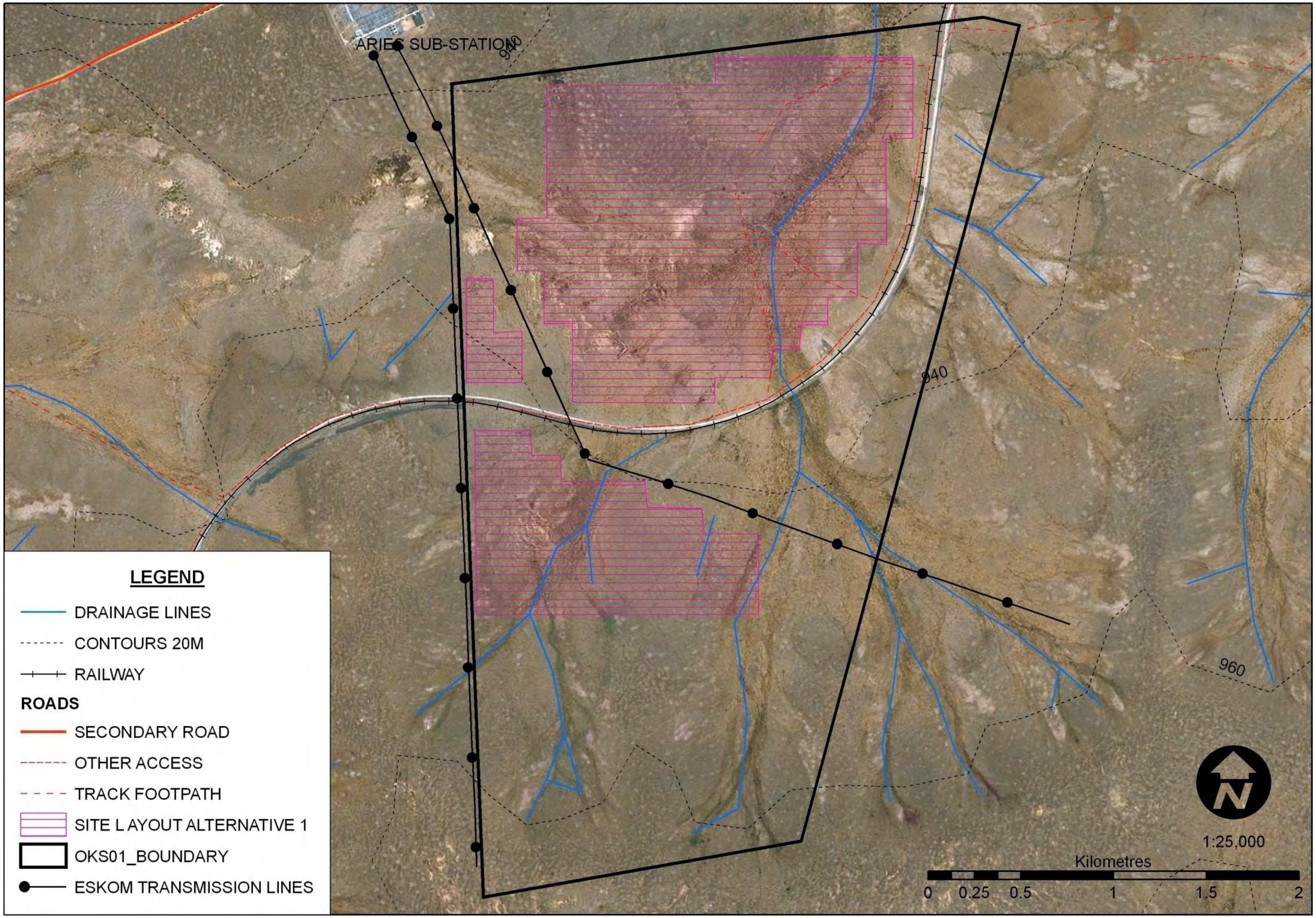


PLATE 4: PROJECT DESCRIPTION: PROPOSED SITE LAYOUT ALTERNATIVE 2

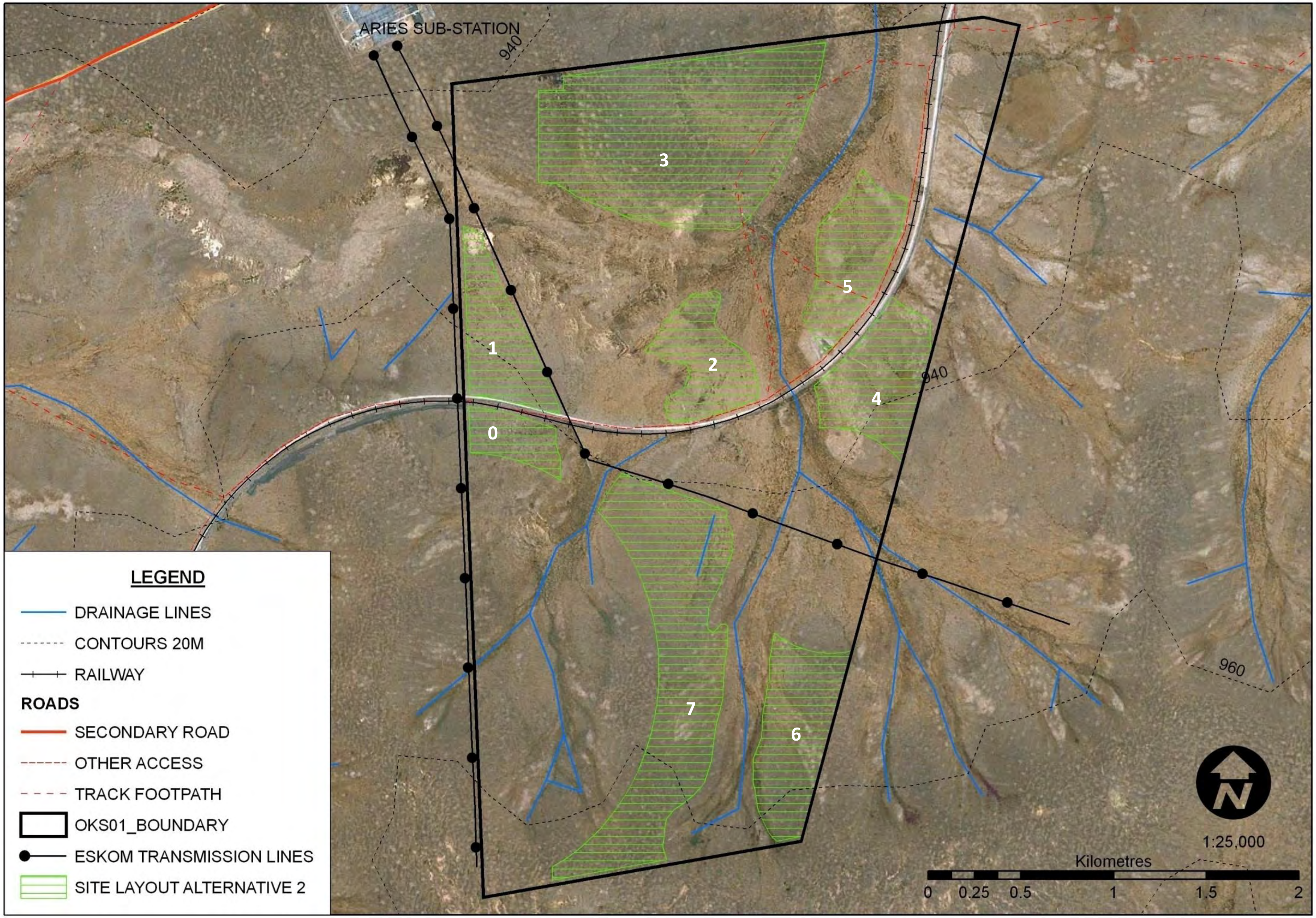


Figure 1: Photograph example of construction site of solar power panels *(Source: ERM)*

Figure 2: Photograph example of solar power panels *(Source: ERM)*

PLATE 5: PROJECT DESCRIPTION: CONSTRUCTION OF SOLAR PANELS

Figure 1: Photograph example of existing power lines in the area *(Source: ERM)*

Figure 2: Example of site clearing *(Source: ERM)*

Figure 3: Example trench construction *(Source: ERM)*

PLATE 6: PROJECT DESCRIPTION: CONSTRUCTION OF INFRASTRUCTURE

PLATE 7: REGIONAL LANDSCAPE CHARACTER

Figure 1*:* View towards Kenhardt and Quiver Forest *(GPS 009)*

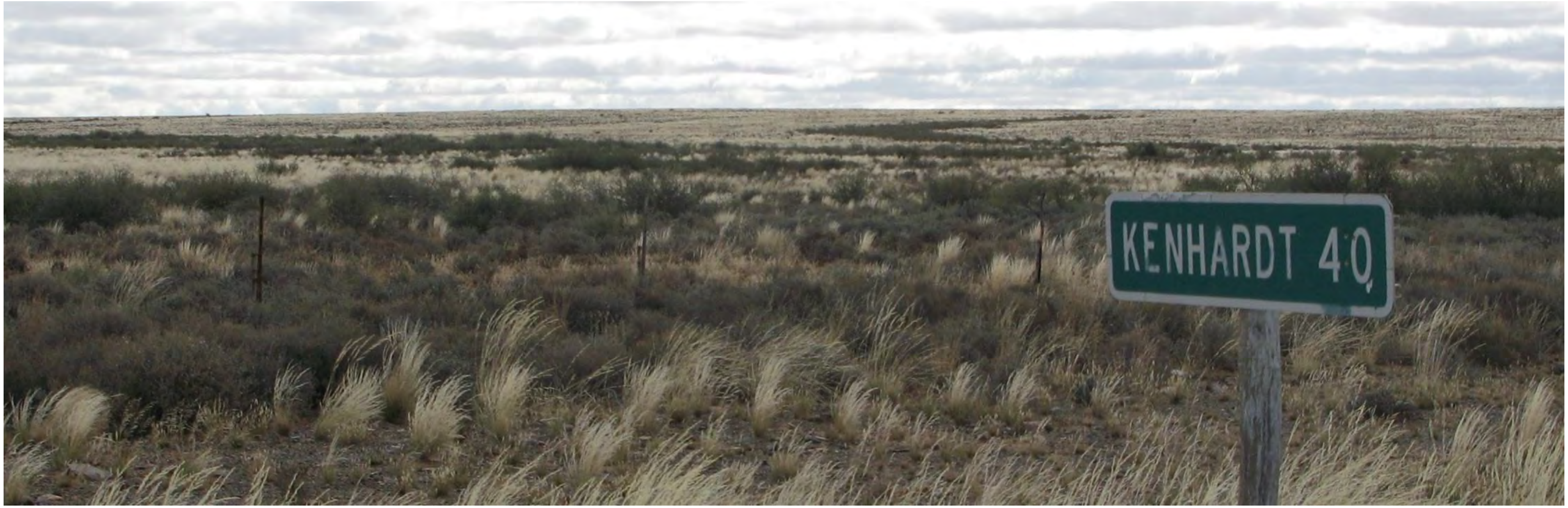


Figure 2*:* View of regional sense of place *(GPS 018)*

Figure 1*: View of existing vegetation (GPS 015)*

Figure 2*: View of existing arid gravel soil, sparse grass clumps and sporadic tree clumps (GPS 012)*

PLATE 8: EXISTING VISUAL CONTEXT: VEGETATION

PLATE 9: EXISTING VISUAL CONTEXT: MODIFIED

Figure 1: View of existing railway line *(GPS 009)*

Figure 2: Existing airstrip *(GPS 029)*

Figure 1: Existing site entrance gate looking towards Aeries sub-station *(GPS 023)*

Figure 2: Existing industial infrastructure (GPS 14)

Figure 3: Aries sub-station (GPS 013)

PLATE 10: EXISTING VISUAL CONTEXT: TRANSFORMED

Figure 1: View SSE of old quarry *(GPS 025)*

Figure 2: View towards Aeries showing existing structure on site in amongst trees *(GPS 026)*

Figure 3: Zoom of existing structure on site *(GPS 026)*

PLATE 11: LANDSCAPE CHARACTER: SITE MODIFICATIONS

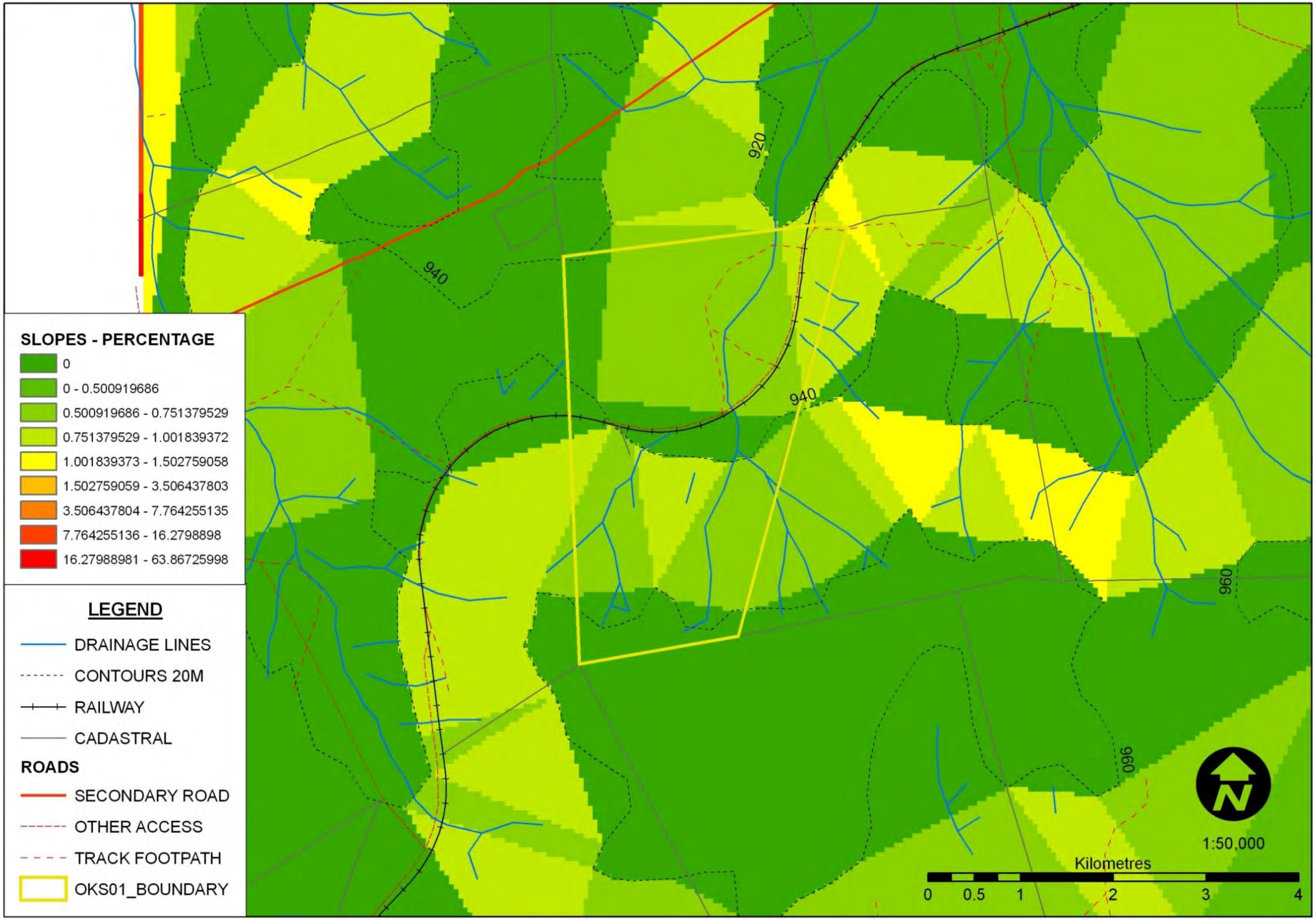


PLATE 12: SITE SLOPES MAP

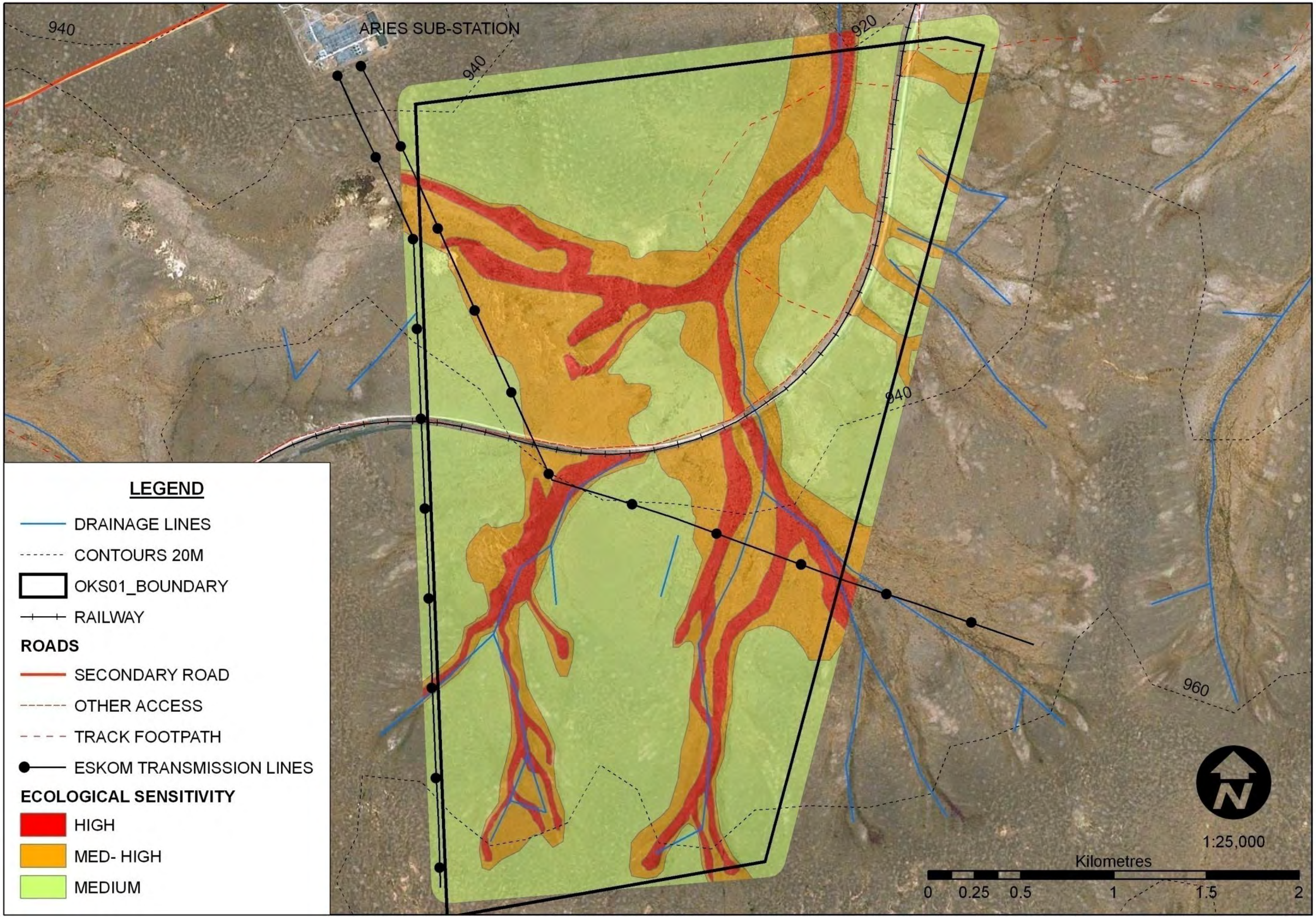


PLATE 13: SITE ECOLOGICAL SENSITIVITY MAP

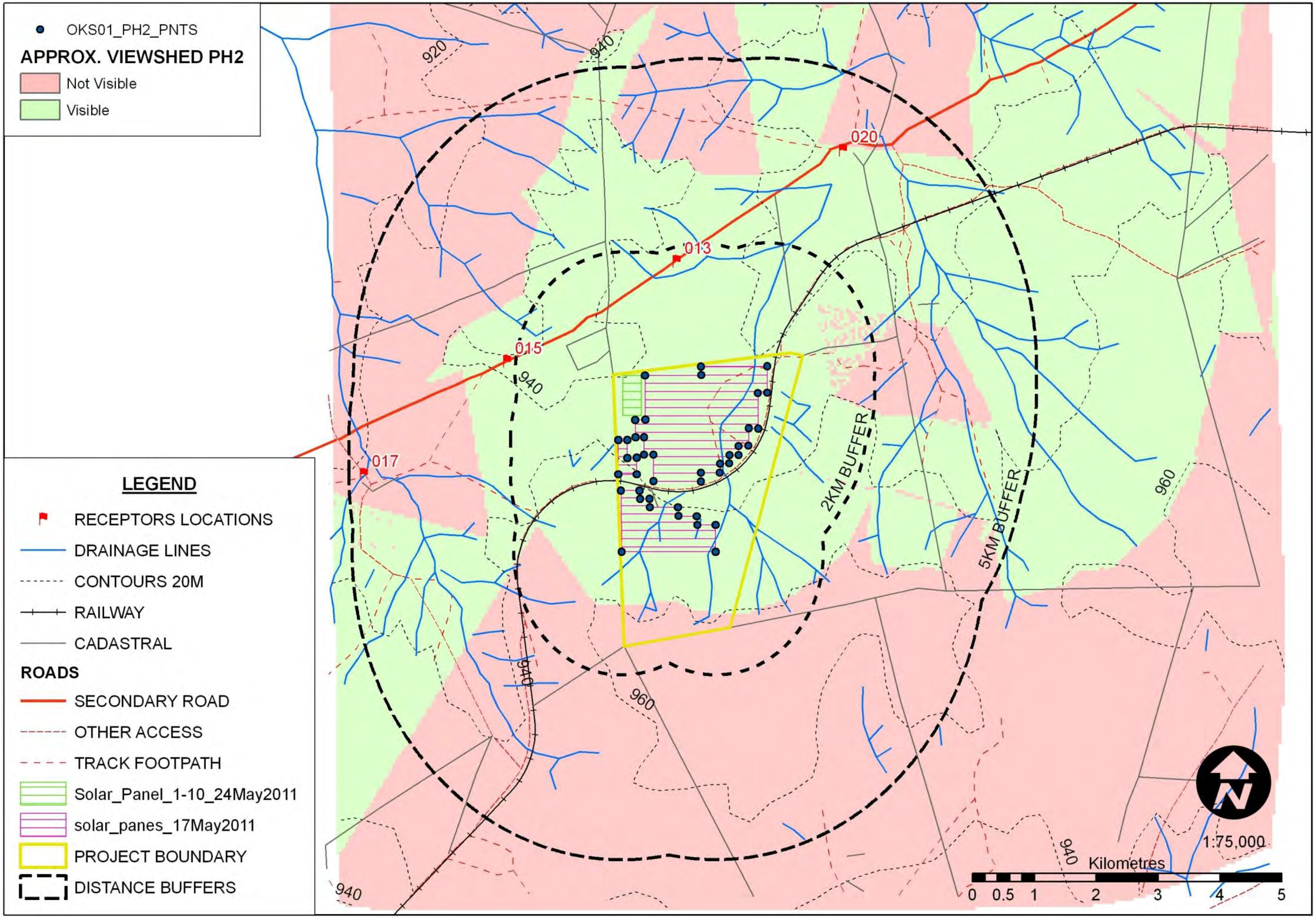


PLATE 14: VIEWSHED MAP: ALTERNATIVE 1

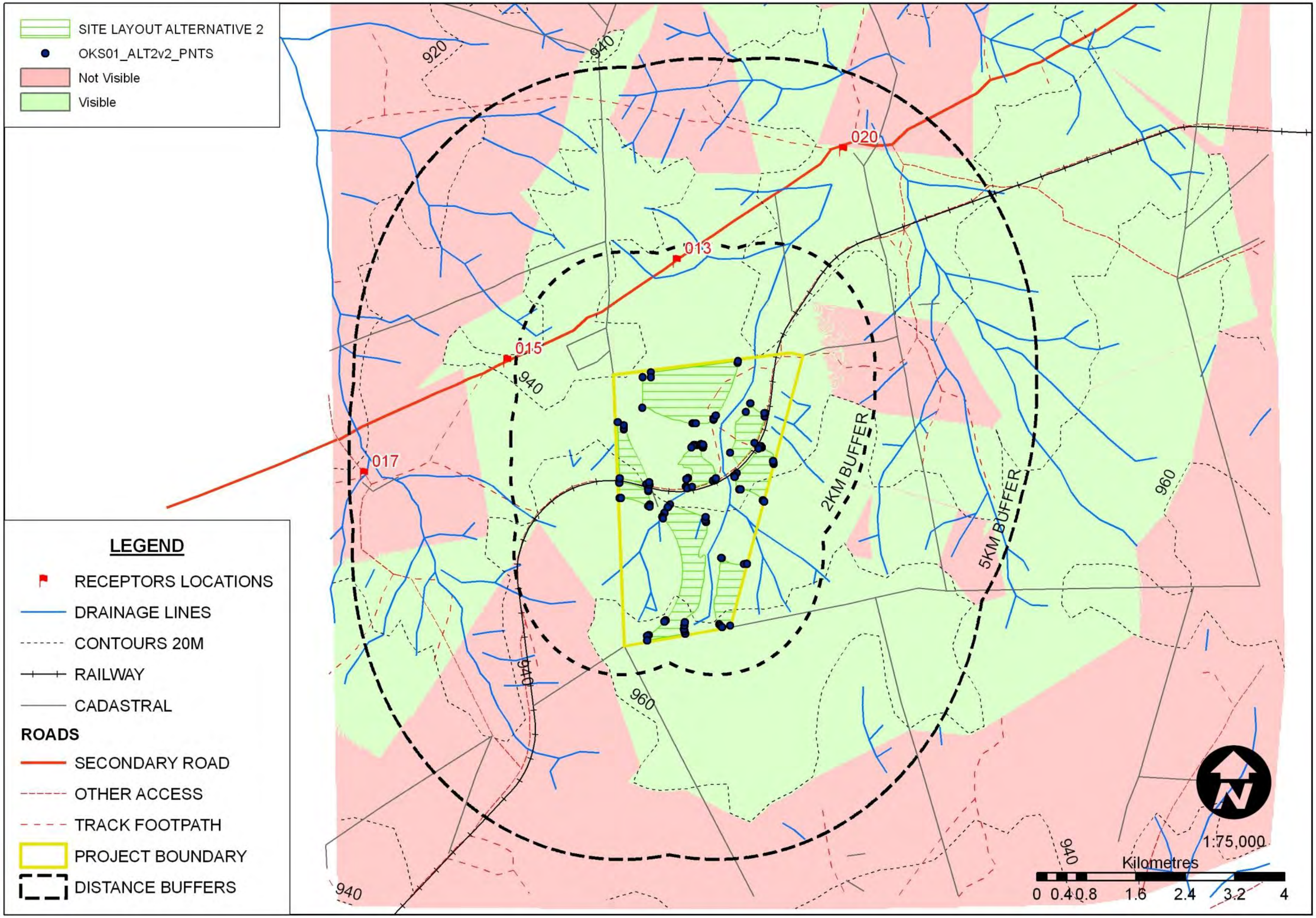


PLATE 15: VIEWSHED MAP: ALTERNATIVE 2

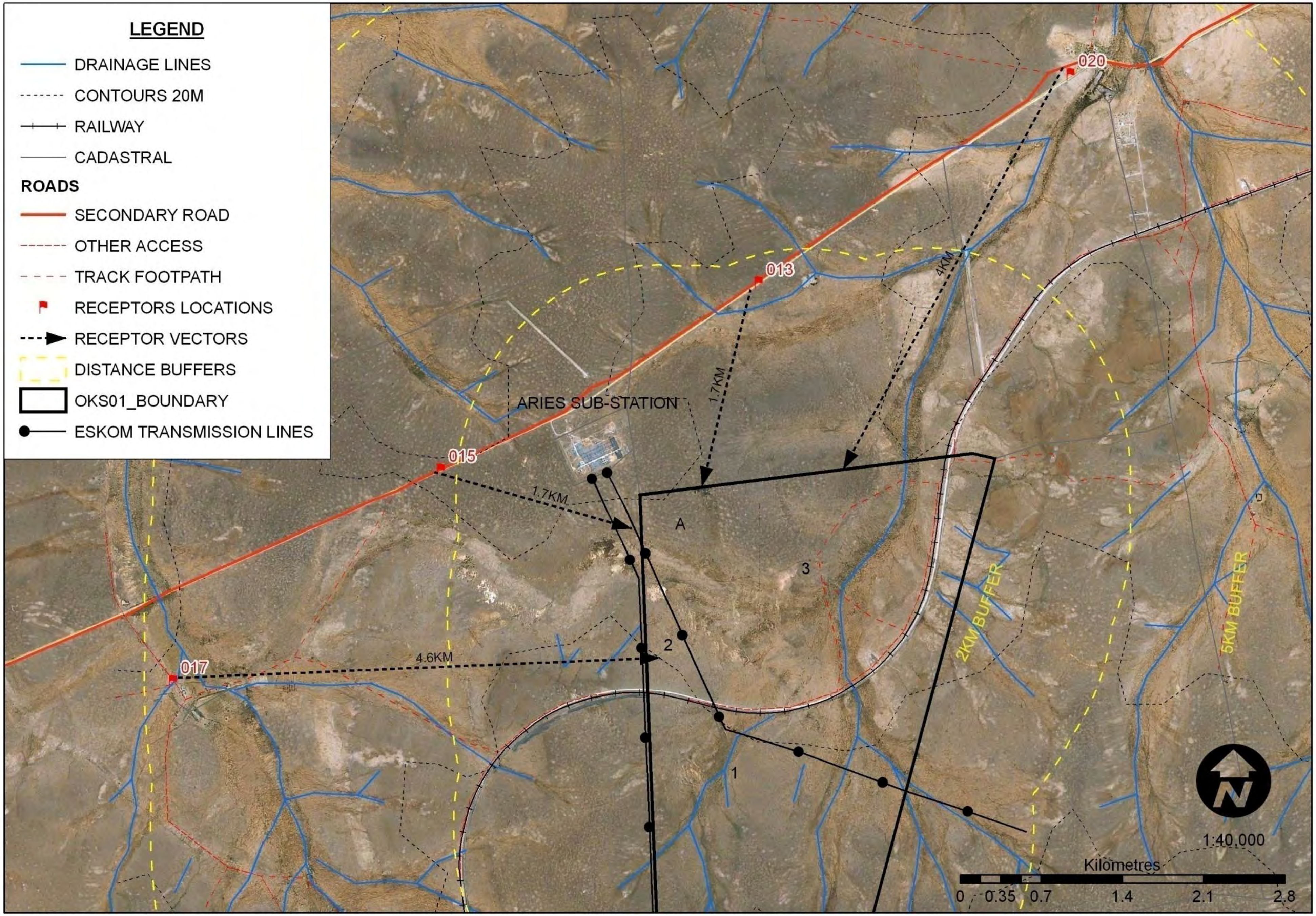


PLATE 16: RECEPTORS: LOCALITY MAP

Figure 1: Sense of place of clustered small farm buildings with medium to large shade trees.

Figure 2: View SSE in the direction of the proposed site from the entrance to the receptor dwelling (Aries Substation visible in the distance on the right)

PLATE 17: RECEPTOR: FARMSTEAD 1 (GPS 020)

Figure 1: Gravel road sense of place at location with the Aries Substation dominating the landscape context.

Figure 2: View south to south east towards the site from the gravel road travelling west (Aries Substation to the right)

PLATE 18: RECEPTOR: GRAVEL ROAD (GPS 013)

Figure 1: View of gravel road sense of place

Figure 2: Panoramic view south-east towards site as seen from the gravel road receptors travelling east. Aries substation indicated on the left.

PLATE 19: RECEPTOR: GRAVEL ROAD (GPS 015)

Figure 1: View of farmstead sense of place*(GPS 016)*

Figure 2: Panoramic view north east to east towards site. Aries substation indicated on the left.

PLATE 20: RECEPTOR: FARMSTEAD 2 (GPS 017)

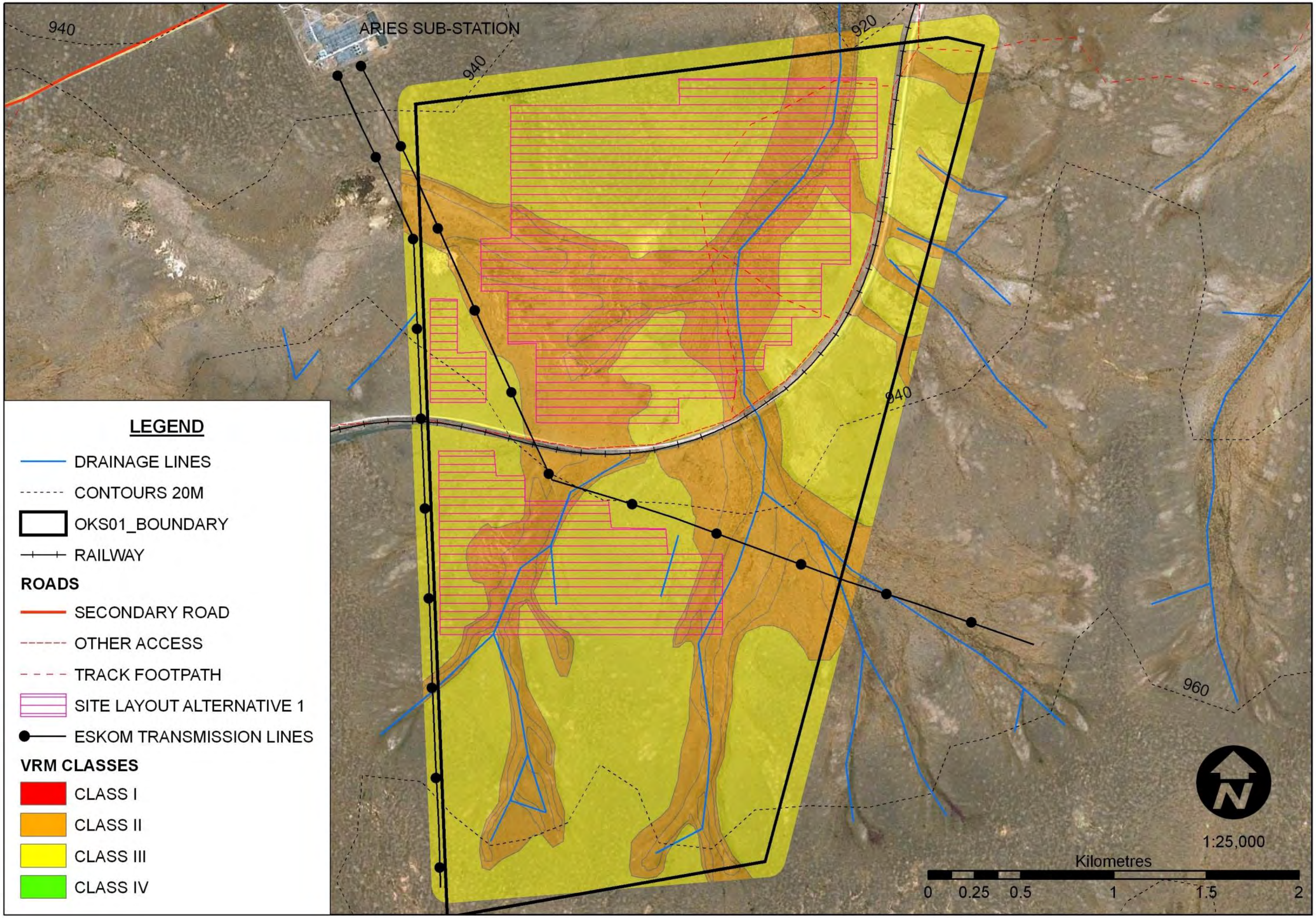


PLATE 21: VRM MAP: SITE LAYOUT ALTERNATIVE 1

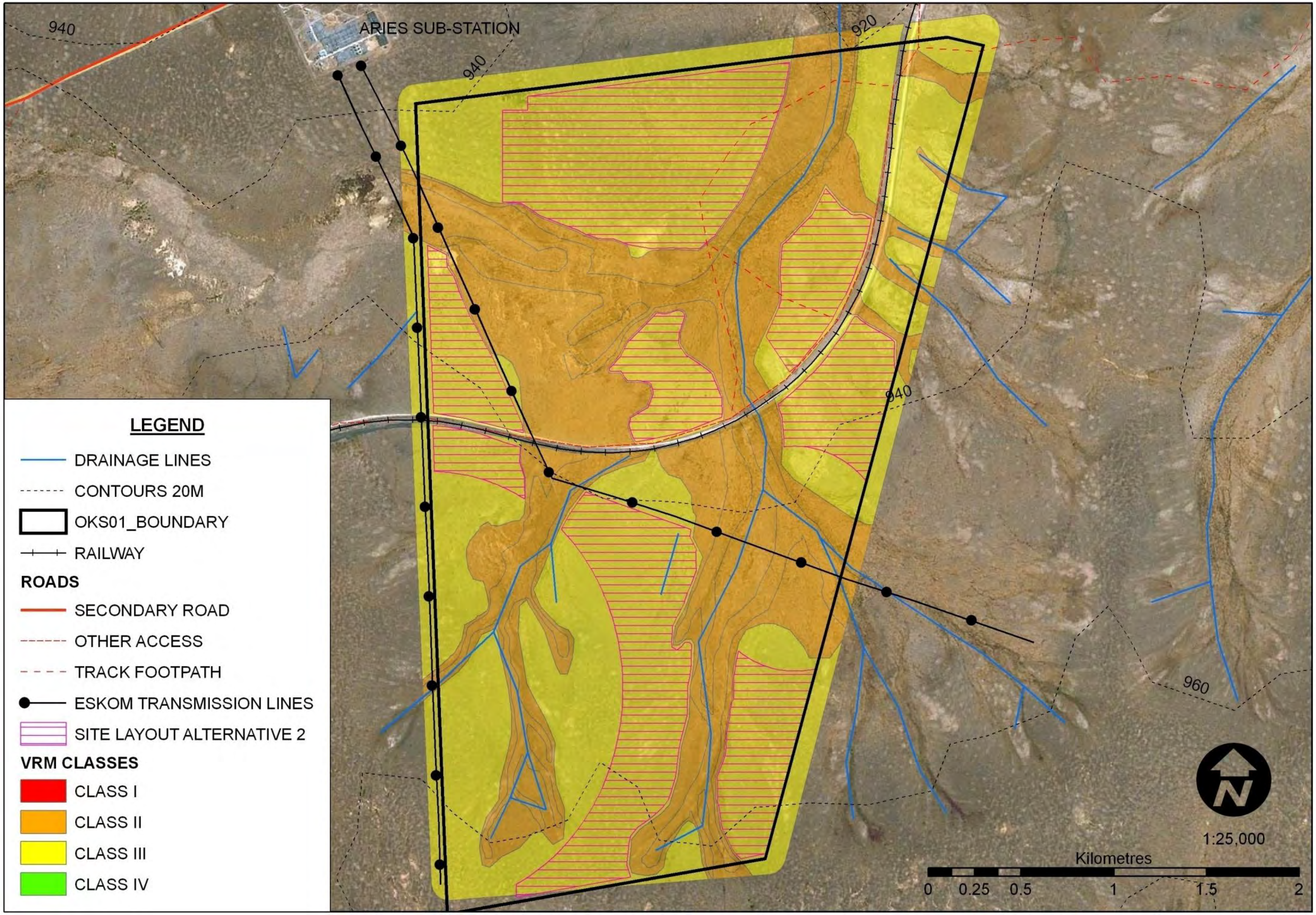
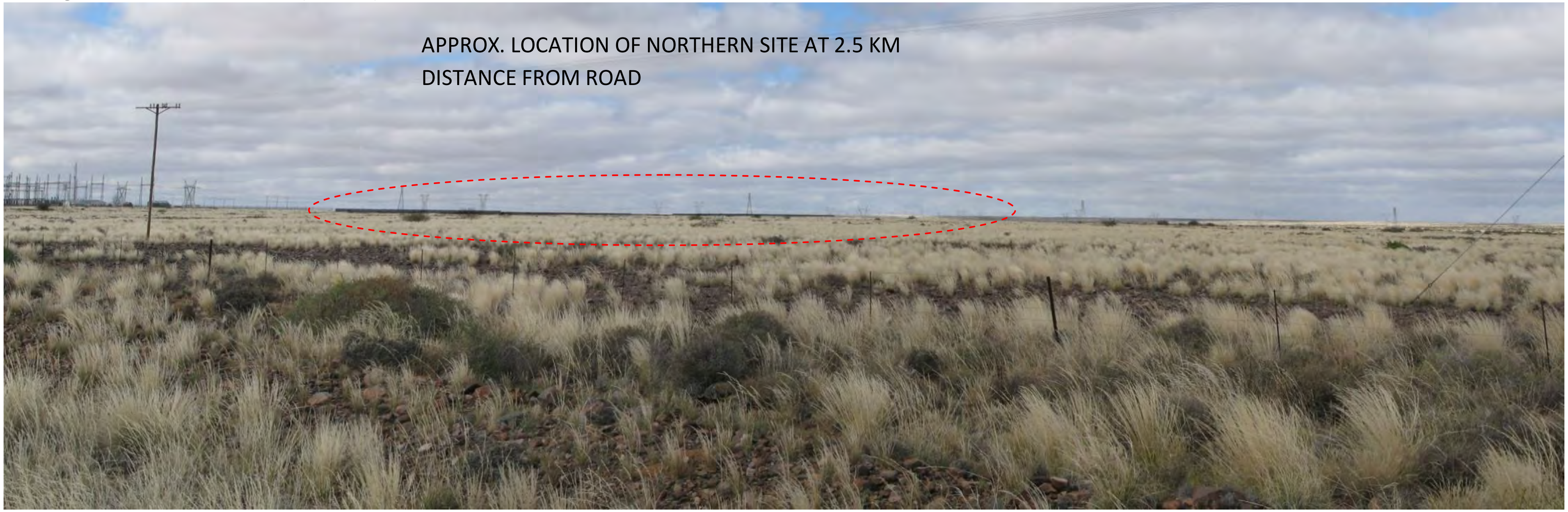


PLATE 22: VRM OVERLAY MAP: SITE LAYOUT ALTERNATIVE 2

PLATE 23: PHOTOMONTAGE: VIEW FROM GPS 15 (DISTRICT ROAD)

Existing view from district road (GPS 15)

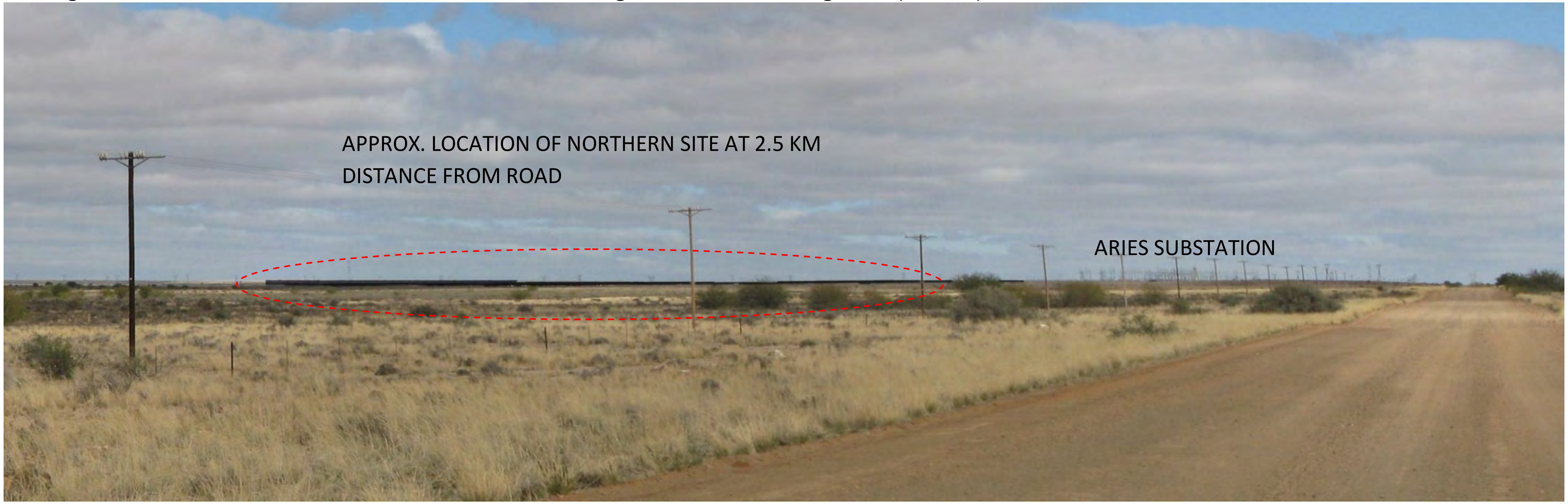


Modified view

For illustrative purposes only

PLATE 24: PHOTOMONTAGE: GRAVEL ROAD (GPS 20)

Existing view south to south east towards the site from the gravel road travelling west (GPS 13)



Modified view

For illustrative purposes only

PLATE 25: GOOGLE EARTH GPS POINT MAP

Annex J

Drainage Lines Report- Geotechnical and Hydrological Survey

GEOTECHNICAL AND HYDROLOGICAL REPORT

ON

OLYVEN KOLK SOLAR POWER PLANT DEVELOPMENT NEAR KENHARDT.

FOR

ERM.

DATE: OCTOBER 2011
REF: 1/24/11

M. van Wieringen & Assoc.
CONSULTING GEOTECHNICAL ENGINEERS
& ENGINEERING GEOLOGISTS
P.O. BOX 32224
CAMPS BAY
8040

CONTENTS

M.van Wieringen & Associates

CONSULTING GEOTECHNICAL ENGINEERS
AND ENGINEERING GEOLOGISTS

P.O. BOX 32224
CAMPS BAY
SOUTH AFRICA
8040

M.van Wieringen
MSc.(CIV.ENG.),BSc.(CIV.ENG.),BSc.(GEOL.),Pr.Eng.,Pr.Sci.Nat.

Phone 27 (021) 4383001
Fax 27 (021) 4382106
E-mail mvwgeo@iafrica.com

GEOTECHNICAL AND HYDROLOGICAL SURVEY FOR THE OLYVEN KOLK SOLAR POWER PLANT NEAR KENHARDT.

1. INTRODUCTION

It was requested by ERM on behalf of AES Solar by way of an appointment dated 23/5/11, that an investigation be conducted into the following aspects of the remaining portion of portion 14 being, in turn, a portion of portion 4 of the farm Olyven Kolk number 187, Siyanda District near Kenhardt, Northern Cape, insofar as they will affect or be affected by the proposed development on the site of a photo voltaic solar power plant:-

a) The drainage regime.

b) The geological and geotechnical conditions.

In both cases the level of investigation is of a preliminary nature involving a desk study and a visual study only and is primarily, intended to inform the Environmental Impact Assessment conducted by ERM.

After the initial investigation and report and a mitigation workshop to discuss proposed layouts of the plant, it was further requested on the 14/10/11 that the report be amended to include comments on a revised plant layout. These are included at the end of the report.

2. DECLARATION OF INDEPENDENCE

It is hereby declared that I, Mr. M. van Wieringen, the author of this specialist report am an independent consultant appointed by ERM to provide specialist input on the Olyven Kolk Solar Power Plant project. I hereby confirm that I have no business, financial, personal or other interest in the activity application or appeal in respect of which I have been appointed other than fair remuneration for work performed in connection with the application. All opinions expressed in my specialist report are my own.

My qualifications in this regard include:-
Pr. Eng.; Pr. Sci. Nat.; MSc. Civ. Eng.; BSc. Civ. Eng.; BSc. Geol.; FSAICE.; MSAIEG.

3. METHODOLOGY

The investigation comprized a desk study of available literature followed by a two day visual survey on site.

The desk study reviewed, the South African Council for Geoscience 1:250 000 geological map and memorandum, 1:50 000 topocadastral maps, and Google Earth images as well as a preliminary geological report for a nearby farm provided by ERM.

Air-photo interpretation of the colour Google Earth image was carried out prior to visiting the site and re-assessed after visiting it.

On site, the entire site was traversed by vehicle and on foot. Soil types, rock outcrops, vegetation patterns, the drainage regime and any other indicators relating to ground and water conditions were noted and mapped.

The investigation reflects surface observations only. All sub-surface conditions are consequently interpretive and predictive and need to be confirmed or disproved by sampling and excavation or probing.

4. DESCRIPTION OF AFFECTED ENVIRONMENT

Refer to drawing number 2 with regards to this section.

4.1 TOPOGRAPHY

The site is relatively flat and slopes to the north north east with an elevation difference of approximately 40 m over a distance of 4,6 km which equates to an average slope of approximately half a degree. The highest areas are in the north west and south with the lowest in the north east.

4.2 SITE GEOLOGY

4.2.1 Petrology

The entire site is mapped on the Department of Geoscience map as being underlain by bedrock of the Dwyka Group, Karoo Supergroup. This bedrock typically comprizes undeformed dark grey to red-brown diamictites and tillites with subordinate sandstone and dark grey to green mudstones.

Although not shown on the map, dolerite sills of Karoo age are present within the Dwyka rocks.

Red-brown, aeolian sands, possibly derived from the Gordonia Formation, Kalahari Group are present in small pockets and are concentrated as alluvium mainly but not only, in the drainage corridors.

Rock outcrops on the site are virtually absent with only very minor outcrops of tillite and dolerite visible in the slightly higher areas of the north west corner of the site, the western edge immediately south of the railway and the southern extremity. Massive tillite is visible in the railway cutting immediately west of the western boundary and a borehole drilled next to the railway not far north of the northern boundary encountered grey-green mudrock and sandstones to a depth of 40 m.

The large borrow pit next to the railway and close to the centre of the site, is however in moderately to highly weathered dolerite. The overburden to this borrow area comprizes a very thin gravelly soil layer over nodular to honeycomb calcrete up to 0,7 m thick grading downwards into highly weathered and calcareous dolerite becoming less weathered and less calcareous with depth. Calcretization is associated with the contact metamorphism of the mudrocks by the dolerite intrusion.

Two boreholes drilled next to the railway to the south-west of the borrow pit encountered dolerite to a depth of at least 30 m beneath 9 m of Dwyka tillite.

It is difficult from the surface expressions to predict areas of Dwyka and dolerite but it is likely that areas with calcrete at surface are underlain directly by dolerite or by a thin layer of shale overlying dolerite.

4.2.2 Lineations

A number of lineations are evident on the satellite image as traversing the site. These trend approximately N-S, NW-SE, NNW-SSE and NNE-SSW. These have significant control over the drainage pattern and probably represent major joint orientations, minor dykes and or the surface exposure of sills. There is no evidence of the presence of major fault lines.

4.3 SOILS

The soil types and profiles present on the site are difficult to predict without digging trial pits as there exist very few excavations or natural erosion features that expose the ground profile. The vegetation coupled with the surface soils and rocks as well as the geomorphological setting all however contribute to being able to compile a land facet map that is indicative of expected soil conditions. At this stage it is intended as a rough guide only and could be subject to significant change after sampling.

The thickness of soil is expected to be very thin on average with exposed bedrock or bedrock close to surface over most of the site except for in the alluvium in the drainage channels where it is expected to attain thicknesses in excess of a metre or two. A good indicator of the presence of soils of the order of a metre or more thick are the presence of Aardvark and Suricate burrows. These were found in abundance near the small dam and along the eastern boundary.

The site has very approximately been divided into eight land or soil facets, these are in terms of likely increasing soil thickness:-

A Flat areas with very thin clayey sand generally overlying shale that retain surface water as small pans after rain.

B Mainly doleritic coarse sub-angular gravel on surface with minor sandstone and tillite finer gravel becoming a sandy gravel with depth. Minor dolerite rock outcrops in higher areas. Soil thickness probably 0 – 0,3 m on average. Expect mostly dolerite bedrock but large areas of tillite also present.

C Mainly finer shale and tillite sub-rounded gravels on surface becoming a sandy gravel with depth. Minor tillite rock outcrops in places. Soil thickness probably 0 – 0,5 m on average. Expect mostly tillite bedrock although dolerite might also be present.

D Mixed doleritic, shale and tillite, fine to medium gravels on surface overlying gravelly sand becoming sandy gravel then very highly weathered tillite. Some very minor rock outcrops in places. Soil thickness probably 0 – 0,6 m on average.

E Calcareous gravels on surface underlain by very thin calcareous sands grading into nodular then honeycomb calcrete resting on calcretized tillite and, in some areas, dolerite. Soil thickness 0 – 0,3 m with calcrete down to 0,3 – 0,8 m.

F Patches of fine surface gravels resting on mixed sands and gravels on tillite and shale. Soil thickness generally thin averaging 0,1 – 0,4 m on average.

G Patches of coarse and fine surface gravels resting on transported, mainly alluvial and hillwash, sands with minor gravel. Soil thickness expected to be 0,3 – 1,2 m on average.

H Red sands typically alluvial on surface but of aeolian origin. Indurated to form a duricrust locally known as dorbank on slopes. Thickness 0,5 to possibly in excess of 1,5 m in low lying areas.

The distribution of these has been plotted on drawing number 2 based on photo interpretation of the Google Earth image.

4.4 GROUNDWATER

There exist two boreholes close to each other in the centre of the northern portion of the site to the north of the railway. See drawing no. 2. One is currently being pumped and supplies a stock watering trough at the borehole and another tank and trough via a pipeline immediately south of the railway near the large box culvert. The water appears to be of good quality, clear and drinkable. No water quality testing or borehole yield tests have been done however.

The water table in the second borehole was plumbed and found to reside at a depth of 19 m.

Two exploration boreholes drilled on the road near to the borrow pit were found to be dry.

No natural seeps or springs were found on the site.

4.5 DRAINAGE

4.5.1 Drainage Pattern, Catchments and Run-Off

The natural drainage pattern is a dendritic one with the main limbs corresponding in terms of orientation with the lineations mentioned earlier. See drawing number 1.

The drainage paths are ill-defined and typically comprise wide areas within broad gentle valleys that are discernible mostly by a change in vegetation type. Darker green, more bushy Rhigozum trichotomum commonly known as Kriedoring or Granaatbos tend to inhabit these areas with the size and density of cover increasing as the soil moisture and soil thickness increases towards the centres of the drainage lines and downstream.

No large drainage lines enter the site from beyond its boundaries and most of the surface catchment for the single main drainage line that leaves the site to the north east lies within the boundaries. The headwaters of the drainage lines along the eastern boundary do however extend beyond the boundary to some small extent.

The railway acts as a cut-off across the entire site which concentrates the flows through culverts beneath the railway. Berms have been placed above many of these culverts to divert water into them and have thus further modified the natural drainage pattern. These may not be removed. Concentrated water flows will clearly occur where these culverts discharge. They however discharge directly onto the service road and no provision is made for water flows over or under the road.

Each of the culverts caters for a distinct catchment area and these are added to by the catchment area to the north of the railway. These catchments and the corresponding culvert positions are shown on the appended drawings numbers 2 and 3 and the sizes are tabulated below.

TABLE NUMBER 1

CATCHMENTS AND CULVERTS

Catchment Number	Approx. Area Km^2	Culvert Opening m^2	Culvert Type	
1	3,9	1,7	2 x 1,0 m	dia. pipe
2	0,6	0,7	3 x 0,6 m	dia. pipe
3	2,6	4,0	2 m x 2 m	box
4	2,9	1,5	4 x 0,7 m	dia. pipe
5	1,3	2,9	7 x 0,6 m x 0,7 m	boxes
6	2,7	2,8	5 x 0,8 m	dia. pipe
7	0,3	0,8	2 x 0,7 m	dia. pipe
8	0,6	0,8	2 x 0,7 m	dia. pipe
9	7,1			
Total Area	22,0			

It is not known what flood return period was used in sizing the culverts but they are generally large and would correspond to very high flood volumes passing through the site. It is likely that the 2 x 2 m box culvert is intended as an underpass as well as a culvert.

There are no perennial streams on the site and it is expected that running water would only be found during and immediately after significant rainstorms. The site was visited soon after a period of good rains but no surface water whatsoever was observed.

A small, shallow dam has been excavated towards the north west corner of the site. It is not expected to hold water very often or for very long. A number of flat rocky depressions akin to pans also exist in this area where there is evidence of shallow standing water at times.

Run-off coefficients are generally high once the thin soil cover becomes saturated but infiltration can appear to be high for small rainfall events until saturation occurs. The more sandy valleys will absorb more rainfall than the intervening more rocky ridges.

Indications are that run-off occurs over the entire site in the form of sheetwash with only a few short sections of narrow incised channels, generally less than 0,5 m deep and 0,5 m wide, present. These are to be found mainly in a small area between the eastern boundary and the railway line where it parallels it and where erosion of vehicle tracks running normal to the contours has occurred in the centre of the site. It can be expected that channels will develop with time immediately below the culvert outlets due to the concentration of water at these locations.

4.5.2 Impacts and Constraints

Construction on the site could lead to increased erosion by concentrating water flows and removing the natural erosion protection as well as increasing run-off off the site and thus reducing infiltration and groundwater recharge.

The vegetation, surficial gravel layer and soil duricrust all act as protection against erosion by water and wind. Removal of these by excavation, grading or clearing will not only encourage erosion but will increase flow velocities and thus reduce infiltration and increase potential flood peaks downstream below the site.

Obstructions such as foundations and roadways will direct flows and concentrate them to erode gullies or dongas, the depths of which will be dictated by the depth of soil cover present. Flows diverted along tracks and infilled trenches will also result in similar occurrences especially if not orientated along the contours.

It will be necessary to keep open the main drainage lines or hydraulic corridors traversing the site especially immediately below the culvert outlets. These need to be wide as the water flow depths are small and widths of the order of 100 m are indicated if the formation of gullies is to be avoided.

An alternative although a less preferred one, could be to formalize the drainage lines into channels excavated down to bedrock and to discharge these into retention dams at regular intervals so as to keep total run-off low and to maintain infiltration. Erosion protection on bends and where soil is deeper using gabions and Reno mattresses would be necessary. The existing borrow pit could be used as such a retention dam. Such channels would only need to be of the order of 5 m wide in a buffer zone some 25 m wide. The siting of such drains and ponds is indicated on drawing number 3. They will require more detailed design after a more detailed topographic and geotechnical survey has been undertaken.

A further mitigatory measure would be to divide the area with undisturbed or “no go” buffer zones between blocks of solar panels to act as erosion barriers and flow retardants. Bear in mind that revegetation of cleared areas would be extremely slow.

An attempt has been made to categorize the impacts and possible mitigatory measures below. The impacts are considered to be on site, permanent, and related to the biophysical environment.

Activity	Impact	Likelihood	Magnitude	Significance before mitigation	Mitigatory Measures	Significance after mitigation
Clearing of vegetation	Erosion by wind and water resulting in dongas and soil loss	Likely	Medium	Moderate	Maintain buffer strips at regular intervals. Replant or re-seed. Try not to remove root stock by riding over plants rather than clearing.	Minor
Clearing of gravel	Erosion by wind and water resulting in dongas and soil loss	Likely	Medium	Moderate	Maintain buffer strips at regular intervals. Stockpile gravel and spread afterwards.	Minor
Develop across main drainage channels	Blockage of drainage paths and damage to panels by debris and flooding	Definite	High	Major	Maintain adequate breadth and width below panels and supports so as not to trap debris. No cables underground. Protect disturbed surfaces against erosion.	Minor
Dig formal drainage channels	Deepening and sidewards erosion of channels. Loss of infiltration. Increased flooding downstream.	Likely	Medium	Major	Create retention dams. Protect bends with gabions. Install gabion weirs.	Minor
Flow diversion and concentrati on by roads	Erosion of dongas in areas of soil	Likely	Medium	Moderate	Build regular diversion humps in roads. Orientate along contour.	Negligible
Flow diversion and concentrati on by structures and foundations	Erosion of dongas in areas of soil	Likely	Medium	Moderate	Maintain adequate space below structures close to the ground and bury all foundations.	Negligible
Flow diversion and concentrati on by trenches	Erosion of dongas along trenches	Likely	Medium	Moderate	Orientate along contour where possible. Create berms across trenches at regular intervals. Pack stones over backfill in high erosion areas.	Negligible

5. GEOTECHNICAL CONSIDERATIONS

5.1 FOUNDING

Founding conditions are generally considered to be good ranging as they do from dense sands through calcretes to rock. For lightly loaded foundations, normal shallow strip or pad footings will suffice with safe net bearing pressures ranging from 100 kPa in the sands to in excess of 500 kPa on the rock. It is expected that heavier loads could in most cases be taken down to rock with relatively shallow excavation.

The installation of posts into the ground on which to support the photo voltaic panels would require some form of drilling or auguring depending on the depth of embedment required and where on the site. It is possible that steel H sections or similar could be driven to depths of 1,5 to 2,0 m in the areas of soil types G and H but there will almost certainly be areas where refusal will occur above such depths. A powerful post-hole auger ought to be able to create holes of adequate depth over most of the site, particularly as shallower depths of penetration will be required in the weathered rock and calcrete. It is expected however that the only method that can be used with confidence over the whole site would be to use percussion drilling. Holes can be expected to stand open in all the soil and rock types and it is unlikely that any casing would be required.

It is suggested that the red sands would be suitable for backfilling the holes around the posts. Saturating them in place would encourage adequate consolidation.

It could prove to be economical to situate the first phase in an area of deeper soil where there is a possibility of using an auger rather than a percussion drill.

5.2 EXCAVATION

Excavation in the sand and gravels would classify as soft but most of the rest of the materials in the form of the calcretes and bedrock would classify as intermediate and hard.

Trenches of up to approximately 0,7 m depth ought to be achievable by a digger-loader in the areas of soil types G and H but elsewhere it will require an excavator over much of the site and could even require blasting in isolated areas of hard dolerite. An option could be to rip the trenches with a single tine behind a dozer prior to excavation in the more resistant areas.

Over much of the site it would be beneficial to keep excavation to a minimum and rather suspend cables above ground where possible. Trenches should preferably be orientated along the contour in order to reduce erosion during infrequent significant rainfall events.

In all materials, excavation faces are likely to stand near vertically in the short term, up to heights of the order of 2 m if kept dry.

5.3 EROSION

Erosion potential in the natural state on the site is generally low. It does however become significant in terms of rainfall and wind when surfaces are disturbed by denudation of the vegetation or the surface gravels, removal of the resistant dorbank or calcrete or the placing of fill.

Erosion tends to be episodic and severe during infrequent significant rainfall events.

It is recommended that erosion potential be reduced by the stockpiling and spreading of gravels, stone pitching using selected surface cobbles, utilizing calcareous material for backfilling and preservation as much as possible of root stock and surface vegetation.

5.4 ACCESS ROUTES

Existing tracks on the site have generally remained in good useable condition except for where gradients are relatively steep and minor erosion has occurred on account of concentrated water flows following the wheel ruts. In all cases the tracks have been formed by compaction by traffic with no associated cut or fill. Water diversion berms have been formed on the tracks serving the power lines and these must be maintained. It is recommended that the same approach be adopted for new tracks and that existing tracks be utilized as much as possible.

5.5 CONSTRUCTION MATERIALS

5.5.1 Calcrete

The calcretes with their recementing capabilities make good road building materials and are extensively used in the area for road layerworks and surfacing.

5.5.2 Fill Materials

The sands, gravels, crushed dolerite, shales, tillite and calcrete can all be used as good quality fill material and have been used on the railway, roads and other structures in the area. The shales can however be expected to slake and consolidate with time. They are also favoured locally as a wearing course on dirt roads.

5.5.3 Aggregates

The sands and gravels or crushed rock are not expected to be suitable for concrete or mortar although the red sands are used locally for poor quality plaster.

5.5.4 Stone

Careful selection by hand of the surface gravels and rock outcrops will yield good quality and well-shaped stone for use in gabions and stone pitching. This will be labour intensive however.

5.5.5 Water

The borehole water is likely to be suitable for use in concrete. It still needs to be tested however.

6. CONCLUSION AND RECOMMENDATIONS

An attempt has been made to provide guidelines and recommendations for the development on the site as a whole in terms of the drainage and the geotechnical conditions. These are summarized below.

6.1 DRAINAGE

Drainage channels are ill-defined and run-off is mainly by sheetwash over broad valleys. These need to remain unobstructed if flow concentrations and consequent erosion is to be avoided. Widths of up to 100 m are indicated as being required.

An alternative would be to formalize the drainage paths by excavating channels and thus permitting narrower drainage corridors to be kept open. As this will increase run-off and decrease infiltration it needs to be coupled with the creation of retention ponds to facilitate and encourage infiltration. Widths of the order of 25 m ought to suffice under such conditions. Erosion protection of these channels will be required in places. Concentrated flows can be expected below the outlets of the culverts beneath the railway and these need to be accommodated. Diversion berms exist above these culverts and protrude some distance into the site. These may not be removed or altered.

Run-off is generally minimal but the area is subject to infrequent flash floods of significant size.

6.2 GEOTECHNICAL ASPECTS

The chief consideration is likely to be that of excavatability for foundation posts and trenches with ground conditions ranging from soft sand to hard rock.

It will be beneficial to concentrate development in the areas of deeper soils or to at least commence the initial phases in such areas. If possible cables should be kept above ground to minimize the trenching required.

Founding conditions for most types of structures are considered to be good and natural construction materials are available.

7. ADDITIONAL COMMENTS RELATING TO AMENDED PROPOSED PLANT LAYOUTS.

7.1 PLANT LAYOUTS

The initial layout of the photovoltaic panels on the site was as is depicted on drawing no. 5. Subsequent to the mitigation workshop, the layout was amended to as is depicted on the same drawing no. 5.

7.2 CONSEQUENCES OF THE REVISED LAYOUT

The most significant consequence of the revised layout is that it avoids transgressing most of the drainage lines which was identified as a significant potential impact in the earlier parts of this report. The only remaining conflict in this regard remains in the area of panels in the centre of the site immediately to the north of the railway where culvert no. 2 discharges into the area from beneath the railway. It is recommended that some form of drainage corridor will need to be provided through this area as is depicted on drawing no. 3. Most other impacts identified remain pertinent although significantly reduced in scale.

The table below attempts to summarize the impacts and constraints as was done in section 4.5.2 but providing a comparison between the original proposed layout and the revised one.

Activity	Impact	Significance before mitigation. Initial layout. Alternative 1	Significance before mitigation. Revised layout. Alternative 2	Mitigatory Measures	Significance after mitigation. Revised layout. Alternative 2
Construction Phase					
Clearing of vegetation	Erosion by wind and water resulting in dongas and soil loss	Moderate	Moderate	Maintain buffer strips at regular intervals. Replant or re-seed. Try not to remove root stock by riding over plants rather than clearing.	Minor
Clearing of gravel	Erosion by wind and water resulting in dongas and soil loss	Moderate	Moderate	Maintain buffer strips at regular intervals. Stockpile gravel and spread afterwards.	Minor
Develop across main drainage channels	Blockage of drainage paths and damage to panels by by debris and flooding	Major	Moderate	Maintain adequate breadth and width below panels and supports so as not to trap debris. No cables underground. Protect disturbed surfaces against erosion.	Minor
Dig formal drainage channels	Deepening and sidewards erosion of channels. Loss of infiltration. Increased flooding downstream.	Major	Moderate	Create retention dams. Protect bends with gabions. Install gabion weirs.	Minor
Flow diversion and concentration by roads	Erosion of dongas in areas of soil	Moderate	Moderate	Build regular diversion humps in roads. Orientate along contour.	Minor
Flow diversion and concentration by structures and foundations	Erosion of dongas in areas of soil	Moderate	Minor	Maintain adequate space below structres close to the ground and bury all foundations.	
Flow diversion and concentration by trenches	Erosion of dongas along trenches	Moderate	Moderate	Orientate along contour where possible. Create berms across trenches at reguilar intervals. Pack stones over backfill in high erosion areas.	Minor
Operational Phase					
Develop across main drainage channels	Blockage of drainage paths and damage to panels by by debris and flooding	Major	Minor	Maintain adequate breadth and width below panels and supports so as not to trap debris. No cables underground. Protect disturbed surfaces against erosion.	Negligible
Dig formal drainage channels	Deepening and sidewards erosion of channels. Loss of infiltration. Increased flooding downstream.	Major	Minor	Create retention dams. Protect bends with gabions. Install gabion weirs.	Negligible
Flow diversion and concentration by roads	Erosion of dongas in areas of soil	Moderate	Minor	Build regular diversion humps in roads. Orientate along contour.	Negligible
Flow diversion and concentration by structures and foundations	Erosion of dongas in areas of soil	Moderate	Minor	Maintain adequate space below structres close to the ground and bury all foundations.	Negligible
Flow diversion and concentration by trenches	Erosion of dongas along trenches	Moderate	Minor	Orientate along contour where possible. Create berms across trenches at reguilar intervals. Pack stones over backfill in high erosion areas.	Negligible

8. INFORMATION GAPS, UNCERTAINTIES, STUDY LIMITATIONS AND UNDERLYING ASSUMPTIONS

This investigation is based purely upon a desk study and a visual field survey coupled with past experience in the area. Many of the predictions and recommendations are based on indicators only. These need to be confirmed by testing and sampling.

It is envisaged that a trial pitting and probing exercise will confirm soil profiles, excavation depths and types and will yield samples to test for use as construction materials. Water samples should also be taken for analysis.

The information provided is offered as guidelines only to ways and areas of development. On site testing could modify suggested boundaries and depths.

It is recommended that not only mineral and mining rights over the property as well as those relating to borrow pits be determined but also that restrictions relating to development and working close to or beneath power lines and the railway be investigated.

M.van Wieringen
Pr.Eng.,Pr.Sci.Nat.

Dated 18/10/11
Ref. No. 24/11

APPENDIX A

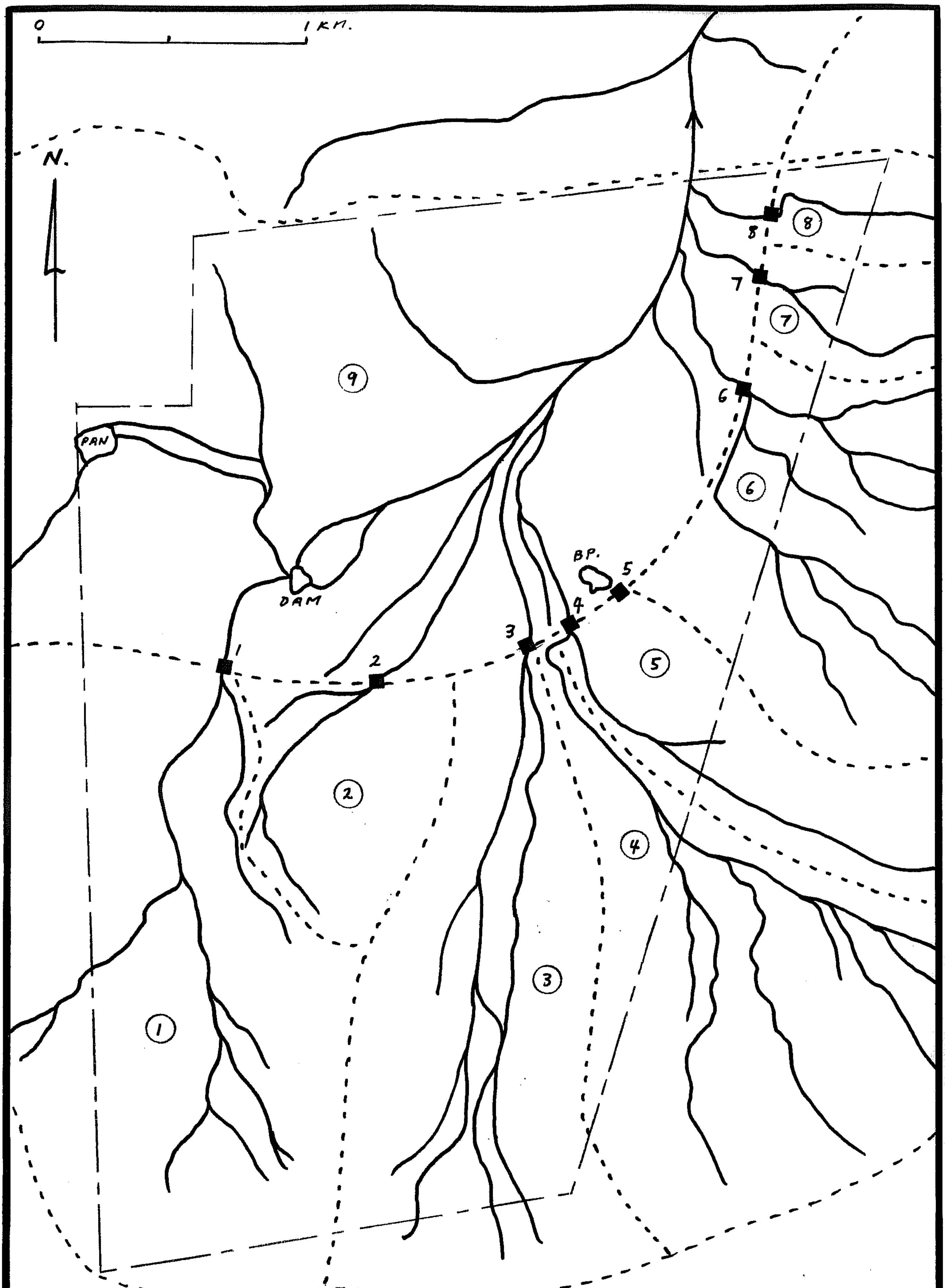
REFERENCES

Sheet 2920 Kenhardt	1:250 000 Geological Map of the Department of Survey of R. S. A.	Geological
Sheets 2920 BD and DB	1:50 000 Topocadastral Maps of the Directorate Mapping of R. S. A.	Of Surveys and

Explanation of Kenhardt Geological sheet 2920 – Council for Geoscience of R. S. A.

APPENDIX B

DRAWINGS NUMBERS 1 TO 5.



M.van Wieringen & Associates CONSULTING GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS P.O. BOX 32224, CAMPS BAY, SOUTH AFRICA, 8040 Phone 27 (021) 4383001 Fax 27 (021) 4382108 E-mail mvwgeo@iafrica.com	TITLE	DRAWING PATTERN, CULVERTS AND CATCHMENTS	DRAWN BY	M V W	JOB NO.	24/11
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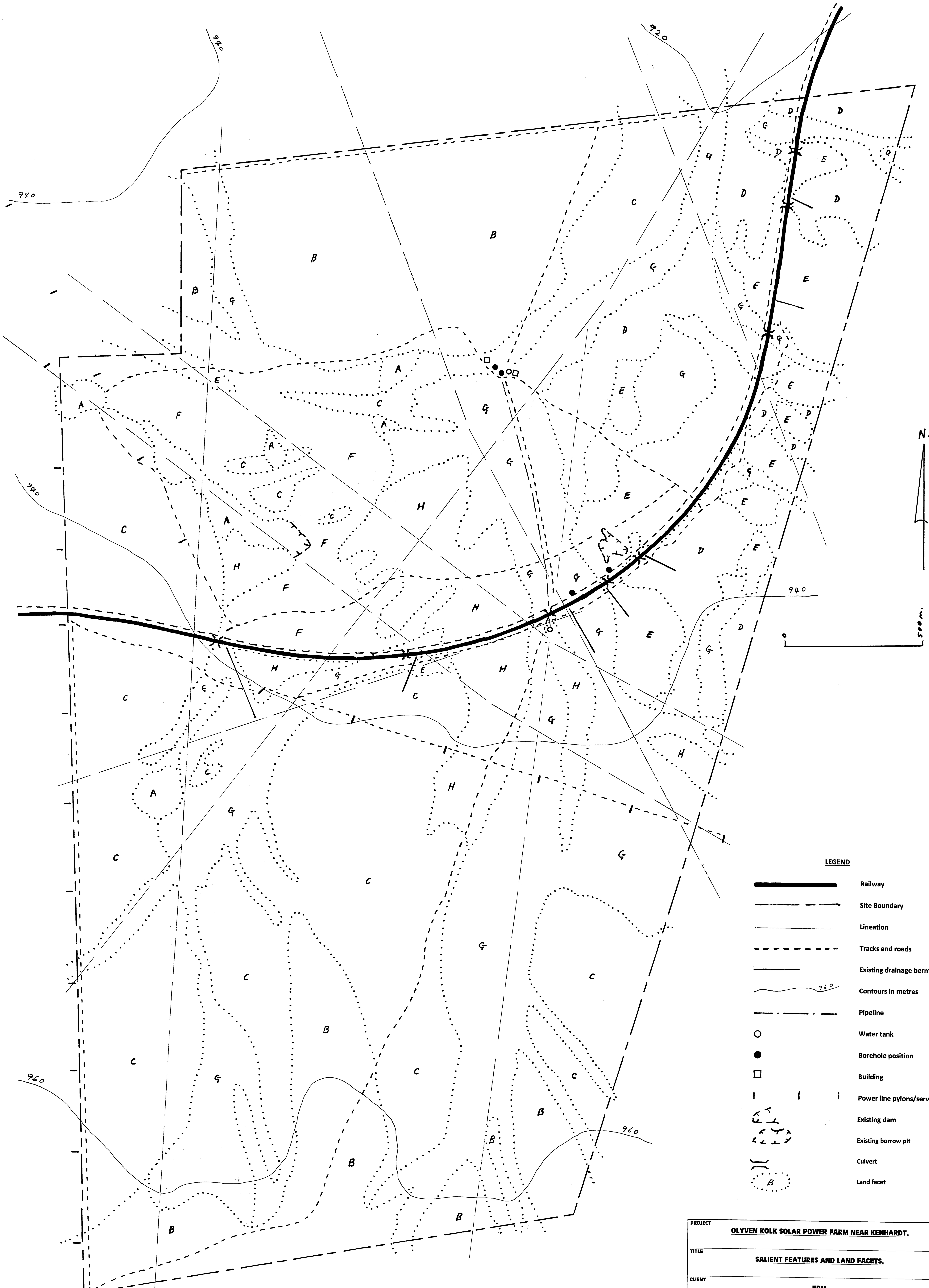
	CLIENT	ERM	DATE	24/6/11	DWG. NO.	1



PROJECT

OLYVEN KOLK SOLAR POWER FARM NEAR KENHARDT.

TITLE

SALIENT FEATURES AND LAND FACETS.

CLIENT

ERM

M.van Wieringen & Associates
CONSULTING GEOTECHNICAL ENGINEERS
AND ENGINEERING GEOLOGISTS
P.O. BOX 32224, CAMPS BAY, SOUTH AFRICA, 8040
Phone 27 (021) 4383001 Fax 27 (021) 4382106
E-mail mvwgeo@iafrica.com

TRACED BY		DATE	24/6/11
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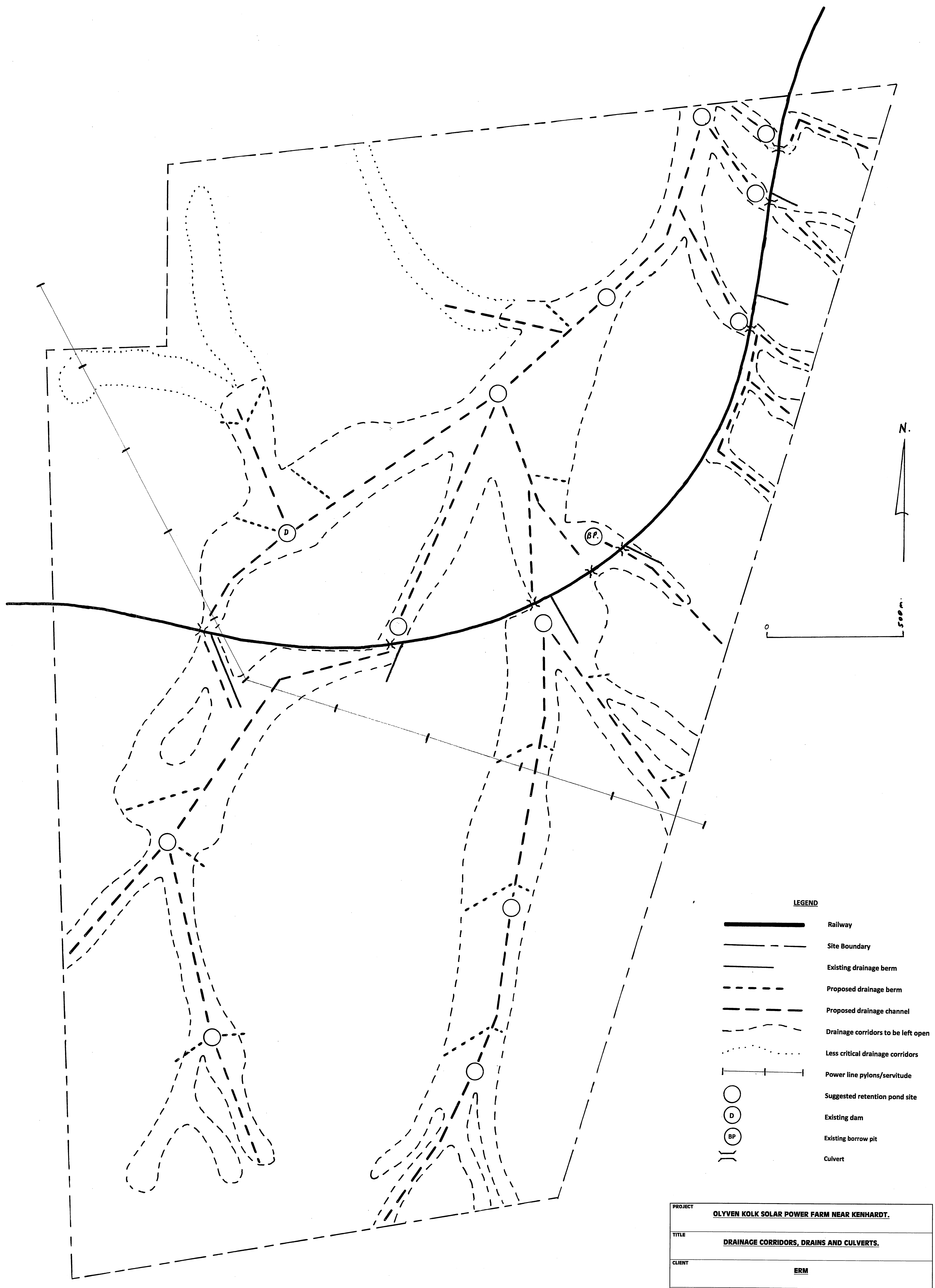

PROJECT

OLYVEN KOLK SOLAR POWER FARM NEAR KENHARDT.

TITLE

DRAINAGE CORRIDORS, DRAINS AND CULVERTS.

CLIENT

ERM

M.van Wieringen & Associates
CONSULTING GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
P.O. BOX 32224, CAMPS BAY, SOUTH AFRICA, 8040
Phone 27 (021) 4383001 Fax 27 (021) 4382106
E-mail mvwgeo@iafrica.com

TRACED BY		DATE	24/6/11
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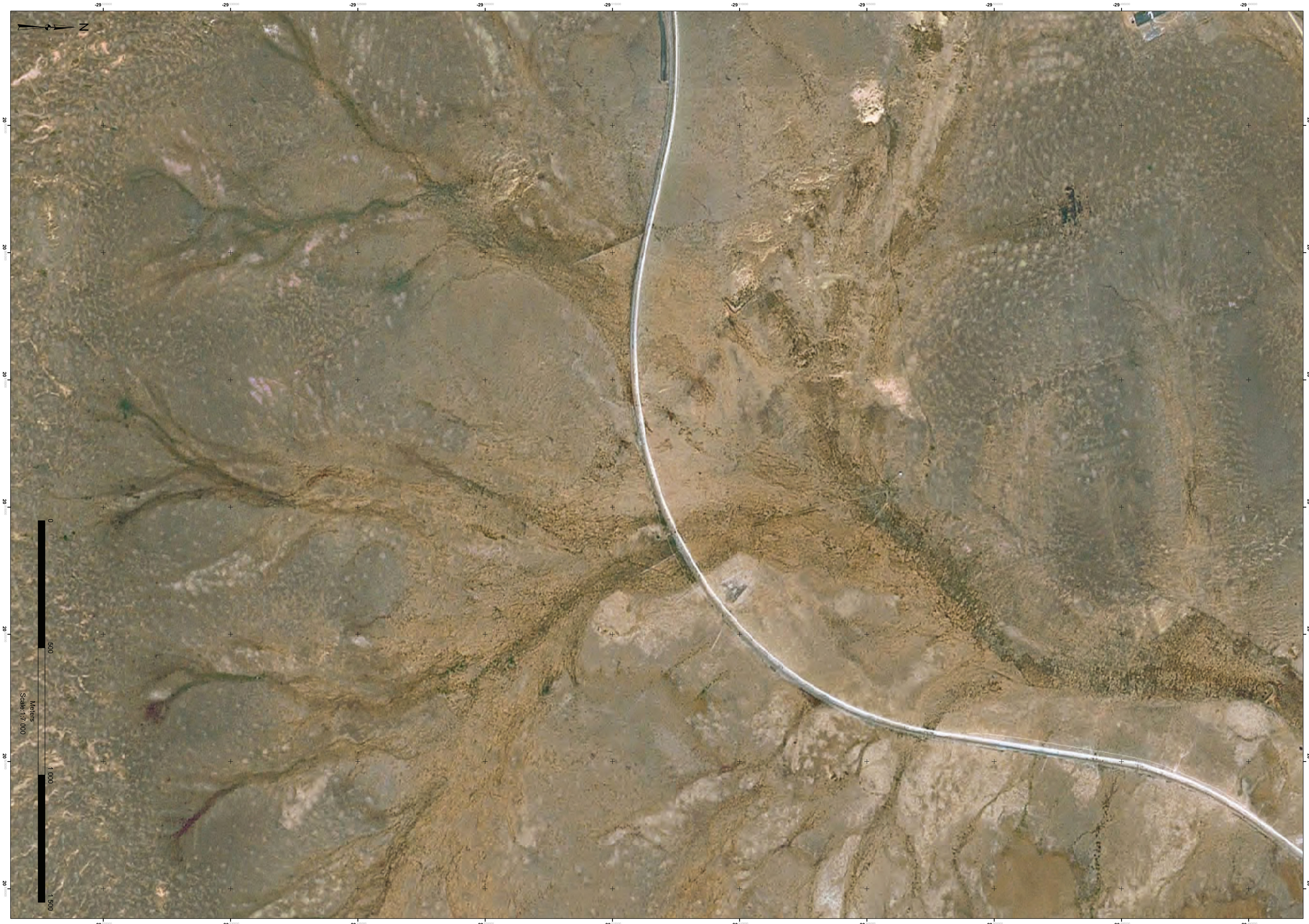

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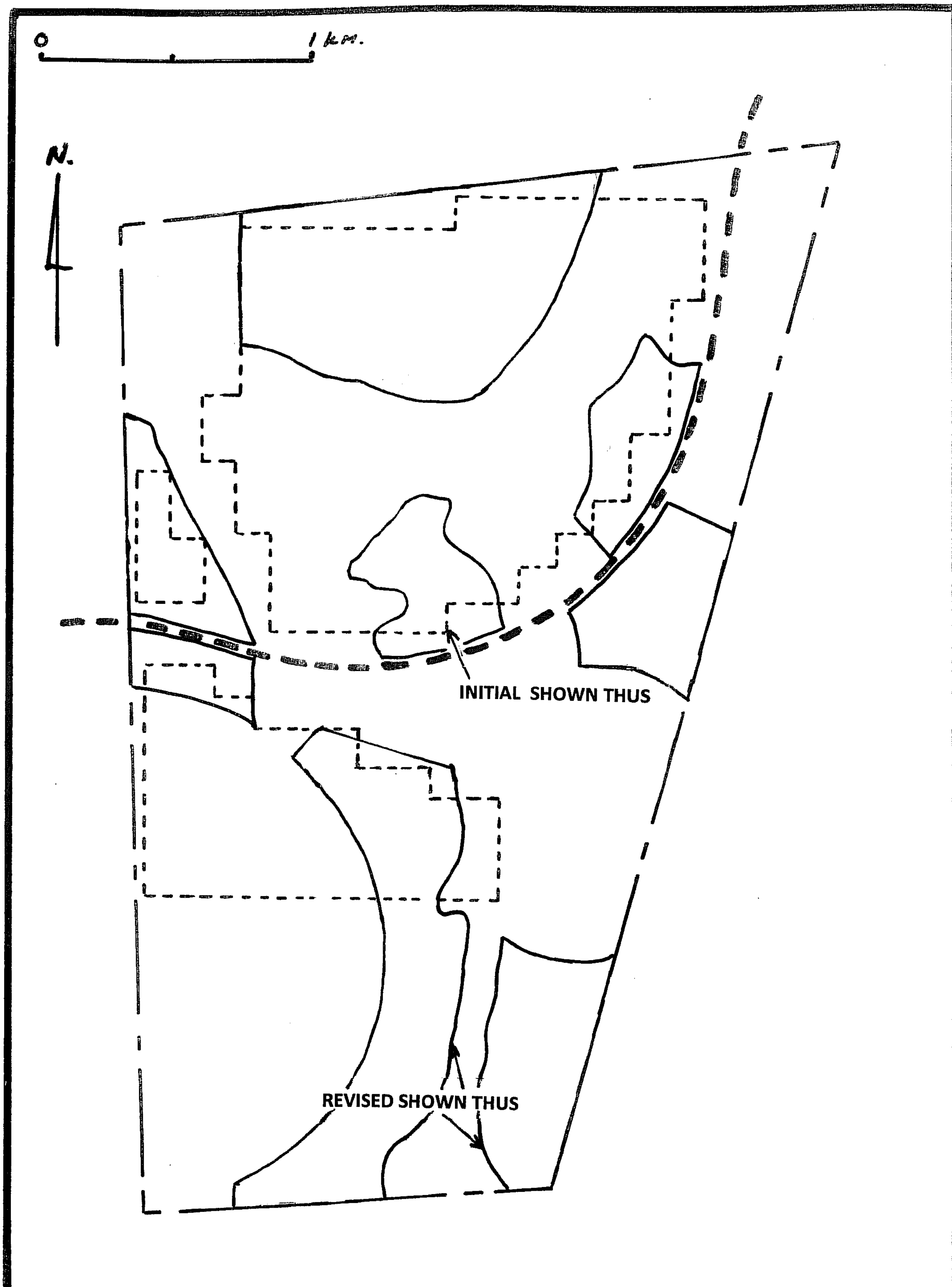


M.van Wieringen & Associates CONSULTING GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS	TITLE	INITIAL AND REVISED SOLAR PANEL LAYOUTS	DRAWN BY	M v W	JOB NO.	24/11
P.O. BOX 32224, CAMPS BAY, SOUTH AFRICA, 8040	PROJECT	OLYVEN KOLK SOLAR POWER FARM	REG. NO	760509	SCALE	As shown
Phone 27 (021) 4383001 Fax 27 (021) 4382106 E-mail mvwgeo@iafrica.com	CLIENT	ERM	DATE	24/8/11	DWG. NO.	5

Annex K

Environmental Management Programme (EMP)

CONTENTS

1 *ENVIRONMENTAL MANAGEMENT PROGRAMME*

1.1 *INTRODUCTION*

An Environmental Management Programme (EMP) is a set of guidelines and actions aimed at ensuring that construction and/or installation activities, and subsequent management of facilities, are undertaken in a manner that minimises environmental risks and impacts.

The following EMP has been prepared by ERM Southern Africa (Pty) Ltd, for Rotifield Solar Energy Ltd, hereafter referred to as Rotifield, for the proposed construction and operation of a 40 MW Solar Power Plant planned for Olyven Kolk Farm 4. In the event of the project being taken over by another party, that party would assume the responsibilities and conditions of this EMP. This EMP addresses potential impacts associated with the installation/ construction, operation and decommissioning phases of the project.

The EMP is required in order to:

- assist in ensuring continuing compliance with South African legislation and Rotifield's Environmental Health and Safety Policy (this policy is currently being developed);

- provide a mechanism for ensuring that measures identified in the EIR designed to mitigate potentially adverse impacts, are implemented;

- provide a framework for mitigating impacts that may be unforeseen or unidentified until construction is underway;

- provide assurance to regulators and stakeholders that their requirements with respect to environmental and socio-economic performance will be met; and

- provide a framework for compliance auditing and inspection programs.

The EMP will remain a draft document until after it has been updated with the conditions stipulated in the environmental authorisation.

The EMP specifies the following:

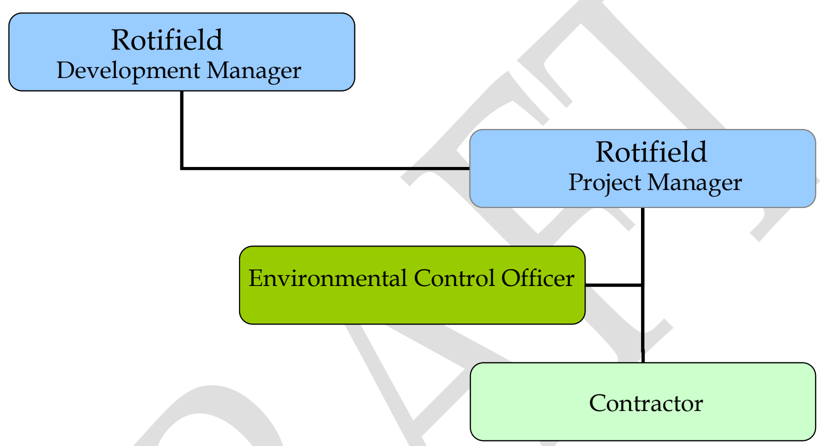
- roles and responsibilities for implementation of the EMP (*Section 1.2*);
- subsidiary plans and policies (*Section 1.8*);
- stakeholder engagement (*Section 1.9*);
- permit requirements (*Section 2*);
- biological monitoring requirements for pre-construction, construction and operation (*Section 3*);

- mitigation and compliance monitoring measures (*Section 4*); and
- contractor compliance standards (*Section 5*)

1.2 ROLES AND RESPONSIBILITIES

The following section outlines the roles and responsibilities of those involved in the proposed installation, operation and decommissioning of the solar power plant. An organogram showing reporting structures is provided in *Figure 1.1*.

Figure 1.1 Reporting Structures



1.2.1 *Rotifield*

Development Manager

Rotifield's Development Manager will have the ultimate responsibility for ensuring the measures outlined in the EMP are delivered and that the measures are implemented by their contractors and subcontractors. In this respect the Development Manager will review and approve contractor plans for delivery of the actions contained in the EMP during construction and ensure that during operation performance will be evaluated through monitoring and auditing.

The Development Manager's responsibilities will encompass the following:

- Liaison with the project engineers to ensure that the solar power plant is designed to meet all the specified environmental parameters and legal requirements as specified in the EMP and Environmental Authorisation;
- Authority to stop works in emergency situations;
- Approval of method statements; and
- Liaison with authorities.

The Project Manager [(1)], or any other person appointed to the role, is responsible for the implementation of the EMP, and will report directly to the Development Manager on environmental, health and safety matters.

Project Manager

The Project Manager [(2)], is the designated person responsible for the implementation of the EMP and therefore the person responsible for managing the environmental issues that arise during the construction phase of the project.

The Project Manager's main role is to regularly inspect and manage the construction activities on site in order to ensure compliance with the EMP. The Project Manager will liaise with the Environmental Control Officer (ECO) and Contractor and report to the Development Manager.

The Project Manager's responsibilities will encompass the following:

- Training of contractors on environmental matters;
- Inspect the site at least once every two weeks for the duration of the construction phase;
- Management of the contractors in terms of the EMP;
- Review of contractor method statements and ensure alignment with the EMP;
- Reporting on environmental problems to the Development Manager;
- Record keeping of:
    - environmental incidents;
    - contractors non-compliance to the EMP; and
    - contractor fines and penalties.
- Making recommendations or implementing actions relating to a contractor's failure to comply with the EMP, which may include enforcement of penalties and even contract termination and removal of contactor from the site;
- Recommend the suspension of work activities where such activities contravene the EMP requirements; and
- The authority to stop works in emergency situations when the Development Manager is not available and construction activities seriously threaten the environment.

The Project Manager will also be responsible for implementing the community engagement plan. The Project Manager will be required to participate in community meetings that will be held in affected communities prior to, during and upon completion of construction.

(1) Yet to be appointed to the role.
(2) Yet to be appointed to the role.

During the construction phase an Environmental Control Officer (ECO) will be responsible for ensuring the overall environmental and socio-economic objectives of the EMP are met. When working on site, the ECO will report to the Project Manager.

1.2.2 Environmental Control Officer

Rotifield will appoint an independent Environmental Control Officer (ECO) prior to commencement of construction and throughout the construction phase of the project until such time as rehabilitation is complete and the site is ready for operation. The ECO shall hold a relevant environmental degree or diploma and have a few years of experience in ECO work.

The primary role of the ECO will be to monitor the construction activities and ensure that the mitigation measures of the EMP and Environmental Authorisation (EA) are implemented.

The ECO's responsibilities will encompass the following:

- Brief the Contractor on EMP requirements and site layout;
- Retain a copy of the EMP and EA and all records relating to monitoring and auditing on site, and keep these available for inspection;
- Visit the site at least once a day, particularly for the following activities:
    - Site clearance;
    - PV array and structures arrival, assembly and placement;
    - Establishment of all works areas including latrines and wash areas.

- Specific tasks of the ECO will include ensuring:
    - Sensitive areas are demarcated and cordoned off;
    - Activities are restricted to demarcated works areas;
    - No sensitive features are damaged or disturbed;
    - Any notifiable features (eg fossils or other heritage remains) are recorded and work stopped or redirected to avoid such areas, and the appropriate authorities informed;
    - All incidents are recorded in a logbook and appropriate remedial action taken;
    - Site visit reports are kept and feedback provided to the Project Manager and other senior management, as required; and
    - Liaise with DEA regarding implementation of the EMP, if and when required.

The ECO will be expected to be contactable telephonically in case of emergencies at all times.

1.2.3 *Contractors and Site Personnel*

During site preparation and construction, the contractor will be responsible for ensuring compliance with all relevant legislation as well as adherence to all environmental and socio-economic mitigation measures specified in the EMP. The contractor is also responsible under the contract for managing the potential environmental, socio-economic, safety and health impacts of all contracted activities whether these are undertaken by themselves or by their subcontractors. The contractor has overriding responsibility for the activities of all direct staff and subcontractors.

Adherence to the provisions of the EMP will be a condition of contract with the contractor. The contractor will need to demonstrate to Rotifield's satisfaction how compliance with the requirements of the EMP will be met. The contractor will also be expected to demonstrate commitment to the EMP at all levels in the contractor's management structure and will be required to identify individuals responsible for overall environment, socio-economic, safety and health management.

The contractor will be required to undertake regular environmental and socio-economic inspections and provide reports to Rotifield to monitor and evaluate performance against the measures and objectives established in the EMP. In this regard, the contractor's performance in complying with the EMP will be monitored and audited by the ECO, Project Manager and Development Manager.

1.3 *ALLOCATION OF RESOURCES*

Financial and personnel resources must be allocated to the implementation of the EMP, including provisions for contractor training and environmental awareness, contingencies to deal with environmental emergencies, monitoring and auditing. Such resources must be available during the operational and closure, as well as the construction phase.

Environmental requirements requiring cost allocation must be clearly identified the terms of reference for contractors and suppliers to ensure these service providers budget effectively.

1.4 *TRAINING AND HSE AWARENESS*

Training and awareness raising around HSE issues is essential for ensuring that the EMP is effectively implemented and that unforeseen HSE incidents are managed timeously and appropriately. The ultimate responsibility for environmental training and awareness raising rests with Rotifield. It is suggested that the following be included in the approach to training and awareness raising:

- Induction course/briefing for all contractors including a description of Rotifield's expectations, specific responsibilities of workers with regard to HSE issues. The briefing will usually take the form of an on site talk and demonstration by the ECO. The education / awareness programme should be aimed at all levels of personnel within the contractor team;
- Refresher courses as and when required;
- Focused training sessions in relation to specific tasks, such as the erection of solar arrays; and
- Toolbox talks to alert workers to particular HSE concerns associated with their tasks for the day/period and to encourage generally responsible behaviour on site.

Courses should be provided by a qualified person and in a language and medium understood by contractors/employees.

1.5 *DOCUMENTATION AND RECORD KEEPING*

All documentation relevant to the implementation of the EMP during construction, operation and closure must be maintained on site in a structured and ordered manner. These documents should be distributed in a controlled manner to affected personnel and must also be made available for public / authority inspection, if requested.

The type of documents that should be managed and retained include, at minimum:

- Method statements;
- Policies and plans;
- Project specific HSE audit reports;
- Training material and records of attendance;
- Incident reports;
- Emergency preparedness and response procedures;
- Monitoring reports; and
- Minutes of key meetings with service providers and project team members.

1.6 *AUDITING AND REPORTING*

Auditing by an external, independent auditor should be undertaken at the end of both the construction and rehabilitation phases, as well as regular audits thereafter during operation, subject to DEA requirements. After each audit a report should be submitted to the DEA and other relevant authorities. The audit must cover compliance with any specific conditions included in the Environmental Authorisation as well as specific management actions included in this EMP. The completed audit reports must be accurately dated and form part of the document control system.

A monthly audit should be undertaken by the independent ECO during construction and the resultant independent audit reports will be communicated with senior management within Rotifield and sent to the DEA and other relevant authorities as required.

1.7 REVISION OF THE EMP

This EMP has been formulated in draft so as to allow for appropriate changes and modifications subject to inclusion of final requirements as per the EA. The EMP should be subject to review by senior management responsible for the project at the following stages of the project:

- Prior to the initiation of the construction phase to ensure that all relevant management actions have been included;
- Following the construction phase and after the start of operation, to capture additional and unforeseen mitigation measures that are identified during these activities, and would be relevant to the operational phase; and
- Prior to final decommissioning.

1.8 SUBSIDIARY PLANS AND POLICIES

Environmental and socio-economic management issues at various stages in the life of the project from detailed design through to decommissioning, are governed or guided by a number of standards, including:

- those contained in South African legislation;
- those required by Rotifield policy or manufactures specifications;
- those within relevant international standards (e.g. World Bank environmental guidelines, IFC Performance Standards, World Health Organisation, International Labour Organisation); and
- commitments made in the EIA.

Prior to construction a number of subsidiary plans, policies and monitoring programmes will be required to manage various activities or potential risks. These are summarised in *Box 1.1*.

Box 1.1 Summary of Subsidiary Plans, Policies and Programmes required for the EMP

Policies, Plans and programmes to be developed

- Environmental Policy
- Recruitment Policy
- Local Procurement Policy
- Health and Safety Policy
- Human Resources Policy
- Code of Conduct
- Emergency Preparedness and Response Plan
- Health and Safety Plan
- Traffic Management Plan
- Waste Management Plan
- Community Engagement Plan (CEP)

1.9 STAKEHOLDER ENGAGEMENT

Rotifield will continue to engage with stakeholders throughout project construction and operation. Communication with local communities and other local stakeholders will be a key part of this engagement process and will require Rotifield and the contractor to work closely during the construction period. Development of a Community Engagement Plan (CEP) will be important to facilitate this communication.

The objectives of communication and liaison with local communities are the following.

- To provide residents in the vicinity of the solar power plant (e.g. neighbouring landowners/ farmers) and other interested stakeholders, with regular information on the progress of work and its implications.

- To monitor implementation of mitigation measures and the impact of construction on communities via feedback from those affected in order to ensure that mitigation measures are implemented and the mitigation objectives achieved.

- To manage any disputes that may arise between Rotifield, the contractors and local people.

1.9.1 *Grievance Procedure*

Rotifield should develop a grievance procedure to ensure fair and prompt resolution of problems that may arise from the project. The grievance procedure should be underpinned by the following principles and commitments:

- Implement a transparent grievance procedure, and disseminate key information to directly impacted stakeholders.

- Seek to resolve all grievances timeously.

- Maintain full written records of each grievance case and the associated process of resolution and outcome for transparent, external reporting.

The responsibility for resolution of grievances will lie with Rotifield and its contractors. The ECO should ensure that the grievance procedure is made accessible to the local community and other relevant stakeholder.

2 PERMIT REQUIREMENTS

Activities undertaken during site preparation, construction and operation may require additional permits, over and above the Environmental Authorisation. Rotifield is responsible for ensuring that the necessary permits are in place in order to comply with national and local regulations. Additional permit requirements are described below.

2.1 HERITAGE

The protection and management of South Africa's heritage resources is controlled by the National Heritage Resources Act (NHRA), 1999 (Act No. 25 of 1999). The objective of the NHRA is to introduce an integrated system for the management of national heritage resources.

Archaeology, Palaeontology and Meteorites

According to Section 35 (Archaeology, Palaeontology and Meteorites) and Section 38 (Heritage Resources Management) of the South African National Heritage Resources Act, palaeontological heritage impact assessments (PIAs) and archaeological impact assessments (AIAs) are required by law in the case of developments in areas underlain by potentially fossiliferous (fossil-bearing) rocks, especially where substantial bedrock excavations are envisaged, and where human settlement is know to have occurred during prehistory and the historic period. Depending on the sensitivity of the fossil and archaeological heritage, and the scale of the development concerned, the palaeontological, and archaeological impact assessment required may take the form of (a) a stand-alone desktop study, or (b) a field scoping plus desktop study leading to a consolidated report. In some cases these studies may recommend further palaeontological and archaeological mitigation, usually at the construction phase. *Table 2.1* outlines when a permit is required depending on the sensitivity of the heritage resources.

Table 2.1 Permitting requirements for fossil, built environment and Stone Age archaeology

PERMIT APPLICATION SECTION 35 – FOSSILS, BUILT ENVIRONMENT FEATURES, SHIPWRECKS & STONE AGE ARCHAEOLOGY (Ref : NHRA 1999: 58):
(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite; (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite; (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite.

Burial Grounds and Graves

A Section 36 permit application is made to the South African Heritage Resources Agency (SAHRA) which protects burial grounds and graves that are older than 60 years, and must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make such arrangements for their conservation as it sees fit. SAHRA must also identify and record the graves of victims of conflict and any other graves which it deems to be of cultural significance and may erect memorials associated with these graves and must maintain such memorials. A permit is required under the conditions listed in *Table 2.2*.

Table 2.2 Permitting requirements for burial grounds and graves older than 60 years to historic burials to the South African Heritage Resources Agency (SAHRA)

PERMIT APPLICATION SECTION 36 – BURIAL GROUNDS & GRAVES (REF: NHRA 1999 : 60)
(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves
(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals
(d) SAHRA or a provincial heritage resources authority may not issue a permit for The destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant

Table 2.3 Permitting requirements for heritage resources management

PERMIT APPLICATION SECTION 38 (Ref: NHRA 1999 : 62)
(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
(b) the construction of a bridge or similar structure exceeding 50 m in length;
(c) any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent; or
(ii) involving three or more existing erven or subdivisions thereof; or
(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or
(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

2.2 *WATER USE*

Given the minimal volumes of water required for the plant's operations, it is unlikely that a water use licence will be required. The Department of Water Affairs (DWA) have stipulated that projects of this nature take necessary measures to ensure that water needs are adequately catered for by a usage assessment. In the event that a water usage licence is required, this will be processed only once the Power Purchase Agreement has been awarded.

2.3 *ABNORMAL VEHICLE LOADS*

Solar power technology components will be delivered to site using road transport and due to the large volume of the components, the vehicles used to deliver the components will be considered abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989). A permit for a vehicle carrying an abnormal load must be obtained from the relevant Provincial Authority. The vehicle must comply with the Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads, issued by the Department of Transport, 2009.

2.4 *FLORA*

Two plant species observed on site require a permit obtainable from DENC should the develop require the removal or cause destruction or disturbance of these species, *Hoodia gordonii* and *Aloe claviflora* . Any individuals of these species falling within areas that will need to be cleared for the development, should be located, marked and translocated within the site to an area outside the development footprint. Prior to commencement of construction activities, Rotifield should apply with the consent of the landowner for such a permit and the translocation of plants should take place under the supervision of an ecologist or someone else with experience in this regard.

3 BIOLOGICAL MONITORING

3.1 INTRODUCTION

Specific biological monitoring requirements that are required to be undertaken through the various phases of the Olyven Kolk Farm 4 solar power plant are identified in this section. Biological monitoring is required during the pre-construction and construction phases of the project.

Table 3.1 provides a summary of what monitoring is required at the various phases of the development. Rotifield is responsible for ensuring that all monitoring measures described in this section are undertaken by appointing the relevant specialists where necessary.

Table 3.1 Monitoring Requirements

	Ecology	**Avifauna**
Pre-construction	X	X
Construction	X	X
Operation	X	X

3.2 PRE-CONSTRUCTION PHASE

Pre-construction monitoring is an essential requirement prior to construction in order to validate within reason that the arrangement of the arrays and project infrastructure, as well as mitigation and management measures as included in this EMP, will minimize potential impacts on ecological components.

3.2.1 Ecological Monitoring

Monitoring Impacts on Rare or Endangered Plant Species

The primary concern in terms of endangered plant species at the site is the potential impact on *Hoodia gordonii* and *Aloe claviflora*. The following monitoring action is recommended during the pre-construction phase:

Prior to construction the areas planned for installation of solar arrays or associated infrastructure should be searched for *Hoodia gordonii* and *Aloe claviflora* as well as any other plant species of conservation concern that may occur in the area. All individuals located should be marked and translocated to similar habitat outside the development footprint under the supervision of an ecologist or someone with experience in plant translocation. As indicated in *Section 2.4,* a permit will be required to relocate listed plant species.

3.2.2 *Avifauna Monitoring*

Monitoring protocols: Avian densities before and after

A set of at least 10 walk-transect routes, each of at least 250 m in length, should be established in areas representative of all the avian habitats present within a 2 km radius of centre of the Olyven Kolk Farm 4. Each of these should be walked at least once every two months over the six months preceding construction, and at least once every two months over the same calendar period, at least six months after the PV plant is commissioned. The transects should be walked after 06h00 and before 09h00, and the species, number and perpendicular distance from the transect line of all birds seen should be recorded for subsequent analysis and comparison

Monitoring protocols: Bird activity monitoring

Monitoring of bird activity in the vicinity of the solar power plant should be done over a single day at least every two months for the six months preceding construction, and at least once per quarter for a full calendar year starting at least six months after the solar power plant is commissioned. Each monitoring period should involve full-day counts of all species flying over or past the PV plant impact area (see passage rates below).

3.3 CONSTRUCTION PHASE

Mammals, reptiles and amphibians are most likely to be exposed to impacts during the construction phase of the solar power plant primarily through loss of habitat and impacts associated with construction vehicles and workforce. This section describes the biological monitoring measures that should be undertaken during the construction phase.

3.3.1 *Ecological Monitoring*

In general, during the construction phase, monitoring should be used to ensure that the development takes place within the guidelines provided by this document to ensure that construction minimises or avoids impacts on adjacent natural vegetation, fauna and ecosystems. This monitoring could be undertaken by the ECO.

Monitoring Loss of Habitat and Habitat Fragmentation

Habitat loss and fragmentation is primarily a concern during the construction phase since this is when the majority of disturbance will take place. Specific areas that should be monitored include:

- Any deviations from the final construction plan, including the location, extent and nature of vegetation impact and transformation.

- Any inadvertent or otherwise unintended destruction of natural vegetation and the remediation steps taken to encourage the recovery of the impacted areas.
- Monitoring frequency would need to be high, at least weekly during the construction phase.

Monitoring Impacts on Sensitive Environments

The sensitive environments at the site require specific attention to avoid and mitigate negative impacts to these areas. Sensitive areas include the drainage areas. These areas will be particularly vulnerable to negative impact during the construction phase while the project infrastructure associated with the development is laid down. During the construction phase, monitoring should largely be directed towards enforcement to ensure that these areas are not negatively impacted. As such monitoring of these aspects should be on a continuous basis.

Recommendations include:

- Where internal gravel compacted roads traverse drainage lines, the sites should be monitored to ensure that the presence of the road does not result in changes to the morphology such as erosion. Monthly monitoring during the construction phase would be adequate.

Monitoring Impacts on Rare or Endangered Plant Species

As mentioned in *Section 3.2*, the primary concern in terms of endangered plant species at the site, is the potential impact on *Hoodia gordonii* and *Aloe claviflora*. The measures identified for pre-construction should be undertaken during the construction phase. In particular to the following monitoring actions are relevant during construction:

- The relocated individuals should be marked and monitored for at least a year after transplanting to establish the success rate of the relocation exercise.

Monitoring Direct Faunal Impacts

Direct faunal impacts, particularly of listed reptile species, are of concern during the construction phase as a result of habitat clearance and road kills by construction vehicles, and possibly collection or death by construction workers. Construction phase monitoring should monitor the extent of human-animal interactions and to identify additional measure that can help to minimize such impacts. Specific recommendations include:

- The traffic on the access and internal gravel compacted service roads poses a significant risk to many animals, particularly during the construction phase when traffic volumes on the roads are likely to be heavy. Any fauna accidentally killed during construction should be reported and a log of such mortalities maintained. Where possible the species killed should be collected and frozen by the ECO and shown to an ecologist periodically for identification. Species identified should be recorded. Monitoring should be on an ad-hoc basis, as incidents occur.

- The activities of construction staff should be monitored to ensure that undesirable activities such as hunting, illegal collecting of plants, seeds or any other biological material does not occur, and that fires are not made outside of the designated and demarcated areas. Any incidents or transgressions relating to these aspects should be logged, as well as the remedial steps taken to rectify the situation.

3.4 OPERATIONAL PHASE

This section describes the monitoring measures to be undertaken during the operational phase of the solar power plant.

3.4.1 Ecological Monitoring

During the operational phase, monitoring should be focused on ensuring that that there are no residual impacts such as soil erosion and alien plant invasion resulting from the construction phase, and on reducing the day to day impact of the solar power plant.

Operational monitoring can be undertaken by the ECO on a monthly basis throughout the first year after construction (or more frequently after storm or extended rainfall events to check for erosion). After the first year, monitoring of rehabilitation measures could be checked twice annually for the next two years, and thereafter construction monitoring could be restricted to annual checks.

Specific aspects to be monitored during operation by the ECO would include:

Disturbance of sensitive habitat during maintenance:

Habitat damage caused by movement of vehicles and equipment during infrastructure maintenance activities.

Erosion

Erosion has been identified as one of the major risks to the terrestrial ecology associated with the development, and therefore construction monitoring of the development should focus on checking the presence and persistence of erosion at the site, and identifying additional erosion control measures. Erosion on the site may result from inadequate drainage measures along the roads or base of the solar arrays. The site should be checked for erosion at least quarterly during the first three years and after major storm events or extended rainfall periods. Monitoring should continue until all erosion-related problems are rectified; vegetative cover restored, and the drainage measures functioning effectively. Photographs and a record of erosion measures and interventions should be logged.

Alien Plant Invasion

The large amount of disturbance at the site is likely to render it highly vulnerable to alien plant invasion, particularly in the first few years post-construction. Monitoring for aliens should include the following:

- An alien monitoring system should be set up which allows for the occurrence, persistence and treatment of alien plants to be monitored in a manner which allows the data to be interrogated in a GIS.
- Monitoring for alien plants could be done simultaneously with erosion monitoring and at a similar interval.
- The system should record the species present, their location, the control measures used and their success rate.

3.4.2 *Avifauna Monitoring*

Monitoring protocols: Bird flight behavior and activities around solar arrays

Bird traffic over and around the solar power plant should be conducted from suitable vantage points (selected and used to provide coverage of avian flights in relation to all areas of the solar plant). Once in position at the selected count station, the observer should record (preferably on a specially designed data sheet) the date, count number, start-time and conditions at start - extent of cloud cover, temperature, wind velocity and visibility – and proceed with the count. The counts should detail all individuals or flocks of the stipulated priority bird species, all raptors, and any additional species of particular interest or conservation concern, seen flying within 200 m of the envisaged or actual periphery of the solar power plant. Each record should include the following data: time, updated weather assessment, species, number, mode of flight (flapping, gliding, soaring), flight activity (commuting, hunting other), direction of flight and, for post construction monitoring, notes on any obvious evasive behaviour or flight path changes observed in response to the solar power plant. The time and weather conditions should again be noted at the end of each count. These observations should also detail (time, species, nature, location, duration) all direct interactions between birds and the solar panels (e.g. perching, hunting, displaying, nest-building).

Monitoring of avian collisions

Collision monitoring should have two components: (i) experimental assessment of search efficiency and scavenging rates of bird carcasses on the site, and (ii) regular searches of the vicinity of the solar power plant for collision casualties.

Monitoring of avian collisions: Assessing search efficiency and scavenging rates

The value of surveying the area for collision victims only holds if some measure of the accuracy of the survey method is developed (Morrison 2002). To do this, a sample of suitable bird carcasses (of similar size and colour to the priority species – e.g. Egyptian Goose *Alopochen aegyptiacus*, domestic waterfowl and pigeons) should be obtained and distributed randomly around the site without the knowledge of the surveyor, some time before the site is surveyed. This process should be repeated opportunistically (as and when suitable bird carcasses become available) for the first two months of the monitoring period, with the total number of carcasses not less than 10. The proportion of the carcasses located in surveys will indicate the relative efficiency of the survey method.

Simultaneous to this process, the condition and presence of all the carcasses positioned on the site should be monitored throughout the initial two-month period, to determine the rates at which carcasses are scavenged from the area, or decay to the point that they are no longer obvious to the surveyor. This should provide an indication of scavenge rate that should inform subsequent survey work for collision victims, particularly in terms of the frequency of surveys required to maximize survey efficiency and/or the extent to which estimates of collision frequency should be adjusted to account for scavenge rate (Osborn *et al.* 2000, Morrison 2002). Scavenger numbers and activity in the area may vary seasonally so, ideally, scavenge and decomposition rates should be measured twice during the monitoring year, once in winter and once in summer.

Monitoring of collisions: Collision victim surveys

The area within a radius of at least 20 m of each solar panel, the area on and under the panel itself, and the area within 5 m on either side of any new lengths of power line, should be checked regularly for bird casualties (Anderson *et al.* 1999, Morrison 2002). The frequency of these surveys should be informed by assessments of scavenge and decomposition rates conducted in the initial stages of the monitoring period (see above), but they should be done at least weekly for the first two months of the study. All suspected mortality incidents should be comprehensively documented, detailing the apparent cause of death, precise location (preferably a GPS reading), date and time at which the evidence was found, and the site of the find should be photographed with all the evidence *in situ*. All physical evidence should then be collected, bagged and carefully labeled, and refrigerated or frozen to await further examination. If any injured birds are recovered, each should be contained in a suitably-sized cardboard box, and the local conservation authority should be notified and requested to transport casualties to the nearest reputable veterinary clinic or wild animal/bird rehabilitation centre.

These surveys should also include detailing (location, extent, size, number) of all bird products (e.g. faeces, pellets, nest structures etc) found on the solar panels

4 MITIGATION AND COMPLIANCE MONITORING MEASURES

Mitigation and compliance monitoring measures required to be undertaken by the developer, Rotifield or the ECO, are presented in this section under the following headings:

- Pre-Construction Planning Phase;
- Construction Phase; and
- Operational Phase.

Mitigation and compliance monitoring measures listed in this section must be implemented by Rotifield during the various phases of the project. These measures are based on best practice to minimise impacts on the Olyven Kolk Farm 4.

A separate document, containing Contractor Compliance Standards has been drafted (Section 5) in order to clearly identify the roles and responsibilities of contractors appointed during the various phases of the project. These standards should be included as part of the contract documentation between Rotifield and the contractor, and Rotifield is responsible for ensuring the Contractor Compliance Standards are fully implemented by the contractor.

4.1 PRE-CONSTRUCTION PLANNING PHASE

In order to ensure compliance with environmental legislation and best practice guidelines the following actions are applicable to the pre-construction planning phase for the solar power plant. The persons responsible for implementation of the actions are listed in the table below, the majority of which are the responsibility of Rotifield.

Key activities during the pre-construction planning phase will include:

- Pre-construction monitoring (see *Section 3.2*);
- Notification of DEA of final layout (if required) and additional mitigation / management measures, where needed;
- Drafting of subsidiary plans, policies and procedures;
- Developing with the contractor the following:
    - A Site Layout Plan
    - Method Statements

These activities are described in more detail in the matrix below.

PRE-CONSTRUCTION PLANNING PHASE							
Aspect		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**		**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Aspect**		**#**	**Commitment / Actions Required / Key Controls**			
1.	Stakeholder engagement	Notify all registered Interested and Affected Parties of Environmental Authorisation (EA).	1.1	Notify all registered I&APs and key stakeholders of the Environmental Authorisation opportunity and appeal procedure.	Notices sent to relevant parties on the stakeholder database. List of those to whom it was sent on file	ERM	Within 5 days from the issuing of the Environmental Authorisation.
2	Permit Requirements	Ensure compliance with legal and other permitting requirements.	2.1	Ensure that all relevant legal requirements have been met.	Permits	Rotifield	Prior to construction
3	Finalisation of EMP and Contractor Compliance Standards	Update EMP with EA conditions and other mitigation measures from monitoring	3.1 3.2	Incorporate additional mitigation measures specified by DEA in the EA into the EMP and Contractor Compliance Standards. Contractor to keep copy of EMP and Contractor Compliance Standards on site and to provide ECO with a copy.	EMP and Contractor Compliance Standards	Rotifield	Prior to construction
4	Notification to DEA: Director of Compliance Monitoring	Ensure that DEA are notified of commencement date.	4.1	Notify DEA prior to commencement of construction.	Proof of communication.	Rotifield	14-days in advance of commencement of construction.
		Keep DEA informed of any aspects of non-compliance with EMP or ES	4.2	Notify DEA with reasons if any provisions of the EMP or EA cannot be implemented, and provide alternative	DEA notification	Rotifield	Prior to construction
		Keep DEA informed of current contact details of applicant	4.3	Notify DEA of any change of contact details of the applicant	DEA notification	Rotifield	Prior to construction
		Provide Site Layout Plan to DEA	4.4	Submit the detailed Site Layout Plan (see section 5.1 below) to DEA prior to construction	DEA notification	Rotifield	Prior to construction
		Keep DEA informed of contact details of ECO	4.5	Submit the name and contact details of the appointed ECO prior to construction	DEA notification	Rotifield	Prior to construction
		Submit copies of all permits to DEA	4.6	Copies of all permits and written approvals obtained by relevant authorities should be submitted to DEA and shall include but not necessarily limited to: • Removal of protected plants • Approval from SAHRA relating to disturbance of heritage features	DEA notification	Rotifield	Prior to construction
5.	Site Layout Plan	Ensure final site layout minimises environmental and social risks and complies	5.1	Prepare a detailed Site Layout Plan that demarcates the following:	Site Layout Plan	Rotifield	Prior to construction

PRE-CONSTRUCTION PLANNING PHASE							
Aspect		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Aspect		#	Commitment / Actions Required / Key Controls			
		with EMP		• Solar arrays, cables, temporary buildings, access and internal compacted gravel roads, etc • Stormwater drainage measures • Waste disposal and storage areas • Offices, works areas and ablutions • Storage of materials and equipment • Vehicle maintenance and storage			
6.	Subsidiary plans	Develop Subsidiary Plans to minimises environmental and social risks	6.1	The following subsidiary plans will be required prior to construction: • Health and Safety Plan • Traffic Management Plan • Transport Study • HIV Policy and Awareness Plan • Rehabilitation Plan • Policy for assessing all damages and losses • Recruitment Policy • Procurement Policy • Code of Conduct • Grievance Procedure These are referred to below, where relevant.	Subsidiary plans	Rotifield	Prior to construction
7.	Health and Safety	Ensure the health and safety of site personnel during construction.	7.1	A Health and Safety Plan must be developed prior to the commencement of construction to identify and avoid work related accidents. This shall include: • Safety zones from residences, roads, right of way. • Chemical ablution facilities.	Health and Safety Documentation	Rotifield	Prior to construction
8	Procurement of Services and Tender Procedures	Ensure that procurement of local, regional and national services is maximised:	8.1 8.2	Establish a procurement policy which sets reasonable targets for the procurement of goods and services from South African residents /suppliers, particularly local residents as far as possible. Procurement should advertise tenders in local	Procurement policy Local and national advertisements	Rotifield	Prior to construction

PRE-CONSTRUCTION PLANNING PHASE							
Aspect		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**		**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Aspect**		**#**	**Commitment / Actions Required / Key Controls**			
				and national newspapers.			
			8.3	Procurement processes should identify and invite bids from local suppliers.	Invited bids from local suppliers		
			8.4	Adopt transparent adjudication process for local suppliers.	Demonstrate transparent process of adjudicating tenders		
9	Employment & Recruitment	Ensure that employment of local people is maximised	9.1	Work closely with relevant local authorities, community representatives and organisations to ensure that the use of local labour and is maximised and stipulate this as part of contractors contract.	Meeting minutes	Rotifield	Prior to construction
			9.2	All skill requirements to be communicated to the local communities via appointed people prior to the commencement of the construction phase.	Meeting minutes / advertisements		
			9.3	Ensure that the appointed project contractors and suppliers have access to Health, Safety, Environmental and Quality training as required by the Project.	Training material and records of training		
			9.4	No employment will take place at the entrance to the site. Only formal channels for employment will be used.			
			9.5	Rotifield to work closely with the suppliers to provide the requisite training to the workers. The training provided will focus on development of local skills			
10	Good community relations	Minimise raised expectations in local community and limit social disruption	10.1	Information boards: containing background information on the construction activity and the relevant contact details for complaints shall be erected near the entrance to the site.	Large info board erected at the site and correct information provided (contact details)	Contractor	Prior to construction
			10..2	Notification of onset of construction: Notify	Proof of notification of onset of construction to Rotifield, relevant authorities and local community		

PRE-CONSTRUCTION PLANNING PHASE							
Aspect		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Aspect		#	Commitment / Actions Required / Key Controls			
			10.3	Employer, relevant authorities and local community in writing as well as verbally of the onset of construction activities, including contact details for complaints. Community liaison assistants to inform the local community members of the recruitment process and onset of construction and schedule.	Recruitment records of community liaison assistance		
11	Social Ills and disruption	To limit, where possible, social ills brought about by the construction and operation of the renewable energy facility	11.1 11.2 11.3 11.4 11.5	Develop an induction programme, including a Code of Conduct, for all workers. All workers will agree to the Code of Conduct and be aware that contravention of the Code could lead to dismissal. A grievance procedure will be established whereby complaints are recorded and responded to. A HIV Policy and Awareness Plan must be developed and implemented. Ensure contractor does not undertake recruitment to be done at the project site (to avoid workers camping and queuing at the site)	Code of Conduct Code of Conduct Grievance Procedure HIV Policy	Rotifield	Prior to construction
12.	Property Prices and Desirability of Property	Minimise the negative impacts on property prices.	12.1 12.2 12.3	Design site layout in a manner that limits the footprint of the facility and all associated infrastructure. Prepare a site Rehabilitation Plan that will be implemented post construction and as part of the decommissioning phase. All directly affected and neighbouring farmers will be able to lodge grievances with Rotifield using the Grievance Procedure.	Site Layout Plan Rehabilitation Plan Grievance Procedure	Rotifield	Prior to construction

PRE-CONSTRUCTION PLANNING PHASE							
Aspect		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	**Description of Aspect**		**#**	**Commitment / Actions Required / Key Controls**			
13.	Traffic Impact	Minimise negative effects associated with the increase in traffic.	13.1	A Transport Study must be undertaken prior to construction to determine the most appropriate route from port to site.	Transport Study	Rotifield	Prior to construction
			13.2	Rotifield will develop a Traffic Management Plan including strict controls over driver training, vehicle maintenance, speed restrictions, appropriate road safety signage, and vehicle loading and maintenance measures.	Traffic Management Plan		
			13.3	Rotifield will liaise with Transnet to mitigate or minimise disturbance or impacts to the Sishen-Saldanha railway.	Policy		
			13.4	Rotifield will develop a policy and procedure for assessing all damages and losses (e.g. damage to property, injury or death of people or livestock) resulting from project vehicles.	Permits		
			13.5	All necessary transportation permits will be applied for at this stage and obtained from the relevant authorities, including permits for abnormal loads if relevant. Oversee development of permits required by contractors.			
14.	Damage or Destruction of Cultural Heritage Interests	Avoid damage or destruction of cultural heritage aspects	14.1	Palaeontological fossils preserved within alluvial sediments will be largely safeguarded by avoiding the drainage areas on site.	Site Layout Plan	Rotifield	Prior to construction
15.	Waste and effluent	Prevent soil and/or groundwater contamination from waste and effluent.	15.1	A suitable area for waste skips must be selected, away from drainage lines, and included in the site layout plan.	Waste Management Plan	Rotifield	Prior to construction
16.	Soil compaction and erosion	Minimise soil compaction and erosion	16.1	Workers are to use existing farm tracks as far as possible. If vehicles must leave the road, they should utilize a single track and should not take multiple paths.	Site Layout Plan	Rotifield	Prior to construction

PRE-CONSTRUCTION PLANNING PHASE							
Aspect		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**		**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Aspect**		**#**	**Commitment / Actions Required / Key Controls**			
			16.2	Appropriate erosion control and water diversion structures should be constructed at the same time as the vegetation is cleared so that the loosened soil is not left vulnerable to erosion.			
			16.3	Formalise the drainage paths found onsite by excavating channels and thus permitting narrower drainage corridors to be kept open. Widths of the order of 25 m ought to suffice under such conditions. Erosion protection of these channels will be required in places.			
			16.4	Maintain adequate breadth and width below panels and supports so as not to trap debris. Protect disturbed surfaces against erosion.			
17.	Loss of Vegetation	Minimise impacts associated with vegetation loss	17.1	Mow the vegetation down to the required height rather than using destructive clearing methods where possible.	Appropriate contractor for monitoring	Rotifield	Prior to construction
			17.2	Avoid placing solar infrastructure in close proximity to drainage lines.	Site Layout Plan		
			17.3	The development footprint area should be searched for listed plant species (*Hoodia gordonii* and *Aloe claviflora*) by an ecologist or similarly qualified person. All individuals located should be marked and translocated to similar habitat outside the development footprint under the supervision of an ecologist or someone with experience in plant translocation. A permit will be required to relocate listed plant species.	Botanist		
			17.4	If topsoil must be removed, it should be replaced or used as soon as possible elsewhere as it will contain seed of local species which will aid the natural recovery of the vegetation.			
			17.5	All bare areas should be revegetated at least with a perennial grass layer of locally occurring species, to bind the soil and limit erosion			

PRE-CONSTRUCTION PLANNING PHASE							
Aspect		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	**Description of Aspect**		**#**	**Commitment / Actions Required / Key Controls**			
			 17.6 17.7	potential. No natural vegetation should be transformed for temporary activities. Restricting service roads and underground cabling to previously disturbed lands, avoiding natural vegetation.			
18.	Faunal Impacts	Minimise impacts to onsite fauna	18.1 18.2 18.3	Measures of habitat loss above should be implemented to minimise impacts to fauna. Security fencing surrounding the site should be constructed so as to allow the free movement of animals, especially during the construction phase when animals may need to leave the site. Strand fending is highly preferable to mesh fencing in this regard. The design of the solar power plant and associated infrastructure must be bird-friendly.	Site Layout Plan	Rotifield	Prior to construction
19.	Bird Impacts	Minimise impacts on birds through habitat loss, destruction and displacement	19.1 19.2	Exclude development within a 1 km radius of the Martial Eagle nest site Exclude development within a A 500 m radius of the Lanner Falcon nest site	Site Layout Plan	Rotifield	Prior to commencement of construction.
20.	Visual Impacts	Minimise visual impacts	20.1 20.2	The final layout should be reviewed by ERM and the visual specialists, prior to the commencement of construction activities. Surface disturbance for internal compacted gravel roads and construction camp should be minimized and erosion control and dust suppression undertaken to minimize exposed soil.	Site Layout Plan and building designs	Rotifield	Prior to commencement of construction.

PRE-CONSTRUCTION PLANNING PHASE							
Aspect		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Aspect		#	Commitment / Actions Required / Key Controls			
			20.3 20.4	Disturbance of areas of indigenous vegetation should be minimized and disturbed areas should be prioritized for construction facilities. No advertising billboards will be permitted and any signs limited to those informing the public on solar power plants.			

4.2 CONSTRUCTION PHASE

In order to ensure compliance with environmental legislation requirements and NEMA best practise the following actions are applicable to the construction phase and are the responsibility of Rotifield. Standard construction phase compliance standards that need to be implemented by the contractor are contained in section 5.

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
1.	Compliance with EMP and EA	Confirm Rotifield commitment to adherence to EMP and Contractor Compliance Standards	1.1	Ensure that the EMP; Contractor Compliance Standards and EA are available at the site throughout construction and implemented by the contactor.	Copy of signed EMP and EA with subcontractor	Rotifield	Prior to construction
		Auditing of compliance with EMP and EA	1.2	An audit report must be undertaken by an independent auditor at the end of the construction phase, and shall be submitted to DEA.	Audit report and proof of submission to DEA	Rotifield	End of Construction
			1.3	The audit report shall indicate the date of the audit, name of auditor; and outcome of audit in terms of compliance with the environmental authorisation and conditions of the EMP.			
2.	Health and Safety	Ensure the health and safety of subcontractors and site users	2.1	A Health and Safety Plan must be developed prior to the commencement of construction to identify and avoid work related accidents. This plan must be adhered to by the appointed construction contractors and meet Occupational Health and Safety Act (OHSAct), Act 85 of 1993, requirements.	Signed Health and Safety Plan	Rotifield	During construction
			2.2	Appropriate Personal Protective Equipment (PPE) must be worn by all construction personnel. This shall include the use of ear protection in areas where the 8-hour ambient noise levels exceed 75dBA.	Signed Health and Safety Plan	Contractor	
			2.3	No smoking to be allowed near the fuel storage area and notices depicting “No Smoking”, “No Naked Lights” and “Danger” to be erected at the fuel storage site.	Signed Health and Safety Plan	Contractor	
3.	Dust and emissions	Limit fugitive dust and exhaust emissions	3.1	Dust abatement should be implemented especially during windy conditions and in areas prone to generation of airborne dust. This shall include spraying of water and covering of stockpiled and transported materials.	ECO records	Rotifield	During construction
			3.2	Rotifield Project Manager to keep records of any complaints regarding dust.	Grievance procedure documentation/logbook		
4.	Noise pollution	Avoid disturbing surrounding land-users	4.1	Vehicles must to adhere to speed limits on site, and not exceed 40km/hr	Signage on site	Rotifield	During construction
			4.2	A grievance procedure will be established whereby complaints are recorded and responded to.	Grievance procedure logbook		

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
			4.3	Construction workers and personnel must wear hearing protection equipment when the 8-hour ambient noise levels exceed 75dBA.		Contractor	
5.	Vegetation loss	Prevent unnecessary disturbance and damage to natural vegetation and topsoil loss	5.1	Educate all contractors as to the importance of the undisturbed conservations areas and prohibitions on fires, and collection of plant material.	Training materials and records of attendance	Rotifield	On appointment of contractor
			5.2	Contractors are to use existing farm tracks as far as possible. If vehicles must leave the road, they should utilize a single track and should not take multiple paths.			
			5.3	If topsoil must be removed, it should be replaced or used as soon as possible elsewhere as it will contain seed of local species which will aid the natural recovery of the vegetation.			
			5.4	Areas to be cleared should be clearly demarcated.			
			5.5	Vegetation should only be cleared when and where absolutely necessary. If possible a vegetative cover should be left in place. It is preferable to mow the vegetation down to the required height than to use other more destructive clearing methods			
			5.6	Any individuals of protected species observed within the development footprint during construction, should be translocated under the supervision of the ECO.			
			5.7	All bare areas should be revegetated at least with a perennial grass layer of locally occurring species, to bind the soil and limit erosion potential.			
			5.8	Remove alien vegetation from disturbed areas.			
			5.9	Soil disturbance should be kept to an absolute minimum			
6.	Traffic Impact	Mitigate traffic impacts	6.1	The traffic management plan will be adhered to including adherence to speed limits and 'rules of the road'.	Traffic Management Plan	Rotifield	During construction
			6.2	All directly affected and neighbouring farmers and local residents will be able to lodge grievances with Rotifield using the Grievance Procedure regarding dangerous driving or other	Grievance Procedure		

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
				traffic violations that could be linked to the Project.			
			6.2	During construction, arrangements and routes for abnormal loads (if required) must be agreed in advanced with the relevant authorities and the appropriate permit must be obtained for the use of public roads.			
			6.3	A grievance procedure will be established whereby any complaints by neighbours or affected parties are recorded and responded to.			
7.	Damage or Destruction of Cultural Heritage Interests	Minimise damage to cultural heritage interests	7.1	Heritage Northern Cape to be notified immediately if a burial/human remains is uncovered during the construction of the solar power plant.	ECO Report & SAHRA response	Rotifield	Prior to and throughout construction
			7.2	All directly affected and neighbouring farmers will be able to lodge grievances with Rotifield using the Grievance Procedure.	Grievance procedure and logbook		
			7.3	Trenches and excavations should be inspected by a palaeontologist	Palaeontologist Report and HNC Response		
8.	Socio-cultural issues	Minimize impacts associated with influx of jobseekers.	8.1	Rotifield code of conduct developed prior to the construction phase must be adhered to.	Code of conduct must be available on site.	Rotifield	During construction
			8.2	The HIV Policy and Awareness Plan developed prior to the commencement of construction must be adhered to by Rotifield employees.	HIV policy must be available on site.		
			8.3	A grievance procedure will be established whereby complaints are recorded and responded to.			
9.	Faunal Impacts	Mitigate impacts on fauna	9.1	Poaching or hunting should be strictly forbidden.	ECO Report and photographic evidence	Rotifield	During construction
			9.2	Fauna must have 'right of way' on internal roads. Slow moving animals such as tortoises which may be in the way, should be placed at the side of the road in the direction the animal was seen travelling.	Road signage and ECO reports & grievance logs		
			9.3	All vehicles must stick to designated and prepared internal roads and a speed limit (up to 40 km/hr) must be enforced.			
			9.4	No harvesting or collecting of plants, seeds, animals or their	Worker training & awareness records		

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
				parts to be allowed.			
			9.5	It should be mandatory for staff of Rotifield to attend an environmental briefing and training session with respect to the guidelines outlined in this EMP.	Training material and records of training		
10.	Visual Impacts	Minimise visual impacts	10.1	Measures to control wastes and litter should be included in the contract specification documents.	Evidence in contract specification documents.	Rotifield	Throughout construction
11.	Loss of agricultural land	Minimise the loss of agricultural land	11.1	Rotifield to minimise the damage to farmland caused by construction activities by ensuring strict compliance with construction plans to minimise the development footprint and to implement a 'Code of Conduct' governing workers.		Rotifield	
			11.2	Rotifield to design the infrastructure layout in a manner that limits the project footprint and allow for continued grazing on the land.			
			11.3	Rotifield's Community Development Fund will seek to increase the extent of farming or the intensity of farming practice in order to counter the effects of agricultural land loss.			
			11.3	Rotifield to minimise the damage caused by construction activities to the farmland by ensuring strict compliance with construction plans and worker 'Code of Conduct'.			
12	Waste and Effluent	Minimise generation of waste and effluent	12.1	All waste must be separated into skips for recycling, reuse and disposal. Recycled waste will be removed by an appropriate contractor, as per the EMP recommendations.	Site inspection and photographic evidence	Contractor	Throughout construction phase
			12.2	Vegetative material will be kept on site and mulched after construction to be spread over the disturbed areas to enhance rehabilitation of the natural vegetation.			
			12.3	Effluent from concrete washings etc will be contained within a bunded area.			
			12.4	All hazardous and liquid waste materials e.g. fuel for generators, including any contaminated soils will be stored in a bunded area and disposed of by a licensed contractor.			
			12.5	Effluent and stormwater run-off will be discharged away			

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
				drainage lines.			
			12.6	Materials that cannot be re-used or recycled will be placed in a skip and removed from site to a licensed disposal facility.			
13	Impact on Surface and Groundwater	Minimise impacts on surface and groundwater	13.1	Soil stockpiles will be protected from wind or water erosion through placement, vegetation or appropriate covering.	Site inspection and photographic evidence	Contractor	Throughout construction phase
			13.2	Proper drainage controls such as culverts, cut-off trenches will be used to ensure proper management of surface water runoff to prevent erosion.			
			13.3	Cleared or disturbed areas will be rehabilitated as soon as possible to prevent erosion.			
			14.4	Fuel, oil and used oil storage areas will have appropriate secondary containment (ie bunds).			
			13.5	Spill containment and clean up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of to a licensed landfill by a licensed operator.			
			13.6	Construction vehicles and equipment will be serviced regularly and provided with drip trays, if required.			
			13.7	Workshop areas will be lined to prevent subsurface ingress of contaminants and drainage from these areas will not be allowed to drain into drainage channels.			
14	Loss of topsoil, Soil Compaction and Erosion	Minimise impacts and loss of topsoil	14.1	If topsoil must be removed, it should be replaced or used as soon as possible elsewhere as it will contain seed of local species which will aid the natural recovery of the vegetation.	Site inspection Photographic evidence ECO Report	Contractor	During Construction
15	Bird Impacts	Minimise impacts on birds through habitat loss, destruction and displacement	15.1	Timing construction to avoid sensitive times (e.g. Martial Eagle pre-breeding, incubation and small nestling seasons from March/April to June/July).		Bird specialist	Prior to construction
			15.2	Relocate both the eagle nest structures to more distant pylons			

4.3 *OPERATIONAL PHASE*

In order to ensure compliance with environmental legislation requirements and recommendations specified by the EIR Team during the EIR process, the following generic and specific requirements are applicable during the operational phase of the Olyven Kolk Farm 4 solar power plant. It is likely that DEA will require a separate operational EMP prior to the start of operation which should be informed by pre-construction and construction monitoring results and other new information from geotechnical studies or technological improvements. The operational mitigation and monitoring measures specified here provide a foundation for further development of the Operational EMP.

OPERATIONAL PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
1.	Visual impacts	Minimize the visual impacts during the operation phase.	1.1 1.2	Signage related to the solar power plant must be discrete and confined to entrance gates. No advertising will be permitted. Footprint of the facilities, as well as parking and vehicular circulation, should be clearly defined.	Photographic evidence	Rotifield	Throughout operation
2.	Health and Safety	Maintain health and safety standards	2.1	Regular maintenance of solar infrastructure, cables and buildings must be undertaken to ensure optimal functioning.	Inspection records	Rotifield	Throughout operation
3.	Dust and emissions	Limit fugitive dust and exhaust emissions.	3.1	Vehicles travelling on internal unpaved or gravel roads should not exceed a speed of 40 km/hr.	Signage	Rotifield	Throughout operation
4.	Waste and Effluent	Prevent soil and groundwater pollution	4.1 4.2 4.3	Used oil stored on site must be stored in an impervious container, within a bunded area. General waste must be removed from site by a licensed contractor. Areas disturbed during construction will be re-vegetated with indigenous vegetation to prevent erosion.	Photographic evidence Waste manifest documents Photographic evidence	Rotifield	Throughout operation
5.	Traffic	Minimise traffic impacts	5.1	All internal and access roads that will be used by Rotifield during the operational phase of the project will be maintained by Rotifield throughout the life of the Project.	Permits	Rotifield	Throughout operation
6.	Damage or Destruction of Cultural Heritage Interests	Minimise damage to cultural heritage interests	6.1	Prevent access of workers to any areas identified as sensitive in a cultural heritage context during per-construction to ensure sites are not vandalized	Monitoring data	Rotifield	Throughout operation
7.	Loss of Topsoil, Soil Compaction and Erosion	Minimise erosion	7.1 7.2 7.3	Long-term monitoring to be undertaken (see *Section 3*). Erosion control measures should be initiated as soon as signs of erosion problems become apparent. All bare areas should be revegetated at least with a perennial grass layer of locally occurring species, to bind the soil and limit erosion potential.	Monitoring reports and photographic evidence	Rotifield	Biannually
8.	Loss of Vegetation	Minimise impacts associated with loss of vegetation	8.1	Vegetation that needs to be reduced in height should be mowed or brush-cut to an acceptable height, and not to ground level except where necessary.	Monitoring reports and photographic evidence	Rotifield	Throughout operation

OPERATIONAL PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
			8.2	On-site employees and visitors to the site will be educated about the conservation of vegetation. This will include strict guidelines for remaining on existing roads while on site to avoid unnecessary destruction or damage to undisturbed and rehabilitated vegetation.	Signage		
			8.3	A Fire Management Policy and guidelines will be developed to ensure that the operation of the solar power plant is compatible with the long-term fire ecology of the site.			
			8.4	Remove alien vegetation from any disturbed areas.			
			8.5	Workers are to use existing farm tracks as far as possible. If vehicles must leave the road, they should utilize a single track and should not take multiple paths.			
			8.6	When alien plants are detected, these should be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur.			
			8.7	No herbicides to be used at the site.			
9.	Fauna	Minimise impacts to fauna on site	9.1	Poaching or hunting should be strictly forbidden and control poaching by banning dogs on site and enclosing worker compounds.	ECO reports and photographic evidence	Rotifield	Throughout operation
			9.2	Fauna must have 'right of way' on the internal gravel compacted roads. Slow moving animals such as tortoises which may be in the way, should be placed at the side of the road in the direction the animal was seen travelling.			
			9.3	All vehicles must stick to designated and prepared roads and a speed limit (up to 40 km/hr) must be enforced.			
			9.4	No harvesting or collecting of plants, seeds, animals or their parts to be allowed.	Training material and records of training		

OPERATIONAL PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
			9.5	It should be mandatory for staff of Rotifield to attend an environmental briefing and training session with respect to the guidelines outlined in this EMP.			
			9.6	The large burrow systems of aardvark, porcupines and other similar medium-sized mammals should not be disturbed or leveled as the animals are likely to be retreated into the burrows during the day time. If such burrows occur within areas that need to be cleared, then this should take place when it is certain that the animals are not within their burrows			
			9.7	Any security or other fencing surrounding the site should be constructed so as to allow the free movement of animals (i.e include animal crossings at appropriate intervals), especially during the construction phase when animals may need to leave the site. Strand fending is highly preferable to mesh fencing in this regard			
			9.8	Electrified fencing can cause high mortality of tortoises; therefore no electrified strands should be placed within 20 cm of the ground on any fence within or surrounding the site. Most other animals should be able creep or dig under the electrified strand if it is not less than 20 cm off the ground			
10	Loss of agricultural land	minimise the loss of agricultural land	10.1	Rotifield to minimise the damage to farmland caused by construction activities by ensuring strict compliance with construction plans to minimise the development footprint and to implement a 'Code of Conduct' governing workers.			
			10.2	Rotifield to design the infrastructure layout in a manner that limits the project footprint and allow for continued grazing on the land.			
			10.3	Rotifield's Community Development Fund will seek to increase the extent of farming or the intensity of farming practice in order to counter the effects of agricultural land loss.			
			10.4	Rotifield to minimise the damage caused by construction activities to the farmland by ensuring strict compliance with			

OPERATIONAL PHASE							
Activity		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**		**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Activity**		**#**	**Commitment / Actions Required / Key Controls**			
				construction plans and worker 'Code of Conduct'.			
11	Traffic Impact	Mitigate traffic impacts	11.1 11.2	During operation, if abnormal loads are required for maintenance, the appropriate arrangements will be made to obtain the necessary transportation permits and the route agreed with the relevant authorities to minimise the impact of other road users.	Traffic Management Plan Grievance Procedure	Rotifield	During operation
12	Bird Impacts	Minimise impacts on birds through habitat loss, destruction and displacement	12.1	Maintenance activities should be scheduled to avoid disturbances to sensitive areas (identified through operational monitoring) during breeding season. These sensitive areas will apply particularly to Lanner Falcon and Martial Eagle nest sites.	Bird monitoring plan	Rotifield	During operation

4.4 *DECOMMISSIONING PHASE*

A detailed decommissioning and rehabilitation plan should be developed prior to decommissioning of the solar power plant. This plan should include, but should not be limited to, conditions regarding removal of solar arrays and supporting structures and other infrastructure, management of waste and/or contaminated soil, dust suppression and re-vegetation.

5 GENERAL CONTRACTOR COMPLIANCE STANDARDS

The following Contractor Compliance Standards have been drafted for use by any contractors appointed by Rotifield during the construction of the Olyven Kolk Farm 4 solar power plant. Guidelines for Contractors developed for the Cape Metropolitan Council by Ninham Shand (2002) and relevant to the expected construction phase of solar power plant were extracted and modified as the basis for this schedule of Contractor Compliance Standards. The Contractor appointed will use these as a basis for guiding all construction activities. Rotifield will retain overall responsibility during all stages of any construction activity and ensure that all construction activities are in compliance with the EMP. The contractors shall with due care and diligence execute and complete the works in accordance with the provisions of the Contractor Compliance Standards and any other requirements set out by Rotifield.

Identification of targets helps to identify the desired outcome of implementing the management measure can assist in deriving an audit report.

As far as possible, the contractor compliance standards are set out in accordance with the following phasing, typical of a construction project:

- Pre-Construction Planning;
- Construction; and
- Post-Construction.

PRE- CONSTRUCTION PLANNING PHASE							
Aspect		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**		**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Aspect**		**#**	**Commitment / Actions Required / Key Controls**			
1.	Stakeholder engagement	Notify all registered Interested and Affected Parties of Environmental Authorisation (EA).	1.1	Notify all registered I&APs and key stakeholders of the Environmental Authorisation opportunity and appeal procedure.	Notices sent to relevant parties on the stakeholder database. List of those to whom it was sent on file	ERM	Within 5 days from the issuing of the Environmental Authorisation.
1.	EMP and Contractor Compliance Standards legally binding on contractor	Contractor compliance with EMP	1.1	Contractor requirement to implement the EMP and Contractor Compliance Standards is legally binding through the contract with Rotifield. Contractor to keep copy of EMP and Contractor Compliance Standards on site and to provide ECO with a copy.	EMP provisions relevant to contractor	Contractor	Prior to construction
2.	Notification to DEA: Director of Compliance Monitoring	Ensure that DEA are notified of commencement date.	2.1	Notify DEA prior to commencement of construction.	Proof of communication.	Rotifield	14-days in advance of commencement of construction.
		Keep DEA informed of any aspects of non-compliance with EMP or ES	2.2	Notify DEA with reasons if any provisions of the EMP or EA cannot be implemented, and provide alternative	DEA notification	Rotifield	Prior to construction
		Keep DEA informed of current contact details of applicant	2.3	Notify DEA of any change of contact details of the applicant	DEA notification	Rotifield	Prior to construction
		Keep DEA informed of contact details of ECO	2.4	Submit the name and contact details of the appointed ECO prior to construction	DEA notification	Rotifield	Prior to construction
3.	Subsidiary plans	Develop Subsidiary Plans to minimises environmental and social risks	3.1	The following subsidiary plans may be required prior to construction: • Health and Safety Plan • Traffic Management Plan • HIV Policy and Awareness Plan • Rehabilitation Plan • Policy for assessing all damages and losses • Recruitment Policy • Procurement Policy • Code of Conduct • Grievance Procedure These are referred to below, where relevant.	Subsidiary plans	Rotifield	Prior to construction
4.	Procurement and	Ensure that procurement	4.1	Establish a Procurement Policy which sets reasonable targets for the	Procurement Policy	Contractor	Throughout

PRE- CONSTRUCTION PLANNING PHASE							
Aspect		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Aspect		#	Commitment / Actions Required / Key Controls			
	Tender	of local, regional and national services is maximised		procurement of goods and services from South African residents /suppliers, particularly local residents as far as possible.			construction
			4.2	Procurement should advertise tenders in local and national newspapers.	Local and national advertisements		
			4.3	Procurement processes should identify and invite bids from local suppliers.	Invited bids from local suppliers		
			4.4	Adopt transparent adjudication process for local suppliers.	Demonstrate transparent process of adjudicating tenders		
5.	Employment & Recruitment	Ensure that employment of local people is maximised	5.1	No employment will take place at the entrance to the site. Only formal channels for employment will be used.	Recruitment Policy	Contractor	Prior to construction
			5.2	All skill requirements to be communicated to the local communities via appointed people prior to the commencement of the construction phase.	Evidence of recruitment		
			5.3	Rotifield to work closely with the suppliers to provide the requisite training to the workers. The training provided will focus on development of local skills. Ensure that the appointed project contractors and suppliers have access to Health, Safety, Environmental and Quality training as required by the project.	Training material and records of training		
6.	Good community relations	Minimise raised expectations in local community and limit social disruption	6.1	Information boards: containing background information on the construction activity and the relevant contact details for complaints shall be erected near the entrance to the site.	Large info board erected at the site and correct information provided (contact details)	Contractor	Prior to construction
			6.2	Notification of onset of construction: Notify Employer, relevant authorities and local community in writing as well as verbally of the onset of construction activities, including contact details for complaints.	Proof of notification of onset of construction to Rotifield, relevant authorities and local community		
			6.3	Community liaison assistants to inform the local community members of the recruitment process and onset of construction and schedule.	Recruitment records of community liaison assistance		
7.	Social Ills and disruption	To limit, where possible, social ills brought about by	71	Develop an induction programme, including a Code of Conduct, for all workers. All workers will agree to the Code of Conduct and be aware	Code of Conduct	Contractor	Prior to construction

PRE- CONSTRUCTION PLANNING PHASE							
Aspect		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Aspect		#	Commitment / Actions Required / Key Controls			
		the construction and operation of the renewable energy facility	 7.2	that contravention of the Code could lead to dismissal. HIV Policy and Awareness Plan developed by Rotifield must be adhered to	 HIV Policy and Awareness Plan		
8.	Traffic Impact	Minimise negative effects associated with the increase in traffic.	9.1	All necessary transportation permits will be applied for at this stage and obtained from the relevant authorities, including permits for abnormal loads (if applicable).	Permits	Contractor	Prior to construction
9.	Soil compaction and erosion	Minimise soil compaction and erosion	9.1 9.2 9.3 9.4	Workers are to use existing farm tracks as far as possible. If vehicles must leave the road, they should utilize a single track and should not take multiple paths. Appropriate erosion control and water diversion structures should be constructed at the same time as the vegetation is cleared so that the loosened soil is not left vulnerable to erosion. Formalise the drainage paths found onsite by excavating channels and thus permitting narrower drainage corridors to be kept open. Widths of the order of 25 m ought to suffice under such conditions. Erosion protection of these channels will be required in places. Maintain adequate breadth and width below panels and supports so as not to trap debris. Protect disturbed surfaces against erosion.	Site Layout Plan	Contractor	Prior to construction
10.	Waste and effluent	Prevent soil and/or groundwater contamination from waste and effluent.	10.1	A suitable area for waste skips must be selected, away from drainage lines, and included in the site layout plan.	Waste Management Plan	Contractor	Prior to construction
11.	Loss of Vegetation	Minimise impacts associated with vegetation loss	11.1 11.2 11.3	During maintenance, mow the vegetation down to the required height rather than using destructive clearing methods where possible. Restricting service roads and underground cabling to previously disturbed lands, avoiding natural vegetation. The development footprint area should be searched for listed plant species (*Hoodia gordonii* and *Aloe claviflora*) by an ecologist or similarly qualified person. All individuals located should be marked and translocated to similar habitat outside the development footprint under the supervision of an ecologist or someone with experience in plant translocation. A permit will be required to relocate listed plant species.	Site Layout Plan	Contractor	Prior to construction

PRE- CONSTRUCTION PLANNING PHASE							
Aspect		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**		**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Aspect**		**#**	**Commitment / Actions Required / Key Controls**			
			11.4	If topsoil must be removed, it should be replaced or used as soon as possible elsewhere as it will contain seed of local species which will aid the natural recovery of the vegetation.			
			11.5	All bare areas should be revegetated at least with a perennial grass layer of locally occurring species, to bind the soil and limit erosion potential.			
12.	Faunal Impacts	Minimise impacts to onsite fauna	12.1	Measures to minimise habitat loss listed above should be implemented to minimise impacts to fauna.	As above	Contractor	Prior to construction
			12.2	Security fencing surrounding the site should be constructed so as to allow the free movement of animals, especially during the construction phase when animals may need to leave the site. Strand fending is highly preferable to mesh fencing in this regard.			
			12.3	The design of the solar power plant and associated infrastructure must be bird-friendly.			
13.	Bird Impacts	Minimise impacts on birds through habitat loss, destruction and displacement	13.1	Exclude development within a 1 km radius of the Martial Eagle nest site Exclude development within a A 500 m radius of the Lanner Falcon nest site. If this is not possible, then a relocation program for the nest sites will be undertaken by a certified specialist.	Site Layout Plan	Rotifield	Prior to commencement of construction.
14	Visual Impacts	Minimise visual impacts	14.1	Surface disturbance for internal compacted gravel roads and construction camp should be minimized and erosion control and dust suppression undertaken to minimize exposed soil.	Site Layout Plan and building designs	Rotifield	Prior to commencement of construction.
			14.2	Disturbance of areas of indigenous vegetation should be minimized and disturbed areas should be prioritized for construction facilities.			
			14.3	No advertising billboards will be permitted and any signs limited to those informing the public of solar power plants.			
15	Damage or Destruction of Cultural Heritage Interests	Minimise damage to cultural heritage interests	15.1	Palaeontological fossils preserved within alluvial sediments will be largely safeguarded by avoiding the drainage areas on site.	Site Layout Plan	Rotifield	Prior to commencement of construction.

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
1.	Compliance with EMP	Confirm contractors commitment to adherence to EMP.	1.1	Ensure that the EMP and EA are available at the site during installation.	Copy of signed EMP and EA.	Contractor	Outset of construction
			1.2	Ensure that equipment is in place to meet EMP requirements and Contractor Compliance Standards.	Checklist of EMP requirements		
			1.3	Signed commitment from subcontractors to compliance with EMP and Contractor Compliance Standards.	Copy of signed EMP with subcontractor		
2.	Health and Safety	Ensure the health and safety of subcontractors and site users	2.1	A Health and Safety Plan developed by Rotifield must be adhered to by the appointed construction contractors and meet Occupational Health and Safety Act (OHSAct), Act 85 of 1993, requirements.	Signed Health and Safety Plan	Contractor	During construction
			2.2	Appropriate PPE must be worn by all construction personnel.	ECO Reports	ECO	
			2.3	No smoking to be allowed near the fuel storage area and notices depicting "No Smoking", "No Naked Lights" and "Danger" to be erected at the fuel storage site.	Signed Health and Safety Plan	Contractor	
3.	General environmental damage	Environmental awareness training of workers	3.1	The contractor will be required to employ a full-time ECO at the construction site until rehabilitation is complete.	ECO on site full-time	ECO	Prior to construction
			3.2	The contractor or his representative (e.g. ECO) shall provide training and guidance to site workers before commencing work on relevant components of the EMP, including any new site workers taken on during the course of work.	Proof of training of workers / Signed attendance register	Contractor	
			3.3	Workers shall understand the dos and don'ts of working on the site and controls on causing environmental damage. This should include notification of regulations on harvesting wild fauna and flora from the surrounding area, damage to cultural heritage, littering, use of formal latrines, sexual engagement with locals, etc.	Information posters displayed in social areas on site		
			3.4	Information posters should be put up in worker eating areas depicting typical prohibited activities that should be complied with on and off site.			
			3.5	All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.			

CONSTRUCTION PHASE							
Activity		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**		**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Activity**		**#**	**Commitment / Actions Required / Key Controls**			
4.	Construction area maintenance	General Environmental Protection	4.1	Construction area to be kept neat and clean at all times.	Camp clean and neat	Contractor	During construction
			4.2	Refuse and waste storage to be positioned away from buildings.	Refuse stored away from buildings		
5.	Access roads	General environmental protection and control of nuisances	5.1	Access to the site and works area shall use existing roads or tracks wherever possible.	ECO Report	Contractor and appointed engineer	During construction
			5.2	All temporary access roads shall be rehabilitated to the satisfaction of the Engineer.	ECO Report		
			5.3	Erect and maintain marker pegs or painted stones along the boundaries of work areas, access roads or tracks to prevent unauthorised movement outside designated areas.	Site pegged and marked		
			5.4	Upgrading of access roads should limit activities as far as possible within the existing confines of the road	Deviations of road alignment avoided		
			5.5	Implement dust control measures where windblown dust can create a nuisance.	Dust control implemented & no grievances noted		
			5.6	The contractor shall repair any damage caused to the existing access road as a result of construction activities.	No damage visible and any damage repaired		
			5.7	Install and maintain appropriate traffic warning signs.	Traffic warning signs		
			5.8	Trained and equipped flagmen shall be used in the event that construction activities (e.g. delivery of abnormal loads) may create a traffic hazard on public roads.	Flagmen contracted for solar infrastructure delivery		
6.	Fencing and site access	Minimise impacts to human health and safety	6.1	Access to the site should be off-limits to the public at all times.	Site suitably fenced	Contractor	Throughout lifespan of development
			6.2	Fencing shall be maintained throughout duration of project life.			
7.	Fire protection	Fire prevention.	7.1	No fires are allowed around the construction area.	Adequate fire fighting equipment with the contractor	Contractor	During construction
			7.2	Adequate fire fighting equipment must be available on site and maintained in good working order.			
			7.3	Welding, gas cutting or cutting of metal will only be permitted in an area designated as safe by the contractor.			

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
			7.3	Smoke free areas should be declared and appropriate signage erected.	Appropriate signage		
8.	Damage or Destruction of Cultural Heritage Interests	Minimise damage to cultural heritage interests	8.1 8.2 8.3	Ensure that trenches and excavations are checked by a palaeontologist. Heritage Northern Cape to be notified immediately if a burial/human remains is uncovered during the construction of the solar power plant. The construction activities will be undertaken in accordance with a schedule that will be developed by Rotifield.	ECO reports Minutes/ communications Construction schedule	Palaeontologist Contractor	Prior to and throughout construction
9.	Refuse, waste (refers to all solid waste, including installation debris, timber, cans etc.) and effluent	Limit the potential for site pollution and the accumulation of waste materials on site. Prevent soil and/or groundwater contamination from waste and effluent.	9.1 9.2 9.3 9.4 9.5 9.6 9.7 9.8	Minimise, reduce, reuse and recycle waste material where possible. All waste must be separated into clearly marked skips for recycling, reuse and disposal. All wastes will be re-used or recycled, as far as possible. Vegetative material will be kept on site and mulched after construction to be spread over the disturbed areas to enhance rehabilitation of the natural vegetation. All solid and liquid waste that cannot be reused or recycled will be placed in a skip and must be removed off site and disposed of at a licensed municipal disposal site. Disposal of any waste and/or construction debris by burning or burying to be forbidden. The skips shall be kept in a sheltered place and covered to prevent contents blowing out. Effluent and stormwater run-off will be discharged away from any drainage lines. Effluent from construction site offices and staff facilities will be collected in storage tanks, which will be removed by a licensed sanitary contractor. Effluent from staff facilities will be collected in storage tanks, which will be emptied by a sanitary contractor.	Waste manifest documents Relevant documentation for waste disposal must be prepared and filed (e.g. certificates of safe disposal). Visual inspection of site-ECO Report.	Contractor	Throughout construction
10.	Solid waste management	Limit the potential for site pollution and the accumulation of waste	10.1	The contractor shall set up a solid waste control and removal system in accordance with the Waste Method Statement.	ECO Reports	Contractor and ECO	During construction

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
		materials on site.	10.2	Bins shall be emptied on a daily basis and shall not be left in an overflowing state.			
			10.3	Waste and litter shall be disposed of in scavenger and weatherproof bins stored in a fenced and covered area.			
			10.4	Waste shall be collected and removed from the site at least once a week			
			10.5	Waste disposed of in suitable landfill site to be confirmed and approved by the regulatory authority.			
			10.6	Workers must clean up the contractor's camp and work areas once a week.			
			10.7	If recycling facilities available, the contractor is encouraged to separate waste into glass, paper and tins and dispose of these at recycling depots.			
			10.8	No waste, including plastic waste, is to be burned on site			
11.	Pollution controls from ablution facilities	Minimise environmental impacts from toilet facilities for temporary workers	11.1	Adequate ablution facilities must be provided for staff.	Adequate toilets provided with toilet paper	Contractor and ECO	During construction
			11.2	Excretion or urination will be prohibited other than at provided facilities.	Site layout plan		
			11.3	Facilities for washing hands to be provided as part of or immediately next to all toilet facilities.	Toilets kept clean and no sign of sewage spills		
			11.4	Toilet facilities to be situated at least 50m away from drainage lines.			
			11.5	Discharge of waste from toilets and burial of waste is strictly prohibited.			
			11.6	Ensure no spillage occurs when toilets cleaned or emptied.			
			11.7	Portable toilets shall be properly secured to prevent toppling in wind.			
			11.8	At least 1 toilet per 20 workers to be provided.			
			11.9	Toilets to be maintained in hygienic state and serviced and emptied regularly. Toilet paper to be provided.			

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
12.	Concrete Works	Prevent contamination of soil and groundwater through management of concrete	12.1	If concrete is to be batched on site the following measures apply:	Waste documentation and visual inspection of site-ECO Report	Contractor	During construction
			12.2	Excess or spilled concrete or aggregate to be confined within the work area and then removed to a licensed landfill site.			
			12.3	Concrete to be mixed on mortar boards or in bunded area, away from drainage channels.			
			12.4	Visible remains of the mixing of concrete, either solid or from washings, to be physically removed and disposed of as waste at a licensed landfill site.			
13.	Earthworks	Minimise impact of earthworks on general environment	13.1	All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities and shall be limited to demarcated areas.	ECO Report	Contractor and appointed engineer	During construction
			13.2	No earthworks equipment shall be allowed outside demarcated areas unless permitted by the engineer.			
14.	Impact on Surface and Groundwater	Minimise impacts on surface and groundwater	14.1	Soil stockpiles will be protected from wind or water erosion through placement, vegetation or appropriate covering.	Site inspection and photographic evidence	Contractor	Throughout construction phase
			14.2	Proper drainage controls such as culverts, cut-off trenches will be used to ensure proper management of surface water runoff to prevent erosion.			
			14.3	Cleared or disturbed areas will be rehabilitated as soon as possible to prevent erosion.			
			14.4	Fuel, oil and used oil storage areas will have appropriate secondary containment (ie bunds).			
			14.5	Spill containment and clean up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of to a licensed landfill by a licensed operator.			
			14.6	Construction vehicles and equipment will be serviced regularly and provided with drip trays, if required.			
			14.7	Workshop areas will be lined to prevent subsurface ingress of contaminants and drainage from these areas will not be allowed to drain into drainage channels.			

CONSTRUCTION PHASE							
Activity		**Objective**	**Actions to be undertaken to Mitigate Environmental Impact**		**Parameters for Monitoring**	**Responsibility**	**Frequency / Timing**
#	**Description of Activity**		**#**	**Commitment / Actions Required / Key Controls**			
15.	Loss of Topsoil, Soil Compaction and Erosion	Minimise erosion and loss of topsoil	15.1	Restrict removal of vegetation and soil cover to the development footprint.	Site inspection and photographic evidence- ECO Report	Contractor	Throughout construction phase
			15.2	Appropriate erosion control and water diversion structures should be constructed at the same time as the vegetation is cleared so that the loosened soil is not left vulnerable to erosion.			
			15.3	Soil stockpiles should be vegetated or appropriated covered to reduce soil loss as a result of wind or water to prevent erosion.			
			15.4	Disturbed areas will be rehabilitated as soon as possible to prevent erosion.			
			15.5	Subcontractors are to use existing farm tracks as far as possible. If vehicles must leave the road for construction purposes, they should utilize a single track and should not take multiple paths.			
			15.6	Work areas will be clearly defined and demarcated to avoid unnecessary disturbance of areas outside the development footprint.			
			15.7	If topsoil must be removed, it should be replaced or used as soon as possible elsewhere as it will contain seed of local species which will aid the natural recovery of the vegetation.			
16.	Dust and emissions	Limit fugitive dust and exhaust emissions.	16.1	Vehicles travelling on compacted unpaved roads should not exceed a speed of 40km/hr.	Site inspections	Contractor	During construction
			16.2	Where appropriate, dust abatement measures should be implemented to restrict airborne dust, especially during windy conditions.			
			16.3	Containers for dusty materials will be enclosed or covered by suitable tarpaulins / nets to prevent escape of dust during loading and transfer from site.			
			16.4	Where necessary, stock piles of soil must be covered by suitable shade cloth or netting to prevent erosion, fugitive dust and to prevent the escape of dust during loading and transfer from site.			
			16.5	Vehicles are too kept in good working order and serviced regularly to minimise emissions.	Service records.		
			16.6	Any complaints received from neighbours or site users must be	Grievance procedure		

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
				reported to the Rotifield Project Manager and measures must be taken to limit dust.	documentation/logbook		
17.	Noise pollution	Avoid disturbing surrounding land-users.	17.1 17.2 17.3 17.4	Vehicles and equipment used on site must be in good condition and serviced regularly. Mechanical equipment with lower sound power levels must be selected to ensure that permissible occupation noise-rating limit of 85 dBA is not exceeded. Construction workers and personnel must wear hearing protection equipment when the 8-hour ambient noise levels exceed 75dBA. Vehicles must to adhere to speed limits on site, and not exceed 40km/hr.	Service and maintenance records for equipment and vehicles. ECO Report Signage on site	Contractor	During construction
18.	Vegetation loss	Prevent unnecessary disturbance and damage to natural vegetation and topsoil loss.	18.1 18.2 18.3 18.4 18.5 18.6 18.7 18.8	Subcontractors are to use existing farm tracks as far as possible. If vehicles must leave the road for construction purposes, they should utilize a single track and should not take multiple paths. Topsoil must be set aside to facilitate re-vegetation. No vegetation should be collected for fire wood or other uses. All bare areas should be revegetated at least with a perennial grass layer of locally occurring species, to bind the soil and limit erosion potential. Remove alien vegetation from disturbed areas. Soil disturbance should be kept to an absolute minimum. All contractors must undertake training provided by Rotifield to educate them on the importance of the undisturbed conservations areas. Any individuals of protected species observed within the development footprint during construction, should be translocated under the supervision of the ECO.	ECO reports Photographic evidence ECO report Site inspection Site Layout Plan ECO Report ECO Report Training materials	Contractor Ecologist or botanist Contractor Rotifield	Throughout construction
19.	Traffic Impact	Mitigate traffic impacts	19.1	The Traffic Management Plan will be adhered to including adherence to speed limits and 'rules of the road'.	Traffic Management Plan and ECO reports	Contractor	During construction

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
20.	Socio-cultural issues: Influx of job seekers	Minimize impacts associated with influx of jobseekers and labour. .	20.1	Rotifield's code of conduct and HIV Policy developed by Rotifield must form part of contractual agreement and must be adhered to.	Code of conduct and HIV policy must be available on site.	Contractor	During construction
			20.2	No recruitment of workers shall be permitted at the site	Employment records	Contractor	During construction
			20.3	The construction workers (from outside the area) should be allowed to return home over the weekends or on a regular basis to visit their families; the contractor should make the necessary arrangement to facilitate these visits.	Employment records	Contractor	During construction
21.	Faunal Impacts	Mitigate impacts on fauna	21.1	All vehicles must stick to designated and prepared roads.	ECO reports and photographic evidence	Ecologist	During construction
			21.2	Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re-establishment of plant cover is desirable to prevent erosion.		Contractor	
			21.3	Control poaching by banning dogs on site and enclosing worker compounds.			
			21.4	Fauna must have 'right of way' on the roads. Slow moving animals such as tortoises which may be in the way, should be placed at the side of the road in the direction the animal was seen travelling.			
			21.5	All vehicles must stick to designated and prepared roads and a speed limit (up to 40 km/hr) must be enforced.			
			21.6	No fires should be allowed at the site anywhere other than within demarcated areas within the compound.			
			21.7	No dogs or other pets belonging to the contractor should be allowed at the site.			
			21.8	No harvesting or collecting of plants, seeds, animals or their parts should be allowed.			
			21.9	Poaching or hunting should be strictly forbidden.			
			21.10	Littering should be strictly forbidden and waste generated by staff or at the compound should be disposed of in an appropriate manner, preferably off-site.			
			21.11	It should be mandatory for all contractors to attend an environmental			

CONSTRUCTION PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
			  21.12	briefing and training session with respect to the guidelines outlined in this EMP. The staff accommodation should be fenced off and no personnel should be allowed to wander around at the site for any purpose after hours.	Training material and records of training		
22	Bird Impacts	Minimise impacts on birds through habitat loss, destruction and displacement	22.1 22.2	Timing construction to avoid sensitive times (e.g. Martial Eagle pre-breeding, incubation and small nestling seasons from March/April to June/July). Relocate both the eagle nest structures to more distant pylons		Bird Specialist	Prior to construction
23	Visual Impacts	Minimise visual impacts	23.1 23.2	Measures to control wastes and litter should be included in the contract specification documents and contractor must agree to these. Rehabilitate/ re-vegetate areas damaged by construction activities.	ECO report	Contractor Botanist	Throughout construction

5.1 *Operational Phase*

In order to ensure compliance with environmental legislation requirements and recommendations specified by the EIR Team during the EIA process, the following generic and specific requirements are applicable during the operational phase of the Olyven Kolk Farm 4 solar power plant.

OPERATIONAL PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
1.	Visual impacts	Minimize the visual impacts during the operation phase.	1.1	Signage related to the solar power plant must be discrete and confined to entrance gates. No advertising will be permitted.	Photographic evidence	Rotifield	Throughout operation
			1.2	Footprint of the facilities, as well as parking and vehicular circulation, should be clearly defined.			
2.	Health and Safety	Maintain health and safety standards	2.1	Regular maintenance of solar infrastructure, cables and buildings must be undertaken to ensure optimal functioning.	Inspection records	Rotifield	Throughout operation
3.	Dust and emissions	Limit fugitive dust and exhaust emissions.	3.1	Vehicles travelling on internal unpaved or gravel roads should not exceed a speed of 40 km/hr.	Signage	Rotifield	Throughout operation
4.	Waste and Effluent	Prevent soil and groundwater pollution	4.1	Used oil stored on site must be stored in an impervious container, within a bunded area.	Photographic evidence	Rotifield	Throughout operation
			4.2	General waste must be removed from site by a licensed contractor.	Waste manifest documents		
			4.3	Areas disturbed during construction will be re-vegetated with indigenous vegetation to prevent erosion.	Photographic evidence		
5.	Traffic	Minimise traffic impacts	5.1	All internal and access roads that will be used by Rotifield during the operational phase of the project will be maintained by Rotifield throughout the life of the Project.	Photographic evidence	Rotifield	Throughout operation
6.	Loss of Topsoil, Soil Compaction and Erosion	Minimise erosion	6.1	Erosion control measures should be initiated as soon as signs of erosion problems become apparent.	Photographic evidence	Rotifield	Throughout operation
			6.2	All bare areas should be revegetated at least with a perennial grass layer of locally occurring species, to bind the soil and limit erosion potential.			
7.	Loss of Vegetation	Minimise impacts associated with loss of vegetation	7.1	Vegetation that needs to be reduced in height should be mowed or brush-cut to an acceptable height, and not to ground level except where necessary.	Photographic evidence	Rotifield	Biannually
			7.2	On-site employees and visitors to the site will be educated about the conservation of vegetation. This will include strict guidelines for remaining on existing roads while on site to avoid unnecessary destruction or damage to undisturbed and rehabilitated vegetation.			

OPERATIONAL PHASE							
Activity		Objective	Actions to be undertaken to Mitigate Environmental Impact		Parameters for Monitoring	Responsibility	Frequency / Timing
#	Description of Activity		#	Commitment / Actions Required / Key Controls			
			7.3	Workers are to use existing farm tracks as far as possible. If vehicles must leave the road, they should utilize a single track and should not take multiple paths.			
			7.4	When alien plants are detected, these should be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur.			
			7.5	No herbicides to be used at the site.			
8.	Fauna	Minimise impacts to fauna on site	8.1	Poaching or hunting should be strictly forbidden and control poaching by banning dogs on site and enclosing worker compounds.	Monitoring reports and photographic evidence	Rotifield	Throughout operation
			8.2	Fauna must have 'right of way' on the internal gravel compacted roads. Slow moving animals such as tortoises which may be in the way, should be placed at the side of the road in the direction the animal was seen travelling.			
			8.3	All vehicles must stick to designated and prepared roads and a speed limit (up to 40 km/hr) must be enforced.	Signage		
			8.4	No harvesting or collecting of plants, seeds, animals or their parts to be allowed.			
			8.5	It should be mandatory for staff of Rotifield to attend an environmental briefing and training session with respect to the guidelines outlined in this EMP.			

Annex L

Socio-Economic Specialist Declaration

Environmental Resources Management

Silverwood House, Block A
Steenberg Office Park
Steenberg, 7945
Cape Town, South Africa
Tel: +27 (0) 702 9100
Fax: +27 (0) 701 7900

www.erm.com

24 October 2011

Declaration of Consultants Independence

I, Kerryn McKune Desai, author of the Socio-economic specialist report, hereby declare that I am employed at Environmental Resources Management (ERM) an independent environmental consultancy. I compiled the Socio-economic Baseline and Impact Assessment Chapters based on independent research and analysis of the proposed AES Solar Power Plant. I hereby confirm that I have no business, financial, personal or other interest in the activity, application or appeal in respect of which I have been involved. All opinions expressed in my specialist report are my own.

Socio-Economic Specialist Report

The findings of my Socio- economic study have been integrated directly into the Environmental Impact Report. None of my findings have been omitted or changed without my consent.

Refer to *Chapter 6*for the detailed Socio-economic Baseline and *Chapter 12* of the EIR for the detailed Socio-economic Impact Assessment.

Kerryn McKune Desai
October 2011

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Poland
Portugal
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Singapore
South Africa
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US
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Venezuela

ERM's Cape Town Office
Silverwood House, Block A
Steenberg Office Park
Steenberg, 7944
Cape Town, South Africa
T: +27 (0)21 702 9100
F:+27 (0) 21 701 7900

ERM's Durban Office
Unit 6, St Helier Office Park,
Cnr St Helier & Forbes Drive
Gillitts, 3610
Durban, South Africa
T:+27 (0) 31 767 2080
F:+27 (0) 31 764 3643

ERM's Johannesburg Office
Building 32, The Woodlands Office Park,
Woodlands Drive,
Woodmead, 2148
Johannesburg, South Africa
T:+27 (0) 11 798 4300
F:+27 (0) 11 804 2289

ERM's Pretoria Office
Hatfield Bridge 3C,
213 Richard Street,
Hatfield, 0083
Pretoria, South Africa
T:+27 (0)12 342 2895
F:+27 (0)12 430 4686

www.erm.com