ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
FINAL ENVIRONMENTAL IMPACT REPORT

PROPOSED SIRIUS SOLAR PV PROJECT NEAR UPINGTON NORTHERN CAPE PROVINCE

Project One - DEA REF NO.: 14/12/16/3/3/2/469
Project Two - DEA REF NO.: 14/12/16/3/3/2/481

FINAL FOR PUBLIC REVIEW
07 February 2014 – 27 February 2014

Prepared for:

APS
2D Nautica Building
Waterclub Complex
100 Beach Road, Granger Bay
Cape Town
8001

Prepared by:

Savannah Environmental Pty Ltd

UNIT 10, BLOCK 2
5 WOODLANDS DRIVE OFFICE PARK,
CORNER WOODLANDS DRIVE & WESTERN
SERVICE ROAD, WOODMEAD, GAUTENG
PO BOX 148, SUNNINGHILL, 2157
TEL: +27 (0)11 656 3237
FAX: +27 (0)86 684 0547
E-MAIL: INFO@SAVANNAHSA.COM
WWW.SAVANNAHSA.COM

PROJECT DETAILS

DEA Reference No.	:	Project One: Sirius Solar PV Project - 14/12/16/3/3/2/469 Project Two: Sirius Solar PV Project - 14/12/16/3/3/2/481
Title	:	Environmental Impact Assessment Process Final Environmental Impact Assessment Report: Proposed Sirius Solar PV Project near Upington, Northern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Lusani Rathanya Ravisha Ajodhapersadh Karen Jodas
Sub-consultants	:	Marianne Strohbach (Savannah Environmental) Johann Lanz (Johann Lanz Consulting) Brian Colloty (Scherman Colloty & Associates) Stephan Gaigher (G & A Heritage) Francois Durand (G & A Heritage) Lourens Du Plessis (MetroGIS) Tony Barbour (Tony Barbour Consulting)
Client	:	APS
Report Status	:	Final Environmental Impact Assessment Report for public review
Review Period	:	07 February 2014 – 27 February 2014

When used as a reference this report should be cited as: Savannah Environmental (2014) Final Environmental Management Programme: Proposed Sirius Solar PV Project near Upington, Northern Cape Province for APS

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APS is proposing to establish two commercial photovoltaic solar energy facilities, as well as associated infrastructure on a site located approximately 20 km south-west of Upington, in the Northern Cape Province. The project is known as the **Sirius Solar PV project** comprising of two development projects (refer to Figure 1). Each project will have an electricity export capacity of up to 75MW and are referred to as follows:

» Project One: Sirius Solar PV Project One, Northern Cape Province
» Project Two: Sirius Solar PV Project Two, Northern Cape Province

APS Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for the proposed facility. The EIA process is being undertaken in accordance with the requirements of the EIA Regulations of June 2010 (of GNR543) promulgated in terms of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The Final EIA Report consists of eight sections:

Chapter 1: Provides background to the proposed facility and the environmental impact assessment.
Chapter 2: Provides a description of the proposed project.
Chapter 3: Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.
Chapter 4: Outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.
Chapter 5: Describes the existing biophysical and socio-economic environment.
Chapter 6: Presents the assessment of environmental impacts associated with the proposed facility (Project One).
Chapter 7: Presents the assessment of environmental impacts associated with the proposed facility (Project Two).
Chapter 8: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (Project One).
Chapter 9: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (Project Two).
Chapter 10: Provides a list of references and information sources used in undertaking the studies for this EIA Report.

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses those identified potential environmental

impacts and benefits associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provided stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report has incorporated all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

INVITATION TO COMMENT ON THE FINAL EIA REPORT

Registered I&APs are invited to comment on the Final EIA Report which has been made available for a 21-day public review and comment from **07 February 2014 – 27 February 2014**. The document is available for download at:

» www.savannahSA.com

Requests for copies of the document can be submitted to the contact person below.

Please submit your comments to
Gabriele Wood of Savannah Environmental (Pty) Ltd PO Box 148, Sunninghill,2157, Gauteng Tel: 011 656 3237 Fax: 086 684 0547 E-mail: gabriele@savannahsa.com
The due date for comments on the Final EIA Report is **27 February 2014**

Comments can be made as written submission via fax, post, or e-mail.

EXECUTIVE SUMMARY

APS is proposing to establish two commercial photovoltaic solar energy facilities, as well as associated infrastructure on a site located approximately 20 km south-west of Upington, in the Northern Cape Province. The project is known as the **Sirius Solar PV project** comprising of two development project. Each project will have an electricity export capacity of up to 75MW and are referred to as follows:

» Project One: Sirius Solar PV Project One, Northern Cape Province
» Project Two: Sirius Solar PV Project Two, Northern Cape Province

Photovoltaic (PV) technology is proposed to be utilised for the site. Each project will have a maximum electricity export capacity of 75MW. Each Project of the solar energy facility will include the following infrastructure:

» Arrays of photovoltaic panels.
» Mounting structure to support the PV panels.
» Cabling between the project components, to be lain underground where practical.
» A new on-site substation to evacuate power from the PV facility to the Eskom grid, various power line alternatives were identified for consideration, including:
    - Project One: Power Line:
        * Alternative 1: lies on the south eastern side of the site and runs parallel to the Oasis-Oranje No.1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
        * Alternative 2: lies on the eastern side of the proposed site and power would feed into the Eskom electricity network via a 'loop in and loop out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
    - Project Two: Power Line:
        * Alternative 1: lies on the southern side of the proposed site and runs parallel to the Oasis-Oranje No.1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
        * Alternative 2: lies on the eastern side of the proposed site and power would feed into the Eskom electricity network via a 'loop in and loop out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
» Internal access roads and fencing.
» Workshop area for maintenance, storage, and offices.

The nature and extent of this facility, as well as potential environmental

impacts associated with the construction and operation of a facility of this nature are explored in more detail in this Environmental Impact Assessment (EIA) Report

In summary, the following conclusions have been drawn for the two projects from the specialist studies undertaken:

SIRIUS SOLAR PV PROJECT ONE: OVERALL CONCLUSION (IMPACT STATEMENT)

This section deals with the Sirius Solar PV Project One. The applicant for this phase is Sirius Solar PV Project One (Pty) Ltd.

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The technical viability of establishing the Sirius Solar PV Project One with an export capacity of 75 MW on a site located on the remaining extent of the farm Tungsten Lodge 638 has been established by Sirius Solar PV Project One (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Northern Cape Province include the following:

- The potential to harness and utilise solar energy resources within the Northern Cape Province
- The project would assist the South African government in reaching their set targets for renewable energy.
- The project would assist the South African government in the implementation of its green growth strategy and job creation targets.
- The project would assist the Northern Cape Provincial Government in meeting their objective for the development of a Solar Corridor which includes the area around Upington.
- The project would assist the district and local municipalities in reducing level of unemployment

through the creation of jobs and supporting local business
» The National electricity grid in the Northern Cape Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

Based on findings of the specialist studies undertaken within this EIA and the sensitivity map (**Figure 2**, no environmental fatal flaws were identified to be associated with the Sirius Solar PV Project One that may prevent the proposed project from being developed. Any threat to ecologically sensitive areas can be successfully avoided by deviation of the proposed access road and power line and avoidance of the riparian areas on the site. The final layout can therefore be developed to avoid all environmental sensitive areas within the proposed site.

The significance levels of the majority of identified negative impacts can be reduced to acceptable levels through implementation of the recommended mitigation measures as contained in this EIA report and the draft EMPr. The Sirius Solar PV Project One is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix L**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

PROJECT ONE: OVERALL RECOMMENDATION

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the developmental impacts of the Sirius Solar PV Project One can be avoided and/or mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

The following conditions would be required to be included within an authorisation issued for the project:

» The draft Environmental Management Programme (EMPr) as contained within **Appendix L** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used

to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

» All riparian vegetation around natural vleis (100m buffer) and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. The latter should cross where the lowest number of indigenous trees are present.

» Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be taken.

» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum. Aim to maintain vegetation where it will not interfere with the construction or operation of the development.

» Disturbed areas should be rehabilitated as soon as possible once construction is complete in an area.

» Rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the EMPr.

» An Invasive Plant Management Plan to be in place prior to commencement of the activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase. All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended.

» Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.

» The occurrence of Stone Tools suggests that other sub-surface heritage sites could be located nearby or on the site. Due to the close proximity of the site to the Orange River, it is prone to alluvial deposits that could burry any Stone Age sites. A suitably qualified heritage practitioner to be appointed by the developer to perform periodic inspections (preferably fortnightly) of excavated materials during the construction phase.

» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.

» All rehabilitated areas should be monitored for at least a year

following decommissioning, and remedial actions implemented as and when required.

» Compile a comprehensive storm water management method statement, as part of the final design of the project and implement during construction and operation.

» An independent **Environmental Control Officer** (ECO) must be appointed by Sirius Solar PV Project One (Pty) Ltd prior to the commencement of any authorised activities.

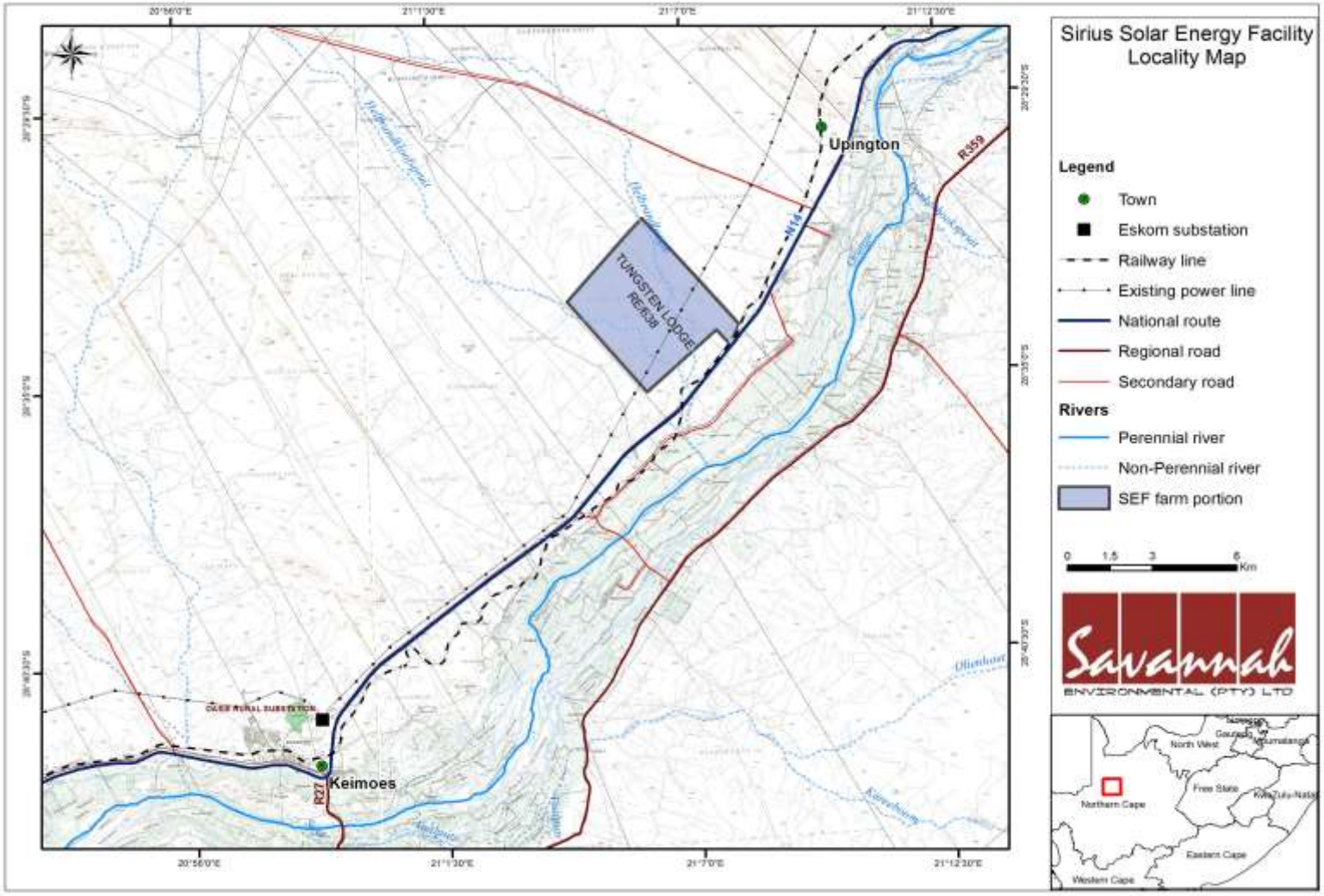

Figure 1: Locality Map showing the proposed Sirius Solar PV project

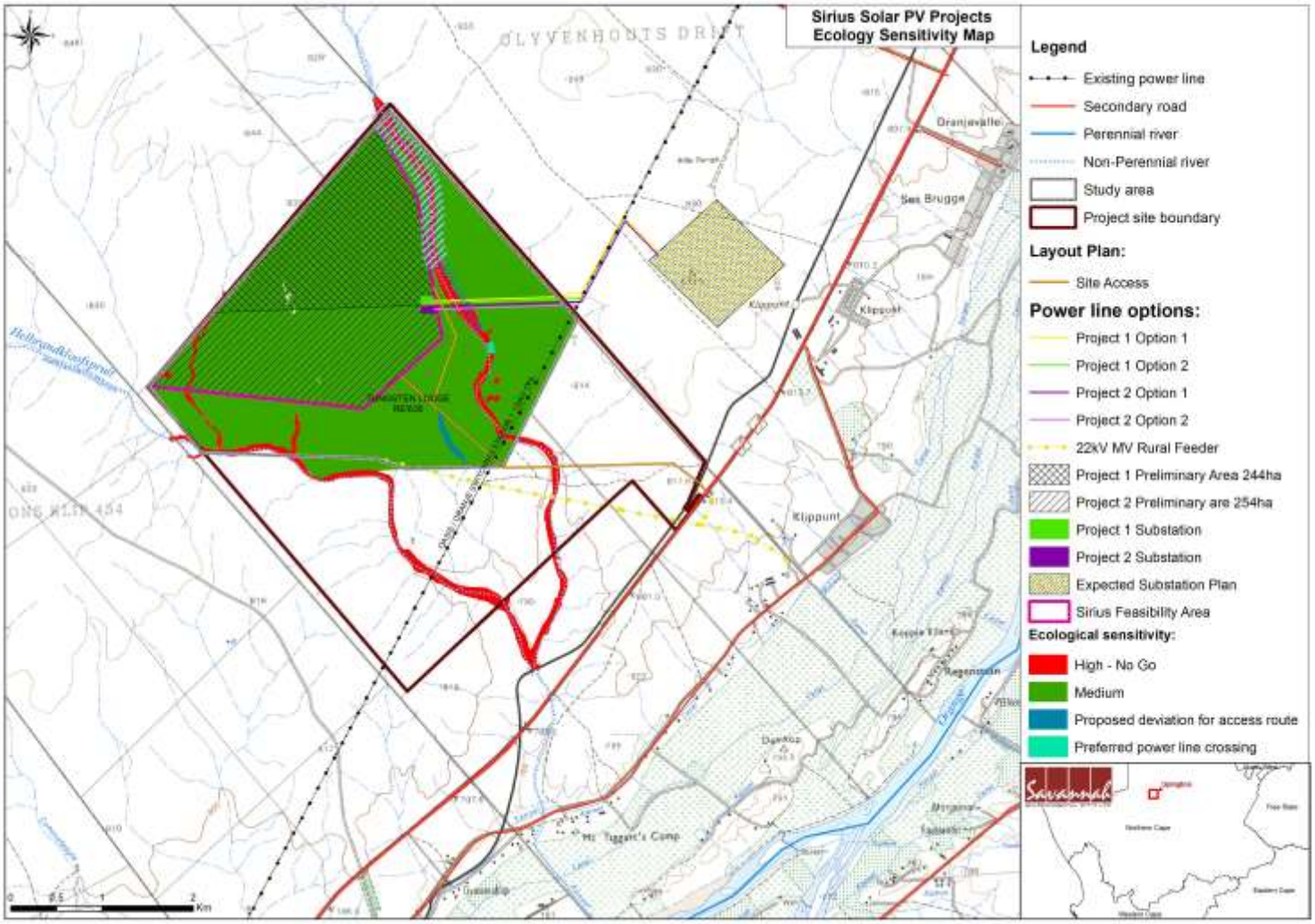

Figure 2: Environmental Sensitivity Map for the proposed Sirius Solar PV Project (Project One & Two)

SIRIUS SOLAR PV PROJECT TWO: OVERALL CONCLUSION (IMPACT STATEMENT)

This section deals with the Sirius Solar PV Project Two. The applicant for this phase is Sirius Solar PV Project Two (Pty) Ltd.

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The technical viability of establishing the Sirius Solar PV Project Two with an export capacity of 75 MW on a site located on the remaining extent of the farm Tungsten Lodge 638 has been established by the applicant Sirius Solar PV Project Two (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Northern Cape Province include the following:

- The potential to harness and utilise solar energy resources within the Northern Cape Province
- The project would assist the South African government in reaching their set targets for renewable energy.
- The project would assist the South African government in the implementation of its green growth strategy and job creation targets.
- The project would assist the Northern Cape Provincial Government in meeting their objective for the development of a Solar Corridor which includes the area around Upington.
- The project would assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business
- The National electricity grid in the Northern Cape Province would benefit from the additional generated power.
- Promotion of clean, renewable energy in South Africa
- Creation of local employment, business opportunities and skills development for the area.

Based on findings of the specialist studies undertaken within this EIA and the sensitivity map (**Figure 2**), no environmental fatal flaws were identified to be associated with the Sirius Solar PV Project Two that may prevent the proposed project from being developed. Any threat to ecologically sensitive areas can be successfully avoided by deviation of the proposed access road and power line and avoidance of the riparian areas on the site. The final layout can therefore be developed to avoid all environmental sensitive areas within the proposed site.

The significance levels of the majority of identified negative impacts can be reduced to acceptable levels through implementation of the recommended mitigation measures as contained in this EIA report and the draft EMPr. The Sirius Solar PV Project Two is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix M**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

PROJECT TWO: OVERALL RECOMMENDATION

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the developmental impacts of the Sirius Solar PV Project Two can be avoided and/or mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

The following conditions would be required to be included within an authorisation issued for the project:

» A flood line calculation study (determination of the 1:100 year flood line) must be undertaken by the developer to inform the final development footprint.
» The draft Environmental Management Programme (EMPr) as contained within **Appendix M** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to

be key in achieving the appropriate environmental management standards as detailed for this project.

» All riparian vegetation around natural vleis (100m buffer) and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. The latter should cross where the lowest number of indigenous trees present. Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be taken.

» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum. Aim to maintain vegetation where it will not interfere with the construction or operation of the development.

» Disturbed areas should be rehabilitated as soon as possible once construction is complete in an area.

» Rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the EMPr.

» An Invasive Plant Management Plan to be in place prior to commencement of the activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase. All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended.

» Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.

» The occurrence of Stone Tools suggests that other sub-surface heritage sites could be located nearby or on the site. Due to the close proximity of the site to the Orange River, it is prone to alluvial deposits that could contain Stone Age sites. A suitably qualified heritage practitioner to be appointed by the developer to perform periodic inspections (preferably fortnightly) of excavated materials during the construction phase.

» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.

» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.

» Compile a comprehensive storm water management method statement, as part of the final design of the project and

implement during construction and operation.

» An independent **Environmental Control Officer** (ECO) must be appointed by Sirius Solar PV Project Two (Pty) Ltd prior to the commencement of any authorised activities.

TABLE OF CONTENTS

PAGE

APPENDICES

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Archaeological material: Remains resulting from human activities which are 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.

Cumulative impacts: The impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the 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.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

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.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

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 co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

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 supply water to a reservoir that supply water to the activity). These types of impacts include all 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 party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Photovoltaic effect: Electricity can be generated using photovoltaic panels (semiconductors) which are comprised of individual photovoltaic cells that absorb solar energy to produce electricity. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as the Photovoltaic Effect.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CO_2	Carbon dioxide
DEA	National Department of Environmental Affairs
DEADP	Department of Environment Affairs and Development Planning
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GHG	Green House Gases
GWh	Giga Watt Hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IPP	Independent Power Producer
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
MAR	Mean Annual Rainfall
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NGOs	Non-Governmental Organisations
NWA	National Water Act (Act No. 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework

INTRODUCTION CHAPTER 1

APS is proposing to establish two commercial photovoltaic solar energy facilities, as well as associated infrastructure on a site located approximately 20 km south-west of Upington, in the Northern Cape Province. The project is known as the **Sirius Solar PV project** comprising of two development projects (refer to Figure 1.1). Each project will have an electricity export capacity of up to 75MW and are referred to as follows:

» Project One: Sirius Solar PV Project One, Northern Cape Province
» Project Two: Sirius Solar PV Project Two, Northern Cape Province

In terms of the Department of Energy's (DoE) competitive bidding process for procuring renewable energy from Independent Power Producers in South Africa a threshold has been set for the maximum amount of megawatts per project entered into the bid. This threshold for a single solar PV facility for bid submission is currently set at 75 MW. Therefore, each of the two projects will have an electricity export capacity of up to 75MW, in line with the DoE requirements.

This EIA report considers the broader farm portion within which both projects are proposed (i.e. the remaining extent of Farm Tungsten Lodge 638). The remaining extent of farm Tungsten Lodge 638 is approximately 1913 ha in extent. Each project of the proposed facility will be constructed and operated by separate Special Purpose Vehicles (SPV); as such separate Environmental Authorisations will be required to be obtained for each project. Each project has been registered with the National DEA under the following project names and reference numbers:

» Project One: Sirius Solar PV project One (DEA Ref. No. 14/12/16/3/3/2/469)
» Project Two: Sirius Solar PV project Two (DEA Ref. No. 14/12/16/3/3/2/481)

Although each project is being assessed separately in this EIA Report, one consolidated EIA process and public participation process is being undertaken for the two development project. Each solar energy facility is proposed to accommodate several arrays of **photovoltaic (PV) panels** and associated infrastructure. The solar panel technology considered for the project includes tracking PV panels, static PV panels or CPV panels.

From a regional perspective, this region of the Northern Cape Province is preferred by virtue of its **climatic conditions** (primarily due to the economic viability of a solar energy facility being directly dependent on the annual direct solar irradiation values for a particular area). From a local perspective, the site is preferred due to:

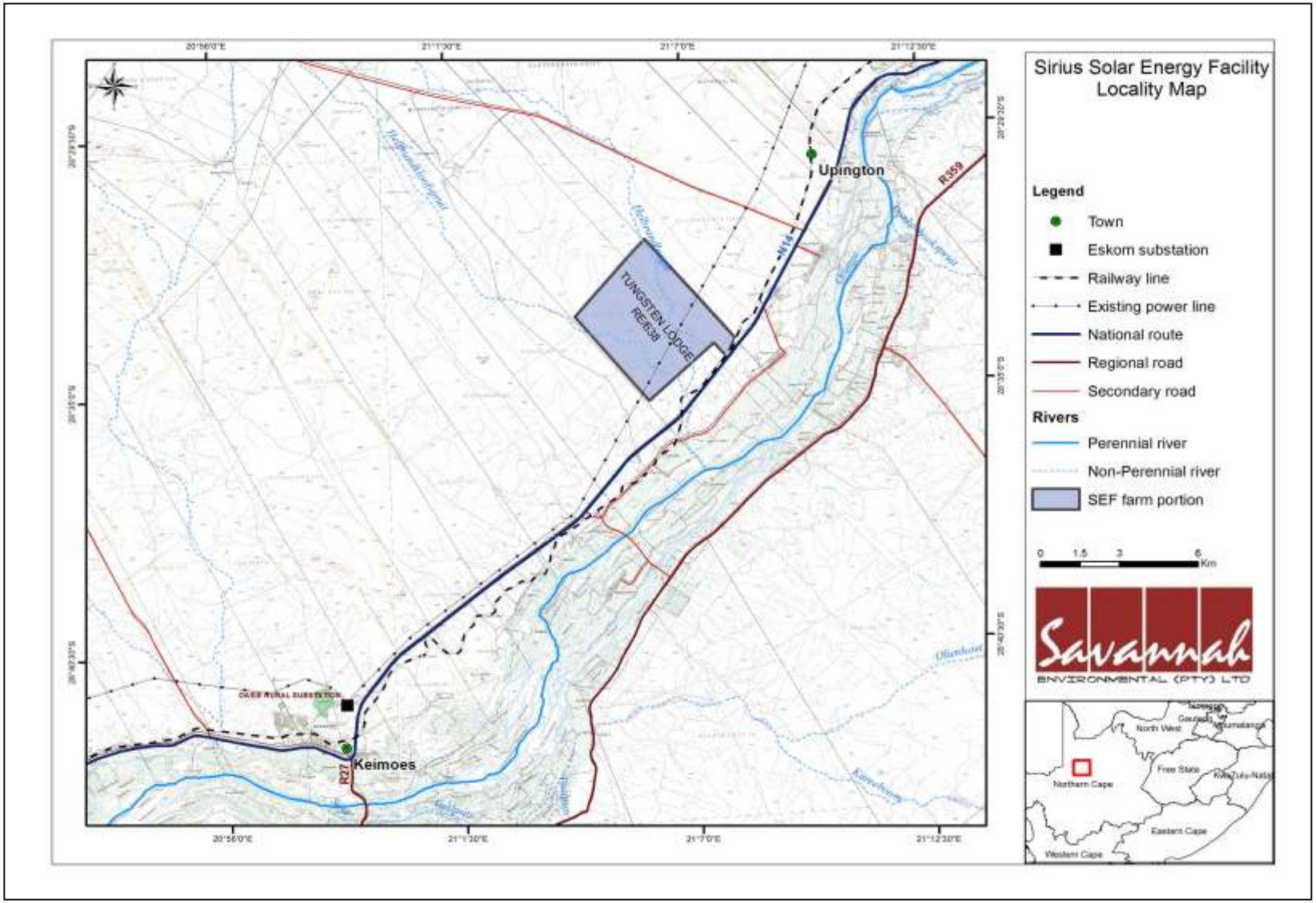

Figure 1.1: Locality Map showing the proposed site for the Sirius Solar PV Project (150MW) to be located on Farm Tungsten Lodge RE/638

- suitable topography,
- grid connection (132 kV power lines will be constructed to connect to the proposed Eskom Substation to be located on the Farm Olyvenhouts drift, or turn in and turn out of the existing Oasis-Oranje Switching Station 1 (132 kV)),
- access (the site can be accessed directly from the N14), and
- extent of the site (the site is 1913 ha and ~500ha is required for development of two projects therefore sufficient land space is available to developed 2 x 75MW facilities on the remaining extent of Farm Tungsten Lodge 638).

The nature and extent of Project One and Project Two of the Sirius PV Project, as well as the potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Final EIA Report. The Final EIA Report consists of ten chapters, which include:

Chapter 1: Provides background to the proposed facility and the environmental impact assessment.
Chapter 2: Provides a description of the proposed project and infrastructure.
Chapter 3: Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.
Chapter 4: Outlines the process which was followed during the EIA Phase, including the consultation process that was undertaken and input received from interested parties.
Chapter 5: Describes the existing biophysical and socio-economic environment potentially affected by the proposed project.
Chapter 6: Presents the assessment of environmental impacts associated with the proposed facility and associated infrastructure for **Project One**.
Chapter 7: Presents the assessment of environmental impacts associated with the proposed facility and associated infrastructure for **Project Two.**
Chapter 8: Presents the conclusions of the EIA, as well as an environmental impact statement on the proposed project for **Project One**.
Chapter 9: Presents the conclusions of the EIA, as well as an environmental impact statement on the proposed project for **Project Two**.
Chapter 10: Provides a list of references and information sources used in undertaking the studies for this EIA Report.

1.1. Summary of the proposed Development

Photovoltaic (PV) technology is proposed to be utilised for the site. Each project will have a maximum electricity export capacity of 75MW. Each Project of the solar energy facility will include the following infrastructure:

» Arrays of photovoltaic panels.
» Mounting structure to support the PV panels.

- Cabling between the project components, to be lain underground where practical.
- A new on-site substation to evacuate power from the PV facility to the Eskom grid, various power line alternatives were identified for consideration, including:
    - Project One: Power Line:
        - Alternative 1: lies on the south eastern side of the site and runs parallel to the Oasis- Oranje No.1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
        - Alternative 2: lies on the eastern side of the proposed site and power would feed into the Eskom electricity network via a 'loop in and loop out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
    - Project Two: Power Line:
        - Alternative 1: lies on the southern side of the proposed site and runs parallel to the Oasis-Oranje No.1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
        - Alternative 2: lies on the eastern side of the proposed site and power would feed into the Eskom electricity network via a 'loop in and loop out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
- Internal access roads and fencing.
- Workshop area for maintenance, storage, and offices.

The overarching objective for each solar energy facility is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. In order to meet these objectives, local level environmental and planning issues will be assessed through the EIA through site-specific studies in order to delineate areas of sensitivity within the broader site; this will serve to inform the design of the facility.

The scope of Project One and Project Two of the proposed facility, including details of all elements of the project (for the design/planning, construction, operation and decommissioning Phases) is discussed in more detail in **Chapter 2.**

1.2. Conclusions from the Scoping Phase

The full extent of the project development site (i.e. the entire extent of the remaining extent of the Farm Tungsten 638) was evaluated within the Scoping phase of the EIA process. The following sensitive environmental features were identified (shown in **Figure 1.2**):

» **Erosion sensitive soils on the site**

Streams/ drainage lines are sensitive in terms of erosion sensitivity of the soils. The soils most susceptible to erosion are those where loose, sandy or silty topsoil overlies a denser or stiff, structured soil (also known as duplex soils) which restrict infiltration. The expected subsurface profile in areas between drainage lines is characterised by thin gravelly sandy soils overlying calcrete or granite bedrock. Although the fine soil matrix is potentially erodible, the presence of significant coarser particles (gravel) in the soil and the generally dense consistency results in a fairly high soil shear strength, and therefore only localised minor erosion has historically occurred on the site. Also, the likelihood of this occurring is low due to the arid nature of the climate and the low slope gradients, which negatively affects potential energy of the run-off. The potential magnitude of erosion of the in situ soils is also considered to be low because the soil cover is generally thin. However, if soils are loosened or excavated and stockpiled in heaps, the resultant material can be highly erodible. It was, therefore, recommended that perennial grasses which occur naturally in the area are considered for proactive use post-construction to stabilise the site after it has been disturbed. The layout/ design of the facility should avoid the steeper parts of the site as far as possible. In addition, good soil management and soil erosion control measures will be included in the EMPr to mitigate and avoid excessive erosion.

» **Ephemeral Streams**

There are two dendritic ephemeral stream systems crossing the site, i.e. the Helbrandleegtespruit draining the north-eastern half of the farm portion and the Helbrandkloofspruit draining the south-western portion. These two streams join one another just south of the site and flow into a system of irrigation canals near Dyasonsklip settlement which overflow in peak periods into the Orange River. Surface water erosion is directly related to the hydrology of the site which is largely controlled by the topography, geology and soil cover. Infiltration of rainfall into the ground is largely determined by the soil thickness, permeability and vegetation. Infiltration is inversely proportional to run-off, and therefore in areas where infiltration into the ground is high, run-off is generally low, up to a point where the amount of rainfall exceeds the infiltration rate, and beyond that point excess rainfall ends up as run-off. Run-off is the primary trigger of erosion.

» **Visual / Social Receptors**

There are farmsteads in the broader study area which are considered sensitive visual / social receptors during the construction and operational phase of the project. It is evident from the preliminary viewshed analyses presented in the scoping report that the proposed projects would have a relatively contained core area of potential visibility (i.e. within a 2.5km radius of the site). This area of

exposure is generally restricted to the farm earmarked for the development itself, and the neighbouring solar energy developments. Visibility in the 2.5km to 5km zone surrounding the proposed development site is scattered and generally interrupted due to the undulating nature of the topography, and the generally constrained vertical dimensions of the proposed structures. Most of this area of exposure falls within vacant land, with only a short section (approximately 2.7km in length) that may include exposure from the N14 national road.

No environmental fatal flaws were identified to be associated with development of the proposed Sirius Solar facility (Project One and Project Two) on the site during the scoping phase of the EIA. However, areas of potential environmental sensitivity were identified through the scoping phase (as detailed above). These areas of sensitivity relate mainly to ephemeral streams within the site and are illustrated in the sensitivity map (refer to **Figure 1.2**). It was recommended that infrastructure should be placed so as to consider the identified sensitive areas and that the implementation of mitigation measures during construction and operation is required. Subsequently, the layout/ design of the two projects of the solar energy facility have been undertaken by the developer. The proposed layout of infrastructure is presented and discussed further in Chapter 2.

From the conclusions of the Scoping Phase of the EIA, the potentially significant issues identified as being related to the **construction** of the Sirius PV Projects and requiring further investigation in the EIA Phase include, *inter alia*:

» Loss of or disturbance to protected flora and fauna and associated habitats (local and site specific).
» Loss of soil and impacts on agricultural potential.
» Soil erosion during construction activities.
» Socio-economic impacts, both positive and negative (including job creation and business opportunities, impacts associated with construction workers in the area).

The potentially significant issues related to the **operation** of the Sirius PV Projects requiring further investigation in the EIA Phase include, *inter alia*:

» Visual impacts and impacts on "sense of place" on nearby residential areas and observers travelling on main roads.
» Positive socio-economic impacts.
» Generation of clean, renewable energy (positive).

The potentially significant issues related to the decommissioning of the Sirius PV Projects requiring further investigation in the EIA Phase include, *inter alia*:

- Loss of or disturbance to protected flora and fauna and associated habitats (local and site specific).
- Soil erosion during decommissioning activities.
- Socio-economic impacts, both positive and negative (including job creation, nuisance).

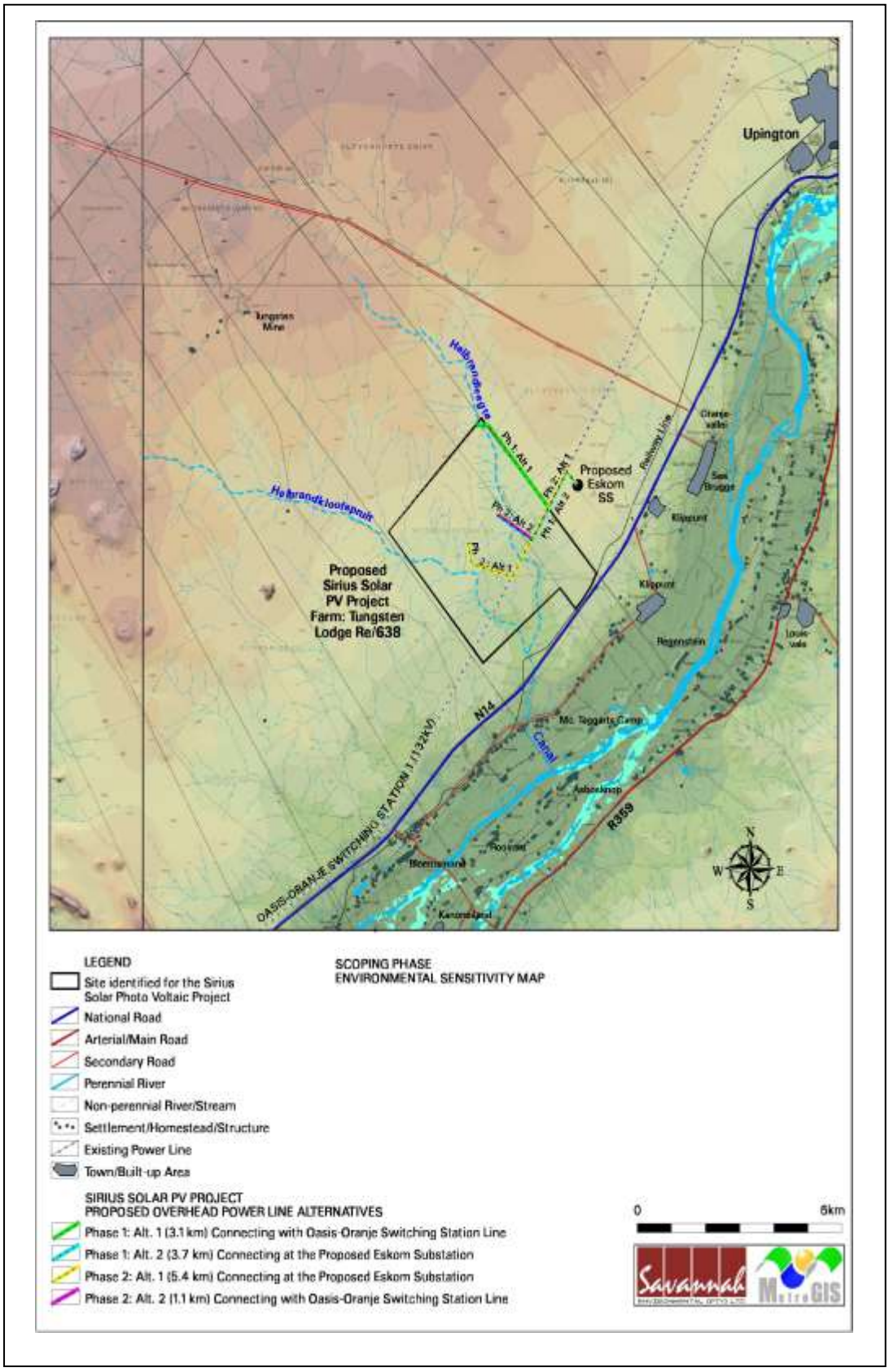

Figure 1.2: Scoping Phase Desktop Environmental Sensitivity Map of the proposed Sirius Solar PV Project showing ephemerals streams

1.3. Requirement for an Environmental Impact Assessment Process

The proposed Sirius Solar PV project is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA) 107 of 1998. This section provides a brief overview of the EIA Regulations and their application to this project.

NEMA is the national legislation that provides for the authorisation of 'listed activities'. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent (decision-making) authority and the Northern Cape Department of Environmental and Nature Conservation (DENC) the commenting authority. An application for authorisation has been accepted by DEA under application reference numbers:

» Project One: Sirius Solar PV project One(DEA Ref. No. 14/12/16/3/3/2/469)
» Project Two: Sirius Solar PV project Two (DEA Ref. No. 14/12/16/3/3/2/481)

The need to comply with the requirements of the EIA Regulations ensures that the competent authority is provided with the opportunity to consider the potential environmental impacts of a project early in the project development process and to assess if potential environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision APS appointed Savannah Environmental as the independent Environmental Assessment Practitioner (EAP) to conduct an EIA process for the proposed project.

An EIA is also an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be forewarned of potential environmental issues, and allows for resolution of the issues reported on in the Scoping and EIA Reports as well as dialogue with interested and affected parties (I&APs).

The EIA process comprises two phases – i.e. Scoping and Impact Assessment – and involves the identification and assessment of environmental impacts though specialist studies, as well as public participation. The proposed Sirius project has

been considered within a consolidated EIA process. Both projects have been considered through Scoping and EIA assessments. The intention is for the applicant to obtain separate authorisations for two stand-alone solar projects.

In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543; GNR544; GNR545; and GNR546 as amended in December 2010, the following 'listed activities' are triggered by each proposed 75MW solar energy facility:

Relevant Notice	**Activity No.**	**Description of Listed Activity**	**Relevant Component(s) of Facility**	**Applicability of proposed project to listed activity**
GN544, 18 June 2010	10	The construction of facilities or infrastructure for the transmission and distribution of electricity- (i).Outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.	*The construction of a 132kV overhead power line from the solar facility to the Eskom electricity grid*	A new power line will loop in loop out to the existing Eskom's Theseus Oryx substation from the proposed on-site substation (~150m x 150m in extent) in order to evacuate electricity generated to the national grid.
GN544, 18 June 2010	11	The construction of ~~vi) bulk storm water outlet structures; and~~ (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.	*The construction of the proposed solar facility may impede on drainage lines on the site due to infrastructure such as storm water structures, access roads and PV panels*	There are non-perennial drainage lines within the site that could be impacted upon by the [proposed development. A water use licence application will be undertaken with the Department of Water Affairs.
~~GN544, 18 June 2010~~	~~13~~	~~The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not~~	~~*The facility may require the storage and handling of dangerous goods such as fuels, oil or chemicals.*~~	The listed activity was deemed not applicable as the storage and handling of dangerous goods will be less than 500 cubic metres.

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	**Applicability of proposed project to listed activity**
		~~exceeding 500 cubic metres.~~		
GN544, 18 June 2010	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from (i). a water course	*The proposed activity might will require the infilling and deposition of materials within watercourses.*	The infilling or depositing of material for access roads will be obtained from a registered borrow pit. Infilling or depositing of these access roads may impact on watercourse outside development area.
GN544, 18 June 2010	22	The construction of a road, outside urban areas, (i) with a reserve wider than 13.5 metres or, ~~(ii) where no road reserve exists where the road is wider than 8 metres~~	*The facility will require an access road of approximately 5km in length and 7m in width.*	The proposed facility falls outside urban areas and internal roads will be constructed where no road reserve exists and will not exceed 8 m.
~~GN 544, 18 June 2010~~	~~26~~	~~Any process or activity identified in terms of section 53 (1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)~~ ~~(i) Impacts on orange or red data plant species may be a process or activity identified in terms of section 53(1) of~~	~~*The applicability of this activity will be confirmed during the EIA Phase.*~~	The listed activity was found to be not applicable as no red data plant species are located within the site.

Relevant Notice	**Activity No.**	**Description of Listed Activity**	**Relevant Component(s) of Facility**	**Applicability of proposed project to listed activity**
		~~the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).~~		
GN545, 18 June 2010	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	*Each phase of the PV facility will have an export capacity of up to 75MW.*	The proposed PV facility will have an export capacity of more than 75 MW to be transmitted to the national grid.
GN545, 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; ~~Except where such physical alteration takes place for:~~ ~~(ii) Linear development activities.~~ (iii) ~~Agriculture or afforestation where activity 16 in this schedule will apply.~~	*Each Phase of the PV facility will have a development footprint greater than 20 hectares.*	The establishment of the proposed 75 MW facility will transform the land from agriculture to a PV facility.
~~GN546, 18 June 2010~~	~~4~~	~~The construction of a road wider than 4 metres with a reserve less than 13.5 metres (Free State~~	~~*Access roads may be constructed during the development of the proposed*~~	The listed activity was found to be not applicable as no roads will be constructed in sensitive areas

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	**Applicability of proposed project to listed activity**
		~~Province)~~ ~~ii. Outside Urban areas, in:~~ ~~(cc). sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority~~	~~*facility.*~~	
GN546, 18 June 2010	14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, (i) All areas outside urban area	*The project is proposed outside urban areas and 75% or more of the vegetative cover might be impacted upon.*	The establishment of the proposed 75 MW facility and access roads will require the clearance of indigenous vegetation within the site.

Activities deleted in the list above are those which were initially considered to be potentially applicable to the project but have been confirmed as not applicable through the EIA process. Activity 13 Listing Notice 1 (GN 544), Activity 26 Listing Notice 2 (GN545) and Activity 4 Listing Notice 3 (GN546) are not applicable as the proposed development will not use or handle dangerous goods exceeding 500 cubic metres and the site is not considered to be located in a sensitive environment.

The EIA phase was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of NEMA.

1.4. Objectives of the EIA Process

The Scoping Phase was completed in **August 2013** with the submission of a Final Scoping Report to the DEA, and the acceptance of scoping was received from DEA on **11 September 2013**. The scoping phase included desk-top studies and served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. The Scoping Phase included input from the project proponent, specialists with experience in the study area and in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA Phase (i.e. the current phase) assesses identified environmental impacts (direct, indirect, and cumulative as well as positive and negative) associated with the different project development phases (i.e. design, construction, operation, and decommissioning). The EIA Phase also recommends appropriate mitigation measures for potentially significant environmental impacts. The release of a draft EIA Report provided stakeholders with an opportunity to verify that issues they have raised through the EIA Process have been captured and adequately considered. The Final EIA Report has incorporated all issues and responses raised during the public review phase prior to submission to DEA.

1.5. Details of the Environmental Assessment Practitioner

Savannah Environmental was contracted by APS as the independent EAP to undertake both Scoping and EIA processes for the two projects of the proposed Sirius Solar PV Project. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to APS. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing holistic environmental management services, including environmental impact assessments and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team have considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of

projects throughout South Africa, including those associated with electricity generation.

» *Lusani Rathanya* - the principle author of this report holds an Honours Bachelor degree in Environmental Management and Analysis. Her key focus is on environmental impact assessments, waste and water licences, and environmental management plans and programmes for a variety of environmental projects. She is currently involved in several EIAs for renewable energy projects EIAs across the country.
» *Ravisha Ajodhapersadh*, the co-author of this report, holds an Honours Bachelor of Science degree in Environmental Management and has 6 years experience in environmental management. She has undertaken EIAs for various proposed solar energy facilities in South Africa and has been involved in other projects in this area.
» *Karen Jodas* is a registered Professional Natural Scientist and holds a Master of Science degree and is the registered EAP on the proposed project. She has 16 years of experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy projects across the country.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has appointed the following specialist sub-consultants to conduct specialist impact assessments:

» Ecology – Marianne Strohbach (Savannah Environmental)
» Soils and Agricultural Potential – Johann Lanz (Johann Lanz Consulting)
» Hydrology – Brian Colloty (Scherman Colloty & Associates)
» Heritage – Stephan Gaigher (G & A Heritage)
» Palaeontology – Francois Durand (G & A Heritage
» Visual – Lourens Du Plessis (MetroGIS)
» Social – Tony Barbour (Tony Barbour Consulting)

Refer to Appendix A for the curricula vitae for the Savannah Environmental EAPs, and the specialist sub-consultants.

DESCRIPTION OF THE PROPOSED PROJECT CHAPTER 2

This chapter provides an overview of the proposed Project One and Project Two of the Sirius PV Project near Upington, Northern Cape Province. The project scope includes the planning and design, construction, operation and decommissioning phases during which potential impacts on the environment will vary in terms of their nature and significance. This chapter also describes the project alternatives considered, including the "Do-Nothing" alternative - that is the alternative of not establishing the solar energy facility.

2.1 Purpose of the Proposed Project

Globally there is an increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources. Due to the exploitation of and large scale reliance on non-renewable resources and the potential subsequent impacts on climate, there is increasing pressure globally to increase the share of renewable energy generation. South Africa currently depends on fossil fuels for the supply of approximately 90% of its primary energy needs.

The current electricity imbalances in South Africa highlight the significant role that renewable energy can play in terms of power supplementation. Given that renewables can generally be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses. At present, South Africa is some way off from exploiting the diverse gains from renewable energy and from achieving a considerable market share in the industry.

With economic development over the next several decades resulting in an ever increasing demand for energy, there is some uncertainty as to the availability of economically extractable coal reserves for future use. Furthermore, several of South Africa's power stations are nearing the end of their economic life, require refurbishment, or have been recently returned to service (re-commissioned) at great expense (i.e. the Camden, Komati, and Grootvlei Power Stations).

In order to meet the long-term goal of a sustainable renewable energy industry, a target of 17.8 GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010 and incorporated in the IPP Procurement Programme. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power

generation being derived from renewable energy forms by 2030. The proposed project is to contribute towards this goal for renewable energy.

The purpose of the proposed Sirius Solar PV project is to sell the electricity generated to Eskom as part of the Renewable Energy Independent Power Producers (IPP) Procurement Programme. The IPP Procurement Programme has been introduced by the Department of Energy (DoE) to promote the development of renewable power generation facilities by IPPs. Selling of electricity according to the IPP Procurement Programme has the advantage of giving developers long-term stability and predictability, as well as providing the opportunity for the South African Government to introduce renewable energy into the power generation technology mix within the country, as per the aims of the Integrated Resource Plan (IRP) for the period 2010 – 2030.

APS will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA), as well as a power purchase agreement from Eskom (i.e. typically for a period of 20 - 25 years) in order to build and operate each of the proposed PV facilities. As part of the agreement, APS will be remunerated per kWh by Eskom who will be financially backed by government. Depending on the economic conditions following the lapse of this period, the facility can either be decommissioned or the power purchase agreement may be renegotiated and extended.

2.1.1 The Desirability of the Proposed Project

The use of solar irradiation for electricity generation is essentially a non-consumptive use of a natural resource. A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard.

The proposed site was selected for the development of a solar energy facility based on its predicted climate (solar resource), suitable proximity in relation to the existing electricity grid, and minimum technical constraints from a construction and technical perspective. Studies of solar irradiation worldwide indicate that the Northern Cape shows great potential for the generation of solar power. The region in the vicinity of the Upington has particularly high solar irradiation levels and is considered to be a highly suitable location for a solar energy project, as shown by the solar irradiation model below (see Figure 2.1).

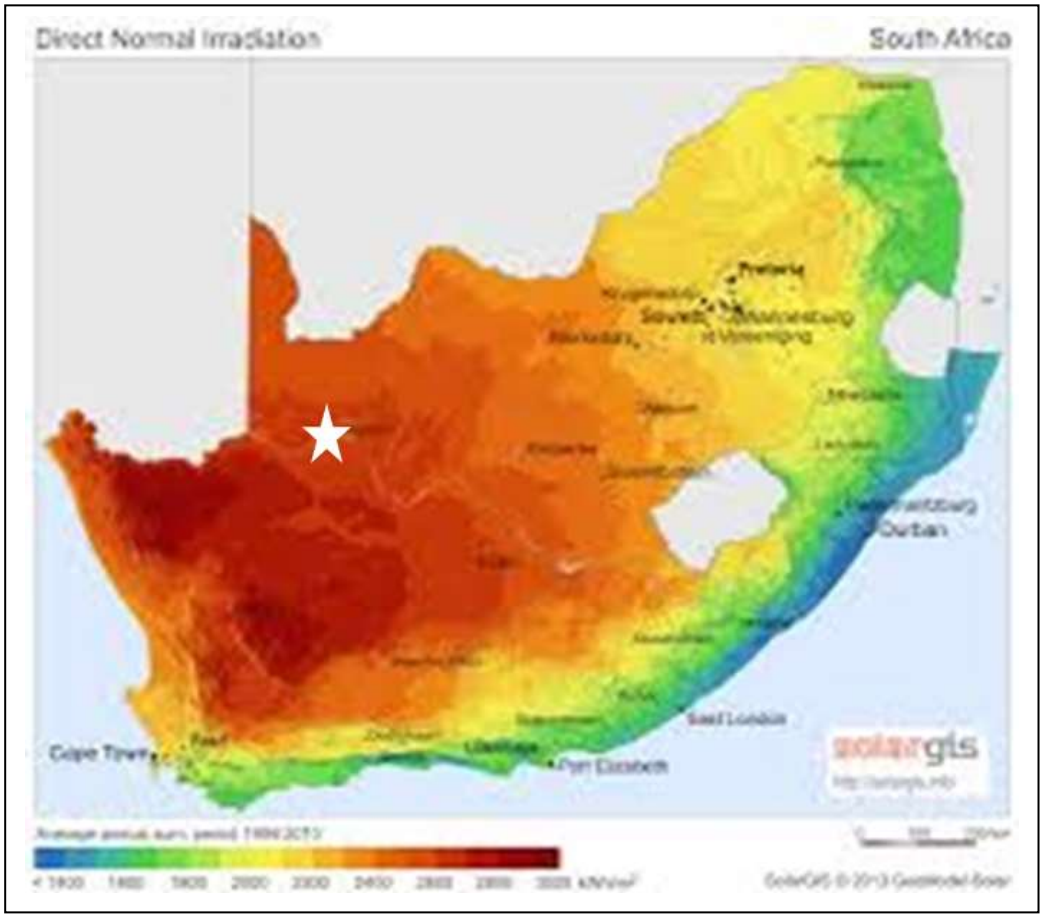

Figure 2.1: Solar irradiation map for South Africa (Source: adapted from GeoModel Solar, 2011)

APS considers this area, and specifically the demarcated site which is available for lease from the landowner, to be highly preferred for solar energy facility development. The below-mentioned depicts some of the need and desirability of the project:

» The project will have significant benefits to the local community with;
  * At least 12% of all project employees coming from the local community with approximately 150 jobs created for the duration of the construction period
  * At least 2.5% of the project owned by the local community
  * At least 1.0% of the project revenue being spent on Socio economic development contributions
» The project will have an efficient and cost effective grid connection
  * Currently Eskom is designing a new substation - the Solar Park Upington MTS substation - 3 km from the site. This is intended to house several 500MVA 400/132kv Transformers which would have capacity to connect the proposed facility to the grid
  * The Sirius Solar PV Project is located next to what will become a major transmission node on the national electricity network. With such significant

export capacity available, this project is able to supply energy to areas where it is needed most, without requiring additional grid infrastructure.

- The project site has also been selected due to its high irradiation of 1950kWh/kWp using Generic Poly Silicon Panels and Nasa data input to PVSyst5
- PV plants use significantly less water than other power generation options, with water only used during operations for the cleaning of panels
- The site is located within the proposed Solar Corridor as demarcated by the Northern Cape Spatial Development Plan.

The current land-use on the site is agriculture (grazing). The development of the Sirius PV Projects will allow current livestock grazing to continue on areas of the farm portions which will not be occupied by solar panels and associated infrastructure. Therefore the current land-use will be retained on much of the site, while also generating renewable energy from the sun and providing an additional source of income to the landowner. This represents a win-win situation for landowners, the site and the developer. Conformance of the proposed project to the regional planning of the area has been discussed in **Chapter 3**.

2.2 Description of the Proposed Solar Energy Facility

The facility is proposed to accommodate either static, tracking photovoltaic (PV) or CPV panels, to harness the solar resource on the site. The facility is proposed to have a combined export capacity of up to 150 MW. Each project will have a capacity of up to 75MW. An area of approximately 500 ha in extent will be occupied by the PV panels and associated infrastructure associated with both projects. A layout of the proposed Sirius PV Project and associated infrastructure has been provided by the project developer, and is indicated in **Figure 2.2**. This is the layout which has been assessed within this EIA Report. **Table 2.1** summarises the dimensions of the project components.

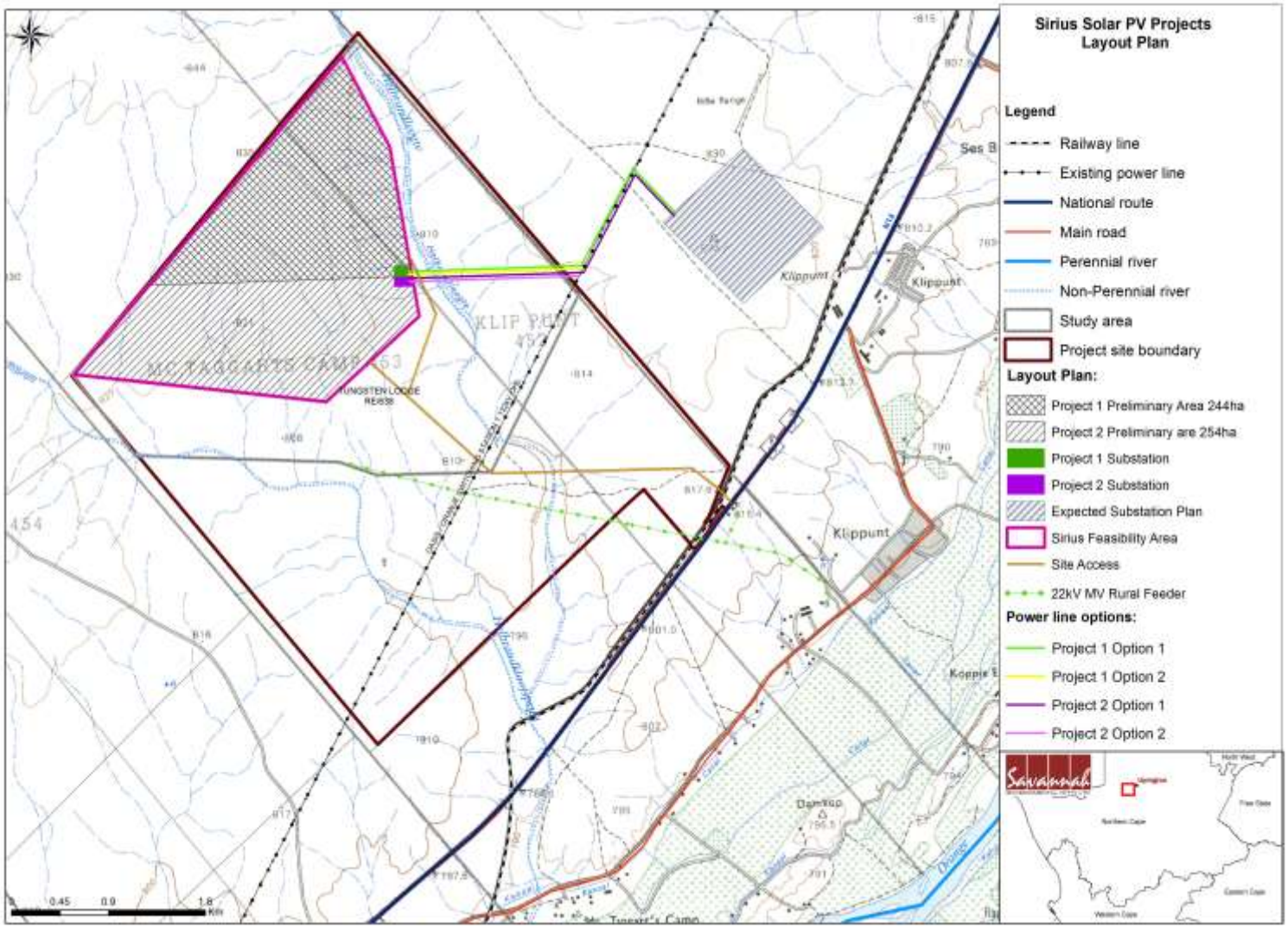

Figure 2.2: Layout for the proposed Project One and Project Two of the Sirius PV Projects including associated Infrastructure

Table 2.1: Technical details for **each proposed 75MW facility**

Component	Description/ Dimensions
Location of the site	~ 20 km south-west of Upington
Municipal Jurisdiction	» Local Municipality » District Municipality
Extent of the proposed development footprint	~ 500ha
PV Panel area	Project One - ~250 ha Project Two - ~250 ha
Extent of broader site available for both developments	~1913 ha
Site access	Access to the site will be via existing roads where possible and where there are no existing roads, new roads will be constructed (new roads of approximately 5 km in length and 7m wide are required).
Export capacity	Project One - 75 MW Project Two - 75 MW
Proposed technology	Ground-mounted photovoltaic panels utilising static, tracking or CPV technology
Cabling	Cabling between the project components is to be lain underground between 2 – 4 meters deep where practical.
Water use	» Water will be sourced from a borehole on site. » ~12 000m^3 required during the construction phase for general use and 2500m^3 for annual operations for cleaning the PV panels. » No effluent will be produced except for the normal sewage from operations staff. » All waste will be disposed of at an authorised waste disposal facility.
Panel Spec (installed capacity)	DC – 260w
Panel Dimensions	~1.1m x ~1.8m
Number of Panels	300 000
Number of inverters	Inverter/transformer building-- 6 m X 3 m brick buildings located within the PV array each containing an inverter and a step up transformer. The number of buildings will

Component	Description/ Dimensions
	be dependent on the size of plant and inverters selected. Alternatively, a pre-packaged inverter/transformer housed in a concrete substation for outdoors can be utilised.
Main Transformer capacity	The grid connection requires transformation of the voltage from 480 V to between 22 000 V and 400 000 V depending on the available infrastructure.
Final Height of installed panels from ground level	9m
Height of Transformers	4m
Height of Buildings	• Maintenance building: 4m • Warehouse: 4m
Width and length of access road	Width: 7 m Length: 5 km
Height of Fencing	2.5m
Substation	A new 132 kV on-site substation (150m X 150m in extent) for each facility to evacuate the power from the facility into the Eskom grid via a loop in loop out connection
Power line connection	» Project One Power Line: * Alternative 1: this power line alternative is approximately 3.7 km in length and lies on the south eastern side of the site and runs parallel to the Oasis- Oranje No.1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site. * Alternative 2: this power line alternative is approximately 3.1 km in length and lies on the eastern side of the proposed site. Power would feed into the Eskom electricity network via a 'loop in and loop out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line. * Project Two Power Line:

Component	Description/ Dimensions
	* Alternative 1: this power line alternative is approximately 5.4 km in length and lies on the southern side of the proposed site and runs parallel to the Oasis-Oranje No.1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site. * Alternative 2: this power line alternative is approximately 1.1 km in length and lies on the eastern side of the proposed site. Power would feed into the Eskom electricity network via a 'loop in and loop out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
Mounting Structure	Mounting structure (up to 4m in height) to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
Services required	• Sewage and Refuse material - all sewage and refuse material generated during the establishment of the proposed site will be collected by a contractor to a registered landfill site • Water and electricity – water will be obtained from the municipality or licence will be obtained for abstracting water from underground. Electricity will be generated from generators for any electrical work on site.
Infilling or depositing material	Any infilling or depositing material that may be required for project development will be obtained from a licensed borrow pit and any excess material will be transported to a registered landfill site.

2.3 Solar Energy as a Power Generation Technology

Solar energy facilities, such as those using PV panels, use the energy from the sun to generate electricity through a process known as the **Photovoltaic Effect (**refer to **Figure 2.3)**. This effect refers to photons of light colliding with electrons, and therefore placing the electrons into a higher state of energy to create electricity.

A photovoltaic (PV) cell is made of silicone which acts as a semi-conductor used to produce the photovoltaic effect. Individual PV cells are linked and placed behind a protective glass sheet to form a photovoltaic panel. The PV cell is positively charged on one side and negatively charged on the other side and electrical conductors are attached to either side to form a circuit. This circuit then captures the released electrons in the form of an electric current (direct current). An inverter must be used to change the direct current (DC) to alternating current (AC). The electricity is then transmitted through a power line for distribution and use.

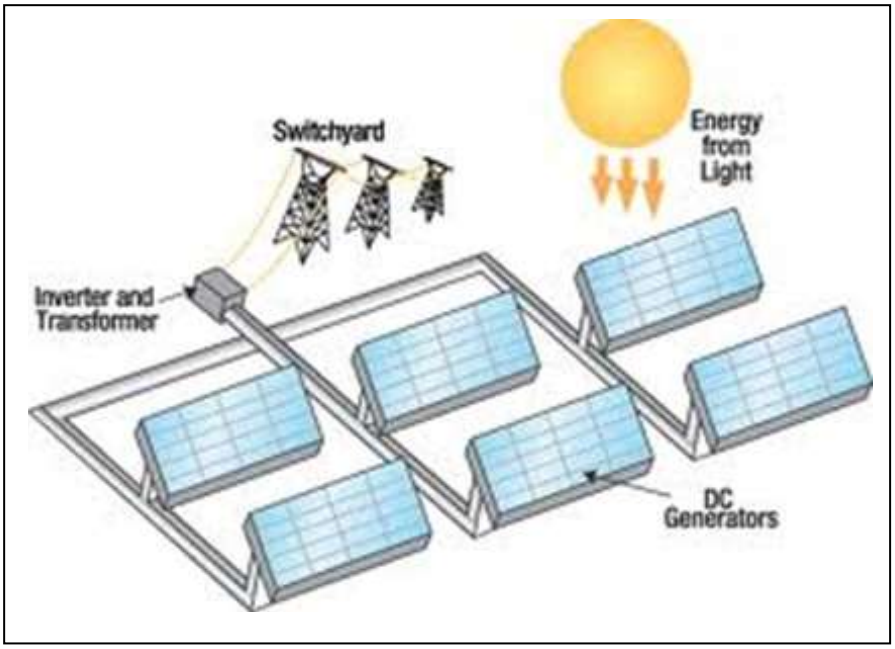

Figure 2.3: Diagram of a PV plant (Sourced from: http://www.solar-green-wind.com/archives/tag/solar-cells)

The Photovoltaic Effect is achieved through the use of the following components:

Photovoltaic Cells

An individual photovoltaic cell is made of silicone which acts as a semiconductor. The cell absorbs solar radiation which energises the electrons inside the cells and

produces electricity. Individual PV cells are linked and placed behind a protective glass sheet to form a photovoltaic panel. A single cell is sufficient to power a small device such as an emergency telephone. However, to produce 150 MW of power, the proposed facility will require numerous cells arranged in multiples/arrays which will be fixed to support structures.

The Inverter

The photovoltaic effect produces electricity in direct current. Therefore an inverter must be used to change it to alternating current.

The Support Structure

The photovoltaic (PV) panels will be attached to a **support structure up to 9m off the ground.** The PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance.

Figure 2.4: Illustration of a photovoltaic solar facility

2.4 Project Alternatives

In accordance with the requirements of the EIA Regulations, project alternatives have been considered within the EIA process. These are detailed below.

2.4.1 Site Alternatives

As part of the site selection process various sites in the Northern Cape and Upington area where considered by the developer. The R/E of the Farm Tungsten Lodge 638 is a preferred site for development of a solar project. A number of factors have been considered in determining this site as a preferred site for development including:

Northern Cape as the Ear-marked for Solar Projects

The Upington area has been ear-marked as a hub for the development of solar energy projects due to the solar resource available in the area, and this area is included in the solar corridor which has been identified by the Northern Cape Spatial Development Framework (refer to Figure 2.5). In addition, The Abengoa CSP Plant is currently being constructed adjacent to the Sirius site, and Eskom proposes a CSP Plant on the farm Olyvenhouts Drift. Eskom is also planning grid expansion and strengthening projects in the area. This makes the area preferred from a technical and infrastructure perspective.

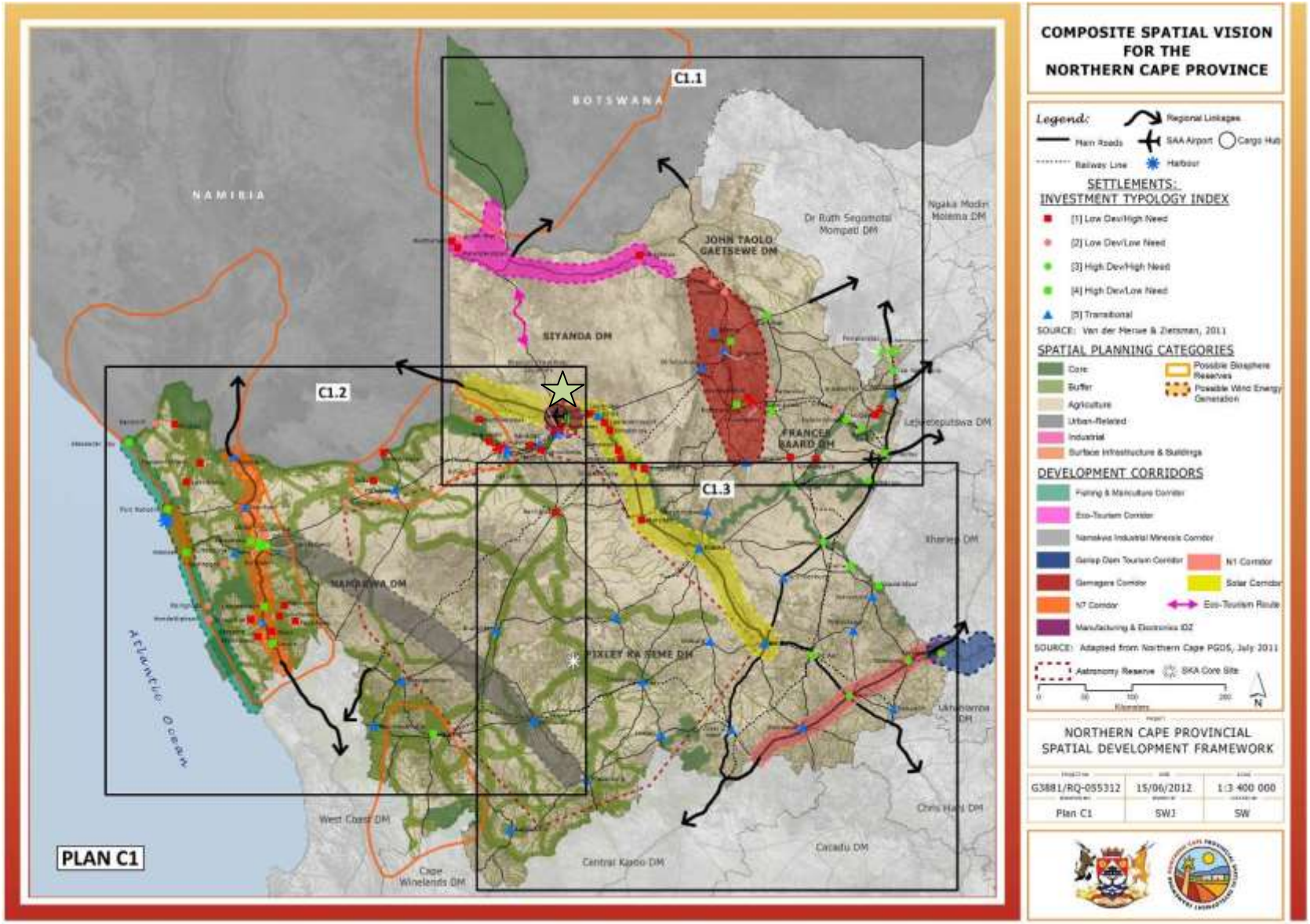

Figure 2.5: Composite Spatial Vision for the Northern Cape showing location of Upington within the Solar Corridor (green star)

Site Extent

Space is a restraining factor for the development of a solar energy facility. The proposed farm portion is approximately 1913 ha in extent, which will therefore be sufficient for the installation of the two projects (500 hectares required) of the proposed Sirius PV facility, and will allow sufficient space for the avoidance of any identified environmental constraints within the final design of each project of the PV Facility.

Site access

The site can be accessed from the N14 via gravel farm access roads. The proposed facility will require one access road, i.e. from the N14, and internal roads within the PV facility (refer to Figures 2.2 and 2.6). Details of the roads are as follows:

Number of Roads	One main road will be constructed from the N14. The constructed route will then be extended to access each proposed facility
Access Road Coordinates: Project One	Start: 28°34'12.97"S 21° 8'5.94"E Middle: 28°34'2.71"S 21° 6'46.21"E End: 28°33'27.92"S 21° 6'5.46"E
Access Road Coordinates: Project Two	Start: 28°34'12.97"S 21° 8'5.94"E Middle: 28°34'2.71"S 21° 6'46.21"E End: 28°32'58.19"S 21° 6'21.06"E

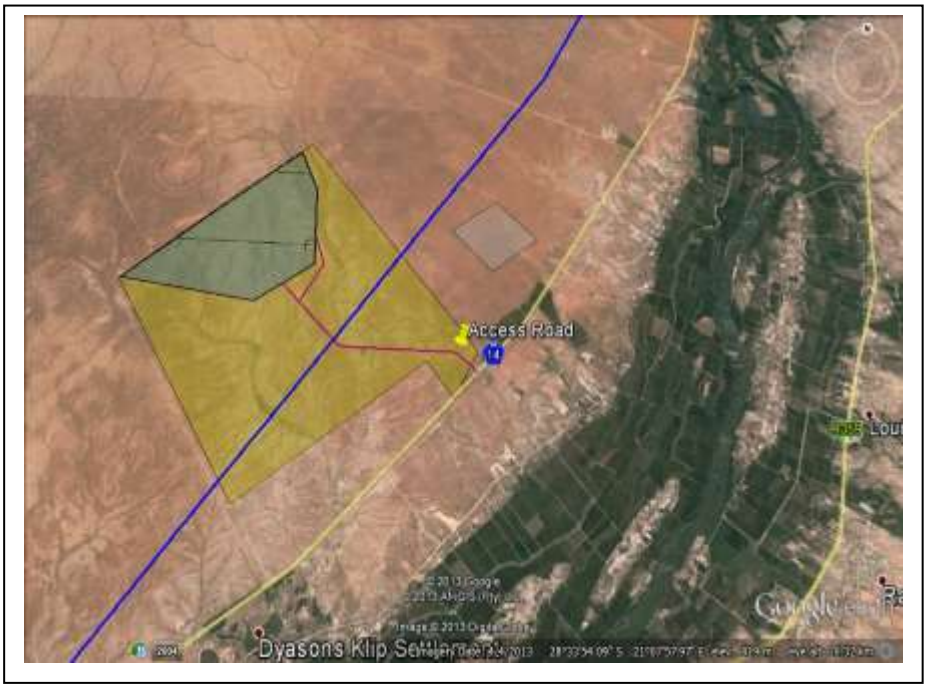

Figure 2.6: Site access road to the proposed Sirius Solar PV Facility (Project One and Project Two)

Climatic Conditions

The economic viability of a photovoltaic plant is directly dependent on the annual direct solar irradiation values. The climate of the study area is arid with an average annual rainfall of less than 200mm. Winter nights are cold, often dropping to below 5°C but frost is rare and normally not severe. Summer daytime temperatures often exceed 40°C with associated high evapotranspiration. Most rainfall occurs during thunderstorms in the hot summer months between November and March, during which period significant run-off is possible.

Gradient

The topography of the broader farm portion is generally characterised by very gently undulating terrain with typical gradients between 1% (1:100) and 8% (1:12). The altitude ranges from 830m in the northern parts of the farm to 795m in the south. This type of terrain is preferred for the installation of PV panels and specifically for PV technologies (Fluri, 2009). This reduces the need for extensive earthworks associated with the levelling of a site, thereby minimising environmental impacts.

Grid Connection

Each facility will require an on-site substation (approximately 150x150m) and associated power line will be required to evacuate the power from the facility into the Eskom grid. The site is located in close proximity to an existing 132kV power line as well as close to a proposed new Eskom Substation.

The final choice of grid connection / power line will depend on Eskom's requirements. There are two alternatives for each facility to connect to the Eskom grid namely:

- Project One Power Lines:
  - Alternative 1: this power line alternative is approximately 3.7 km in length and lies on the south eastern side of the site and runs parallel to the Oasis-Oranje No.1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
  - Alternative 2: this power line alternative is approximately 3.1 km in length and lies on the eastern side of the proposed site. Power would feed into the Eskom electricity network via a 'loop in and loop out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
- Project Two Power Line:
  - Alternative 1: this power line alternative is approximately 5.4 km in length and lies on the southern side of the proposed site and runs parallel to the Oasis-Oranje No.1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
  - Alternative 2: this power line alternative is approximately 1.1 km in length and lies on the eastern side of the proposed site. Power would feed into the

Eskom electricity network via a 'loop in and loop out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.

Based on the above considerations, APS considers the proposed site as a highly preferred site for the development of a PV Solar Energy Facility.

2.4.2 Layout and Design Alternatives

As indicated above, each project of the proposed Sirius PV project is expected to have a development footprint which is smaller than the broader Farm portion i.e. each project will use 250 ha. Therefore each the facility and associated infrastructure (i.e. PV/CPV panels, internal roads, etc.) can be appropriately located in terms of avoidance of sensitive areas within the broader site. Therefore the extent of the site allows for the identification of layout design and site-specific alternatives. The layout proposed for the two projects of the Sirius Solar Facility has avoided identified sensitive areas on the site as far as possible.

2.4.3 Technology Alternatives

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. 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. PV technology is considered favourable over CSP 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 and more space. PV is also preferred when compared to CSP technology because of the lower visual profile and less space required.

Very few technological options exist in as far as PV technologies are concerned; those that are available are usually differentiated by weather and temperature conditions that prevail – so that optimality is obtained by the final choice. The environmental impacts of any of the PV technology choices are similar, with some requiring more area for development than others. Therefore, the choice of technology does not significantly affect the environmental impact of the proposed development. The construction, operation and decommissioning of the facility will therefore be similar irrespective of the technology chosen.

Technologies being considered for this facility by the developer include:

» Fixed / static PV panels;

» Tracking PV panels (with solar panels that rotate to follow the sun's movement);
» Concentrated PV Plants (CPV technology).

Fixed Mounted PV System (Preferred Alternative)

In a fixed mounted PV system, PV panels are installed at a pre-determined angle from which they will not move during the lifetime of the plant's operation. The limitations imposed on this system due to its static placement are offset by the fact that the PV panels are able to absorb incident radiation reflected from surrounding objects. In addition, the misalignment of the angle of PV panels has been shown to only marginally affect the efficiency of energy collection. There are further advantages which are gained from fixed mounted systems, including;

» The maintenance and installation costs of a fixed mounted PV system are lower than that of a tracking system, which is mechanically more complex given that these PV mountings include moving parts.
» Fixed mounted PV systems are an established technology with a proven track record in terms of reliable functioning. In addition, replacement parts are able to be sourced more economically and with greater ease than with alternative systems.
» Fixed mounted systems are robustly designed and able to withstand greater exposure to winds than tracking systems.

For fixed PV technology, the PV panels will be fixed to a support structure (as illustrated in **Figure 2.7**) set at an angle so to receive the maximum amount of solar radiation.

Figure 2.7: Photovoltaic (fixed/ static) Panel

The angle of the panel is dependent on the latitude of the proposed facility and the angles may be adjusted to optimise for summer or winter solar radiation characteristics.

Dual Axis Tracking System

» In a dual axis tracking system, PV panels are fixed to mountings which track the sun's movement. There are various tracking systems. A 'single axis tracker' will track the sun from east to west, while a dual axis tracker will follow the sun's movement directly and in addition be equipped to account for the seasonal waning of the sun.. These systems utilise moving parts and complex technology, including solar irradiation sensors to optimise the exposure of PV panels to sunlight. Tracking systems are a new technology and as such are less suitable to operations in South Africa. This is because:

» A high degree of maintenance is required due to the nature of the machinery used in the system, which consists of numerous components and moving parts. A qualified technician is required to carry out regular servicing of these parts, which places a question on the feasibility of this system given the remote location of the proposed project site.

» The costs of the system are necessarily higher than a fixed mounted system due to the maintenance required for its upkeep and its complex design.

» A larger project site is required for this system given that the separate mountings need to be placed a distance apart to allow for their tracking movement.

A power source is needed to mechanically drive the tracking system and this would offset a certain portion of the net energy produced by the plant.

The adopted mounting structure proposed for this project is a mono axial tracking frame with:

» Direction of rotation axis North – South
» Sun path direction tracking East – West
» Maximum allowed tracking angle, from +45° to -45°
» Maximum modules surface for frame, about 36 m^2

The height of the PV arrays is expected to be up to 9 m. This technology ensures, in term of energy production, an advantage of about 25% compared to the horizontal fixed one.

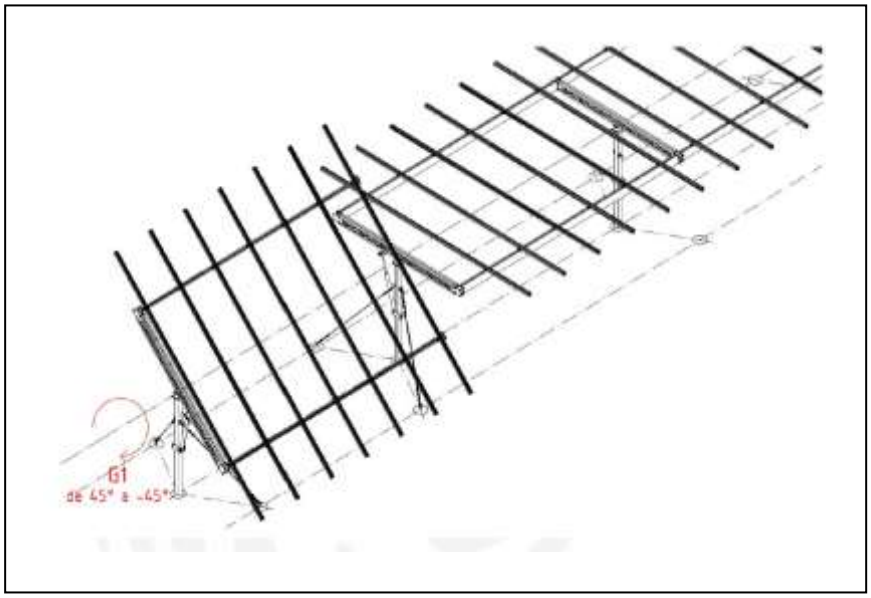

Figure 2.8: Frame, structural details of a tracking PV technology

Concentrated Photovoltaic (CPV) Technology

Concentrated photovoltaic (CPV) technology uses optics such as lenses to concentrate a large amount of sunlight onto a small area of solar photovoltaic materials to generate electricity. Unlike traditional, more conventional flat panel systems, CPV systems are more expensive to produce but provide better efficiency.

The Concentrated Photovoltaic Cell

The light energy from the sun is concentrated through lenses onto the individual CPV cells. This serves to increase the efficiency of the CPV panels (i.e. up to 39% efficiency), as compared to conventional PV technology (i.e. 8 % – 18% efficiency) (refer to Figure 2.9).

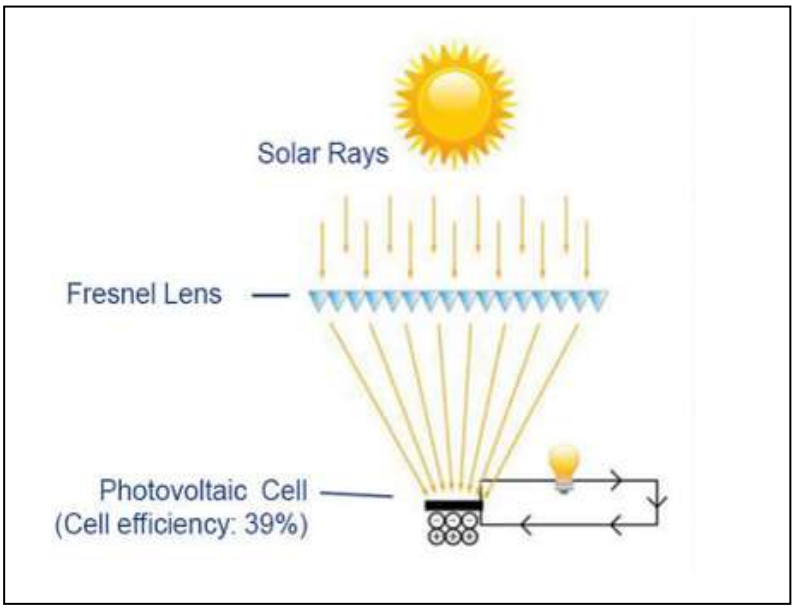

Figure 2.9: The efficiency of the PV/CPV panels is increased through the use of Fresnel Lenses which concentrates the amount of light entering the CPV cells (Source: AmonixTM)

The CPV Modules will be elevated up to 9m above ground level by a support structure and have a total height of up to 20m. The modules will be able to track the path of the sun during the day, thereby increasing the efficiency of the panels (refer to Figure 2.10).

Figure 2.10: The support structures elevate the panels and allow for dual axis tracking of the sun for increased efficiency (Source: AmonixTM)

Each panel will be approximately 22 m wide and 9 m high. As such when the tracking panel is vertical the structure will be at a maximum height of approximately 20m.

2.4.4 The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the proposed projects of the Sirius Solar PV project. Should this alternative be selected then there will be impacts at a local and a broader scale. From a local perspective, the identified site, which is zoned for agricultural purposes, would not be impacted on from an environmental perspective, and could be utilised for future agricultural activities. However, at a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although each project of the facility is only proposed to contribute 75 MW each (i.e. a total of 150MW) to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy.

The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits are explored in further detail in the South Africa REFIT Regulatory Guideline published by NERSA (March 2009), and include:

Increased energy security

The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive transmission and distribution losses.

Resource saving

It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres per annum. This translates into revenue savings of R26.6 million per annum, as fuel for renewable energy facilities is free while compared to the continual purchase of fuel for conventional power stations. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability.

Exploitation of our significant renewable energy resource

At present, valuable national resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy

flows will strengthen energy security through the development of a diverse energy portfolio in South Africa.

Pollution reduction

The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is a non-consumptive use of a natural resource which produces zero emissions.

Climate friendly development

The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita carbon dioxide emissions.

Support for international agreements

The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.

Employment creation

Although the immediate opportunity for job creation is limited due to a lack of local skilled, the sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa in the long-term.

Acceptability to society

Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

Support to a new industry sector

The development of renewable energy offers the opportunity to establish a new industry within the South African economy.

Protecting the natural foundations of life for future generations

Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come. This is the basis of sustainable development.

2.5 Proposed Activities during the Project Development Stages

2.5.1 Construction phase

In order to construct the each project of the Sirius PV project, a series of activities will need to be undertaken. The construction process (which is applicable to and will take place for each project) is discussed in more detail below.

Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to, a geotechnical survey, a site survey and, survey of substation site and road servitudes.

Establishment of Access Roads to the Site

Access to the site (directly from the N14 road) will be required. Within the site itself, access will be required to the individual facility components for construction purposes (and later limited access for maintenance). Upgrade of access roads within the site will be required and new access roads will be required (approximately 5 km in length and 7m wide). Access track construction would normally comprise of compacted rock-fill with a layer of higher quality surfacing stone on top. The strength and durability properties of the rock strata at the proposed site are not known at this stage; this will need to be assessed via a geotechnical study to be conducted by the project proponent. Depending on the results of these studies, it may be possible, in some areas, to strip off the existing vegetation and ground surface and level the exposed formation to form an access track surface. The final layout of the access roads will be determined following the identification of site related sensitivities.

Undertake Site Preparation

Site preparation activities will include clearance of vegetation. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.

Transport of Components and Equipment to Site

The national and proposed internal access roads will be used to transport all components and equipment required during the construction phase of the facility. Some of the components (i.e. transformer) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[1] by virtue of the dimensional limitations (i.e. weight). Typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the construction of the substation and site preparation.

[1] A permit will be required for the transportation of these abnormal loads on public roads.

Establishment of Laydown Areas on Site

Laydown and storage areas will be required for the typical construction equipment which will be required on site. The laydown area will be up to 2 hectares in extent.

Erect PV Cells and Construct Substation & Invertors

The PV cells will be arranged in arrays. The frames will be fixed onto the ground with the use of concrete, depending on the soil conditions at the site. This will make the installation of the plant less invasive for the territory and facilitate the decommissioning at the end of its production cycle. The height of a static PV panel structure is generally up to 4m in height. Tracking PV panels and / CPV panels are generally taller in height and potentially up to 9 m.

Figure 2.11: Frame, structural details (Courtesy of Igeam, 2011)

The following figure shows how the structure is mounted on site.

Figure 2.12: Mounting of the frame for the PV panels (Courtesy of Igeam, 2011)

In order to connect a solar facility to the national grid, numerous inverters will be arranged in several arrays to collect, and convert the produced power. The position of the inverters within the footprint of the broader site will be informed by the final positioning of the PV components.

The construction of a substation would require a survey of the site, site clearing and levelling and construction of access road/s (where required), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas and protection of erosion sensitive areas.

2.5.2. Establishment of Ancillary Infrastructure

Ancillary infrastructure for each facility will include a short power line (either connecting to the proposed Eskom substation adjacent to the site or loop in loop out to the existing Oasis-Oranje Switching Station 1 power line (132 kV)), workshop, storage areas as well as a temporary contractor's equipment camp. An on-site substation would also be required for each facility.

The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required.

Construct On-site substation and Power line

Substations are constructed in the following simplified sequence:

Step 1: Survey the area
Step 2: Final design of the substation and placement of the infrastructure
Step 3: Issuing of tenders and award of contract to construction companies
Step 4: Vegetation clearance and construction of access roads (where required)
Step 5: Construction of foundations
Step 6: Assembly and erection of infrastructure on site
Step 7: Connect conductors
Step 8: Rehabilitation of disturbed area and protection of erosion sensitive areas
Step 9: Testing and commissioning
Step 10: Continued maintenance

Power lines are constructed in the following simplified sequence:

Step 1: Survey of the route
Step 2: Selection of best-suited conductor, towers, insulators, foundations
Step 3: Final design of line and placement of towers
Step 4: Issuing of tenders and award of contract to construction companies

Step 5: Vegetation clearance and construction of access roads (where required)
Step 6: Tower pegging
Step 7: Construction of foundations
Step 8: Assembly and erection of towers on site
Step 9: Stringing of conductors
Step 10: Rehabilitation of disturbed area and protection of erosion sensitive areas
Step 11: Testing and commissioning
Step 12: Continued maintenance

2.5.3. Undertake Site Rehabilitation

Once construction is completed and once all construction equipment is removed, the site must be rehabilitated where practical and reasonable. On full commissioning of the facility, any access points to the site which are not required during the operational phase must be closed and rehabilitated.

2.5.4. Operation Phase

The electricity that is generated from the PV panels at each facility will be stepped up through the on-site inverters and transformers at the on-site substation. Thereafter a power line will transmit the electricity from the on-site substation to the electricity grid, either via the proposed new Eskom substation to be located an adjacent property (likely to be on Farm Olyvenhouts Drift), or a loop in loop out of the existing Oasis-Oranje Switching Station 1 power line (132 kV)).

It is anticipated that a full-time security, maintenance and control room staff will be required on site. Each component within the solar energy facility will be operational except under circumstances of mechanical breakdown, unfavourable weather conditions or maintenance activities.

2.5.5 Decommissioning Phase

Each project is expected to have a lifespan of more than 20 years (with maintenance) and the power plant infrastructure would only be decommissioned once it has reached the end of its economic life. If economically feasible/desirable the decommissioning activities would comprise the disassembly and replacement of the individual components with more appropriate technology/ infrastructure available at that time. However, if not deemed so, then the facility would be completely decommissioned which would include the following decommissioning activities.

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required equipment (e.g. lay down areas) and the mobilisation of decommissioning equipment.

Disassemble and Replace Existing Components

The components would be disassembled, and reused and recycled (where possible), or disposed of in accordance with regulatory requirements.

REGULATORY AND LEGAL CONTEXT CHAPTER 3

3.1 Policy and Planning Context

The need to expand electricity generation capacity in South Africa is based on national policy and informed by on-going strategic planning undertaken by the Department of Energy (DoE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as solar energy facilities is illustrated in **Figure 3.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of the proposed Sirius PV Projects.

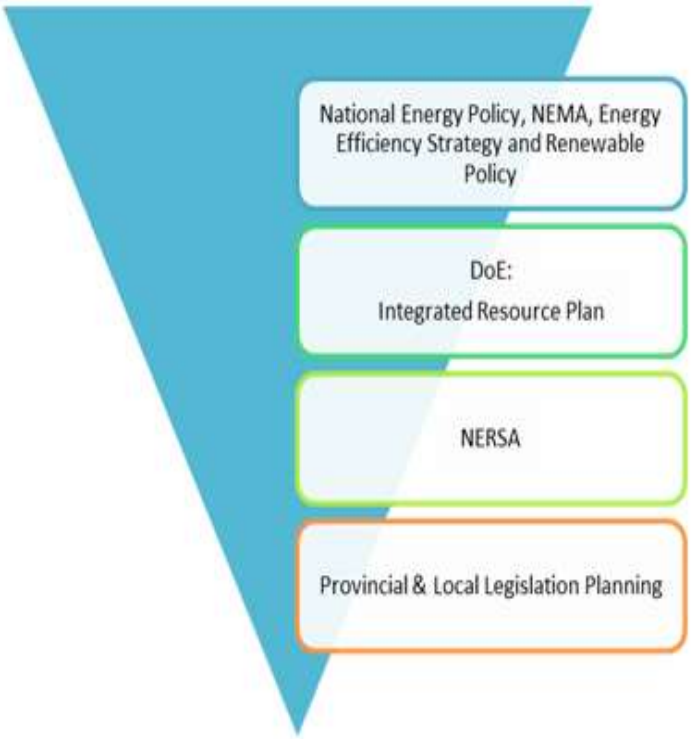

Figure 3.1: Hierarchy of electricity policy and planning documents

3.1.1 White Paper on the Energy Policy of South Africa

Investment in renewable energy initiatives, such as the proposed solar energy facility, is supported by the White Paper on Energy Policy for South Africa (December1998). In this regard the document notes: "Government policy is based on an understanding that renewables are energy sources in their own right, are not limited to small-scale and remote applications, and have significant medium and long-term commercial potential".

"Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future". The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly ***solar*** and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account. Government policy on renewable energy is thus concerned with meeting the following challenges:

» Ensuring that economically feasible technologies and applications are implemented;
» Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and,
» Addressing constraints on the development of the renewable industry.

The White Paper also acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable energy resource base is extensive and many appropriate applications exist. The White Paper also notes that renewable energy applications have specific characteristics that need to be considered. Advantages include:

» Minimal environmental impacts in operation in comparison with traditional supply technologies; and
» Generally lower running costs, and high labour intensities.

Disadvantages include:

» Higher capital costs in some cases;
» Lower energy densities; and
» Lower levels of availability, depending on specific conditions, especially with sun and wind based systems.

The IRP 2010 also allocates 43% of new energy generation facilities in South Africa to renewables.

3.1.2 Renewable Energy Policy in South Africa, 1998

This White Paper on Renewable Energy (November, 2003) (further referred to as the White Paper) supplements the *White Paper on Energy Policy*, which recognizes that the medium and long-term potential of renewable energy is significant. This

Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.
The White Paper notes that while South Africa is well-endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely untapped. As signatory to the Kyoto Protocol[2], Government is determined to make good the country's commitment to reducing greenhouse gas emissions. To this purpose, Government has committed itself to the development of a framework in which a national renewable energy framework can be established and operate.

South Africa is also a signatory of the Copenhagen Accord, a document that delegates at the 15th session of the Conference of Parties (COP 15) to the United Nations Framework Convention on Climate Change agreed to "take note of" at the final plenary on 18 December 2009. The accord endorses the continuation of the Kyoto Protocol and confirms that climate change is one of the greatest challenges facing the world. In terms of the accord South Africa committed itself to a reduction target of 34% compared to business as usual.

Apart from the reduction of greenhouse gas emissions, the promotion of renewable energy sources is aimed at ensuring energy security through the diversification of supply (in this regard, also refer to the objectives of the National Energy Act). Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels.

3.1.3 National Integrated Resource Plan, 2010 - 2030

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation. In addition to all existing and committed power plants, the RBS included a nuclear fleet of 9,6 GW; 6,3 GW of coal; 11,4 GW of renewables; and 11,0 GW of other generation sources.

[2] The **Kyoto Protocol** is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), aimed at fighting global warming. The UNFCCC is an international environmental treaty with the goal of achieving "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan and entered into force on 16 February 2005. As of November 2009, 187 states have signed and ratified the protocol (Wikipedia)

A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions. The main changes were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP) and wind options; the inclusion of learning rates, which mainly affected renewables; and the adjustment of investment costs for nuclear units, which until then represented the costs of a traditional technology reactor and were too low for a newer technology reactor (a possible increase of 40%).

Additional cost-optimal scenarios were generated based on the changes. The outcomes of these scenarios, in conjunction with the following policy considerations, led to the Policy-Adjusted IRP:

» The installation of renewables (solar PV, CSP and wind) were brought forward in order to accelerate a local industry;
» To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW was included in the IRP;
» The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024) was maintained; and
» Energy efficiency demand-side management (EEDSM) measures were maintained at the level of the RBS.

	New build options							
	Coal (PF, FBC, imports, own build)	Nuclear	Import hydro	Gas – CCGT	Peak – OCGT	Wind	CSP	Solar PV
	MW	MW	MW	MW	MW	MW	MW	MW
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	300
2013	0	0	0	0	0	0	0	300
2014	500[1]	0	0	0	0	400	0	300
2015	500[1]	0	0	0	0	400	0	300
2016	0	0	0	0	0	400	100	300
2017	0	0	0	0	0	400	100	300
2018	0	0	0	0	0	400[4]	100[4]	300[4]
2019	250	0	0	237[3]	0	400[4]	100[4]	300[4]
2020	250	0	0	237[3]	0	400	100	300
2021	250	0	0	237[3]	0	400	100	300
2022	250	0	1 143[2]	0	805	400	100	300
2023	250	1 600	1 183[2]	0	805	400	100	300
2024	250	1 600	283[2]	0	0	800	100	300
2025	250	1 600	0	0	805	1 600	100	1 000
2026	1 000	1 600	0	0	0	400	0	500
2027	250	0	0	0	0	1 600	0	500
2028	1 000	1 600	0	474	690	0	0	500
2029	250	1 600	0	237	805	0	0	1 000
2030	1 000	0	0	948	0	0	0	1 000
Total	6 250	9 600	2 609	2 370	3 910	8 400	1 000	8 400

Firm commitment necessary now
Final commitment in IRP 2012

1. Built, owned & operated by IPPs 2. Commitment necessary due to required high-voltage infrastructure, which has long lead time 3. Commitment necessary due to required gas infrastructure, which has long lead time 4. Possibly required grid upgrade has long lead time and thus makes commitment to power capacity necessary

Figure 3.2 National Energy Development Commitments before the next IRP

Figure 3.2 above indicates the new capacities of the Policy commitment. The dates shown in **Figure 3.2** indicate the latest that the capacity is required in order to avoid security of supply concerns. The document notes that projects could be concluded earlier than indicated.

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources. The Policy-Adjusted IRP has therefore resulted in an increase in the contribution from renewables from 11,4 GW to 17,8 GW. The key recommendations contained in the Policy-Adjusted IRP Final Report (March 2011) that have a bearing on the renewable energy sector include:

General

» The dark shaded projects in **Figure 3.2** need to be decided before the next IRP iteration, with the identified capacities thereafter assumed as "committed" projects;
» The light shaded options should be confirmed in the next IRP iteration; and
» All non-shaded options could be replaced during the next, and subsequent, IRP iterations if IRP assumptions change and thus impact on the quantitative model results.

PV Solar energy

» Solar PV programme 2012-2015: In order to facilitate the connection of the first solar PV units to the grid in 2012 a firm commitment to this capacity is necessary. Furthermore, to provide the security of investment to ramp up a sustainable local industry cluster, the first four years from 2012 to 2015 require firm commitment; and
» Solar PV 2016 to 2019: Grid upgrades might become necessary for the second round of solar PV installations from 2016 to 2019, depending on their location. To trigger the associated tasks in a timely manner, a firm commitment to these capacities is necessary in the next round of the IRP at the latest. By then, the assumed cost decreases for solar PV will be confirmed.

3.1.4 Electricity Regulation Act, 2006

Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, NERSA has the mandate to determine the prices at and conditions under which electricity may be supplied by licence to Independent Power Producers

(IPPs). NERSA has recently awarded electricity generation licences for new generation capacity projects under the IPP procurement programme.

3.1.5 National Development Plan

The National Planning Commission tasked with outlining a developmental growth vision and plan for the country during the course of 2011 released documents providing a diagnostic overview and vision statement/ plan. The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030, and provides that such should be the guiding objectives of the NDP over the next 20 years. While the Plan aims to address poverty and exclusion on the one hand, it simultaneously attempts to nurture economic growth by creating a virtuous cycle of expanding opportunities, building capabilities, poverty reduction, involving communities in their own development, all leading to rising living standards.

The NDP identifies 9 key challenges and associated remedial plans. While all nine challenges and plans are envisaged as part of integrated whole, the highest priorities are regarded as employment creation and improving the quality of national education. Managing the transition towards a low carbon national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

3.2 Provincial and Local Context

3.2.1 Northern Cape Province Provincial Growth and Development Strategy

The Northern Cape Provincial Growth and Development Strategy (NCPGDS) identifies poverty reduction as the most significant challenge facing the government and its partners. All other societal challenges that the province faces emanate predominantly from the effects of poverty. The NCPGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development.

The NCPGDS makes reference to the need to ensure the availability of inexpensive energy. The section notes that in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes "the development of energy sources such as ***solar energy***, the

natural gas fields, bio-fuels, etc., could be some of the means by which new economic opportunity and activity is generated in the Northern Cape". The NCPGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised.

The NCPGDS also highlights the importance of enterprise development, and notes that the current levels of private sector development and investment in the Northern Cape are low. In addition, the province also lags in the key policy priority areas of SMME Development and Black Economic Empowerment. The proposed solar energy facility therefore has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Northern Cape Province.

In this regard care will need to be taken to ensure that the proposed solar energy facility and other renewable energy facilities do not negatively impact on the regions natural environment. In this regard the NCPGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation. The document also indicates that due to the provinces exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa.

3.2.2. Northern Cape Provincial Spatial Development Framework (2012)

Northern Cape Provincial Spatial Development Framework (NCSDF) lists a number of sectoral strategies and plans to be read and treated as key components of the PSDF. Of these, there are a number that are relevant to the proposed solar energy facility. These include:

» Sectoral Strategy 1: Provincial Growth and Development Strategy of the Provincial Government.
» Sectoral Strategy 2: Comprehensive Growth and Development Programme of the Department of Agriculture, Land Reform and Rural Development.
» Sectoral Strategy 5: Local Economic Development (LED) Strategy of the Department of Economic Development and Tourism.
» Sectoral Strategy 11: Small Micro Medium Enterprises (SMME) Development Strategy of the Department of Economic Development and Tourism.
» Sectoral Strategy 12: Tourism Strategy of the Department of Economic Development and Tourism.
» Sectoral Strategy 19: Provincial renewable energy strategy (to be facilitated by the Department of Economic Development and Tourism).

The NCSDF (2012) notes the total area of high radiation in South Africa amounts to approximately 194 000 km^2 of which the majority falls within the Northern Cape. It is estimated that, if the electricity production per km^2 of mirror surface in a solar thermal power station were 30.2 MW and only 1% of the area of high radiation were available for solar power generation, then generation potential would equate to approximately 64 GW. A mere 1.25% of the area of high radiation could thus meet projected South African electricity demand in 2025 (80 GW) (NCPSDF, 2012). However the SDF does indicate that this would require large investments in transmission lines from the areas of high radiation to the main electricity consumer centres. The SDF also notes that the implementation of large concentrating solar power (CSP) plants has been proposed as one of the main contributors to greenhouse gas emission reductions in South Africa. In this regard various solar parks and CSP plants have been proposed in the province with Upington being the hub of such developments (NCPSDF, 2012). A solar corridor has been defined for the province. Upington is included within this corridor (refer to Figure 2.3).

Section C8.2.3 of the NPSDF, sets out the energy objectives for the Northern Cape Province. The section makes specific reference to renewable energy. The objectives are listed below:

» Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts.
» Enhance the efficiency of Eskom's power station at the Vanderkloof power station.
» In order to reinforce the existing transmission network and to ensure a reliable electricity supply in the Northern Cape, construct a 400 kV transmission power line from Ferrum Substation (near Kathu/Sishen) to Garona Substation (near Groblershoop). There is a national electricity supply shortage and the country is now in a position where it needs to commission additional plants urgently. Consequently, renewable energy projects are a high priority.
» Develop and institute innovative new energy technologies to improve access to reliable, sustainable and affordable energy services with the objective to realize sustainable economic growth and development. The goals of securing supply, providing energy services, tackling climate change, avoiding air pollution and reaching sustainable development in the province offer both opportunities and synergies which require joint planning between local and provincial government as well as the private sector.
» Develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by the White Paper on Renewable Energy (2003).

Section C8.3.3, Energy Policy, sets out the policy guidelines for the development of the energy sector, with specific reference to the renewable energy sector.

- The construction of telecommunication infrastructure must be strictly regulated in terms of the spatial plans and guidelines put forward in the PSDF. They must be carefully placed to avoid visual impacts on landscapes of significant symbolic, aesthetic, cultural or historic value and should blend in with the surrounding environment to the extent possible.
- EIAs undertaken for such construction must assess the impacts of such activities against the directives listed in (a) above.
- Renewable energy sources such as wind, solar thermal, biomass and domestic hydroelectricity are to constitute 25% of the province's energy generation capacity by 2020.
- The following key policy principles for renewable energy apply:
  - Full cost accounting: Pricing policies will be based on an assessment of the full economic, social and environmental costs and benefits of energy production and utilisation.
  - Equity: There should be equitable access to basic services to meet human needs and ensure human well-being. Each generation has a duty to avoid impairing the ability of future generations and their own well-being.
  - Global and international cooperation and responsibilities: Government recognises its shared responsibility for global and regional issues and act with due regard to the principles contained in relevant policies and applicable regional and international agreements.
  - Allocation of functions: Government will allocate functions within the framework of the Constitution to competent institutions and spheres of government that can most effectively achieve the objectives of the energy policy.
  - The implementation of sustainable renewable energy is to be promoted through appropriate financial and fiscal instruments.
  - An effective legislative system to promote the implementation of renewable energy is to be developed, implemented, and continuously improved.
  - Public awareness of the benefits and opportunities of renewable energy must be promoted.
  - The development of renewable energy systems is to be harnessed as a mechanism for economic development throughout the province in accordance with the Sustainable Development Initiative (SDI) approach (refer to Toolkit D10) or any comparable approach.
  - Renewable energy must, first, and foremost, be used to address the needs of the province before being exported.

3.2.3. Northern Cape Climate Change Response Strategy

The key aspects of the Northern Cape Climate Change Response Strategy (NCCCRS) Report are summarised in the MEC's (NCPG: Environment and Nature Conservation) 2011 budget speech: "The Provincial Climate Change Response Strategy will be underpinned by specific critical sector climate change adaptation and mitigation strategies that include the Water, Agriculture and Human Health sectors as the 3 key Adaptation Sectors, the Industry and Transport alongside the Energy sector as the 3 key Mitigation Sectors with the Disaster Management, Natural Resources and Human Society, livelihoods and Services sectors as 3 remaining key Sectors to ensure proactive long term responses to the frequency and intensity of extreme weather events such as flooding and wild fire, with heightened requirements for effective disaster management".

Key points from MEC address include the NCPG's commitment to develop and implement policy in accord with the National Green Paper for the National Climate Change Response Strategy (2010), and an acknowledgement of the NCP's extreme vulnerability to climate-change driven desertification. The development and promotion of a provincial green economy, including green jobs, and environmental learnership is indented as an important provincial intervention in addressing climate change. The renewable energy sector, including **solar** and wind energy (but also biofuels and energy from waste), is explicitly indicated as an important element of the Provincial Climate Change Response Strategy. The MEC further indicated that the NCP was involved in the processing 7 wind energy facility and 11 solar energy facility EIA applications (March 2011)[3].

3.2.4. ZF Mgcawu District Municipality Integrated Development Plan (2012-2017)

The key priority issues listed in the ZF Mgcawu District Municipality Integrated Development Plan (ZFMDM IDP) include:

» Basic Service Deliver;
» Municipal Institutional Development and Transformation;
» Local Economic Development;
» Municipal Financial Viability and Management;
» Good Governance and Public Participation.

The vision of the ZFMDM is: "To be a model, economically developed district with a high quality of life for all inhabitants". Linked to this vision the mission statement is

[3] (www.info.gov.za/speech/DynamicAction?pageid=461&sid=22143&tid=45200).

to: "Promote economic development to the advantage of the community within the boundaries of the ZFMDM" This will be done by the establishment and maintenance of an effective administration and a safe environment in order to attract tourists and investors to the region".

The development goals listed in the IDP that are relevant to the proposed solar energy facility include:

» To deliver a positive contribution to the sustainable growth and development within its boundaries and the rest of the Northern Cape;
» The creation of a healthy and environmentally friendly environment within and outside of the Councils" district boundaries, must be attempted;
» The promotion of a safe and tourism friendly environment should be furthered in order to promote tourism and investor interest in the region;
» The promotion of human resources within and outside the organization through training and the implementation of new technological aids.

Linked to the developmental goals are a number of developmental objectives. The following objectives are relevant to the proposed solar energy facility:

» Promotion of SMMEs in order to strengthen the Local Economic Sector
» Promote the development of the tourism sector, with specific emphasis on community based tourism;
» Promote the infrastructure development, including electricity.

3.2.5. Kai !Garib Local Municipality Integrated Development Plan (2013-2014)

The Vision set out in the Kai !Garib IDP Review for the Kai !Garib Local Municipality (KGLM) is "Creating an economically viable and fully developed municipality, which enhances the standard of living of all the inhabitants / community of Kai !Garib through good governance, excellent service delivery and sustainable development.". Simply put, the vision is "Improved and sustainable standard of living for all". Linked to the Vision is the Mission statement, which is the "Provision of transparent, accountable and sustainable service delivery".

The IDP identifies a number of Key Performance Areas (KPAs) identified by communities during Phase 1 of the IDP Process. The KPAs that are relevant to the proposed project include:

» KPA 1: Service Delivery and Infrastructure Development
» KPA 2: Local Economic Development

The priority issues identified in the IDP that are relevant to the project and are linked to the KPAs include:

» Lack of Basic Services (KPA 1)
» Poverty & Unemployment (KPA 2)
» Lack of sport and recreational facilities and services (KPA 1)
» Lack of sufficient and proper health services (HIV/AIDS) (KPA 1)

Some of the key social challenges identified by the community during the IDP process include:

» Increase in drug abuse
» Increase in young children (under 10 years) actively abusing alcohol
» Increase in Teenage Pregnancies
» Increase in crime linked to alcohol and drug abuse
» High levels of youth unemployment
» Increase in the prevalence of HIV & Aids

The IDP identifies a number of strategies aimed at addressing the challenges. The strategies that are relevant to and that could potentially benefit from the Community Trust established as part of the project include:

Basic Services
» Upgrading of sanitation systems
» Provision of electricity

Poverty and unemployment, and local economic development
» Skills development and capacity building programmes especially amongst the youth
» Promote Private sector and business partnerships as well as community partnerships
» Establish Local Economic Incentives
» Promote BBBEE and support to small business (through SEDA and provincial Programmes)
» Upgrading of existing business centres
» Provision of additional business facilities
» Skills capacity building of emerging farmers, i.e. stock farming, financial management

The renewable energy sector is also recognized as a key sector. The IDP notes that a number of new opportunities have opened up for KGLM area since the need to facilitate the generation of sustainable energy was introduced in South Africa by Eskom and the South African government. The IDP notes that there are a number of solar projects proposed in the area and that the economic benefits from these projects are eagerly anticipated.

3.3. Regulatory Hierarchy for Energy Generation Projects

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels. As solar energy development is a multi-sectoral issue (encompassing economic, spatial, biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process for solar energy facility project and the related statutory environmental assessment process.

At **National Level**, the main regulatory agencies are:

» *Department of Energy (DoE):* This Department is responsible for policy relating to all energy forms, including renewable energy, and is responsible for forming and approving the IRP (Integrated Resource Plan for Electricity).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for solar energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* SAHRA is a statutory organisation established under the National Heritage Resources Act, No 25 of 1999, as the national administrative body responsible for the protection of South Africa's cultural heritage.
» *National Department of Agriculture, Forestry, and Fisheries (DAFF):* This Department is responsible for activities pertaining to subdivision and rezoning of agricultural land. The forestry section is responsible for the protection of tree species under the National Forests Act (Act No 84 of 1998).
» *South African National Roads Agency (SANRAL):* This Agency is responsible for the regulation and maintenance of all national routes.
» *National Department of Water Affairs:* This Department is responsible for water resource protection, water use licensing and permits. Water use in this area of the Northern Cape cannot be generally authorised, and so all water uses are required to be authorised at the National level via a licence application.
» *Eskom:* Commenting authority regarding Eskom infrastructure and grid connection.

At **Provincial Level**, the main regulatory agency is:

» Northern Cape Department of Environmental and Nature Conservation (DENC). This department is the commenting authority for this project.

» *Department of Transport and Public Works:* This Department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on Provincial public roads.
» *Provincial Department of Water Affairs:* This Department is responsible for water resource protection, water use licensing and permits.
» *Ngwao Boswa ya Kapa Bokone (Northern Cape Heritage Authority):* This body is responsible for commenting on heritage related issues in the Northern Cape Province.
» *Northern Cape Department of Agriculture, Land Reform and Rural Development:* This Department is responsible for all matters which affect agricultural land.
» *Northern Cape Department of Mineral Resources (DMR):* Approval from the may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.

At **Local Level** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use, and the environment. i.e. the Kai !Garib Local Municipality and the ZF Mgcawu District Municipality.

» The Kai !Garib Local Municipality is located within the ZF Mgcawu District Municipality.
» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.
» Spatial Development Frameworks (such as the ZF Mgcawu District Municipality SDF).
» By-laws and policies have been formulated by local authorities to protect visual and aesthetic resources relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc.

There are also numerous non-statutory bodies such as Solar Energy Associations and environmental lobby groups that play a role in various aspects of planning and the environment that will influence solar energy development.

3.3.1 *Legislation and Guidelines that have informed the preparation of this EIA Report*

The following legislation and guidelines have informed the scope and content of this Final EIA Report:

- National Environmental Management Act (Act No 107 of 1998)
- EIA Regulations, published under Chapter 5 of the NEMA (GNR R545, GNR 546 in Government Gazette 33306 of 18 June 2010) as amended
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  - Public Participation in the EIA Process (DEA, 2010)
  - International guidelines – the Equator Principles

Several other Acts, standards or guidelines have also informed the project process and the scope of issues evaluated in the EIA report. A listing of relevant legislation is provided in Table 3.1.

Table 3.1: Relevant policies, legislation, guidelines, and standards applicable to the proposed PV Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	The Environmental Assessment Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GN R543, R544, R545 and R546 of 18 June 2010, an Environmental Impact Assessment Process is required to be undertaken for the proposed project.	Department of Environmental Affairs – competent authority Department of Environmental and Nature Conservation (DENC)- commenting authority	The listed activities triggered by the proposed solar energy facility have been identified and assessed in the Environmental Assessment Process being undertaken. This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	Department of Environmental Affairs	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section has found application during the EIA Process through the consideration of potential impacts (cumulative, direct, and indirect). It will

			continue to apply throughout the life cycle of the project.
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992)	Department of Environmental Affairs Department of Environmental and Nature Conservation (DENC)- Local Authorities	Noise impacts are expected to be associated with the construction phase of the project and are not likely to present a significant intrusion to the local community. Therefore is no requirement for a noise permit in terms of the legislation.
National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required). Consumptive water uses may include the taking of water from a water resource - Sections 21a and b. Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse - Section 21i.	Department of Water Affairs Provincial Department of Water Affairs	A water use license (WUL) is required to be obtained if wetlands or drainage lines are impacted on, or if infrastructure lies within 500m of such features. Pans occur on the project site, but outside of the development footprint. Should water be extracted from groundwater (borehole on site) for use within the facility, a water use license will be required in terms of Section 21(a)

			and 21 (b) of the National Water Act.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act. S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resources that might occur on site.	Department of Mineral Resources	As no borrow pits are expected to be required for the construction of the facility, no mining permit or right is required to be obtained. A Section 53 application will be submitted the Northern Cape DMR office.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Measures in respect of dust control (S32) and National Dust Control Regulations of November 2013. Measures to control noise (S34) - no regulations promulgated yet.	Department of Environmental Affairs	No permitting or licensing requirements arise from this legislation. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that

			the person has failed to comply with the Act. The air quality officer may require a dust monitoring programme as per the Regulations for dust control
National Heritage Resources Act (Act No 25 of 1999)	» Stipulates assessment criteria and categories of heritage resources according to their significance (S7). » Provides for the protection of all archaeological and paleontological sites, and meteorites (S35). » Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36). » Lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development (S38). » Requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction (S44).	South African Heritage Resources Agency	An HIA has been undertaken as part of the EIA Process to identify heritage sites (refer to Appendix D3)
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657.	Department of Environmental Affairs	As the applicant will not carry out any restricted activity, as is defined in S1 of the Act, no permit is required to be obtained in this regard.

	» Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), and vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). » This Act also regulates alien and invader species. » Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species.		Specialist flora and fauna studies (refer to Appendix D1) have been undertaken as part of the EIA Process. As such the potentially occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered.
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Prohibition of the spreading of weeds (S5) » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. » Requirement & methods to implement control	Department of Agriculture	This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil

	measures for alien and invasive plant species (Regulation 15E of GN R1048).		conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.
National Forests Act (Act No. 84 of 1998)	According to this act, the Minister has declared a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.	National Department of Forestry	An application will be made to DAFF should the development impact on protected trees
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Agriculture, Forestry and Fisheries (DAFF)	While no permitting or licensing requirements arise from this legislation, this act will find application during the construction and operational phase of the project.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances	Department of Health	It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they

	or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance Group IV: any electronic product; and Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. S (2 - 4) provides general principles for land development and conflict resolution.	Local Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the Act.
Subdivision of Agricultural Land Act	Details land subdivision requirements and procedures.	Department of	Subdivision will have to be

(Act No 70 of 1970)	Applies for subdivision of all agricultural land in the province	Agriculture	in place prior to any subdivision approval in terms of S24 and S17 of the Act.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	The Minister may by notice in the *Gazette* publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 718), An Environmental Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » Any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking.	National Department of Water and Environmental Affairs Provincial Department of Environmental Affairs (general waste)	As no waste disposal site is to be associated with the proposed project, no permit is required in this regard. Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, as detailed in the EMP. The volumes of waste to be generated and stored on the site during construction and operation of the facility will not require a waste license (provided these remain below the prescribed thresholds).

	» The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.		
National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	» South African National Roads Agency Limited (national roads) » Provincial Department of Transport	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. Transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).

Provincial Legislation			
Northern Cape Nature Conservation Act, Act No. 9 of 2009	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: » Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto	Provincial Department of Environmental Affairs	Permitting or licensing requirements arise from this legislation for the proposed activities to be undertaken for the proposed project as there are a succulent plants species on the proposed development site. A permit is required to remove the plants.
	» or off of a property; » Aquatic habitats may not be destroyed or damaged; » The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species. » The Act provides lists of protected species for the Province.		
Local Legislation			
ZF Mgcawu Environmental Management Framework (EMF)	The purpose of strategies is to create a mechanism for implementing action to address some of the most pertinent issues that came out of the EMF. The strategies are focused on the alleviation of potential key development/environment friction areas by providing direction in respect to how these friction areas should be dealt with. The following strategies have been compiled: » Strategy for the protection and conservation of high quality natural		The proposed facility does not require a permit but will be applicable throughout the project phase

	vegetation across the Siyanda District » Strategy for development on sensitive areas in the Orange River floodplain » Protection of sensitive environmental features on large properties across Siyanda » Strategy for the protection of sensitive environmental features surrounded or abutted by small properties.	

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 4

An EIA process is regulated by the EIA Regulations which involves the identification and assessment of direct, indirect and cumulative environmental impacts (both positive and negative) associated with a proposed project. The EIA process forms part of the feasibility studies for a project, and comprises a Scoping Phase and EIA Phase which culminates in the submission of an EIA Report together with an Environmental Management Programme (EMPr) to the competent authority for decision-making.

The EIA Process for the proposed facility has been undertaken in accordance with the EIA Regulations published in Government Notice 33306 of 18 June 2010, as amended in December 2010, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998.

4.1. Phase 1: Scoping Phase

The Scoping Study, which was completed in **September 2013** with the acceptance of the final Scoping report by the DEA, served to identify potential issues associated with Project One and Project Two of the proposed facility and define the extent of studies required within the EIA Phase. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

I&APs were provided with the opportunity to receive information regarding the proposed project, to participate in the process and to raise issues or concerns. Furthermore, the Draft Scoping Report was made available at the Upington Public Library and on the Savannah Environmental website for I&AP review and comment for a 30-day period. The final scoping report was also available for public comment for a 21-day period. All the comments, concerns, and suggestions received during the Scoping Phase and the review period were included in the Final Scoping Report.

The Scoping Report was submitted to the National Department of Environmental Affairs in August 2013. The Final Scoping Report and Plan of Study for the EIA were accepted by the DEA, as the competent authority, in September 2013. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

4.2. Phase 2: Environmental Impact Assessment Phase

Through the Scoping Study, a number of issues requiring further study for all components of the project were highlighted. These issues have been assessed in detail within the EIA Phase of the process (refer to Chapter 6 & 7). The EIA Phase aims to achieve the following:

» Provide a comprehensive assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility and associated infrastructure.
» Comparatively assess any feasible and reasonable alternatives put forward as part of the project.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public participation process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA Report addresses potential direct, indirect, and cumulative[4] impacts (both positive and negative) associated with all phases of the project including design, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

4.2.1. Tasks completed during the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations published in GN 33306 of 18 June 2010, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.

[4] "Cumulative environmental change or cumulative effects may result from the additive effect of individual actions of the same nature or the interactive effect of multiple actions of a different nature" (Spaling and Smit, 1993).

» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.
» Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.

4.2.2. Authority Consultation

The National DEA is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report and this EIA report. Consultation with the regulating authorities (i.e. DEA and NC DENC) has continued throughout the EIA process. On-going consultation included the following:

» Submission of a final Scoping Report following a public review period and consideration of stakeholder comments received.
» Ad hoc discussions with DEA in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA Phase.

The following will also be undertaken as part of this EIA process:

» Submission of a final EIA Report following the public review period.
» Provision of an opportunity for DEA and NC DENC representatives to visit and inspect the proposed site, and the study area.
» Consultation with Organs of State that may have jurisdiction over the project, including:
    * Provincial and local government departments (including South African Heritage Resources Agency, Department of Water Affairs, South African National Roads Agency Limited, Department of Agriculture, etc.).
    * Government Structures (including the Department of Public Works, Roads and Transport, etc.)

The table below shows the organs of state that were consulted during the commenting period for the Draft Environmental Impact Assessment Report review period and the details of how each were consulted as well as whether comments have been received.

ORGAN OF STATE / GOVERNMENT BODY	NAME AND SURNAME	CONSULTATION	COMMENTS RECEIVED
Northern Cape Department of Environmental Affairs and Nature Conservation	Denver van Heerden and J. Mutyorauta	• Draft Scoping and EIA reports were couried	• No
Department of Agriculture, Forestry and Fisheries	Mashudu Marubini; Jacoline Mans and Thoko Buthelezi	• Draft Scoping and EIA reports were couried	• Yes
South African Civil Aviation Authority (SACAA)	Lizell Stroh	• Notification letter for Draft Scoping and EIA reports were sent	• No
Northern Cape Department of Roads and Public Works	Kholikile Nogwili and Ruth Palm	• Draft Scoping and EIA reports were couried	• No
Department of Water Affairs	J.C. van Rooyen; Mashudu Ranwedzi and Louis Snyders	• Draft Scoping and EIA reports were couried	• Yes
Department of Energy	Northern Cape: Director Wolsey Otto Barnard	• Draft Scoping and EIA reports were couried	• Yes
South African National roads Agency Limited (SANRAL)	Rene de Kock	• Draft Scoping and EIA reports were couried	• Yes
Transnet- Not included in the database because it is not a potential interested and affected party for this Sirius project as there are no Transnet infrastructure that will be impacted by the project	N/A	N/A	N/A
South African Heritage resources Agency (SAHRA)	Kathryn Smuts and Mariagrazia Galimberti	• Draft Scoping and EIA reports were uploaded onto SAHRIS	• Yes
Department of Communication, Sentech and the Square Kilometre Array (SKA)	Adrian Tiplady	• Draft Scoping and EIA reports were couried	• Yes
Kai !Garib Local Municipality	Desery Wellin Fienies and	• Draft Scoping and EIA reports were	• Yes

	Johny Mackay	couried	
//Khara Hais Local Municipality	Willem Engelbrecht	• Draft Scoping and EIA reports were couried	• Yes
ZF Mgcawu District Municipality	Eric Ngxanga	• Draft Scoping and EIA reports were couried	• Yes
Northern Cape Department of Rural Development and Land Reform	Sipho Mbaqa Ali Diteme	• Draft Scoping and EIA reports were couried	• Yes
Department of Rural Development and Land Reform	Debbie Khan Lorato Sehularo	• Draft Scoping and EIA reports were couried	• Yes
Department of Minerals	Ntsundeni Ravhugoni	• Draft Scoping and EIA reports were couried	• No
Ngwao-Boswa ya kapa Bokone (Northern Cape Provincial Heritage Resources Authority)	Ratha Andrew Timothy	• Draft Scoping and EIA reports were couried	• No
Eskom	John Geeringh Andrea van gensen	• Draft Scoping and EIA reports were couried and hand delivered	• Yes
Telkom SA Limited	Leonard Shaw	• Notification of Draft Scoping and EIA reports were sent via email	• No

A record of the consultation in the EIA process is included within **Appendix B**.

4.2.3. Public Involvement and Consultation

The aim of the public participation process was primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
» Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
» Comment received from stakeholders and I&APs was recorded and incorporated into the EIA process.

Below is a summary of the key public participation activities conducted thus far.

» **Identification of I&APs and establishment of a database**
Identification of I&APs was undertaken by **Savannah Environmental**) through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders, Parastatals and Non-Governmental Organisations (refer to **Table 4.1** below).

Table 4.1: Key stakeholder groups identified during the EIA Process

Stakeholder Group	Department
National and Provincial Authorities	» Northern Cape – Department of Environmental and Nature Conservation (DENC) » Northern Cape - Agriculture » Northern Cape – Roads and Public Works » Northern Cape - Water Affairs » South African Heritage Resources Agency National » SANRAL Eastern Region » Northern Cape - Heritage » Department of Agriculture » Department of Energy
Municipalities	» Kai !Garib Local Municipality » ZF Mgcawu District Municipality
Public stakeholders	» Advertisement placed to inform the public of the availability of the report and public meeting » letters were sent to I&APs
Parastatals & service providers	» Eskom Transmission and Distribution » South African Heritage Resources Agency

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA Phase were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (**refer to Appendix C**). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been on-going for the duration of the EIA Process and the project database has been updated on an on-going basis.

» **Newspaper Advertisements**
During the scoping phase a first round of adverts were placed in order to notify and inform the public of the proposed project and notify the public on the availability of the Draft Scoping report for public review and public meeting. These adverts were placed as follows:

* Volksblad (13 March 2013)
* Gemsbok (15 March 2013)

During the scoping phase, a second round of newspaper adverts was placed to inform the public of the review date of the report and details of the public meeting. These adverts were placed in the following newspapers:

* Volksblad (28 March2013)
* Gemsbok (28 March 2013)

During the EIA phase, a third round of newspaper adverts were placed to inform the public of the availability of the Draft EIA report in the following newspapers:

* Volksblad
* Gemsbok

» **Consultation**
In order to accommodate the varying needs of stakeholders and I&APs, the following opportunities have been provided for I&AP issues to be recorded and verified through the EIA phase, including:

* Focus group meetings (stakeholders were invited to attend)
* Written, faxed or e-mail correspondence

In order to further facilitate comments on the Draft EIA report and to provide feedback on the findings of the specialist scoping studies, focus group meetings were held with landowners and different stakeholders.

Records of all consultation undertaken are included within **Appendix D**.

4.2.4. Public Review Period for Draft and Final EIA Report

The Draft EIA Report was made available for public review from **07 January 2014 – 05 February 2014** at the following locations:

» Upington Public Library
» Keimoes Public Library
» www.savannahSA.com

In order to facilitate comments on the Draft EIA Report, focus group meetings were held with landowners and organ of state in December 2014.

Public meeting was not held during the EIA phase as there was no attendance during the scoping phase, rather Focus group meetings were held with different

stakeholders. The meetings gave different stakeholders the opportunity to raise their concerns one on one and have their concerns addressed.

The public review process was advertised in regional and local newspapers. The minutes of the focus group meeting has been incorporated in the Final EIA Report contained in Appendix E. In addition, all registered I&APs were notified of the availability of the report by letter (refer to Appendix E).

4.2.5. Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process were incorporated into Comments and Response Reports and included in the Final EIA report.

4.2.6. Assessment of Issues Identified through the Scoping Process

Issues which require further investigation within the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated below.

Table 4.1: Specialist studies undertaken within the EIA Phase for both Projects

Specialist	Area of Expertise	Refer Appendix
Marianne Strohbach of Savannah Environmental	Ecological Impact Assessment	**Appendix E**
Johann Lanz of Johann Lanz Soil Scientist	Soil and Agricultural Potential	**Appendix F**
Stephan Gaigher of G & A Heritage	Heritage Impact Assessment	**Appendix G**
Francois Durand of G & A Heritage	Palaeontology Impact Assessment	**Appendix H**
Brian Colloty of Scherman Colloty & Associates	Hydrology Impact Assessment	**Appendix I**
Lourens du Plessis of MetroGIS	Visual Impact Assessment	**Appendix J**
Tony Barbour of Tony Barbour Consulting	Social Impact Assessment	**Appendix K**

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the proposed Sirius (Project One and Project Two) PV Solar Project. Issues were assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected, and how it will be affected
- The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high)
- The **duration**, wherein it is indicated whether:
  - The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
  - The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2
  - Medium-term (5–15 years) – assigned a score of 3
  - Long term (> 15 years) - assigned a score of 4
  - Permanent - assigned a score of 5
- The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  - 0 is small and will have no effect on the environment
  - 2 is minor and will not result in an impact on processes
  - 4 is low and will cause a slight impact on processes
  - 6 is moderate and will result in processes continuing but in a modified way
  - 8 is high (processes are altered to the extent that they temporarily cease)
  - 10 is very high and results in complete destruction of patterns and permanent cessation of processes
- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  - Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
  - Assigned a score of 2 is improbable (some possibility, but low likelihood)
  - Assigned a score of 3 is probable (distinct possibility)
  - Assigned a score of 4 is highly probable (most likely)
  - Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)
- The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high
- The **status**, which is described as either positive, negative or neutral
- The degree to which the impact can be reversed
- The degree to which the impact may cause irreplaceable loss of resources
- The degree to which the impact can be mitigated

The **significance** is determined by combining the criteria in the following formula:

S = (E+D+M) P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area)

As the developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. A draft EMP is included for each project as **Appendix L (Project One) and Appendix M (Project)**.

4.2.7. Assumptions and Limitations

The following assumptions and limitations are applicable to the studies undertaken within this EIA Phase:

» All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.
» It is assumed that the development site identified by the developer represents a technically suitable site for the establishment of the proposed solar facility.
» It is assumed correct that the proposed connection to the National Grid is correct in terms of viability and need.
» Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.
» This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

Refer to the specialist studies in **Appendices E – K** for specialist study specific limitations.

DESCRIPTION OF THE RECIEVING ENVIRONMENT CHAPTER 5

This section of the Final EIA Report provides a description of the environment that may be affected by the proposed Project One and Project Two of the Sirius PV Project and associated infrastructure. This information is provided in order to assist the reader in understanding the receiving environment within which the proposed facility is situated. Features of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data, and aims to provide the context within which this EIA is being conducted. The entire project development area (i.e. Project One & Project Two) is described below as the environment for both projects are fairly uniform (and are located directly adjacent to each other). Where there are differences between the environments of the two projects, this is highlighted. A summary of the environment of each of the project development is provided at the end of this Chapter. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices E – K**.

5.1 Regional Setting: Location of the Study Area

Project One and Project Two of the Sirius PV Project will be constructed within a broader study area of~ 500 ha, occupying most of the northern half of the Remaining Extent of the Farm Tungsten Lodge 638, which is approximately 20 km south-west of Upington. The N14 from Upington to Keimoes runs along a small portion of the southern extent of the farm. The farm is located within the Kai !Garib Local Municipality (and the greater ZF Mgcawu (previously referred to as Siyanda) District Municipality, Northern Cape Province.

5.2 Climatic Conditions

The climate information has been derived from climatic data summarised for Upington which is located about 20 km north east of the Remaining Extent of the Farm Tungsten Lodge 638. Upington receives ~170 - 200 mm of rain per year. The area receives its highest rainfall between January and April, peaking in March (37 mm), with winters and early spring being generally dry.

Rainfall amounts can vary significantly from year to year. The average midday temperatures for Upington range from 19.8°C (to 29°C) in July to 33°C (to 42°C)

in January. The region is the coldest during July when the temperatures drop to 4°C on average during the night, but can go as low as -7˚C.

5.3 Access and Transport Routes in the region

The N14 and R359 are the primary roads in the region and are the main link between Gauteng and the Augrabies Falls National Park. Access to the Remaining Extent of the Farm Tungsten Lodge 638 is via a 2.3km existing secondary (gravel) road that joins the N14 national road near the small town of Klippunt. Access to the area to be utilised for the PV facilities' will be supplemented by ~3km of new road to each of the projects.

5.4. Topography

The topography of the region is relatively homogenous and is described pre-dominantly as lowlands with hills and dune hills to the north. Relatively prominent small hills occur towards the west and south-west of the study area (refer to Figure 5.1). The terrain surrounding the farm is predominantly flat with an even south-eastern slope towards the Orange River valley that forms a distinct hydrological feature in the region.

5.5 Land use of the Study Area

The site for the proposed facility is situated approximately 20km by road south-west of Upington on the remaining extent of the farm Tungsten Lodge 638. This farm is located west of the farm Olyvenhouts Drift which is earmarked for the development of the proposed Eskom CSP facility. To the north of the Sirius PV Facility site, the Khi Solar One CSP Facility is currently being constructed on Portion 3 of the Farm McTaggarts Camp 453.

The Khi Solar One CSP facility applied for the utilisation of three different solar technologies on their site, including Concentrating Solar Power (CSP) parabolic troughs, a power tower (central receiver and heliostats) and Concentrating or Tracking Photovoltaic Power (PV), photovoltaic cells. The location of the Khi Solar One Plant in relation to the proposed Sirius PV Facility is shown in Figure 5.2.

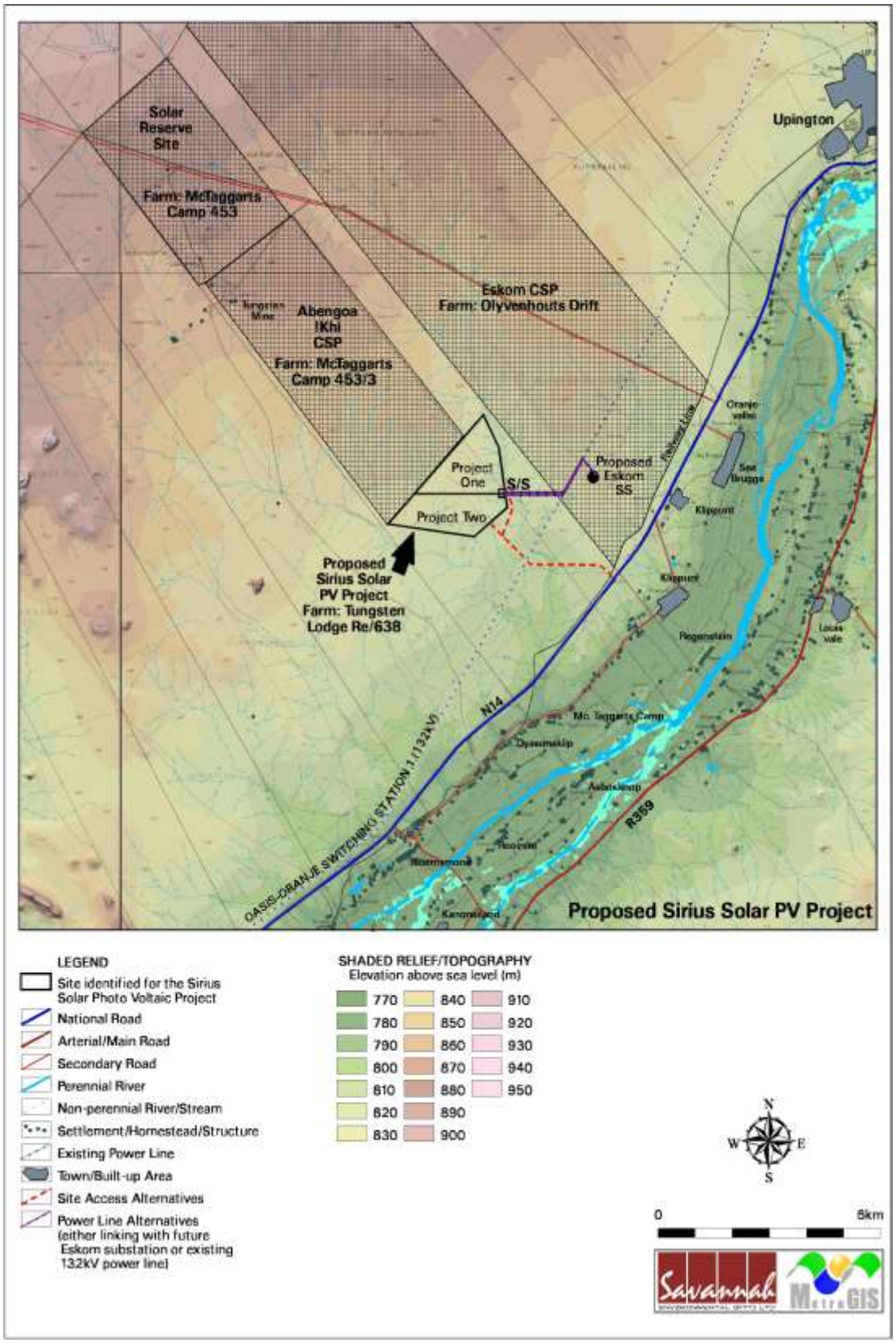

Figure 5.1: A map indicating the topography of the proposed Sirius PV Project site and surrounding environment

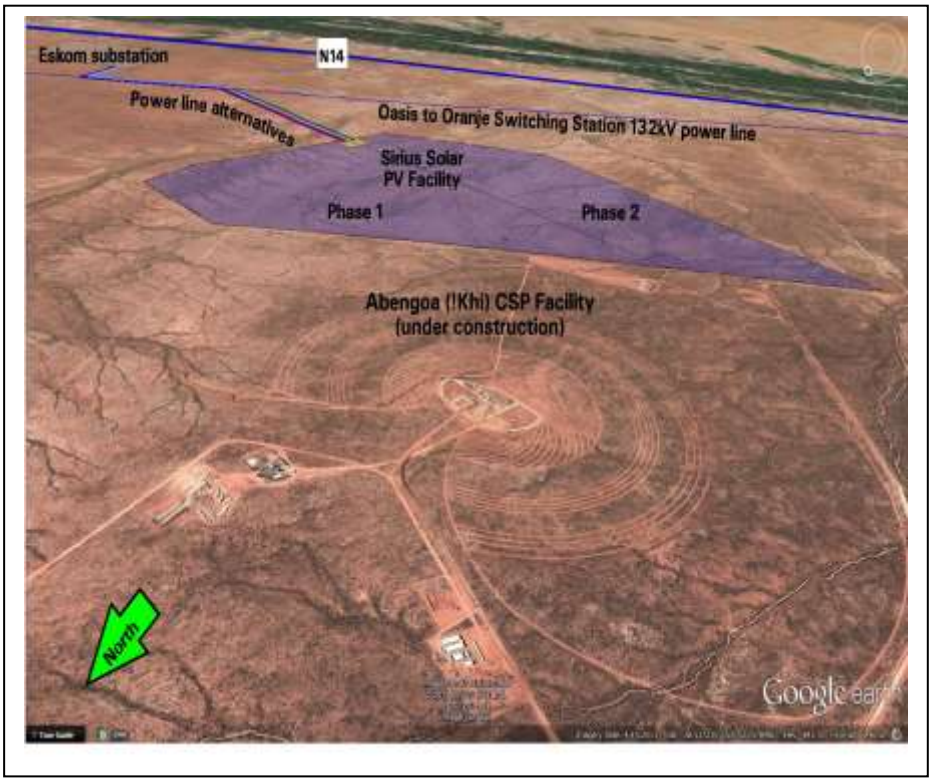

Figure 5.2: Sirius Solar PV Facility in relation to the Abengoa (!Khi) CSP Facility (ground works and construction activities for the central receiver and heliostat field is visible).

The Orange River has, to a large degree, dictated the settlement pattern in this arid region by providing a source of perennial water for the cultivation of grapes and cotton. This and the associated production of wine and dried fruit (raisins and sultanas) are the primary agricultural activity of this district. Cattle and game farming and sheep farming practises also occur, although less intensive. Other land-use activities in the broader region include conservation and nature oriented tourism in the form of the Augrabies Falls National Park (approximately 120 km west of Upington).

The majority of the study area is sparsely populated (less than 10 people per km^2) and consists of a landscape of wide-open expanses and vast desolation (refer to Figure 5.3. The scarcity of water and other natural resources has dictated the settlement patterns of this region. The population distribution is primarily concentrated in and around the small towns along the Orange River. Small towns and settlements along the Orange River include Klippunt, Ses Brugge, Louisvale, Oranjevallei and Kanoneiland.

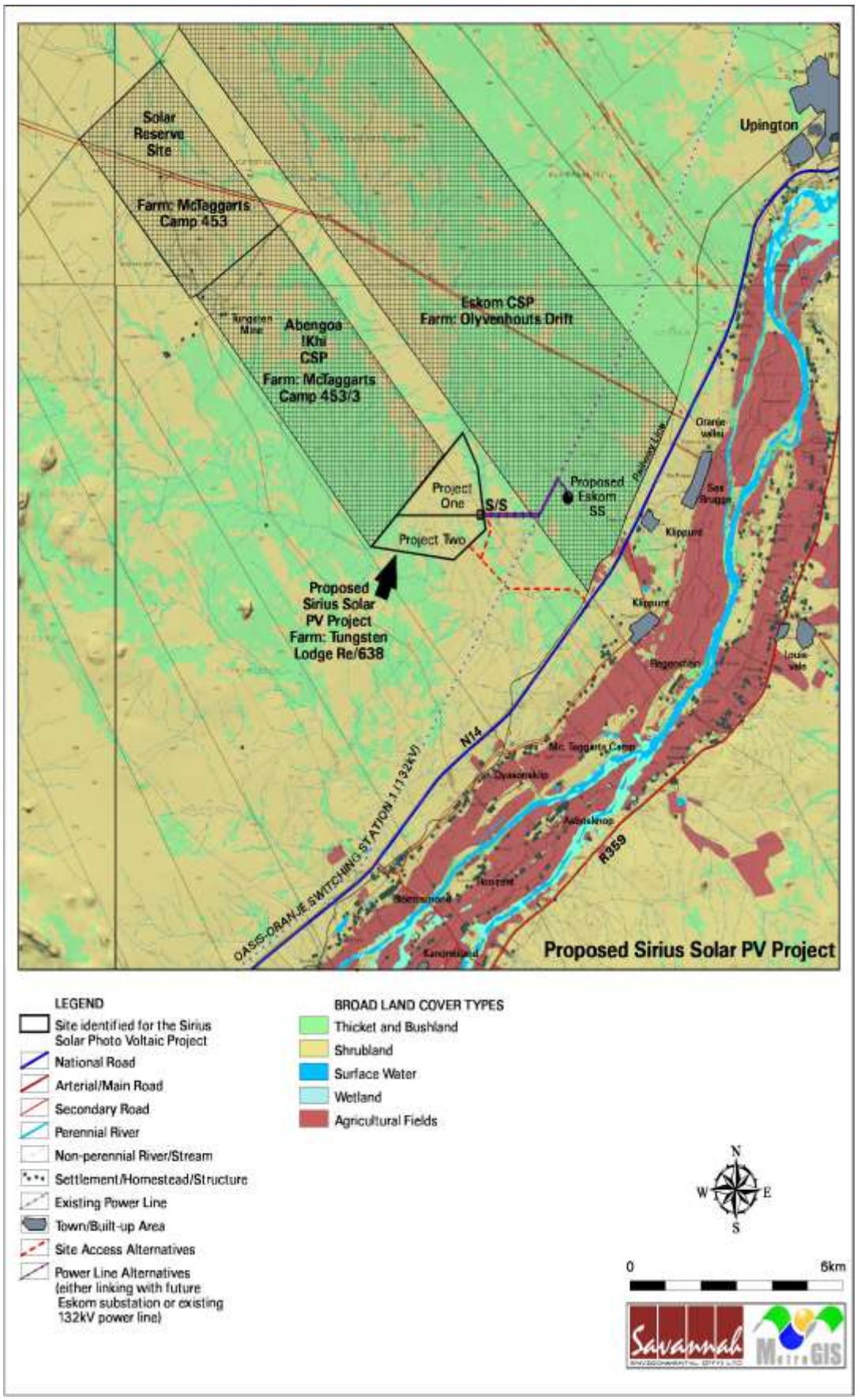

Figure 5.3: Map indicating a broader land cover/use for the proposed Sirius PV Project

5.5.1 Land use and Land capability of the Study Area

Land capability is the combination of soil suitability and climate factors. The site has a land capability classification, on the 8 category scale, as: Class 7 - Non-arable, low potential grazing land. Land on the site is classified as having low to moderate susceptibility to erosion, as it is level to gently sloping. As an indication of agricultural potential on the site, the land is classified on AGIS as having a natural grazing capacity of 18-25 hectares per large stock unit.

The limitations to agriculture are twofold. Extremely shallow, rocky soils dominate the site, with only small patches of deeper soils interspersed between them. Secondly aridity and lack of viable access to water is a serious limitation to agricultural productivity.

5.6 Biophysical Characteristics of the Study Area

5.6.1 Ecological Profile

Vegetation

The study area is situated in the Nama-Karoo biome. The vegetation types covering the study area are Bushmanland Arid Grassland (Nkb 3) and Kalahari Karroid Shrubland (Nkb 5) (refer to Figure 5.4). Both vegetation types are regarded as least threatened. However, due to its high biodiversity of the vegetation on site, it is regarded as having a medium to high conservation priority by the ZF Mgcawu District Municipality Environmental Management Framework. The Lower Gariep Alluvial Vegetation (AZa 3) occurs about 6-7 km beyond the study area along the Orange River and is the only vegetation type that has been listed as an endangered in the region of the study area. It is unlikely, though, that this alluvial vegetation type will be directly impacted on or affected by the proposed development.

The Bushmanland Arid Grassland landscapes consist of extensive or broken plains on a slightly sloping plateau. Vegetation is relatively sparse, dominated by grasses of the genus *Stipagrostis.* Other prominent grass genera include *Enneapogon, Eragrostis,* and *Schmidtia*. A variable density of high shrubs can be found, dominated by *Acacia mellifera, Rhigozum trichotomum,* and *Boscia foetida* subsp *foetida*. Dwarf karroid shrubs are common, especially of the genera *Pentzia, Aptosimum, Pteronia,* and *Salsola* (Mucina & Rutherford 2006).

Within the study area, the Bushmanland Arid Grassland merges in an intricate mosaic into the Kalahari Karroid Shrubland where sands have eroded historically to expose a high amount of surface calcrete and small quartz ridges.

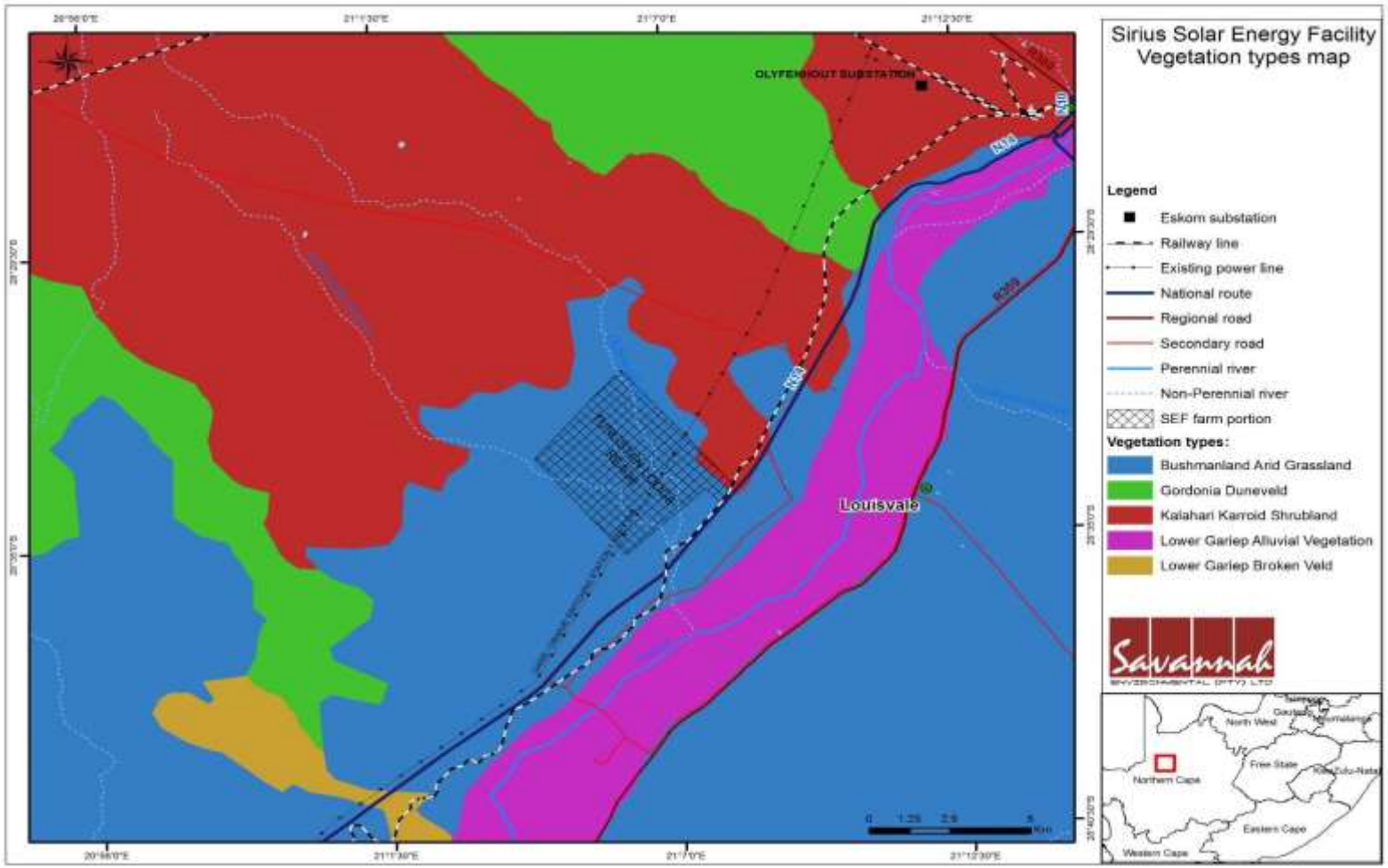

Figure 5.4: Map indicating the vegetation types within the proposed Sirius PV Project and surrounding areas

This vegetation consists of a diverse, low karroid shrub layer, and grasses and shrubs more related to the sandy region of the Kalahari region. Small trees and tall shrubs are dominated by *Acacia mellifera, Rhigozum trichotomum*, *Parkinsonia africana,* and *Boscia foetida* subsp *foetida*. Dominant genera within the low shrub layer include *Hermannia, Aptosimum, Leucosphaera,* and *Monechma*. The grass layer is variable, consisting mostly of *Stipagrostis, Enneapogon, Eragrostis,* and *Schmidtia* species (Mucina & Rutherford 2006).

The Kalahari Karroid Shrubland vegetation is considered as least threatened. Of the 21% target for conservation, up to date only a small portion is protected in the Augrabies National Park. Many of the belts of this vegetation type have, in the past, been preferred for road construction, which has led to the introduction of several alien invasive species (Mucina & Rutherford 2006).

Three vegetation associations could be identified (Figure 5.5 below):

» Association 1: *Ziziphus mucronata – Cenchrus ciliaris* riparian woodlands are restricted to the peripheries of small seasonal pans and larger drainage lines. Density, height and composition of the woody and herb layer vary immensely. Large specimens of the protected *Acacia erioloba (Protected Specie)* and *Boscia albitrunca (protected Specie)* as well as other tree species are scattered along the larger drainage lines south-west, west and north-east of the development area. Several of the large *Acacia erioloba* trees are currently 'occupied' by large active social weavers' nests.

  Sandy plains created either side of these large drainage lines by occasional very large floods merge into vegetation unit 2. Closer to the drainage lines they typically maintain a higher moisture regime, supporting localised dense stands of *Nerine laticoma* (a species associated with areas of seasonal standing water or soils with high seasonal moisture) and many short-lived annuals. Typically, smaller ephemeral washes are also characterised with a dense high shrub layer, but few of these small tributaries hold enough moisture to support a tree layer and the typical herb layer, and have thus not been included and mapped as part of the riparian woodlands.

» Association 2: *Boscia foetida (Protected specie)– Stipagrostis uniplumis* mixed open shrublands cover the lower-lying areas of the study area, where sandy loams naturally eroded off the undulating landscape have accumulated over time. Surface rockiness is variable, but can be moderate. Occasional smaller trees of *Acacia erioloba* do occur, but the area is generally prone to invasion by the indigenous *Acacia mellifera* subsp. *detinens* and *Rhigozum trichotomum*, especially along the small ephemeral washes. There is a moderate presence of low karroid shrubs, but the lower vegetation layer is dominated by *Stipagrostis uniplumis*.

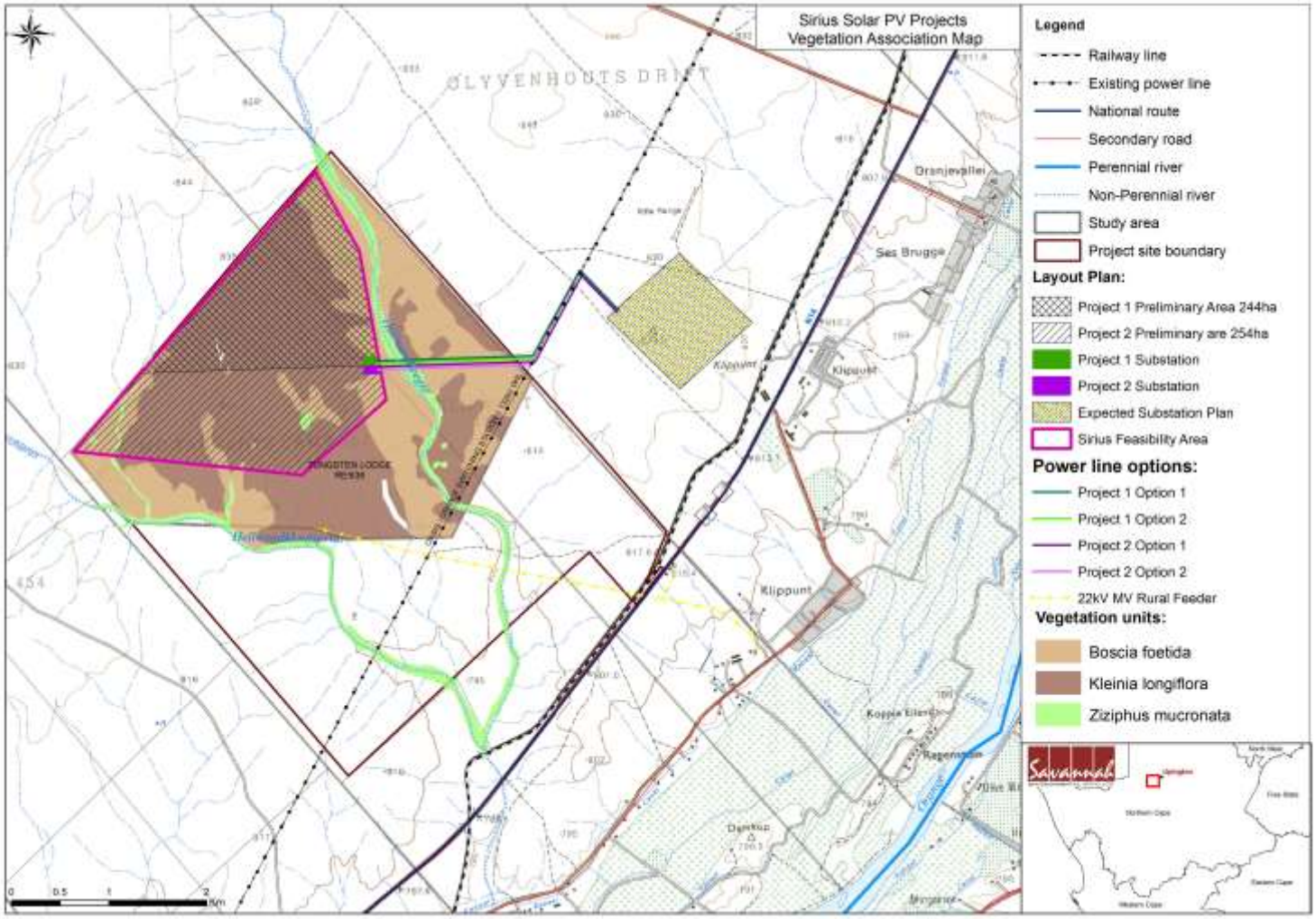

Figure 5.5: The three vegetation associations as identified with a detailed field investigation of the study area.

These sections of the study area thus have the highest grazing potential for larger livestock. However, the cover of perennial grasses can vary significantly from one year to the next, depending on rainfall.

» Association 3: *Kleinia longiflora – Enneapogon scaber* dwarf shrublands occupy most of the study area, especially on the higher-lying portions of the undulating landscape. Species composition is very diverse, but forb and low shrub composition varies to a high degree from one locality to the next, depending on localised geology, soil depth, surface rockiness and slope. Similarly, the presence of grasses and annuals is driven by rainfall during the season and the abiotic characteristics of a specific locality.Of the three vegetation associations within the study area, the riparian woodlands of association 1 and plains adjacent to these woodlands of association 2 should be excluded from the development as much as possible due to their high conservation value. Even on the undulating calcrete plains, ground disturbance should be minimised, and existing gravel roads and tracks used as far as possible to lower the extent of the footprint.

The study area was investigated during the vegetation survey for signs or the presence (observations) of amphibians, reptiles, and mammals. An avifaunal assessment has not been part of this study.

Species and signs of such sighted during the survey on and in the vicinity of the study area were the following:

» Steenbok (Raphicerus campestris)
» Cape Hare (Lepus capensis)
» Common duiker (Sylvicapra grimmia)
» Signs of Porcupine (Hystrix africaeaustralis)
» Signs of Aardwolf (Proteles cristatus)
» Yellow Mongoose (Cynictis penicillata)
» Cape Ground Squirrel (Xerus inauris)
» Bat-eared Fox (Otocyon megalotis)

5.6.2 Conservation Planning

The ZF Mgcawu District Municipality has compiled an Environmental Management Framework (EMF), in which environmental concerns and conservation priorities for all landscapes within the municipality are listed and mapped (refer to Figure 5.6).

According to the EMF, the proposed project area does not fall within areas earmarked for conservation. Nevertheless, Bushmanland Arid Grasslands have been allocated a medium conservation priority, and Kalahari Karroid Shrubland a

high conservation priority. This implies that despite the area not being earmarked for conservation; all care should be taken to disturb/break as little ground as possible.

Similarly, the proposed project area has been mapped as Zone 3 and Zone 7 in the EMF Environmental Control Zones. This indicates a relatively high biodiversity value of the plains.

This implies that the proposed project area does have a medium conservation value due to species diversity over most parts, with portions of high conservation value areas. There is no specific restriction on development of the area, but areas that are more sensitive should be excluded from the development and the footprint area restricted as much as possible.

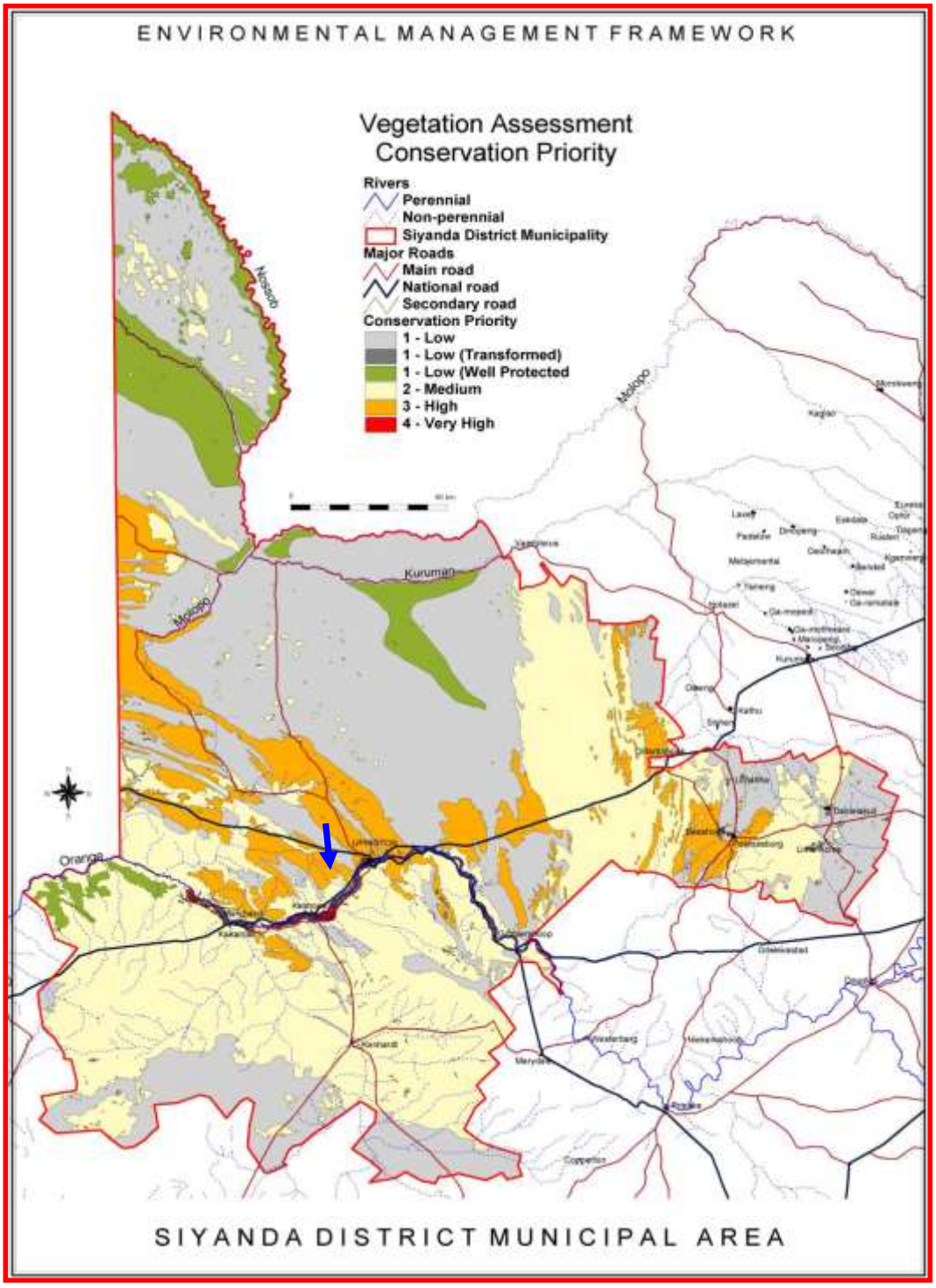

Figure 5.6: Map from the ZF Mgcawu District Municipality EMF showing the conservation priorities for the vegetation types. The approximate proposed development location is indicated by the blue arrow

5.6.3 Geology, Soil and Agricultural Potential

The geology of the site is granite, migmatite and gneiss of the Namaqualand Metamorphic Complex. There is a single land type (Ag1) across the entire farm, which indicates fairly uniform conditions. This land type is dominated by rock outcrops, and a mixture of some deep and some shallow Hutton soils plus extremely shallow Mispah soils on underlying rock. The field investigation of soils revealed that the particular site is entirely dominated by extremely shallow soils (predominantly Mispah soil form) with only small patches of deeper Hutton soils occurring between them.

5.6.4 Hydrology

The perennial Orange River is situated 6.5 km south-east of the proposed development site. On either side of the proposed development site are larger intermittent rivers with some larger tributaries on the north-western edge of the development area. These rivers merge south of the site and become Helbrandskloofspruit, eventually flowing into the Orange River.

The Lower Gariep River System

The Lower Gariep River can be defined as that stretch of the Gariep River between the Gariep-Vaal confluence and Alexander Bay or Oranjemund where the river meets the ocean. The area is hot and dry with rainfall varying from 400mm in the east to 50mm on the west coast and large parts of the catchment considered desert with annual precipitation dropping to below 25mm in some areas (ORASECOM, 2013).

Water quality state can be summarized as follows (ORASECOM, 2009 and Golder Associates, 2009, as cited in Scherman, 2010b):

» Water quality between Boegoeberg and Onseepkans is generally good despite extensive irrigation and settlements in the Upington area.
» The salinity deteriorates downstream of the confluence of the Vaal and Gariep Rivers but still remains good. There is an increase in Electrical Conductivity (EC) from Prieska to Vioolsdrift along the reaches of the lower Gariep River. This is due to irrigation return flows and evaporative losses along the river.
» Eutrophication is evident in localised areas along the Lower Gariep River; intermittent blooms of toxic algae have been reported in the Upington area.
» Some of the water withdrawn for irrigation is returned to the river environment for reuse, but its quality is seriously degraded with considerably higher salts and nutrient concentrations which contribute significantly to the salts load in the Gariep River.

Flow distributions at Upington

The distribution of flow is still similar to the natural seasonal distribution, but much lower in the wet season and a little bit lower in the dry season. The reason for the difference is the large dams upstream and highly regulated flows from Vanderkloof Dam. Figure 5.7 is a seasonality representation of average monthly flows for the total flow record (WRP Consulting, pers. comm., September 2010, for the ORASECOM EFR study).

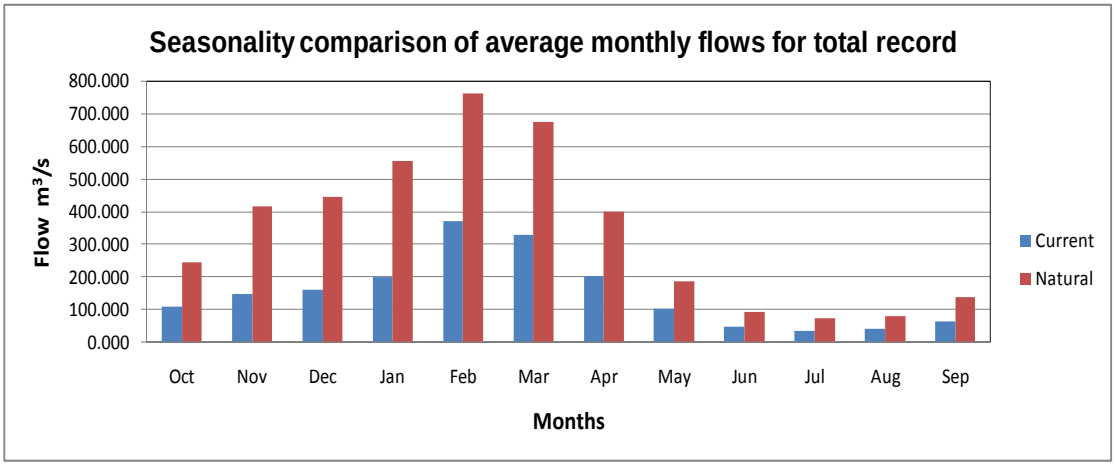

Figure 5.7: Average monthly flows for the total flow record of gauging weir D7H008

Riparian vegetation

This assessment was based on a broad evaluation of the natural vegetation found within the region and how localised surface and groundwater systems functioned in the formation of any recognisable riparian systems. During the site visit these areas were ground-truthed, in order to produce a GIS map of the study site, as well as indicate any additional areas that may be impacted upon by the proposed development. This information was also then compared to the GIS databases such as the National Freshwater Ecosystems Priority Atlas data (NEFPA, Nel *et al*. 2011), 1:50 000 topo-cadastral data and available aerial photographs.

Eighteen woody plant species were found associated with the riparian systems within the study site. Although none of these were obligate or facultative river/wetland species, they do show a preference for riparian soil conditions. Species within the site were dominated by *Acacia erioloba* (Camel Thorn, Kameeldoring), *Acacia haematoxylon* (Grey Camel Thorn), *Boscia foetida* (Stink Shepard's Tree) and *Euclea pseudebenus* (Ebony Tree), notably protected under the National Forest Act.

Few grass or forbs species were successfully identified due to the prevailing dry conditions and the intensity of grazing observed.

The only obligate wetland plants observed were those found in association with the man-made dams found at the confluence of the Helbrandkloofspruit and the Gariep River and along the Gariep River itself. Species observed included *Typha capensis, Phragmites australis, Prosopis glandulosa* and *Cyperus marginatus*. Notably the prevalence of Prosopis and alien invasive tree species had increased between 2010 and this survey within the sites that had been visited previously by this report author.

During the ORASECOM (2011) assessment, the following additional species were also observed within the study area between sites *OSAEH 26 17 and EFR 03:*

Fish fauna

The fish biodiversity in the Lower Gariep River within the Study Area (i.e. from Upington to Onseepkans) is relatively high compared to the entire river system, with a total of 13 indigenous species being recorded, including five of the six endemic Gariep River species. The endemic Namaqua barb, *Barbus hospes* only occurs below the Augrabies Falls, as does an isolated population of the indigenous river sardine, *Mesobola brevianalis*. The nearest adjacent population of river sardine occurs in the Okavango system.

The three other endemic fish species present in the Study Area (Gariep River Mudfish, smallmouth yellowfish and Namaqua barb) were found to be well represented in the May 2010 survey catches by Kotzé (pers. com. 31/08/2010) and appear to be relatively tolerant of the habitat alteration that has occurred.

5.7. Heritage Profile

5.7.1 Stone Age

The archaeological record of this region involves the timespan from the Earlier Stone Age (1 500 000 to about 270 000 years ago), through the Middle Stone Age (about 270 000 – 40 000 years ago), to the Later Stone Age. Towards the east the last 2000 years showed an increase in ceramic sites as well as Iron Age expansions sometimes in conjunction with Stone Age communities (Morris & Beaumont 2004). In contrast with this the areas towards the west could possibly sustain specialized foraging for much longer. In the absence of rock outcrops, no rock art sites are known.

Earlier Stone Age sites have been documented to the south of Eenzaamheid Pan in areas strewn with Dwyka tillite, which provided ample raw material. John Masson (2006) has reported such material at Eenzaamheid Pan. Eroded dunes to the north of the site often result in the exposure of earlier Stone Age materials.

Other known sites in the region are Biesje Poort 2, about 10 km to the west, where an extensive Doornfontein site was dated to 1400 BP (Beaumont et al. 1995), and Renosterkop, 10km to the south west, where two Ceramic LSA sites were found, the one, in a small shelter (Morris & Beaumont 1991). This site and another cave site closer to Keimoes (Smith 1995), are the only regional sites to have yielded stratified successions, with both indicating a MSA presence of likely early MIS 5 age and then LSA occupations of the Holocene.

Some Acheulean sites are found on the farms Droëhout and Ratel Draai, however these are not stratified (Beaumont *et al.* 1995).

Late Holocene Later Stone Age (LSA) sites are often mentioned in surveys in the wider region and along the Orange River (e.g. Morris & Beaumont 1991; Beaumont et al. 1995). These are most probably short-duration occupations by groups of hunter-gatherers. In contrast, there are substantial herder encampments along the Orange River floodplain itself (Morris & Beaumont 1991) and in the hills north of Kakamas (Parsons 2003).

Beaumont et al. (1995:240-1) notes a widespread low-density stone artefact scatter of Pleistocene age across much of Bushmanland to the south where raw materials from Dwyka glacial till produced mainly quartzite cobble. Similar occurrences have been noted north of Upington closer to the study area, in situations where raw materials are abundant. Systematic collections of this material at Olyvenkolk south west of Kenhardt and Maans Pannen east of Gamoep could be separated out by abrasion state into a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA) (Beaumont et al. 1995). It can therefore be anticipated that similar finds could be made within the study area.

The ESA included Victoria West cores on dolerite and quartzite, at sites such as Hondeblaf close to the study area, long blades, and a very low incidence of hand axes and cleavers. The Middle and Lower Pleistocene possibly had a climate more conducive to occupation. This is suggested by the known reliance of Acheulean communities on quite restricted ecological ranges, with proximity to water being a recurrent factor in the distribution of sites.

Very low density "off-site" scatters of ESA and MSA material has been noted over large areas on plains both north and south of the Orange River where raw materials are less readily to hand. These most likely reflect opportunistic knapping of nodules of raw material. These once again could also be anticipated on site.

Webley (2009) mentions the possibility of discovering Middle Stone Age artifacts on the dune plains. Such artifacts have been reported by Morris (2007a) from the Groblershoop area, while Webley, Lanham & Miller (2010) have recovered similar scatters to the east of the Langeberg. These have been found on the edge of calcrete-lined pans and in road cuttings.

Both Middle and Later Stone Age sites have been reported from amongst the dunes to the south of the Langeberg, at Witsand (Morris 1990). The LSA here is classified as Wilton and includes scrapers and backed pieces. Some sites also contain pottery and are termed Ceramic LSA assemblages. Webley, Lanham & Miller (2010) have found a ceramic LSA site on the farm Gaston some 20km northeast in the foothills of the Langeberg Mountains.

5.7.2 Iron Age

Morris (1990) reports that the area to the west of the Langeberg was once settled by the BaTlhaping. He notes that 35 km due north of Witsand lies the modern farm of Nokanna, which he says equates with the former BaTlhaping capital of Nokana or Nokaneng. Historically, the Trekboers traversed this area during the late 19th century.

More recent research by Jacobs shows occupational Tswana site to occur during the later "Bantu Expansion" and "Proto-Difiqane between c1750 and 1830 in the study area. Specifically the Tlhaping and Tlharo chiefdoms are referred to here (N. J. Jacobs, 199). It is even suggested that some Sotho-Tswana people might have preceded the Tlhaping and Tlharo in this region. This is however not a recent postulations since Ellenberger and MacGregor already proposed earlier Iron Age communities in these areas as early as 1912 (Ellenberger & MacGregor, 1912).

The results of the assessment undertaken showed that there are three heritage sites of no significance namely:

This is a small scattering of Late stone Age microlithic stone tools located on the edge of a small pan which is currently being used as a loading ramp for a small livestock enclosure and watering trough (refer to Figure 5.9) . The location did not display any characteristics of being either a manufacturing or occupational site. It is possible that the site occurred as a result of the small pan although its occurrence might be ephemeral. Mostly fully formed re-worked microliths were recovered from a general density of around one tool per 3 m^2. One partial blade was recovered while no cores could be seen. The concentration of tools seemed to be limited to a 8m X 5m.

Figure 5.8: A sample of microliths located at Site 001 within the proposed Sirius Solar PV Project

This site consists of two areas containing microlithic LSA tools. The one area produced a single prepared percussion level core although no further evidence of manufacturing could be identified. As with Site 001 the concentrations were 2-3m^2 to one tool. Investigations of animal burrows showed no signs of sub-surface deposits. The area was characterised by quartz outcrops manifested in linear concentrations of quartz deposits. The rest of the site is characterised by low shrub and red sand substrates.

Figure 5.9: A sample of stone tools from Site 002 within the proposed Sirius Solar PV Project

This site is located on the edge of a run-off ditch. It only consisted of a few LSA artefacts with no further deposits. This find is most likely the result of alluvial run-off.

Figure 5.10: A sample of stone tools from Site 003 within the proposed Sirius Solar PV Project

5.7.3 Paleontology

'Paleontological' 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 trace.

The area is characterised by deep sands and sandy soil covering calcrete and very old non-fossiliferous igneous and metamorphic rocks. There is a very low probability that fossils and subfossilised bones could occur in the windblown sand, sandy soils and calcrete of the area.

5.8 Social Characteristics of the Study Area and Surrounds

5.8.1 Population

The population of the Kai !Garib (KGLM) increased from 58 671 to 65 869 over the period 2001-2011, which represents an increase of ~ 12%. The increase in the population in the KGLM was linked to an increase in the 15-64 age group.

There were decreases in the less than 15 and 65+ age groups. In terms of breakdown, the majority of the population are Coloured (62%), followed by Black African (28%) and Whites (6%). The total population in Ward 8 in 2011, where the solar energy facility site is located, was 5 660. Of this total the majority were Coloured (70%), followed Black Africa (24%) and Whites (3%).

5.8.2 Education levels

Education levels in the KGLM improved between 2001 and 2011 with the percentage of the population over 20 years of age with no schooling dropping from 14.7% to 9.0%. The percentage of the population over the age of 20 with matric also increased from 11.2 to 15.5%. Despite this increase the percentage of the population in the KGLM over the age of 20 with matric is still lower than the SDM (21.7%) and the Northern Cape (22.7%). Overall education levels in the KGLM are therefor still low.

5.8.3 Employment

In terms of employment, the official unemployment rate in the KGLM decreased for the ten year period between 2001 and 2011, falling from 16.1 to 10% of the economically active population. Youth unemployment in the KGLM also dropped over the same period, from 17.7 to 10%. While unemployment figures appear to be low, specifically within the context of the figures for the Northern Cape Province as a whole (27.4% unemployment and 34.5% youth unemployment in 2011), they do not reflect the fact that the majority of the employment in the KGLM is seasonal and linked to the agricultural sector.

5.8.4 Economic context

The Orange River (Gariep River) plays a key economic role in the KGLM, with most of the economic activities linked to and located adjacent to the river. In addition, the majority of towns and settlements are located within close proximity to and or adjacent to the river. The economy of the area is heavily depended on the Agricultural Sector, both intensive and extensive. However the major roads (N14, R27 and R359) assist in the growth the municipal area experience.

The renewable energy sector is also recognized as a key sector. The IDP notes that new opportunities have opened up for KGLM area since the need to facilitate the generation of sustainable energy was introduced in South Africa by Eskom and the South African government. The IDP notes that there are a number of solar projects proposed in the area and that the economic benefits from these projects are eagerly anticipated.

In terms of contribution to local GDP the most important economic sector is Agriculture (51.8%), followed by Community and Government Services (15.9%) and Wholesale and Retail Trade (11.3%).

The Agriculture sector is also a major employer in the Municipality, providing 66.5% of all formal employment. It is also the sector with the largest potential for economic growth. The majority of the agricultural activity is linked to the Orange River, and includes table and wine grapes. Citrus fruit is also becoming more prevalent in the area. There are three wine cellars located in the area in Keimoes, Kakamas and Kanoneiland. Emerging farmers in the area tend to focus more on small stock farming, lucern, cotton, corn, and nuts which are cultivated under irrigation from the Orange River. The IDP identifies a number of constraints facing the agricultural sector, these include, poor quality access roads to and from farms, low farming skills amongst the youth and finances for emerging farmers. The opportunities in the agricultural sector include the expansion of the production of lucern and citrus fruits as well as the possible establishment of ostrich farming. Other sectors that show potential within the sector are agri-tourism.

The tourism sector also plays an important role in the local economy and has been identified a key sector in terms of future growth. The key tourism attractions in the area include the Augrabies Falls, Kokerboom Route, Tierberg Nature Reserve, heritage sites and ancient rock art in Kenhardt, historical routes between islands/ Island Route, water tunnels in Kakamas, Rooibergdam in Kenhardt and Riemvasmaak historical and cultural values. The N14 is also an important route providing access to the Cape in the South and the Kalahari National Park in the north. The tourism accommodation facilities in the area are also of high standard and available in all major towns.

5.9. Description of the Environment - Summary of the Environmental & Social characteristics of the two projects

Environmental Characteristics	Project One1 – Sirius Solar PV Project One	Project Two - Sirius Solar PV Project Two
1. Land Use	» Grazing land (sheep and cattle farming)	» Grazing land (sheep and cattle farming)
2. Land Capability	» The area is within an arid environment and therefore agricultural potential and capability is low	» The area is within an arid environment and therefore agricultural potential and capability is low
3. Climate	» Arid	» Arid
4. Topography	» Very gently undulating terrain with gradient of	» Very gently undulating terrain with gradient of

Environmental Characteristics	Project One1 – Sirius Solar PV Project One	Project Two - Sirius Solar PV Project Two
	1% (1:100) and 8% (1:12)	1% (1:100) and 8% (1:12)
5. Hydrology, Riparian Zones and Watercourses	» Dry or non-perennial drainage lines and two dendritic ephemeral streams (approximately 4km from Orange river) located on the site	» Dry or non-perennial drainage lines and two dendritic ephemeral streams (approximately 4km from Orange river) located on the site
6. Conservation Planning	» Medium conservation value due to species diversity, but there is no specific restriction on development of the area. » The nearby Lower Gariep Alluvial Vegetation on the banks of the Orange River (~4km from the Sirius site); area is regarded as a Critical Biodiversity Area, of which remaining sections have been listed as threatened ecosystems	» Medium conservation value due to species diversity, but there is no specific restriction on development of the area. » The nearby Lower Gariep Alluvial Vegetation on the banks of the Orange River (~4km from the Sirius site); area is regarded as a Critical Biodiversity Area, of which remaining sections have been listed as threatened ecosystems
7. Land Types	» Hutton form	» Hutton form
8. Agricultural Potential	» Low	» Low
9. Vegetation types	» The vegetation types covering the study area are Bushmanland Arid Grassland (Nkb 3) and Kalahari Karroid Shrubland (Nkb 5). Both vegetation types are regarded as least threatened.	» The vegetation types covering the study area are Bushmanland Arid Grassland (Nkb 3) and Kalahari Karroid Shrubland (Nkb 5). Both vegetation types are regarded as least threatened.
10. Heritage and Palaeontology	» Very low density "off-site" scatters of ESA and MSA material has been noted over large areas on plains both north and south of the Orange River where raw materials are less readily to	» Very low density "off-site" scatters of ESA and MSA material has been noted over large areas on plains both north and south of the Orange River where raw materials are less readily to hand.

Environmental Characteristics	Project One1 – Sirius Solar PV Project One	Project Two - Sirius Solar PV Project Two
	hand.	
11. Social Characteristics	» There have been a number of projects proposed in the area, some of which are under construction. This has resulted in numerous job opportunities and economy boost	» There have been a number of projects proposed in the area, some of which are under construction. This has resulted in numerous job opportunities and economy boost

ASSESSMENT OF POTENTIAL IMPACTS: SIRIUS PV PROJECT ONE CHAPTER 6

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed **Sirius Solar PV Project One** (refer to **Figure 6.1**). This assessment is conducted for a 75 MW PV/CPV facility and for all the facility's components including:

- Arrays of photovoltaic (PV/CPV) panels with an export capacity of up to 75MW.
- Mounting structure to support the PV panels.
- Cabling between the project components, to be lain underground where practical.
- A new on-site substation to evacuate power from the PV panels to the Eskom grid.
- A 132 kV power line. The following power line alternatives where assessed in this EIA report:
  - Alternative 1: the power line is approximately 3.7 km in length and lies on the south eastern side of the site and runs parallel to the Oasis- Oranje No.1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
  - Alternative 2: the power line is approximately 3.1 km in length and lies on the eastern side of the proposed site. Power would feed into the Eskom electricity network via a 'turn in and turn out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
- Internal access roads and fencing.
- Workshop area for maintenance, storage, and offices.

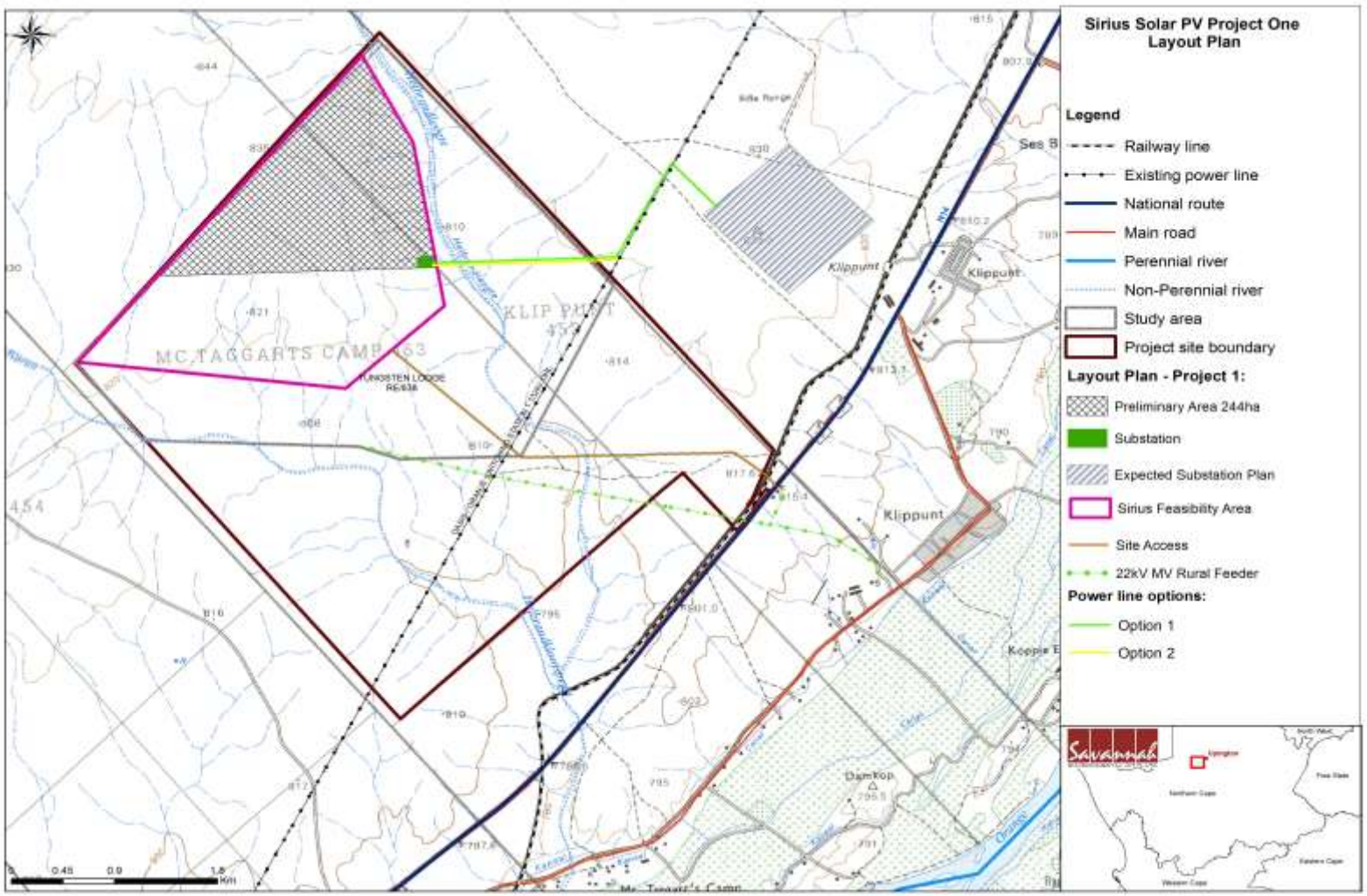

Figure 6.1: Layout map showing the Sirius Solar PV Project One and associated infrastructure

The development of the Sirius Solar PV Project One will comprise the following activities:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access road, electricity generation infrastructure, power line servitudes, construction camp, laydown areas, transportation of components/construction equipment to site; and undertaking site rehabilitation and establishment and implementation of a storm water management plan. This phase is expected to take approximately 16 months.
» *Operation* – will include operation of the facility and the generation of electricity. The operational phase is expected to extend in excess of 20 - 25 years.
» *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

6.1. Assessment of the Potential Impacts associated with the Construction and Operation Phases

The sections which follow provide a summary of the findings of the assessment of potential impacts associated with the construction and operation of the proposed solar energy facility on the identified site. The assessment of potential issues presented in this chapter has involved key input from specialist consultants, the public and the project developer. Issues were assessed in terms of the criteria detailed in Chapter 4 (section 4.2.5). The nature of the potential impact is discussed, and the significance is calculated with and without the implementation of mitigation measures. Recommendations are made regarding mitigation/ enhancement and management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted. Cumulative impacts are assessed in Section 6.2.

6.1.1 Potential Impacts on Ecology

The study area is covered by the Bushmanland Arid Grasslands merging into Kalahari Karroid Shrubland as described by Mucina and Rutherford (2006), with riverine vegetation on the banks of small ephemeral water washes that drains into the Orange River, about 7 km south-east of the study area. Three vegetation associations could be identified (refer to **Figure 6.2**):

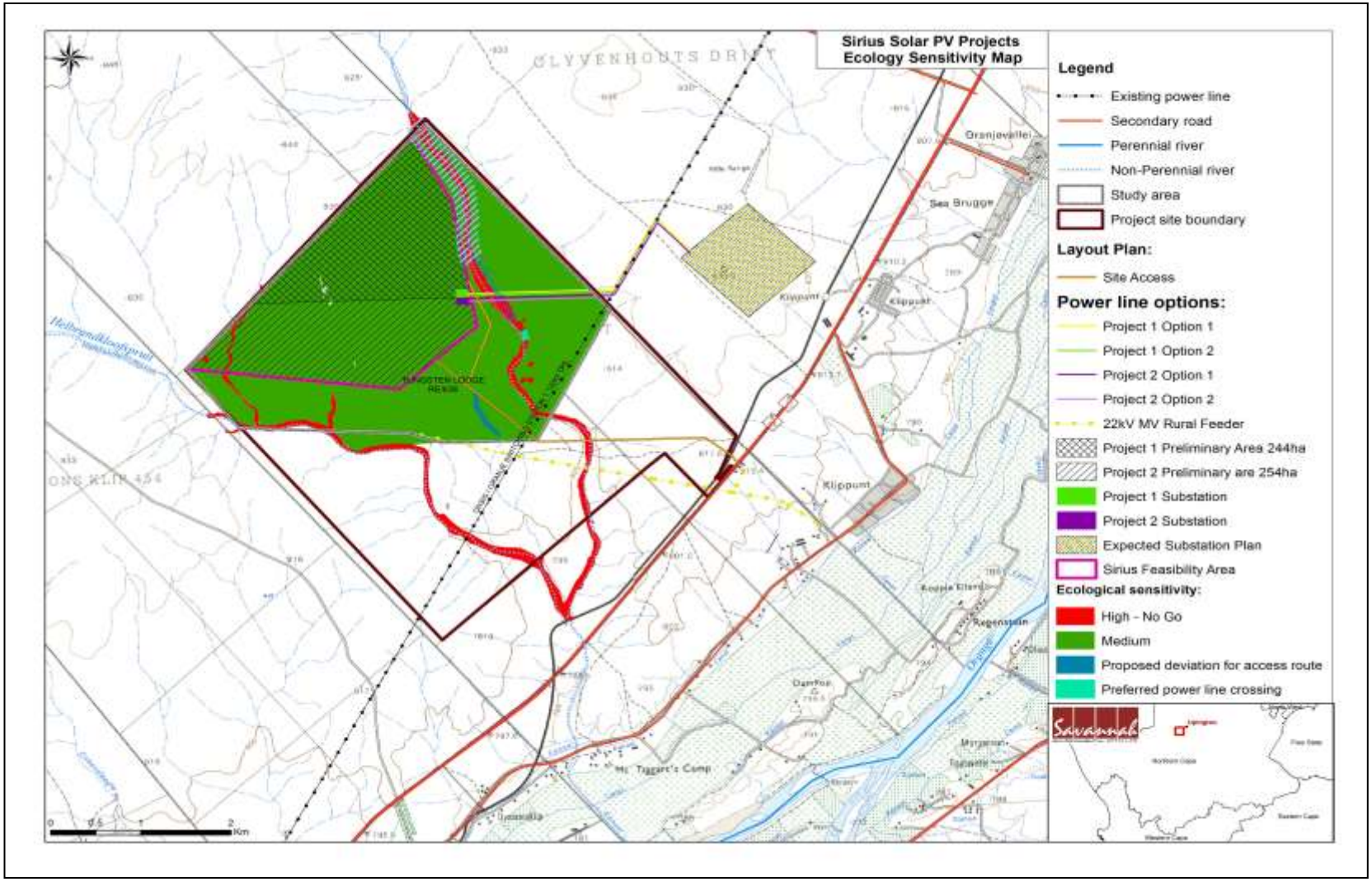

Figure 6.2: Vegetation map showing vegetation units within the proposed Sirius Solar PV Project one

» Association 1: *Ziziphus mucronata – Cenchrus ciliaris* riparian woodlands are restricted to the peripheries of small seasonal pans and larger drainage lines. Density, height and composition of the woody and herb layer vary immensely. Large specimens of the protected *Acacia erioloba* and *Boscia albitrunca* as well as other tree species are scattered along the larger drainage lines south-west, west and north-east of the development area. Several of the large *Acacia erioloba* trees are currently 'occupied' by large active social weavers' nests.

  Sandy plains created either side of these large drainage lines by occasional very large floods merge into vegetation unit 2. Closer to the drainage lines they typically maintain a higher moisture regime, supporting localised dense stands of *Nerine laticoma* (a species associated with areas of seasonal standing water or soils with high seasonal moisture) and many short-lived annuals.

  Typically, smaller ephemeral washes are also characterised with a dense high shrub layer, but few of these small tributaries hold enough moisture to support a tree layer and the typical herb layer, and have thus not been included and mapped as part of the riparian woodlands.

» Association 2: *Boscia foetida – Stipagrostis uniplumis* mixed open shrublands cover the lower-lying areas of the study area, where sandy loams naturally eroded off the undulating landscape have accumulated over time. Surface rockiness is variable, but can be moderate. Occasional smaller trees of *Acacia erioloba* do occur, but the area is generally prone to invasion by the indigenous *Acacia mellifera* subsp. *detinens* and *Rhigozum trichotomum*, especially along the small ephemeral washes. There is a moderate presence of low karroid shrubs, but the lower vegetation layer is dominated by *Stipagrostis uniplumis*. These sections of the study area thus have the highest grazing potential for larger livestock. However, the cover of perennial grasses can vary significantly from one year to the next, depending on rainfall.

» Association 3: *Kleinia longiflora – Enneapogon scaber* dwarf shrublands occupy most of the study area, especially on the higher-lying portions of the undulating landscape. Species composition is very diverse, but forb and low shrub composition varies to a high degree from one locality to the next, depending on localised geology, soil depth, surface rockiness and slope. Similarly, the presence of grasses and annuals is driven by rainfall during the season and the abiotic characteristics of a specific locality.

Ideally, of the three vegetation associations within the study area, the riparian woodlands of association 1 and plains adjacent to these woodlands of association 2 should be excluded from the development as far as possible due to their high

conservation value. Even on the undulating calcrete plains, ground disturbance should be minimised, and existing gravel roads and tracks used as far as possible to minimise the extent of the footprint.

Annual and geophytic species have highly variable emerging patterns, depending on the timing and amount of rainfall received during a season. It is thus expected that the diversity of geophytic and annual species within the study area will be higher than could be determined during the survey.

Ideally, all riparian vegetation around natural vleis and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. The latter should cross where the lowest amount of indigenous trees are present. Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be taken.

The main negative impact from an ecological perspective will be due to loss of vegetation, loss of species of conservation concern, and loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E - Ecology Report** for more details).

a) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase

Nature of the Activity: Relatively large access roads already exist on and to the land portion, however upgrading and/or creation of site access, internal maintenance roads and fences may cause impacts on ecology*: GN 544, 18 June 2010 activity 18(i) and 22(i) and GN 546, 18 June 2010 activity 14(i)*. Impacts include: loss of vegetation, increase in runoff and erosion, possible distribution and increased establishment of alien invasive species, possible disturbance and reduction of habitat or injury to burrowing vertebrates, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of revegetation potential of soil surface, increase in dust levels.		
	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (50)**	**Medium (35)**
Status	Negative	Negative
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of	Probable	Not likely

resources?		
Can impacts be mitigated?	Yes	

Mitigation:

» Avoid or reduce impact on all riparian vegetation around large intermittent rivers during the construction phase.
» Ensure adequate drainage where the Helbrandskloofspruit tributary is crossed by infrastructure.
» Design the access route to utilise existing tracks as far as possible by doing the following:
  * Following the main farm gravel road to position 28°34'00.5" S; 21°06'33.6" E
  * From there upgrade the farm track to the abandoned farmhouse at position 28°33'39.8" S; 21°06'20.9" E
  * Reduce further distances of the access track by combining access to the two development phases as much as possible
» After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  * Protected plant species: must be relocated or obtain a permit for removal of the species.
  * Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
» During construction: create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
» Keep the clearing of natural and semi-natural grasslands to a minimum
» Dust levels must be controlled and minimised
» If filling material is to be used, this should be sourced from areas free of invasive species.
» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must (and can) be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
» Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas
» Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (erosion management plan required)
» Prevent leakage of oil or other chemicals or any other form of pollution, as this may infiltrate local groundwater reserves or end up in the Orange River where it can affect all downstream users
» Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
» After decommissioning, if access roads or portions thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable revegetation program

Cumulative impacts:

» Possible erosion of areas lower than the access road, possible contamination of

groundwater reserves due to oil or other spillage
» Possible spread and establishment of alien invasive species
» Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns

Residual impacts:
» Localised loss of vegetation
» Altered topsoil conditions
» Potential barren areas remaining after decommissioning
» Potential for erosion and invasion by weed or alien species
» Potential for increased dust and its impact on surrounding environments and biodiversity

Nature of the Activity: Construction and operation of the PV panels may result in a loss of natural vegetation: *GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)*. Impacts could include: loss of vegetation and/or species of conservation concern, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in concentrated runoff from PV panels and higher volumes of stormwater and accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased flooding, severe erosion or dust due to lower buffering capacity of sparser vegetation.

	Without mitigation	***With mitigation***
Extent	Local (4)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (9)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (85)**	**High (70)**
Status	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Medium Probability
Can impacts be mitigated?	Reasonably but with limited full restoration potential	

Mitigation:
» As far as possible, avoid all riparian vegetation around natural vleis and large intermittent rivers
» During the design phase, ensure that a buffer of at least 100 m, preferably more, is maintained around all larger intermittent rivers and their riparian vegetation to maintain the species diversity and buffering capacity of these plains surrounding

riparian vegetation

- » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by ECO/construction staff to identify the relevant species and take the following actions:
  - * Protected plant species: must be relocated or obtain a permit for the removal of these species.
  - * Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- » Keep construction areas to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
- » Clear as little vegetation as possible, aim to maintain all indigenous vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
  - o Shred all shrubs cleared and used the chips for dust and erosion control
  - o use only species that were part of the original indigenous species composition as listed in the specialist report
- » Use excavated materials to fill up and close old mining pits
- » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
  - o Revegetation should occur naturally where topsoils were not severely altered
  - o The higher level of shading anticipated from fixed panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if vegetation fails to establish sufficiently.
  - o Alternatively, soil surfaces where no revegetation seems possible will have to be covered with gravel or small rock fragments to increase porosity of the soil surface, slow down runoff and prevent wind- and water erosion
- » Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum*
- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- » If filling material is to be used, this should be sourced from areas free of invasive species
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- » Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
- » Monitor the area below and around the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro-topography and revegetation efforts accordingly
  - o Due to the fixed nature and larger runoff surfaces of the PV panels, the development area should be adequately landscaped and rehabilitated to contain expected accelerated erosion
  - o Runoff may have to be specifically channeled or stormwater adequately controlled

to prevent localised rill and gully erosion
- » Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
- » The rehabilitation plan for all affected areas after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover

Cumulative impacts:
- » If mitigation measures are not strictly implemented the following could occur:
  - * Considerable loss of biodiversity
  - * Possible accelerated erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
  - * possible contamination of drainage lines, lower-lying rivers or wetlands
  - * possible spread and establishment of invasive species
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
- » Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns

Residual impacts:
- » Positive impact: current old mine pits that are dangerous traps to fauna and man will be filled and covered
- » Altered topsoil characteristics
- » Loss of and alteration of microhabitats
- » Altered vegetation composition, lower vegetative cover and loss of species diversity
- » Potential for increased dust and its impact on surrounding environments and biodiversity
- » Higher risk of invasion by alien plant species

Nature of the Activity: Construction of substation and other electricity-related buildings, workshops, offices, guardhouses, etc. *: GN 544, 18 June 2010 activity 10(i), GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)* may cause : loss of vegetation and/or species of conservation concern, loss of microhabitats, reduced vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (3)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Medium (40)**
Status	Negative	Negative

Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- Avoid all riparian vegetation around natural vleis and large intermittent rivers
- During the design phase, ensure that a buffer of at least 100 m, preferably more, is maintained around all larger intermittent rivers and their riparian vegetation to maintain the species diversity and buffering capacity of these plains surrounding riparian vegetation
- Aim to minimise the destruction of indigenous large shrubs and trees
  - Shred all shrubs cleared and used the chips for dust and erosion control
- Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by ECO/construction staff to identify the relevant species and take the following actions:
  - Protected plant species: must be relocated or obtain a permit
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- Limit disturbance to footprint area as far as practically possible
- During construction: stay within demarcated footprint areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
- Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
- Rehabilitate and re-vegetate all areas outside footprint area that have been disturbed
- After decommissioning remove all foreign material prior to starting the rehabilitation
- The rehabilitation plan for all temporarily affected areas and for the development area after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- If mitigation measures are not strictly implemented the following could occur:
  - Erosion of areas around sealed surfaces and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
  - Contamination of ground water resources and possibly the Orange River
  - Spread and establishment of invasive species
- Increased habitat fragmentation and displacement of terrestrial vertebrates in the

region
» Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics

Residual impacts:
» Altered topsoil characteristics
» Loss of microhabitats
» Reduced vegetation cover and loss of species diversity
» Potential for increased dust and its impact on surrounding environments and biodiversity

Nature of the Activity: Transport of materials to site, movement of vehicles on site during construction and maintenance*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)* may cause compaction of soils, possible contamination by oils or fuels, possible introduction and spread of weeds and alien invasives, temporary disturbance of terrestrial fauna. Impacts may include: Loss of vegetation, increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species that could further damage ecosystem functionality

	Without mitigation	***With mitigation***
Extent	Regional (4)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (60)**	**Low (20)**
Status	Negative	Neutral
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:
» Avoid all riparian vegetation around natural vleis and large intermittent rivers, and a buffer of at least 100 m around such areas
» Strictly restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed
» Parking areas should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary stormwater control) if oil and fuel

spillages are highly likely to occur
» Wheels of large machinery should be checked prior to entering the site and cleared of seed material of alien invasive plants if transport routes go through infested areas (especially of species with spiny or bur-like seeds). Such seed must be destroyed.
» Strict speed limits must be set and adhered to
  - Animals accidentally injured by moving vehicles or machinery must be taken to a local veterinarian to be treated or put down in a humane manner
» Dust levels must be controlled and minimised
» Driving between dusk and dawn should be permissible during emergency situations only
» Prevent spillage of any, oils or other chemicals, strictly prohibit other pollution
» Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment

Cumulative impacts:
» Possible pollution of surrounding areas if no mitigation is implemented
» Possible spread of alien invasive species beyond the site if no mitigation is implemented
» Possible increased road collisions and road kill of fauna

Residual impacts:
» Related to access roads and internal maintenance tracks

Nature of the Activity: Impacts during the operational phase of the facility due to PV array components and their continued maintenance and eventual decommissioning and regular washing and possible breakage of panels*: GN 545, 18 June 2010 activity1*. Impacts include localised increase in runoff and accelerated erosion.

	Without mitigation	***With mitigation***
Extent	Regional (4)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Probable (3)
Significance	**Medium (60)**	**Low (15)**
Status	Negative	Neutral
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:
» Where panels need to be washed, no polluting chemicals may be used, and the use of water should be minimal as well

» Where water is used for washing, monitor areas around the PV arrays for signs of accelerated erosion and establishment of weeds or alien invasive species and manage according to the erosion- and invasive species management plan » Prior to construction and up to decommissioning, clear instructions must be drafted and at all times available on site on how any breakages of PV panels will be dealt with, including: * A list of possible toxic substances, heavy metals or other potentially harmful substances that could be released during breakage * How to contain and mitigate the release of such substances * Correct salvage, disposal and preferably also recycling methods (or possibilities) for any broken materials
Cumulative impacts: » Possible pollution of surrounding areas and downstream rivers and wetlands if no mitigation is implemented » Possible increase in and spread of alien invasive species beyond the site if no mitigation is implemented
Residual impacts: » None expected if mitigation measures are implemented

b) Comparative Assessment of Power Line Alternatives

For the Sirius PV Project One, power line Alternative 1 is preferred from an ecological perspective.

Nature of the Activity: Construction of a power line as part of the grid connection – Alternative 2 (direct connection to 132 kV ESKOM line*): GN 544, 18 June 2010 activity 10(i)* *Preferred option on condition that the route follows the ecologically recommended site for crossing the intermittent river*		
Environmental Aspect: Removal of vegetation – especially higher trees and shrubs, compaction of soils, temporary or permanent damage to animal burrows		
Environmental impact: Loss of vegetation, potential loss of individuals of keystone species and associated microhabitats, increase in runoff and erosion, disturbance of burrowing animals		
	Without mitigation	**With mitigation**
Extent (E)	Local (2)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Minor (2)	Small (0)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	**Medium (40)**	**Low (20)**
Status (positive, neutral	Negative	Slightly negative

or negative)		
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- Design the route to cross the intermittent river and riparian vegetation at a point that has no *Acacia erioloba* or *Boscia albitrunca* trees, approximately at the position:
  - 28°33'17.63" S; 21°06'41.55" E
- Aim to minimise the destruction of indigenous large shrubs and trees
  - Shred all shrubs cleared and used the chips for dust and erosion control
- After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - Protected plant species: must be relocated or obtain a permit where affected by pylons, maintenance tracks or construction
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
  - For construction and maintenance access create jeep tracks only as far as is feasible
- Limit clearing of indigenous vegetation to pylon positions only
- Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution
- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna)

Residual impacts:

- Localised alteration of soil surface characteristics
- Localised loss of flora and displacement of fauna

Nature of the Activity: Construction of a power line as part of the grid connection – Alternative 1 (connection to new ESKOM substation)*: GN 544, 18 June 2010 activity 10(i)*

Acceptable option (will be larger footprint) on condition that the route follows the ecologically recommended site for crossing the intermittent river

Environmental Aspect: Limited removal of vegetation, compaction of soils, temporary or permanent damage to animal burrows

Environmental impact: Loss of vegetation, increase in runoff and erosion, disturbance

of burrowing animals		
	Without mitigation	**With mitigation**
Extent (E)	Local (2)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Minor (2)	Small (1)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	**Medium (40)**	**Low (24)**
Status (positive, neutral or negative)	Negative	Slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- Design the route to cross the river at a point that has no Acacia erioloba or Boscia albitrunca trees, approximately at the position:
  - 28°33'17.63" S; 21°06'41.55" E
- After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - Protected plant species: must be relocated or obtain a permit where affected by pylons, maintenance tracks or construction
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- Aim to minimise the destruction of indigenous large shrubs and trees
  - Shred all shrubs cleared and used the chips for dust and erosion control
- During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
    - For construction and maintenance access create jeep tracks only as far as is feasible
- Limit clearing of indigenous vegetation to pylon positions only
- Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution
- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna)

Residual impacts:

- Localised alteration of soil surface characteristics

» Localised loss of flora and displacement of fauna

Nature of the Activity: Construction of a power line as part of the grid connection may cause loss of vegetation, increase in runoff and erosion, disturbance of burrowing animal*): GN 544, 18 June 2010 activity 10(i)*		
	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (1)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (40)**	**Low (24)**
Status	Negative	Slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- » Deviated the Option 2 power line route to cross the river at a point that has no *Acacia erioloba* or *Boscia albitrunca* trees, approximately at the position:
  - 28°33'17.63" S; 21°06'41.55" E
- » After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - Protected plant species: must be relocated or obtain a permit where affected by pylons, maintenance tracks or construction
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- » Aim to minimise the destruction of indigenous large shrubs and trees
  - Shred all shrubs cleared and used the chips for dust and erosion control
- » During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
  - For construction and maintenance access create jeep tracks only as far as is feasible
- » Limit clearing of indigenous vegetation to pylon positions only
- » Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution
- » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- » Possible erosion of surrounding areas if no mitigation is implemented, no major

cumulative impact on flora or fauna expected
Residual impacts: » Localised alteration of soil surface characteristics » Localised loss of flora and displacement of fauna

c) Implications for Project Implementation

- » Exclude all riparian vegetation around natural vleis and large intermittent rivers and maintain a 100 m buffer around them, such that important ecosystem services of these ecosystems can be maintained.
- » The proposed photovoltaic facility development on the site will create a localised reduction of especially slow-growing indigenous trees and shrubs, geophytes and other species restricted to certain microhabitats. This effect is and will be further exacerbated by surrounding and regional developments. At this stage, however, it is not anticipated that the development will significantly lower the current conservation status of any species.
- » All riparian vegetation around natural vleis and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. The latter should cross where the lowest number of indigenous trees are present. Access roads to the development should follow existing tracks as far as possible.
- » Potentially significant negative impacts on the ecological environment could be soil- and associated degradation on and beyond the development area, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction. With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of these impacts can be significantly reduced.
- » The impact on fauna is expected to be small for the development, but may become more of an issue if the cumulative impact of all surrounding developments is considered. Presence of indigenous terrestrial vertebrates within the study area is relatively low due to absence of permanent surface water. Animals that may be permanently present can be relocated or will move away during construction, and may resettle after construction, depending on safety specifications necessitated by the development. No restricted or specific habitat of vertebrates exists on the study area and will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas as recommended.
- » Power line Alternative 1 is preferred from an ecological perspective provided that the route follows the ecologically recommended site for crossing the ephemeral river.

6.1.2 Potential Impacts on Soils and Agricultural Potential

The components of the project that can impact on agricultural resources and

productivity include:

» The footprint of the facility.
» Construction activities that disturb the soil profile, for example for levelling, excavations, etc.

The infrastructure footprint includes the PV arrays, power line connection to the Eskom grid which includes a short section beyond the farm boundary. he most important factor that influences the significance of agricultural impacts is the fact that the site is proposed on land which has limited agricultural potential and is classified as non-arable, low potential grazing land.

Four potential negative impacts of the development on agricultural resources and productivity were identified as:

» Loss of agricultural land use as a result oif direct occupation of land by the solar energy facility footprint (medium significance with and without mitigation).
» Soil Erosion due to alteration of the surface run-off characteristics (medium significance without, but low with mitigation).
» Loss of topsoil in disturbed areas, resulting in a decline in soil fertility (low significance with and without mitigation).
» Degradation of veld due to vehicle movement, trampling and dust deposition (low significance with and without mitigation).

One potential positive impact of the development on agricultural resources and productivity was identified as:

» Generation of alternative land use income through rental for energy facility on agriculturally unproductive land. This will provide landowners with increased rural livelihood (medium significance with and without mitigation).

a) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase

Nature: Loss of topsoil as a result of*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)*: poor topsoil management during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.). Effects could include loss of soil fertility on disturbed areas after rehabilitation.		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Short (2)	Short (2)
Magnitude	Minor (3)	Minor (2)
Probability	Probable (3)	Very improbable (1)

Significance	**Low (18)**	**Low (5)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Strip and stockpile topsoil from all areas where soil will be disturbed. » Topsoil should not be mixed with any other materials (such as subsoils) » After cessation of disturbance, re-spread topsoil over the surface. » Dispose of any sub-surface spoils from excavations where they will not impact on agricultural land, or where they can be effectively covered with topsoil.		
Cumulative impacts: None		
Residual impacts: None		

Nature: Degradation of vegetation due to trampling by vehicles and deposition of dust*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)*		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Short (2)	Short (2)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Improbable (2)
Significance	**Low (15)**	**Low (8)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Minimize road footprint and control vehicle access on roads only. » Control dust as per standard construction site practice using appropriate measures.		
Cumulative impacts: None		
Residual impacts: Low		

Nature: Loss of agricultural land due to direct occupation of land by footprint of solar energy facility infrastructure*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i).*		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)

Magnitude	Small (1)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**Medium (30)**	**Medium (30)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Cumulative impacts: The overall loss of agricultural land in the region due to other developments. The significance is low due to the extremely limited agricultural potential of the development sites in the area.		
Residual impacts: No mitigation possible so same as impacts without mitigation		

Nature: Alternative land use income for landowner*: GN 545, 18 June 2010 activity 1.*		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Minor (3)	Minor (3)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (32)**
Status	Positive	Positive
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Not required	
Cumulative impacts: None		
Residual impacts: None		

Nature: Soil Erosion caused by: alteration of run-off characteristics due to panel surfaces and access roads*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i).* Effects include loss and deterioration of soil resources. There is fairly low risk of erosion due to the very gentle slopes and mostly rocky soils which occur on the site.		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Low (5)	Minor (3)
Probability	Probable (3)	Very improbable (1)
Significance	**Medium (30)**	**Low (8)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	Yes
Mitigation: Implement an effective system of run-off control which collects and disseminates run-off water from hardened surfaces and prevents potential down slope erosion. This should be in place and maintained during all phases of the development.	
Cumulative impacts: None	
Residual impacts: Low	

b) Comparative Assessment of Power Line Alternatives

Alternative power line connections to the Eskom grid are proposed. As power lines have a negligible footprint and impact under the agricultural conditions on site, there are no significant differences between the alternatives in terms of their agricultural impact. Both Alternatives are acceptable from a soils perspective.

c) Implications for Project Implementation

» The development will have low to medium negative impact on agricultural resources and productivity, but it will also result in low to medium positive impacts for the landowner.
» Grazing (current land use) will be able to continue unaffected on all parts of the farm not utilised for the facility, for the duration of the project.
» The significance of agricultural impacts is influenced by the fact that the solar panel sites have extremely limited agricultural potential. The farm has a land capability classification of class 7: non-arable, low potential grazing land.
» Soils are predominantly shallow Mispah soils on underlying rock with only small interspersed pockets of deeper Hutton soils between them.
» Measures to protect soils to be included in the EMPr.
» There are no significant differences between the power line alternatives in terms of their agricultural impact. Both Alternatives are acceptable from a soils perspective.

6.1.3 Assessment of Potential Impacts on Hydrology

A number of sensitive areas within and adjacent to the proposed site were identified. From an aquatic systems point of view most these were associated with dry river beds and riparian zones. Therefore all the dry river beds and the associated riparian systems (refer to **Figure 6.3**) would be rated as extremely sensitive to development, in particular the mainstem systems such as Helbrandleegter and Helbrandkloofspruit, which flows through the site.

When mapping these systems, it became evident that the active channel could not be used to define the lateral extent of the river system. Due to the nature of the

soils and geomorphology, these systems are able to form various meanders within the greater landscape. Placing a buffer of, for example 100 m onto such a system, would still not capture the entire system and therefore not adequately ensure the protection of the riparian zone. It is therefore recommended, due to the number of channels and drainage lines within the area, that a 1:100 year floodline delineation be conducted, and if possible using Lidar data.

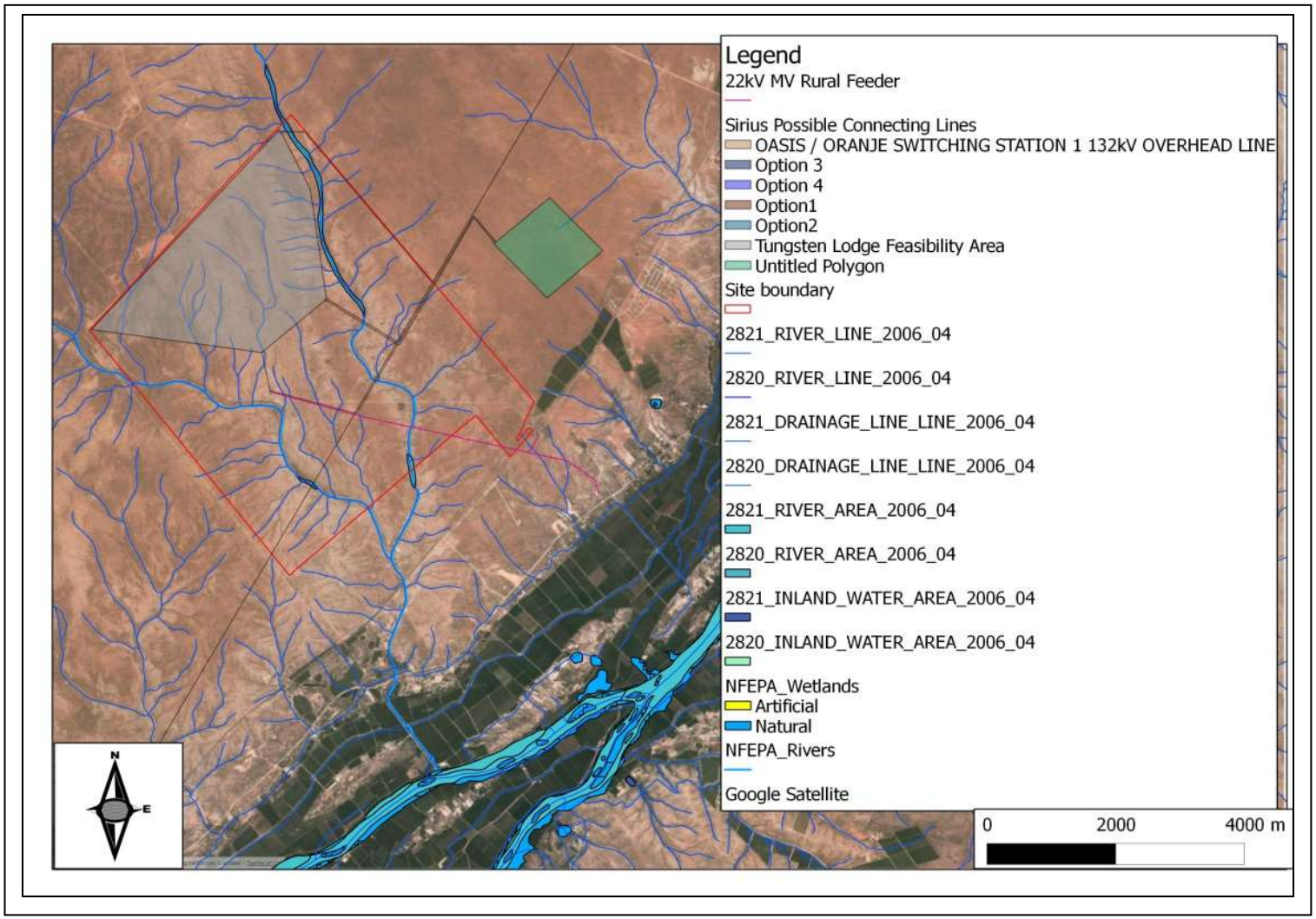

Figure 6.3: Hydrological sensitivity map for the proposed Sirius Solar Project and surrounding areas

a) Water Resources impacts associated with the construction and operation phase of the proposed facility

Riparian zones

The riparian zone component includes the functional or ecosystem services importance of the dry river beds and riparian zones on site and how the proposed development would affect the riparian environment.

Nature: Loss of riparian systems*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)*

The physical removal of the narrow strips of woody riparian zones, being replaced by hard engineered surfaces. This biological impact would however be localised, as a large portion of the remaining farm and the Helbrandleegte and Helbrandkloofspruit catchment would remain intact.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:
The most significant form of mitigation would be to select a development area, which contained no dry river beds. The proposed layout should thus be developed where these areas are avoided.

Cumulative impacts:
None

Residual impacts:
Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

Nature: Impact on dry riverbeds and localised drainage systems*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)*

The physical removal of narrow strips of woody riparian zones being replaced by hard engineered surfaces will alter the hydrological nature of the area, by increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils. This impact would however be localised, as a large portion of the remaining farm and the Helbrandleegte /Helbrandkloofspruit catchment would remain intact.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:

The most significant form of mitigation would be to select a development area, which contained no dry river beds. The proposed layout should thus be developed where these areas are avoided. Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments and reduce flow velocities.

Cumulative impacts:

The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels and however the annual rainfall figures are low.

Residual impacts:

Diversion of run-off away from downstream systems is unlikely to occur as the annual rainfall figures are low.

Nature: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)*

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (19)**
Status (positive or negative)	Negative	Negative

Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments, and reduce flow velocities (e.g. water used when washing the mirrors).		
Cumulative impacts: Downstream alteration of hydrological regimes due to the increased run-off from the area.		
Residual impacts: Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.		

Nature: Increase in sedimentation and erosion within the development footprint*; GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)*		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (1)	Low (1)
Probability	Definite (5)	Probable (3)
Significance	**Medium (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins or other energy dissipation measures to capture large volumes of run-off, trap sediments and reduce flow velocities (e.g. water used when washing the mirrors).		
Cumulative impacts: Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream will then be washed into the Gariep River.		
Residual impacts: During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream will then be washed into the Gariep River.		

Nature: Physical disturbance by the supporting infrastructure on the riparian environment*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 activity 13; GN 544, 18 June 2010 activity 18(i); GN 545, 18 June 2010 activity1, GN 545, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i)*

The proposed power lines will have limited to no impact on the functioning of any riparian systems.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (3)
Probability	Definite (5)	Probable (3)
Significance	**Medium (55)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:

» Care should however be taken that if any clearing is done, that this area is monitored for plant re-growth, firstly to prevent alien plant infestations and to ensure no erosion or scour takes place.
» All towers for the power lines should be outside of any flood lines or dry river beds

Cumulative impacts:
Additional downstream erosion and sedimentation of the Gariep River.

Residual impacts:
During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) will further increase the suspended sediment loads within the Gariep River system.

Gariep River - Flow and quality issues

The flow and quality component focuses on the impact of the development on the availability of the water resources of the area, particularly from the regional context of the Lower Gariep River system.

The distance of the proposed facility from the Gariep River (approximately 3 km) will reduce the risk of contaminated run-off polluting the Gariep River. However the drainage lines or ephemeral streams such as the Helbrandleegte & Helbrandkloofspruit within the site would increase this risk during rainstorms and local flash floods which normally occur during the summer months.

b) Comparative Assessment of Power Line Alternatives

Both the power line alternatives investigated cross the Helbrandleegte spruit. It may be possible to span the power line across the spruit to limit impact on it. It is assumed that pylons will be placed outside of any watercourse (dry river beds) and they would thus have a no direct impact on the aquatic environment. Therefore both Alternative 1 and Alternative 2 can be developed.

c) Implications for Project Implementation

» With suitable mitigation and implementation of the proposed layout, the development should have limited impact on the overall status of the riparian systems on the site and immediate surrounds.
» A flood line calculation study (determination of the 1:100 year flood line) to be undertaken by the developer to inform the final development footprint.
» By excluding all riparian vegetation around natural vleis and large intermittent rivers and maintaining a 100 m buffer around them, important ecosystem services of these ecosystems can be maintained.
» All impacts on water courses that were assessed as being of moderate significance could readily be reduced to low significance by appropriate mitigation.
» It is assumed that pylons will be placed outside of any watercourse (dry river beds) and they would thus have a no direct impact on the aquatic environment. Therefore both Alternative 1 and Alternative 2 can be developed.

6.1.4 Assessment of Potential Impacts on Heritage Resources

The results of the Phase 1 AIA and heritage survey undertaken showed that there are four heritage sites within the proposed site:

» Site 001 - This is a small scattering of Late Stone Age microlithic stone tools located on the edge of a small pan which is currently being used as a loading ramp for a small livestock enclosure and watering trough. The location did not display any characteristics of being either a manufacturing or occupational site. It is possible that the site occurred as a result of the small pan although its occurrence might be ephemeral. Mostly fully formed re-worked microliths were recovered from a general density of around one tool per $3m^2$. One partial blade was recovered while no cores could be seen. The concentration of tools seemed to be limited to an 8m X 5m.
» Site 002 - This site consists of two areas containing microlithic LSA tools. The one area produced a single prepared percussion level core although no further evidence of manufacturing could be identified. As with Site 001 the concentrations were 2-$3m^2$ to one tool. Investigations of animal burrows

showed no signs of sub-surface deposits. The area was characterised by quartz outcrops manifested in linear concentrations of quartz deposits. The rest of the site is characterised by low shrub and red sand substrates.

» Site 003 - This site is located on the edge of a run-off ditch. It only consisted of a few LSA artefacts with no further deposits. This find is most likely the result of alluvial run-off.

» Site 004 - The remains of a holiday resort are located on the Farm Tungsten Lodge. Most of the buildings are in a state of decay. The site was the original Tungsten Lodge and forms part of the Built Environment. Although the site is not older than 60 years it is prominent enough to possible have some cultural significance.

a) Heritage impacts associated with the construction and operation phase of the proposed facility

i) Pre-Contact Sites: Due to the small number of stone tools identified on the site, and the distinct absence of flakes and cores, it is very possible that the finds here were displaced from another area as a result of the water flow action. These stone tools are neither unique nor concentrated enough to warrant preservation of these sites.

***Nature of Impact**:* Possible pre-contact Stone Age site could be damaged locally by excavation activities and associated activities*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 22(i) and GN 545, 18 June 2010 activity 1*		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (2)
Duration	Long term (5)	Long term (5)
Magnitude	Low (1)	Low (1)
Probability	Improbable (1)	Improbable (1)
Significance	**Low (8)**	**Low (8)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resource	No	No
Can impacts be mitigated	Yes	Yes
Mitigation Should some appropriate tertiary institute need representative samples of the stone tools located on LSA sites they should be allowed to perform a surface collection of materials located here.		
Cumulative impacts The growth of renewable energy plants in the Northern Cape could result in a compounding effect as to regards the loss of Stone Tools.		
Residual impacts Loss of low significance heritage related information.		

ii) ***Built Environment:*** Site 004, the remains of a holiday resort, is located on the Farm Tungsten Lodge, on the north-western boundary of the study area. This was however found to be the remains of the Tungsten Lodge for which construction was initiated in 2000 and therefore it holds no heritage significance. Several other smaller built structures of a recent nature, such as single room houses and concrete reservoirs are located in the study area.

iii) ***Palaeontology:*** The proposed project site falls within the Kalahari sediments and calcretes have low fossil potential, and the possibility of fossils being encountered in diggings cannot be totally excluded. The area is characterised by deep sands and sandy soil covering calcrete and very old non-fossiliferous igneous and metamorphic rocks.

The findings of the scoping study showed that there is a very low likelihood that fossils will be found in the study. An exemption letter to undertake further studies during the EIA phase was issued by the specialist and SAHRA - refer to Appendix I.

b) Comparative Assessment of Power Line Alternatives

The two alternative power line alignments for the Sirius Project One development were investigated. The alignments roughly follow the same route there is no preferred alignments as their impact will be similar. Alternative 2 requires a shorter power line to connect to the existing infrastructure than Alternative 1 and therefore the impact of Alternative 2 for Project One should be conceivably lower than the impact of Alternative 1. No important sites were identified in either power line corridor or on the substation site.

c) Implications for Project Implementation

» Based on the Phase 1 Archaeological Impact Assessment (AIA) study and survey it was found that no significant heritage sites occur on the site.
» Four areas of low concentration of stone tools were recorded. It was found that none of the tool concentrations warranted protection or mitigation action. The occurrence of these Stone Tools strongly suggests that a better-defined site could be located nearby or very well sub-surface. Due to the close proximity of the area to the Orange River, it is prone to alluvial deposits that could bury any Stone Age sites.
» It is recommended that a suitably qualified heritage practitioner be appointed by the developer to perform periodic inspections of excavated materials (preferably fortnightly) to ensure than no sub-surface sites are damaged.
» Due to the unlikelihood that fossils could be found in the study area, it has been recommended that no additional Palaeontological studies is required and this has been approved by SAHRA.

6.1.5 Assessment of Potential Visual Impacts

The result of the cumulative viewshed analyses for Project One and Project Two of the proposed facility is shown in Figure 6.4. The proposed facility has a relatively contained core area of potential visibility (i.e. within a 2.5km radius of the site). This area of exposure is generally restricted to the farm earmarked for the development itself, the neighbouring solar energy facility developments and vacant natural land.

» Visibility in the 2.5km to 5km zone surrounding the proposed development site is scattered and generally interrupted due to the undulating nature of the topography, and the generally constrained vertical dimensions of the proposed structures. Most of this area of exposure falls within vacant land, with only a limited area (approximately 2.7km in length) that may include exposure from the N14 national road.
» Visibility subsides drastically beyond a 5km radius with only limited exposure expected to the west and south-west of the site. The exception is where the facility may be exposed from the south-eastern banks of the Orange River and adjacent areas. This area includes a section of the R359 arterial road that may be exposed to the facility for almost 10km. Exposure may be possible from this road and adjacent residences, but is generally expected to be at distances exceeding 8km from the proposed development site.
» Visibility beyond a 10km radius from the development site is expected to be highly unlikely due to the distance between the object (development) and the observer.
» It is envisaged that the structures (where visible from shorter distances) may constitute a high visual prominence, potentially resulting in a high visual impact.
» It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CPV structures (solar troughs, heliostats and central receiver) of the Abengoa (!Khi) solar energy facility, is expected to generally dominate the observer's frame of view.

It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CSP structures of the Abengoa (!Khi) solar energy facility and the Eskom CSP, are expected to generally dominate the observer's frame of view. The visual exposure maps of both these facilities are shown below, displaying much larger areas of potential visual exposure when compared to the Sirius Solar PV structures.

.

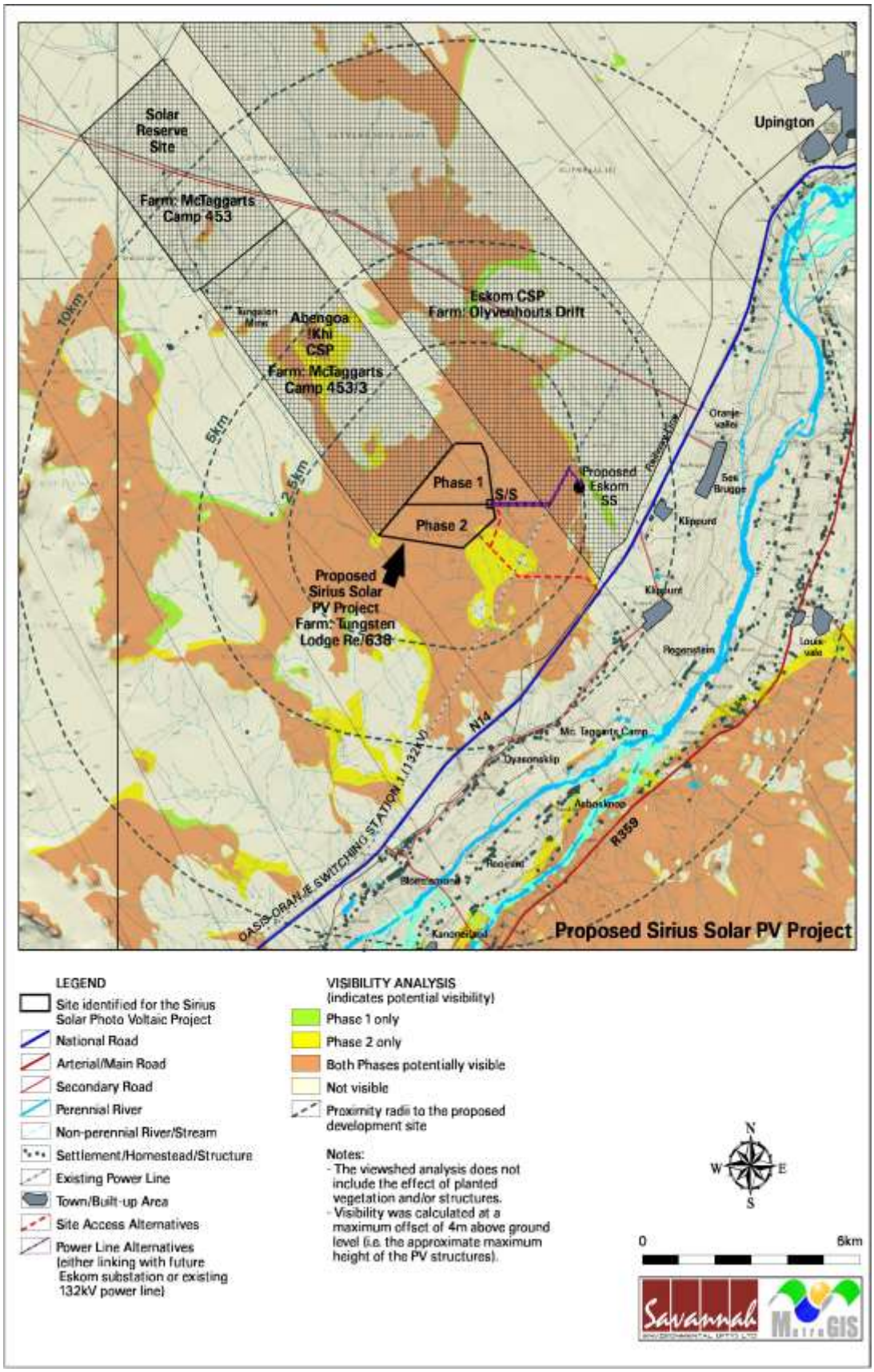

Figure 6.4: Potential visual exposure of the proposed Sirius Solar PV Project

Visual Impact Index

The combined results of the visual exposure, viewer incidence/perception and visual distance for Project One and Project Two of the proposed solar energy facility are displayed in **Figure 6.5** below.

The following is of relevance:

» The visual impact index map indicates a core zone of **moderate** visual impact within a 2.5km radius from the facility (both projects), where the facility may be visible from land generally devoid of sensitive visual receptors (i.e. vacant natural land). A large section of this area also falls within the farms earmarked for the Abengoa and Eskom solar energy facilities and associated infrastructure (e.g. the Eskom substation site).
» There are no homesteads or residences located within this zone.
» The potential visual exposure within the 2.5km to 5km zone from the solar energy facility (both projects) is expected to have a **low** visual impact, where sensitive visual receptors are generally absent, but may be **moderate** along a section of the N14 national road. The Sirius Solar PV facility may be visible from this section of road, although it is more likely that the power tower from the !Khi (Abengoa) CSP (situated behind the PV facility) would attract more attention.
» The visual impact beyond 5km and up to 10km from the solar energy facility, is expected to be **very low**, but may potentially be **low** where observers are present. There are a number of homesteads located within this zone (south-east of the Orange River), as well as a section of the R359 arterial road.
» Visibility beyond 10km from the proposed development is expected to have a **negligible** visual impact.

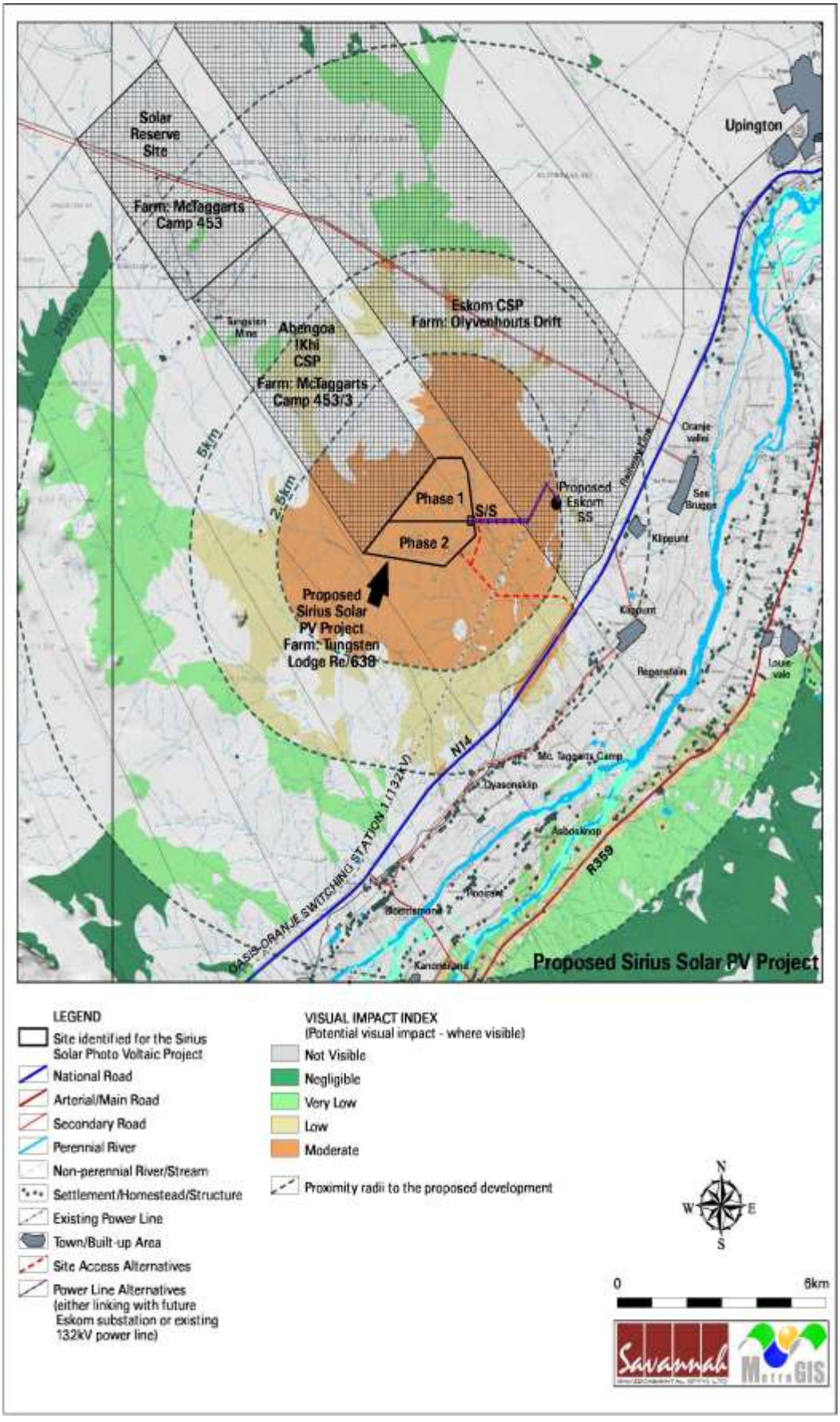

Figure 6.5: Visual impact index of the proposed Sirius Solar PV project

a) Impact tables summarising the significance of visual impacts of the PV facility during the construction and operation

***Nature of Impact**:* Visual impact of construction on sensitive visual receptors*; GN 544, 18 June 2010 activity 10(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i).*

During construction, there will be a noticeable increase in heavy vehicles utilising the national road and district road to the development sites. This increase in traffic and the construction activities on the site is expected to have a moderate visual impact on observers travelling along these roads.

Special programmes need to be followed to rehabilitate disturbed land after construction. It is therefore imperative that the unnecessary removal of vegetation during construction must be avoided at all cost. Appropriate measures to rehabilitate cleared areas after construction, must be carried out.

	Without Mitigation	***With Mitigation***
Extent	Local (4)	Local (4)
Duration	Short Term (2)	Short Term (2)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (42)**	**Moderate (36)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
- Reduce the construction period through careful logistical planning and productive implementation of resources.
- Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust through the use of approved dust suppression techniques as and when required, especially on the dirt road giving access to the site (i.e. whenever dust becomes apparent).
- Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works.

Cumulative impacts:

None.

Residual impacts:

None

Nature of Impact: Visual impact on users of the N14 national road in close proximity to the proposed solar energy facility*: GN 544, 18 June 2010 activity 10(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i).*

The solar energy facility could potentially have a moderate visual impact on road users travelling along the N14 national road traversing south-east of the facility.

	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (42)**	**Low (24)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

General mitigation/management:

Planning:

» Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the facility.

» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.

» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the solar energy facility (two projects) is expected to increase the cumulative visual impact within the immediate area, considering the visual exposure of the much taller structures associated with the approved solar energy facility at this locality. Alternatively, the close proximity of the proposed facilities to each other consolidates the potential visual exposure of solar energy generation infrastructure within a development node, thereby avoiding the proliferation of similar developments within the region. It further allows for the effective connection with the power grid without incurring any additional expanded visual impacts and generally encourages the sharing of infrastructure (e.g. the proposed Eskom substation).

Residual impacts:

The visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.

Nature of Impact: Visual impact on sensitive visual receptors within the region.

Potential visual impact on residents of homesteads in close proximity to the proposed solar energy facility*: GN 544, 18 June 2010 activity 10(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i).*

No homesteads of farm residences were identified within close proximity (4km radius) of the proposed solar energy facility. This visual impact is therefore expected to be of no consequence.

The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond the 5km radius) is expected to be **low** for the proposed solar energy facility, both before and after the implementation of mitigation measures.

	Without mitigation	***With Mitigation***
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (22)**	**Low (11)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

General mitigation/management:

Planning:

» Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the facility.

» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.

» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the solar energy facility (two projects) is expected to increase the cumulative visual impact within the region, considering the visual exposure of the much taller structures associated with the approved solar energy facility at this locality. Alternatively, the close proximity of the proposed facilities to each other consolidates the potential visual exposure of solar energy generation infrastructure within a development node, thereby avoiding the proliferation of similar developments within the region. It further allows for the effective connection with the power grid without incurring any additional expanded visual impacts and generally encourages the sharing of infrastructure (e.g. the proposed Eskom substation).

Residual impacts:

The visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.

Nature of Impact: Visual impact of lighting on sensitive visual receptors*; GN 544, 18 June 2010 activity 10(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i).*

Lighting impacts relate to the effects of glare and sky glow. The source of glare light is unshielded luminaries which emit light in all directions and which are visible over long distances.

Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. It is possible that the PV plant may contribute to the effect of sky glow within the environment which is currently undeveloped.

Mitigation of direct lighting impacts and sky glow entails the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for the solar energy facility and the ancillary infrastructure (e.g. workshop, storage facilities and substation) will go far to contain rather than spread the light.

	Without mitigation	***With Mitigation***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (42)**	**Low (24)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
- Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
- Making use of minimum lumen or wattage in fixtures;
- Making use of down-lighters, or shielded fixtures;
- Making use of Low Pressure Sodium lighting or other types of low impact lighting.
- Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes

Cumulative impacts:

The development of two projects for the facility will contribute to an increase in light sources within the region, and as a result an increase in lighting impact at night.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and

ancillary infrastructure is removed. Failing this, the visual impact will remain.

b) Comparative Assessment of Power Line Alternatives

The two overhead power line alternatives are expected to have a **negligible** visual impact when viewed against the backdrop of the much more prominent PV structures and the existing and future infrastructure (e.g. CSP facilities, Eskom substation, etc.) proposed for the broader area.

The alternatives proposed for the Sirius Solar PV facility are not expected to yield differing viewshed analyses results, due to their location immediately adjacent and parallel to each other. From a visual impact perspective the shortest route, i.e. alternative 2, would be preferred. This is based purely on the premise that the shorter the line, the lower the potential visual impact. The area surrounding the proposed power line infrastructure is also generally devoid of sensitive visual receptors, further lowering the risk of potential visual impact.

c). Implications for Project Implementation

The findings of the Visual Impact Assessment undertaken for Project One of the Proposed Sirius Solar Photovoltaic Facility is that the visual environment surrounding the site, especially within a 2.5km - 5km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years).

The proposed facility would be visible within an area that may incorporate certain sensitive visual receptors. These primarily include users of the N14 national road traversing near the proposed development. The following is a summary of impacts remaining, assuming mitigation as recommended is exercised:

» The solar energy facility could potentially have a moderate visual impact on road users travelling along the N14 national road traversing south-east of the facility. This impact may be mitigated to low.
» The potential visual impact on residents of homesteads in close proximity to the solar energy facility is expected to be negligible due to the general absence of settlements and residences in close proximity (4km radius) of the proposed solar energy facility.
» The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond a 5km radius) is expected to be low for the proposed solar energy facility, both before and after the implementation of mitigation measures.
» The potential visual impact of construction activities on sensitive visual receptors within close proximity to the proposed solar energy facility is likely to

be of moderate significance, both before and after the implementation of mitigation measures.
» The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of moderate significance and may be mitigated to low.
» Measures to limit visual impacts and lighting impacts/ scarring of the landscape are to be included in the EMPr.

The anticipated visual impacts listed above (post mitigation measures) are on average expected to be of **low** to **moderate** significance. The solar energy facility development is not considered to be fatally flawed from a visual perspective. Power line alternative 2 is preferred from a visual perspective.

6.1.6 Assessment of Potential Social Impacts

The key social issues associated with the construction phase include:

Potential positive impacts
» Creation of employment and business opportunities and opportunity for skills development and on-site training

Potential negative impacts
» Impacts associated with the presence of construction workers on site
» Threat to safety and security of farmers associated with the presence of construction workers on site
» Increased risk of stock theft, poaching and damage to farm infrastructure associated with presence of construction workers on the site
» Increased risk of veld fires associated with construction-related activities
» Impact of heavy vehicles, including damage to roads, safety, noise and dust
» Potential loss of grazing land associated with construction-related activities.

The key social issues associated with the operational phase include:
» Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
» Benefits associated with the establishment of a Community Trust;
» The establishment of infrastructure to generate renewable energy.

a) Impact tables summarising the significance of Social impacts of the PV facility during the construction and operation

Nature of Impact: Creation of employment and business opportunities during the construction and operation phase*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*		
	Without Mitigation	***With Enhancement***

Extent	Local – Regional (2)	Local – Regional (3)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (36)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	

Enhancement :

In order to enhance local employment and business opportunities associated with the construction phase the following measures should be implemented:

Employment

» Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
» Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;
» Before the construction phase commences the proponent and its contractors should meet with representatives from the KGLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.
» The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase.
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

» The proponent should seek to develop a database of local companies, specifically Broad Based Black Economic Empowerment (BBBEE) companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;
» The proponent, in consultation with the KGLM and the local Chamber of Commerce, should identify strategies aimed at maximising the potential benefits associated with the project.

Cumulative impacts:

Opportunity to up-grade and improve skills levels in the area.

Residual impacts:

Improved pool of skills and experience in the local area.

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STDs etc. (5)	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STDs etc. (5)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27)** **Moderate-High for specific individuals who may be affected by STDs etc. (57)**	**Low for the community as a whole (24)** **Moderate-High for specific individuals who may be affected by STDs etc. (51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Mitigation:

» Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks;

» The proponent should consider the establishment of a Monitoring Forum (MF) for the construction phase. The MF should be established before the construction phase commences and should include key stakeholders, including representatives from the local community, local councillors, farmers, and the contractor. The role of the MF would be to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should also be briefed on the potential risks to the local community associated with construction workers;

» The proponent and the contractors should, in consultation with representatives from the MF, develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation;

- » The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
- » The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;
- » The contractor should make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the 18 month construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks;
- » The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. This would reduce the risk posed by non-local construction workers to local family structures and social networks;
- » As per the agreement with the local farmers in the area, no construction workers, will be permitted to stay overnight on the site. Security personnel will be housed in the vicinity of the site.

Cumulative impacts:

Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community. The development of other solar energy projects in the area may exacerbate these impacts.

Residual impacts:

Community members affected by STDs etc. and associated impact on local community and burden services etc.

Nature: Potential safety and security risk posed by presence of construction workers on site*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*

	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (21)**
Status	Negative	Negative
Reversibility	No, if local residents are murdered or physically harmed	No, if local residents are murdered or physically harmed
Irreplaceable loss of resources?	Yes, if family member is murdered	Yes, if family member is murdered
Can impact be mitigated?	Yes	Yes

***Mitigation*:**

- » The proponent should liaise with the KGLM with regard the need to establish a Monitoring Forum (MF) for the construction phase. The MF should be established before the construction phase commences and should include key stakeholders, including

representatives from TLM, the local community, local councillors, and the contractor. The role of the MF would be to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should also be briefed on the potential risks to the local community associated with construction workers;

» The proponent and the contractors should, in consultation with representatives from the MF, develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation;

» The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for ensuring that construction workers respect the rights of local farmers and do not pose safety and security threat to them and their families.

Cumulative impacts:

No

Residual impacts:

Include psychological effects associated with attacks or crime related events that may last for many years.

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*

	Without Mitigation	***With Mitigation***
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate due to reliance on livestock for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and losses and damage etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

» Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;

» No smoking on the site, except in designated areas should be permitted;

» Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include clearing working

areas and avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months;
» Contractor should provide adequate fire fighting equipment on-site;
» Contractor should provide fire-fighting training to selected construction staff;
» As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms.
» The contractor should also compensate the fire fighting costs borne by farmers and local authorities.

Cumulative impacts: No, provided losses are compensated for.

Residual impacts: Potential loss of income and impact on livelihoods and economic viability of affected farms.

Nature: Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*

	Without Mitigation	***With Mitigation***
Extent	Local-Regional (2)	Local-Regional (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:
» Drivers should be made aware of the potential risk posed to school children and other residents in Klipsloot. All drivers must ensure that speed limit of 60 km per hour is enforced along the section of the N14 that runs past Klipsloot;
» Abnormal loads along the N14 should be timed to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc.;
» The contractor must ensure that all damage caused to the internal access road by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor;
» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers;
» All vehicles must be road-worthy and drivers must be qualified, made aware of the potential road safety issues, and need for strict speed limits.

Cumulative impacts:
If damage to roads is not repaired then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. The

costs will be borne by road users who were no responsible for the damage.
Residual impacts: Reduced quality of road surfaces and impact on road users

Nature: Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*		
	Without Mitigation	***With Enhancement***
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**High (65)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The proponent in consultation with the KGLM should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; » The proponent in consultation with the KGLM should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the community trust from the SEF are managed for benefit of the community as a whole and not individuals within the community.		
Cumulative impacts: Promotion of social and economic development and improvement in the overall well-being of the community		
Residual impacts: Investment in local economic development in the area that would benefit the community post operational phase		

Nature: Development of clean, renewable energy projects in South Africa*: GN 545, 18 June 2010 activity 1*		
	Without Mitigation	***With Mitigation*** (The provision of renewable energy infrastructure is in itself a mitigation measure)
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)

Significance	**Medium (48)**	**Medium (48)**
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	
Enhancement: • Use the project to promote and increase the contribution of renewable energy to the national energy supply; • Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.		
Cumulative impacts: Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: Not applicable after decommissioning		

b) Comparative Assessment of Power Line Alternatives

The social impacts associated with power line alternative 1 and 2 are likely to be low as they do not impact on residential structures. However, given the shorter distances associated with alternative 2, alternative 2 is the preferred power line option.

c). Implication for project implementation

» The findings of the SIA indicate that the development of the proposed Sirius solar energy facility will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The enhancement measures listed in the report should be implemented in order to enhance these benefits. In addition, the proposed establishment of a number of other renewable energy facilities in the area will create significant socio-economic opportunities for the KGLM, which, in turn, will result in a positive social benefit.
» The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed solar energy facility also creates an opportunity to support local economic development in the area. Given the size of the proposed facility (150MW) this will represent a significant social benefit for an area where there are limited opportunities.
» The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. The establishment of the proposed Sirius solar energy facility is therefore supported by the findings of the SIA.
» Power line alternative 2 is preferred from a social perspective

6.1.7 Impacts resulting from the Decommissioning Phase

Given the relatively small number of people employed during the operational phase (~ 120), the social impact on the local community associated with decommissioning is likely to be low. In addition, the potential impacts can be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative).

The proponent should also investigate the option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 25-30 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure.

6.2. Assessment of Potential Cumulative Impacts

Cumulative impacts, in relation to an activity, refer to the impact of an activity that in-itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area. For cumulative effects analysis to help the decision-maker and inform interested parties, it must be limited to effects that can be evaluated meaningfully (DEAT, 2004). Boundaries must be set so analysts are not attempting to measure effects on everything. Therefore, the cumulative impacts associated with the proposed Sirius PV solar Project have been viewed from two perspectives within this report:

» Cumulative impacts associated with the scale of the project i.e. two 75 MW plants on the farm portion,
» Cumulative impacts associated with other relevant approved or existing solar developments in the area.

Cumulative effects are commonly understood as the impacts which combine from different projects and which result in significant change, which is larger than the sum of all the impacts (DEAT, 2004). The complicating factor is that the projects that need to be considered are from past, present and reasonably foreseeable future development. Cumulative effects can be characterised according to the pathway they follow. One pathway could be the persistent additions from one process. Another pathway could be the compounding effect from one or more processes. Cumulative effects can therefore occur when impacts are:

» additive (incremental);
» interactive;

» sequential; or
» synergistic.

Canter and Sadler (1997) describe a three step process for addressing cumulative effects in an EIA:

» delineating potential sources of cumulative change (i.e. GIS to map the relevant renewable energy facilities in close proximity to one another.
» identifying the pathways of possible change (direct impacts)
» indirect, non-linear or synergistic processes; and
» Classification of resultant cumulative changes

The identified site for the proposed Sirius PV Project is situated approximately 20km by road south-west of Upington on the remaining extent of the Farm Tungsten Lodge 638. Several projects are being proposed in the area, authorised projects include the following:

Proposed projects include the following:

Project Name	Location	Project Status
Proposed establishment of the project Sonnenberg photovoltaic plant located approximately 30km west of Keimoes	Portion 11 of the farm Baviaanz Krantz 11	Authorised
Proposed establishment of the project S-Kol photovoltaic plant near Keimoes	Farm Geel Kop 456	Authorised
Proposed establishment of the Upington solar thermal plant-Phase 2 & 3	Farm McTaggarts Camp 453	EIA process underway
Proposed Rooipunt 19MW Photovoltaic Plant	Farm Rooipunt 617	Received Authorisation
Proposed Sasol Project Solis	Farm Van Roois Vley 443	Received Authorisation
Proposed Khi Solar One	Farm McTaggarts Camp 453	Under construction
Eskom CSP Project	Farm Olivenhouts Drift	Authorised

The **cumulative impacts** associated with Project One and Project Two of the Sirius solar energy facility at a site level are expected to be associated with the scale of the project (i.e. Project One and Project Two, each requiring ~250 hectares in extent). The potential direct cumulative impacts associated with the project are expected to be associated predominantly with the potential ecology impact, potential soil impacts and potential impacts on visual and social in the surrounding area. Approximately 500 hectares of land will be cumulatively impacted upon by Project One and Project Two of the Sirius PV facility.

In addition to cumulative impacts at a site level, cumulative impacts could be associated with this proposed development and other similar developments in the area. At this stage, only one is under construction, four solar energy facilities have been authorised and one is undergoing EIA process.

The cumulative impacts associated with the proposed Project One and Project Two of the Sirius facility primarily refer to those impacts associated with ecology, soil, hydrology, visual and social impacts, and are mainly associated with the existing and planned solar energy facilities in the area.

Potential cumulative impacts associated with numerous solar energy facility developments within the study area are expected to be associated with:

» ***Ecology –*** Excessive clearing of slow growing trees, especially *Boscia albitrunca* and *Acacia erioloba* could significantly impact local and regional population dynamics and microhabitats and resources associated with these species available to other fauna and flora species. Excessive clearing of vegetation can and will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains, small ephemeral to larger intermittent drainage lines, rivers and this could also have detrimental effects on the lower lying Orange River. Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands.
» ***Soil and Agricultural Potential -*** The only viable agricultural land use is the current one i.e. grazing. As a result of the severe soil depth and aridity constraints, the site is not suitable for any other agricultural land use.
» ***Water Resources -*** Cumulative impacts due to artificial elevation of the river banks, embankment construction and earthmoving activities in the floodplain of the Gariep River has severely impacted on ecological functioning of the system. Further manipulation will exacerbate these impacts, but to a very limited degree with a localised impact. Man-induced erosion and sedimentation in this area from intensive farming activities along the Gariep River is expected to be unnaturally high. The cumulative impact on the Gariep River could thus exceed the tolerances of the aquatic biota, including sensitive fish species.
» ***Visual –*** The area already has a CSP project under construction and an Eskom CSP has been authorised which will have significant impact on the viewshed of the area. The most significant impact associated with these projects and associated infrastructure is the visual impact on the scenic resources and cultural landscape of this region imposed. It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CPV structures (solar troughs, heliostats and central receiver)

of the Abengoa (!Khi) solar energy facility, is expected to generally dominate the observer's frame of view

» ***Heritage –*** several renewable energy facilities are being proposed with the proposed Sirius Solar PV Project. This could results to heritage materials being exposed during developmental stages of the projects. Therefore increased in loss of heritage materials and palaeontology.

» ***Social –*** The development of numerous solar energy facilities within the study area will have a cumulative impact on several existing issues within the area, predominately within rural settlements associated with the potential influx of workers and job seekers. With the increased population density, this may lead to a cumulative impact on housing requirements, services (i.e. water, electricity and sanitation), health issues, safety and security. New informal townships are unlikely to have the required infrastructure and services. With the existing rural settlements in the area this will have a cumulative impact on the environment and health (i.e. in terms of ablution facilities). The main social impact, however, will be in terms of visual impacts and associated impacts on sense of place.

» ***Positive impacts -*** Cumulative positive impacts are also anticipated. Two CSP projects have been authorised; one is under construction. This results in job creation opportunities, business opportunities for local companies, skills development and training. The development of renewable energy facilities will have a positive impact at a national and international level through the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project would fit in with the government's aim to implement renewable energy projects as part of the country's energy generation mix over the next 20 years as detailed in the Integrated Resource Plan (IRP).

The Upington area is ear-marked as a hub for solar energy projects and for solar projects to be clustered in one area, and also falls within the solar corridor proposed by the Northern Cape Spatial Development Plan. In the case of the proposed Sirius Solar PV Project (Project One), there are other projects proposed around the site and in the broader Upington area (refer to **Figure 6.6** and **Table 6.1** below). The clustering of solar projects in this region near Upington is suitable from a technical and environmental perspective.

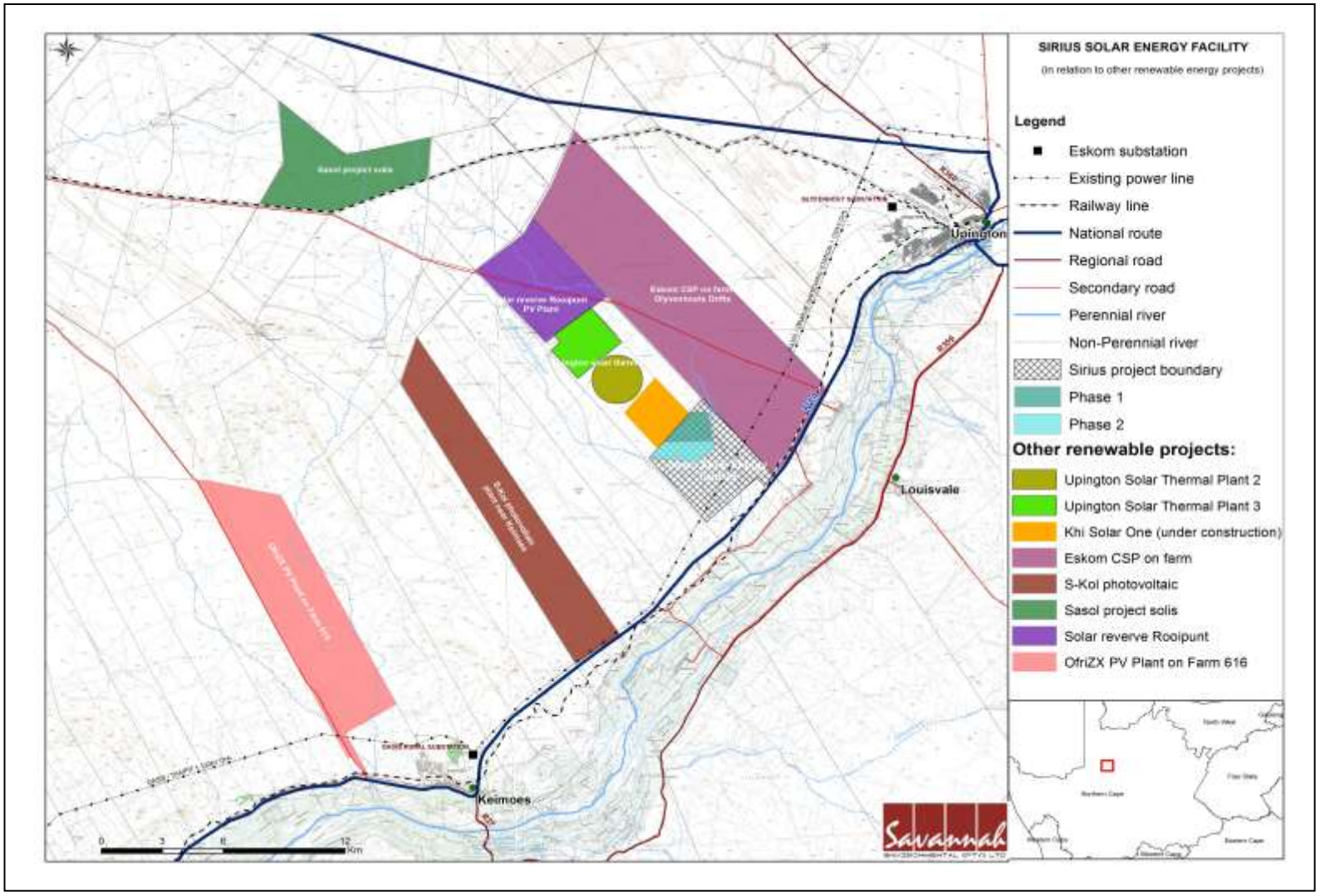

Figure 6.6: Cumulative Impacts map associated with the proposed Sirius Solar PV Project One

6.3. Assessment of the Do Nothing Alternative

The 'do-nothing' alternative is the option of not constructing of the proposed Sirius Solar PV Project One. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of a solar energy facility.

At a local level, the level of unemployment will remain the same and there will not be any transfer of skills to people in terms of the construction and operation of the solar energy facility. The landowners would have lost an opportunity of using his land for alternative activities to generate additional income. Furthermore, the community would lose the opportunity to improve and uplift their infrastructures through the community trust.

At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the facility is only proposed to contribute 75 MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

» **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability.

» ***Exploitation of our significant renewable energy resource:*** At present, valuable national resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.

» ***Pollution reduction:*** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions.

» ***Climate friendly development:*** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita carbon dioxide emissions.

» ***Support for international agreements:*** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.

» ***Employment creation:*** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.

» ***Acceptability to society:*** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

» ***Support to a new industry sector:*** The development of renewable energy offers the opportunity to establish a new industry within the South African economy.

The 'do nothing' alternative will not assist the South African government in addressing climate change, in reaching the set targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country. In addition the Northern Cape Province power grid will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid. The 'do nothing alternative is, therefore, not a preferred alternative.

6.4 Summary of Impacts

Table 6.1 summarises all potential impacts associated with the proposed Sirius Solar PV Project One

Table 6.1: Summary of impacts associated with the proposed development

Construction / Decommissioning Impacts	Significance of Impact		
	Without mitigation	**With mitigation**	**Applicability to listed activities (GN 544,545,546 of 18 June 2010)**
Loss of vegetation	M (50)	M (35)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Increase in runoff and erosion	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible distribution and increased establishment of alien invasive species	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible disturbance and reduction of habitat or injury to burrowing vertebrates	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible change of natural runoff and drainage patterns,	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible loss of protected species,	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible permanent loss of revegetation	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Potential of soil surface, increase in dust levels	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Potential loss of individuals of keystone species and associated microhabitats	M (40)	L (20)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible mortality incidents of terrestrial fauna	M (40)	L (20)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Loss of topsoil	L (18)	L (5)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Degradation of veld vegetation	L (15)	L (8)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Loss of agricultural land use	M (30)	M (30)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Generation of alternative land use income	M (32)	M (32)	GN 545 activity 1

Soil Erosion	M (30)	L (8)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Loss of riparian systems	M (55)	M (45)	GN 544 activity 10(i); GN 544 activity 11(xi); GN 544 activity 18(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Impact on dry riverbeds and localised drainage systems	M (45)	L (24)	GN 544 activity 10(i); GN 544 activity 11(xi); GN 544 activity 18(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Impact on riparian systems through the possible increase in surface water runoff on riparian form and function	M (35)	L (19)	GN 544 activity 10(i); GN 544 activity 11(xi); GN 544 activity 18(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Increase in sedimentation and erosion within the development footprint	M(30)	L (18)	GN 544 activity 10(i); GN 544 activity 11(xi); GN 544 activity 18(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires	M (36)	L (24)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	M (33)	L (24)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development	M.(36)	H (65)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Possible pre-contact Stone Age site could be damaged locally by excavation activities and associated activities	L (8)	L (8)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Visual impact of construction on sensitive visual receptors	M (42)	M (36)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Creation of employment and business opportunities during the construction and operation phase	M (32)	M (36)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Potential impacts on family structures and social networks associated with the presence of construction workers	L (27)	L (24)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15

Operational Impacts	Significance of Impact		
	Without mitigation	**With mitigation**	**Applicability to listed activities (GN 544,545,546 of 18 June 2010)**
Localised increase in runoff and accelerated erosion	H (60)	L (15)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Possible release of toxic substances and/or heavy metals and associated contamination of soil and groundwater	H (60)	L (15)	GN 544 activity 10(i); GN 545 activity 545 1
Reduced vegetation cover	H (60)	L (20)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Altered distribution of rainfall and resultant runoff patterns	H (60)	L (20)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion	H (60)	L (20)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Reduction of habitat and resource availability for terrestrial fauna during the construction of substation	M (60)	M (40)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Sediment input into the Gariep River	M (40)	L (10)	GN 544 activity 10(i); GN 545 activity 545 1
Chemical and other pollutants into the Gariep River	M (30)	L (10)	GN 544 activity 10(i); GN 545 activity 545 1
Operation of the reservoir and high pressure sand filtration plant	L (24)	L (21)	GN 544 activity 10(i); GN 545 activity 545 1
Visual impact on users of the N14 national road in close proximity to the proposed SEF	M (42)	L (24)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Visual impact on sensitive visual receptors within the region	L (22)	L (11)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Visual impact of lighting on sensitive visual receptors	M (42)	L (24)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Creation of employment and business opportunities during the construction and operation phase	M (32)	M (36)	GN 544 activity 10(i); GN 545 activity 545 1
Promotion of clean, renewable energy	M (48)	M (48)	GN 544 activity 10(i); GN 545 activity 545 1

L **Low** M **Medium** H **High**

ASSESSMENT OF POTENTIAL IMPACTS: SIRIUS PV PROJECT 2 CHAPTER 7

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed Sirius Solar PV Project Two (refer to **Figure 7.1**). This assessment is conducted for a 75 MW facility and for all the facility's components including:

- Arrays of photovoltaic (PV/CPV) panels.
- Mounting structure to support the PV panels.
- Cabling between the projects components, to be lain underground where practical.
- A new on-site substation to evacuate power from the PV panels to the Eskom grid.
- A 132 kV power line. The following power line alternatives where assessed in this EIA report:
  - Alternative 1: the power line is approximately 5.4 km in length and lies on the southern side of the proposed site and runs parallel to the Oasis-Oranje 1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
  - Alternative 2: the power line is approximately 1.1 km in length and lies on the eastern side of the proposed site and power would feed into the Eskom electricity network via a 'turn in and turn out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
- Internal access roads and fencing.
- Workshop area for maintenance, storage, and offices.

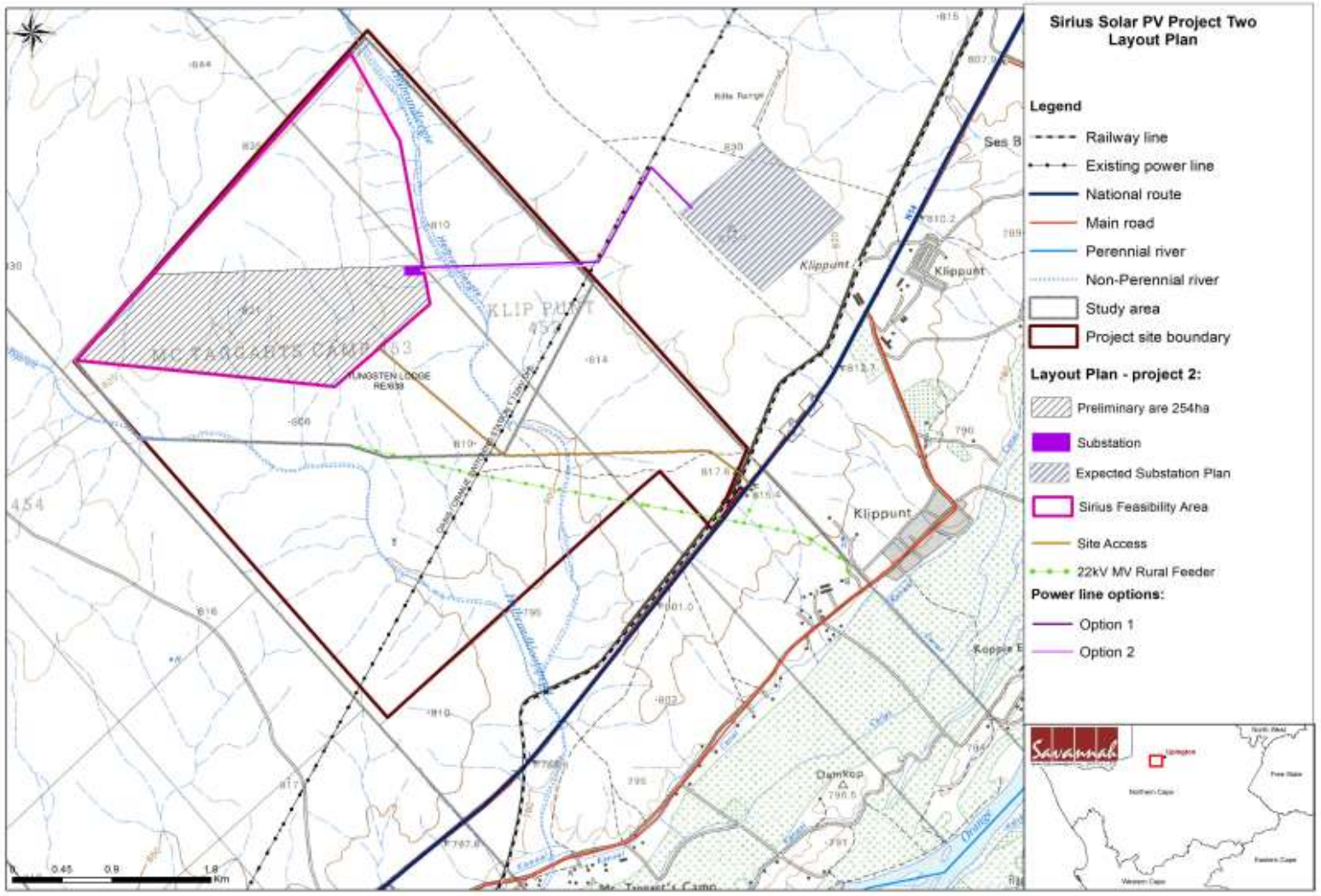

Figure 7.1: Layout map showing the Sirius Solar PV Project Two and associated infrastructure

The development of the Sirius Solar PV Project Two will comprise the following activities:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access road, electricity generation infrastructure, power line servitudes, construction camp, laydown areas, transportation of components/construction equipment to site; and undertaking site rehabilitation and establishment and implementation of a storm water management plan. This phase is expected to take approximately 16 months.
» *Operation* – will include operation of the facility and the generation of electricity. The operational phase is expected to extend in excess of 20 - 25 years.
» *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

7.1 Assessment of the Potential Impacts associated with the Construction and Operation Phases

The sections which follow provide a summary of the findings of the assessment of potential impacts associated with the construction and operation of the proposed solar energy facility on the identified site. The assessment of potential issues presented in this chapter has involved key input from specialist consultants, the public and the project developer. Issues were assessed in terms of the criteria detailed in Chapter 4 (section 4.2.5). The nature of the potential impact is discussed, and the significance is calculated with and without the implementation of mitigation measures. Recommendations are made regarding mitigation/enhancement and management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted. Cumulative impacts are assessed in Section 7.2.

7.1.1 Potential Impacts on Ecology

The study area is covered by the Bushmanland Arid Grasslands merging into Kalahari Karroid Shrubland as described by Mucina and Rutherford (2006), with riverine vegetation on the banks of small ephemeral water washes that drains into the Orange River, about 7 km south-east of the study area. Three vegetation associations could be identified (refer to **Figure 7.2**):

» Association 1: *Ziziphus mucronata – Cenchrus ciliaris* riparian woodlands are restricted to the peripheries of small seasonal pans and larger drainage lines. Density, height and composition of the woody and herb layer vary immensely. Large specimens of the protected *Acacia erioloba* and *Boscia albitrunca* as well as other tree species are scattered along the larger drainage lines south-west, west and north-east of the development area. Several of the large *Acacia erioloba* trees are currently 'occupied' by large active social weavers' nests.

  Sandy plains created either side of these large drainage lines by occasional very large floods merge into vegetation unit 2. Closer to the drainage lines they typically maintain a higher moisture regime, supporting localised dense stands of *Nerine laticoma* (a species associated with areas of seasonal standing water or soils with high seasonal moisture) and many short-lived annuals.

  Typically, smaller ephemeral washes are also characterised with a dense high shrub layer, but few of these small tributaries hold enough moisture to support a tree layer and the typical herb layer, and have thus not been included and mapped as part of the riparian woodlands.

» Association 2: *Boscia foetida – Stipagrostis uniplumis* mixed open shrublands cover the lower-lying areas of the study area, where sandy loams naturally eroded off the undulating landscape have accumulated over time. Surface rockiness is variable, but can be moderate. Occasional smaller trees of *Acacia erioloba* do occur, but the area is generally prone to invasion by the indigenous *Acacia mellifera* subsp. *detinens* and *Rhigozum trichotomum*, especially along the small ephemeral washes. There is a moderate presence of low karroid shrubs, but the lower vegetation layer is dominated by *Stipagrostis uniplumis*. These sections of the study area thus have the highest grazing potential for larger livestock. However, the cover of perennial grasses can vary significantly from one year to the next, depending on rainfall.

» Association 3: *Kleinia longiflora – Enneapogon scaber* dwarf shrublands occupy most of the study area, especially on the higher-lying portions of the undulating landscape. Species composition is very diverse, but forb and low shrub composition varies to a high degree from one locality to the next, depending on localised geology, soil depth, surface rockiness and slope. Similarly, the presence of grasses and annuals is driven by rainfall during the season and the abiotic characteristics of a specific locality.

Ideally, of the three vegetation associations within the study area, the riparian woodlands of association 1 and plains adjacent to these woodlands of association 2 should be excluded from the development as much as possible due to their high

conservation value. Even on the undulating calcrete plains, ground disturbance should be minimised, and existing gravel roads and tracks used as far as possible to lower the extent of the footprint.

Annual and geophytic species have highly variable emerging patterns, depending on the timing and amount of rainfall received during a season. It is thus expected that the diversity of geophytic and annual species within the study area will be higher than could be determined during the survey.

Ideally, all riparian vegetation around natural vleis and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. The latter should cross where the lowest amount of indigenous trees are present. Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be taken.

The main negative impact from an ecological perspective will be due to loss of vegetation, loss of species of conservation concern, and loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E - Ecology Report** for more details).

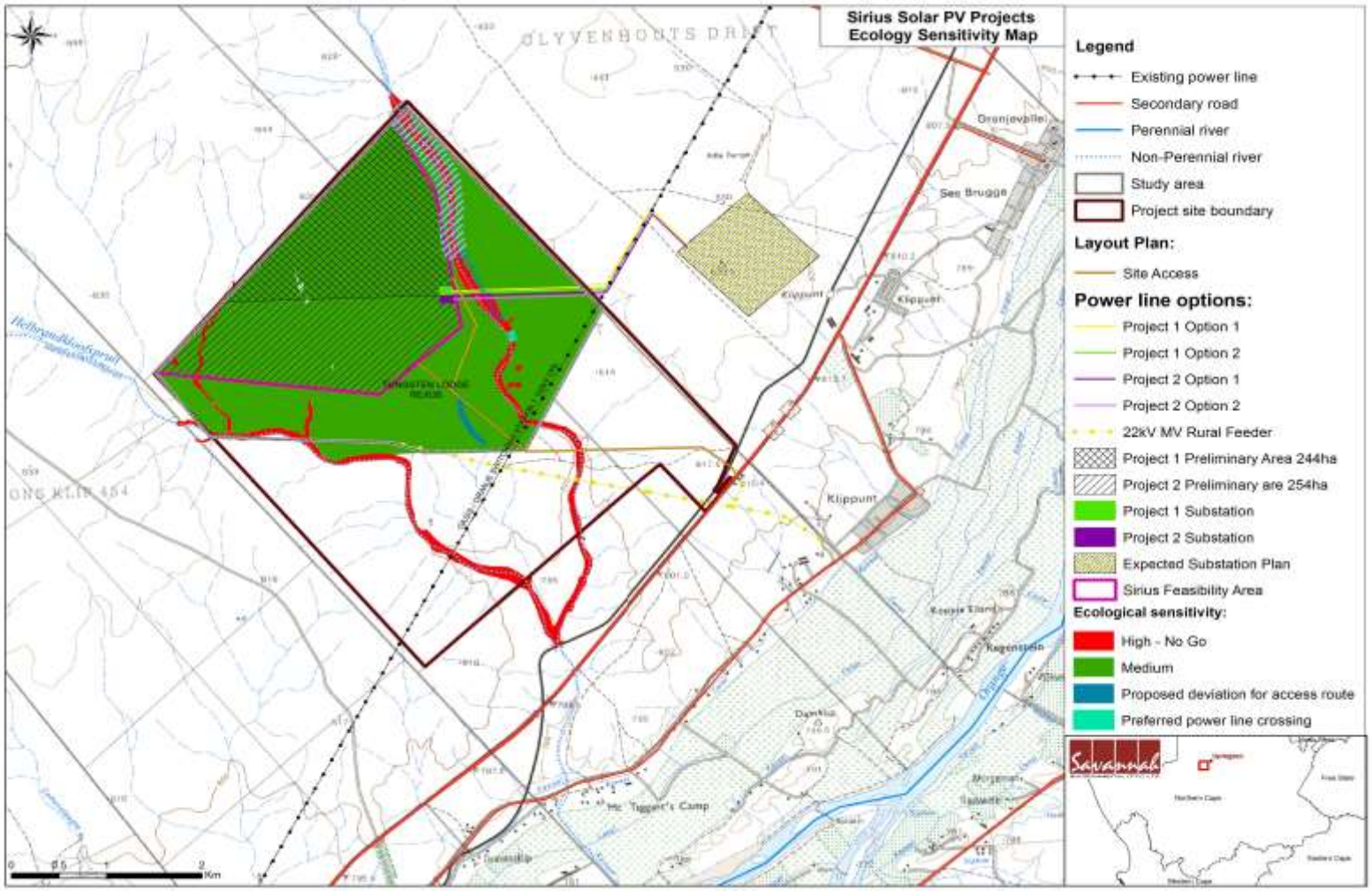

Figure 7.2: Vegetation map showing vegetation units within the proposed Sirius Solar PV Project Two

a) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase

Nature of the Activity: Note: relatively large access roads already exist on and to the land portion, however upgrading and/or creation of site access, internal maintenance roads and fences may cause impacts on ecology*: GN 544, 18 June 2010 activity 22(i)*. Impacts include: loss of vegetation, increase in runoff and erosion, possible distribution and increased establishment of alien invasive species, possible disturbance and reduction of habitat or injury to burrowing vertebrates, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of revegetation potential of soil surface, increase in dust levels.

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (50)**	**Medium (35)**
Status	Negative	Negative
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Yes	

Mitigation:

- » Avoid or reduce impact on all riparian vegetation around large intermittent rivers during the construction phase.
- » Ensure adequate drainage where the Helbrandskloofspruit tributary is crossed by infrastructure.
- » Design the access route to go as far as possible along existing tracks by doing the following:
  - * Following the main farm gravel road to position 28°34'00.5" S; 21°06'33.6" E
  - * From there upgrade the farm track to the abandoned farmhouse at position 28°33'39.8" S; 21°06'20.9" E
  - * Reduce further distances of the access track by combining access to the two development projects as much as possible
- » After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - * Protected plant species: must be relocated or obtain a permit for removal of the species.
  - * Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
- » During construction: create designated turning areas and strictly prohibit any off-road

driving or parking of vehicles and machinery outside designated areas
» Keep the clearing of natural and semi-natural grasslands to a minimum
» Dust levels must be controlled and minimised
» If filling material is to be used, this should be sourced from areas free of invasive species.
» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must (and can) be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
» Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas
» Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (erosion management plan required)
» Prevent leakage of oil or other chemicals or any other form of pollution, as this may infiltrate local groundwater reserves or end up in the Orange River where it can affect all downstream users
» Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
» After decommissioning, if access roads or portions thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable revegetation program

Cumulative impacts:
» Possible erosion of areas lower than the access road, possible contamination of groundwater reserves due to oil or other spillage
» Possible spread and establishment of alien invasive species
» Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns

Residual impacts:
» Localised loss of vegetation
» Altered topsoil conditions
» Potential barren areas remaining after decommissioning
» Potential for erosion and invasion by weed or alien species
» Potential for increased dust and its impact on surrounding environments and biodiversity

Nature of the Activity: Construction and operation of the PV panels may result in a loss of natural vegetation*: GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)*. Impacts could include: loss of vegetation and/or species of conservation concern, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in concentrated runoff from PV panels and higher volumes of stormwater and accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased flooding, severe erosion or dust due to lower buffering capacity of sparser vegetation.

	Without mitigation	***With mitigation***

Extent	Local (4)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (9)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (85)**	**High (70)**
Status	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Medium Probability
Can impacts be mitigated?	Reasonably but with limited full restoration potential	

Mitigation:

» As far as possible, avoid all riparian vegetation around natural vleis and large intermittent rivers

» During the design phase, ensure that a buffer of at least 100 m, preferably more, is maintained around all larger intermittent rivers and their riparian vegetation to maintain the species diversity and buffering capacity of these plains surrounding riparian vegetation

» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by ECO/construction staff to identify the relevant species and take the following actions:

  * Protected plant species: must be relocated or obtain a permit for the removal of these species.
  * Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor

» Keep construction areas to a minimum, strictly prohibit any disturbance outside the demarcated footprint area

» Clear as little vegetation as possible, aim to maintain all indigenous vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP

  - Shred all shrubs cleared and used the chips for dust and erosion control
  - use only species that were part of the original indigenous species composition as listed in the specialist report

» Use excavated materials to fill up and close old mining pits

» After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP

  - Revegetation should occur naturally where topsoils were not severely altered
  - The higher level of shading anticipated from fixed panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if vegetation fails to establish sufficiently.
  - Alternatively, soil surfaces where no revegetation seems possible will have to be

covered with gravel or small rock fragments to increase porosity of the soil surface, slow down runoff and prevent wind- and water erosion

- » Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum*
- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- » If filling material is to be used, this should be sourced from areas free of invasive species
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- » Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
- » Monitor the area below and around the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro-topography and revegetation efforts accordingly
  - o Due to the fixed nature and larger runoff surfaces of the PV panels, the development area should be adequately landscaped and rehabilitated to contain expected accelerated erosion
  - o Runoff may have to be specifically channeled or stormwater adequately controlled to prevent localised rill and gully erosion
- » Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
- » The rehabilitation plan for all affected areas after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover

Cumulative impacts:

- » If mitigation measures are not strictly implemented the following could occur:
  - * Considerable loss of biodiversity
  - * Possible accelerated erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
  - * possible contamination of drainage lines, lower-lying rivers or wetlands
  - * possible spread and establishment of invasive species
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
- » Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns

Residual impacts:

- » Positive impact: current old mine pits that are dangerous traps to fauna and man will be filled and covered
- » Altered topsoil characteristics
- » Loss of and alteration of microhabitats
- » Altered vegetation composition, lower vegetative cover and loss of species diversity
- » Potential for increased dust and its impact on surrounding environments and biodiversity

» Higher risk of invasion by alien plant species

Nature of the Activity: Construction of substation and other electricity-related buildings, workshops, offices, guardhouses, etc. *: GN 544, 18 June 2010 activity 10(i) and GN 546, 18 June 2010 activity 14(i)* may cause : loss of vegetation and/or species of conservation concern, loss of microhabitats, reduced vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (3)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Medium (40)**
Status	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» Avoid all riparian vegetation around natural vleis and large intermittent rivers
» During the design phase, ensure that a buffer of at least 100 m, preferably more, is maintained around all larger intermittent rivers and their riparian vegetation to maintain the species diversity and buffering capacity of these plains surrounding riparian vegetation
» Aim to minimise the destruction of indigenous large shrubs and trees
  - Shred all shrubs cleared and used the chips for dust and erosion control
» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by ECO/construction staff to identify the relevant species and take the following actions:
  * Protected plant species: must be relocated or obtain a permit
  * Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
» Limit disturbance to footprint area as far as practically possible
» During construction: stay within demarcated footprint areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
» Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately

- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
- Rehabilitate and re-vegetate all areas outside footprint area that have been disturbed
- After decommissioning remove all foreign material prior to starting the rehabilitation
- The rehabilitation plan for all temporarily affected areas and for the development area after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- If mitigation measures are not strictly implemented the following could occur:
  - Erosion of areas around sealed surfaces and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
  - Contamination of ground water resources and possibly the Orange River
  - Spread and establishment of invasive species
- Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
- Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics

Residual impacts:

- Altered topsoil characteristics
- Loss of microhabitats
- Reduced vegetation cover and loss of species diversity
- Potential for increased dust and its impact on surrounding environments and biodiversity

Nature of the Activity: Transport of materials to site, movement of vehicles on site during construction and maintenance may cause compaction of soils, possible contamination by oils or fuels, possible introduction and spread of weeds and alien invasives, temporary disturbance of terrestrial fauna*: GN 544, 18 June 2010 activity 10(i) and GN 545, 18 June 2010 activity 1*. Impacts may include: Loss of vegetation, increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species that could further damage ecosystem functionality

	Without mitigation	***With mitigation***
Extent	Regional (4)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)

Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (60)**	**Low (20)**
Status	Negative	Neutral
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- » Avoid all riparian vegetation around natural vleis and large intermittent rivers, and a buffer of at least 100 m around such areas
- » Strictly restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed
- » Parking areas should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary stormwater control) if oil and fuel spillages are highly likely to occur
- » Wheels of large machinery should be checked prior to entering the site and cleared of seed material of alien invasive plants if transport routes go through infested areas (especially of species with spiny or bur-like seeds). Such seed must be destroyed.
- » Strict speed limits must be set and adhered to
  - o Animals accidentally injured by moving vehicles or machinery must be taken to a local veterinarian to be treated or put down in a humane manner
- » Dust levels must be controlled and minimised
- » Driving between dusk and dawn should be permissible during emergency situations only
- » Prevent spillage of any, oils or other chemicals, strictly prohibit other pollution
- » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment

Cumulative impacts:

- » Possible pollution of surrounding areas if no mitigation is implemented
- » Possible spread of alien invasive species beyond the site if no mitigation is implemented
- » Possible increased road collisions and road kill of fauna

Residual impacts:

- » Related to access roads and internal maintenance tracks

Nature of the Activity: Impacts during the operational phase of the facility due to PV array components and their continued maintenance and eventual decommissioning and regular washing and possible breakage of panels*: GN 544, 18 June 2010 activity 10(i) and GN 545, 18 June 2010 activity 1*. Impacts include localised increase in runoff and accelerated erosion

	Without mitigation	***With mitigation***
Extent	Regional (4)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Probable (3)
Significance	**Medium (60)**	**Low (15)**
Status	Negative	Neutral
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- Where panels need to be washed, no polluting chemicals may be used, and the use of water should be minimal as well
- Where water is used for washing, monitor areas around the PV arrays for signs of accelerated erosion and establishment of weeds or alien invasive species and manage according to the erosion- and invasive species management plan
- Prior to construction and up to decommissioning, clear instructions must be drafted and at all times available on site on how any breakages of PV panels will be dealt with, including:
  - A list of possible toxic substances, heavy metals or other potentially harmful substances that could be released during breakage
  - How to contain and mitigate the release of such substances
  - Correct salvage, disposal and preferably also recycling methods (or possibilities) for any broken materials

Cumulative impacts:

- Possible pollution of surrounding areas and downstream rivers and wetlands if no mitigation is implemented
- Possible increase in and spread of alien invasive species beyond the site if no mitigation is implemented

Residual impacts:

- None expected if mitigation measures are implemented

b) Comparative Assessment of Power Line Alternatives

For the Sirius Solar PV Project Two, power line Alternative 2 is preferred from an ecological perspective.

Nature of the Activity: Construction of a power line as part of the grid connection – Alternative 2 (direct connection to 132 kV ESKOM line*): GN 544, 18 June 2010 activity 10(i)*

Preferred option on condition that the route follows the ecologically recommended site for

crossing the intermittent river

Environmental Aspect: Removal of vegetation – especially higher trees and shrubs, compaction of soils, temporary or permanent damage to animal burrows

Environmental impact: Loss of vegetation, potential loss of individuals of keystone species and associated microhabitats, increase in runoff and erosion, disturbance of burrowing animals

	Without mitigation	**With mitigation**
Extent (E)	Local (2)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Minor (2)	Small (0)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	**Medium (40)**	**Low (20)**
Status (positive, neutral or negative)	Negative	Slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- Design the route to cross the intermittent river and riparian vegetation at a point that has no *Acacia erioloba* or *Boscia albitrunca* trees, approximately at the position:
  - 28°33'17.63" S; 21°06'41.55" E
- Aim to minimise the destruction of indigenous large shrubs and trees
  - Shred all shrubs cleared and used the chips for dust and erosion control
- After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - Protected plant species: must be relocated or obtain a permit where affected by pylons, maintenance tracks or construction
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
  - For construction and maintenance access create jeep tracks only as far as is feasible
- Limit clearing of indigenous vegetation to pylon positions only
- Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution
- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts: » Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna)
Residual impacts: » Localised alteration of soil surface characteristics » Localised loss of flora and displacement of fauna

Nature of the Activity: Construction of a power line as part of the grid connection – Alternative 1 (connection to new ESKOM substation): *GN 544, 18 June 2010 activity 10(i) Acceptable option (will be larger footprint) on condition that the route follows the ecologically recommended site for crossing the intermittent river*		
Environmental Aspect: Limited removal of vegetation, compaction of soils, temporary or permanent damage to animal burrows		
Environmental impact: Loss of vegetation, increase in runoff and erosion, disturbance of burrowing animals		
	Without mitigation	**With mitigation**
Extent (E)	Local (2)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Minor (2)	Small (1)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	**Medium (40)**	**Low (24)**
Status (positive, neutral or negative)	Negative	Slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Design the route to cross the river at a point that has no Acacia erioloba or Boscia albitrunca trees, approximately at the position: o 28°33'17.63" S; 21°06'41.55" E » After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows o Protected plant species: must be relocated or obtain a permit where affected by pylons, maintenance tracks or construction o Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor		

- Aim to minimise the destruction of indigenous large shrubs and trees
  - Shred all shrubs cleared and used the chips for dust and erosion control
- During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
  - For construction and maintenance access create jeep tracks only as far as is feasible
- Limit clearing of indigenous vegetation to pylon positions only
- Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution
- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna)

Residual impacts:

- Localised alteration of soil surface characteristics
- Localised loss of flora and displacement of fauna

Nature of the Activity: Construction of a power line as part of the grid connection may cause loss of vegetation, increase in runoff and erosion, disturbance of burrowing animals *GN 544, 18 June 2010 activity 10(i).*

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (1)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (40)**	**Low (24)**
Status	Negative	Slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- Deviated the alternative 1 power line route to cross the river at a point that has no *Acacia erioloba* or *Boscia albitrunca* trees, approximately at the position:
  - 28°33'17.63" S; 21°06'41.55" E
- After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - Protected plant species: must be relocated or obtain a permit where affected by pylons, maintenance tracks or construction

∗ Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor » Aim to minimise the destruction of indigenous large shrubs and trees o Shred all shrubs cleared and used the chips for dust and erosion control » During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas ∗ For construction and maintenance access create jeep tracks only as far as is feasible » Limit clearing of indigenous vegetation to pylon positions only » Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
Cumulative impacts: » Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected
Residual impacts: » Localised alteration of soil surface characteristics » Localised loss of flora and displacement of fauna

c) Implications for Project Implementation

» Exclude all riparian vegetation around natural vleis and large intermittent rivers and maintaining a 100 m buffer around them, important ecosystem services of these ecosystems can be maintained. The latter should cross where the lowest amount of indigenous trees are present.

» Tributaries of the Helbrandkloofspruit occur on the western edge of the PV panel area for Project Two. This area is regarded as a no-go area and will require revision of the layout for Project Two during the detailed design stage. Placing a buffer of, for example 100 m onto such a system, would still not capture the entire system and therefore not adequately ensure the protection of the riparian zone. It is therefore recommended, due to the number of channels and drainage lines within the area, that a 1:100 year floodline calculation be conducted, and if possible using Lidar data.

» Access roads to the development should follow existing tracks as far as possible.

» The proposed photovoltaic facility development on the site will create a localised reduction of especially slow-growing indigenous trees and shrubs, geophytes and other species restricted to certain microhabitats. This effect is and will be further exacerbated by surrounding and regional developments. At this stage, however, it is not anticipated that the development will significantly lower the current conservation status of any species.

» Potentially significant negative impacts on the ecological environment could be soil- and associated degradation on and beyond the development area, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction. With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of these impacts can be significantly reduced.
» The impact on fauna is expected to be small for the development, but may become more of an issue if the cumulative impact of all surrounding developments is considered. Presence of indigenous terrestrial vertebrates within the study area is relatively low due to absence of permanent surface water. Animals that may be permanently present can be relocated or will move away during construction, and may resettle after construction, depending on safety specifications necessitated by the development. No restricted or specific habitat of vertebrates exists on the study area and will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas as recommended.

7.1.2 Potential Impacts on Soils and Agricultural Potential

The components of the project that can impact on agricultural resources and productivity include:

» The footprint of the facility.
» Constructional activities that disturb the soil profile, for example for levelling, excavations, etc.

The infrastructure footprint includes the PV arrays, power line connection to the Eskom grid which includes a short section beyond the farm boundary. The most important factor that influences the significance of agricultural impacts is the fact that the site is proposed on land which has limited agricultural potential and is classified as non-arable, low potential grazing land.

Four potential negative impacts of the development on agricultural resources and productivity were identified as:

* Loss of agricultural land use caused by direct occupation of land by the energy facility footprint (medium significance with and without mitigation).
* Soil Erosion caused by alteration of the surface run-off characteristics (medium significance without, but low with mitigation).
* Loss of topsoil in disturbed areas, causing a decline in soil fertility (low significance with and without mitigation).
* Degradation of veld due to vehicle trampling and dust deposition (low significance with and without mitigation).

One potential positive impact of the development on agricultural resources and productivity was identified as:

* Generation of alternative land use income through rental for energy facility on agriculturally unproductive land. This will provide land owners with increased rural livelihood (medium significance with and without mitigation).

b) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase

Nature: Loss of topsoil caused by*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)* poor topsoil management during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.). Effects could include loss of soil fertility on disturbed areas after rehabilitation.		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Short (2)	Short (2)
Magnitude	Minor (3)	Minor (2)
Probability	Probable (3)	Very improbable (1)
Significance	**Low (18)**	**Low (5)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Strip and stockpile topsoil from all areas where soil will be disturbed. » After cessation of disturbance, re-spread topsoil over the surface. » Dispose of any sub-surface spoils from excavations where they will not impact on agricultural land, or where they can be effectively covered with topsoil.		
Cumulative impacts: None		
Residual impacts: None		

Nature: Degradation of veld vegetation due to trampling by vehicles and deposition of dust*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)*		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site

Duration	Short (2)	Short (2)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Improbable (2)
Significance	**Low (15)**	**Low (8)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Minimize road footprint and control vehicle access on roads only. » Control dust as per standard construction site practice.		
Cumulative impacts: None		
Residual impacts: Low		

Nature: Loss of agricultural land due to direct occupation of land by footprint of solar energy facility infrastructure*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)*		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Small (1)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**Medium (30)**	**Medium (30)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Cumulative impacts: The overall loss of agricultural land in the region due to other developments. The significance is low due to the extremely limited agricultural potential of the development sites in the area.		
Residual impacts: No mitigation possible so same as impacts without mitigation		

Nature: Generation of alternative land use income for landowner*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)*		
	Without mitigation	**With mitigation**

Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Minor (3)	Minor (3)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (32)**
Status	Positive	Positive
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Cumulative impacts: None		
Residual impacts: None		

Nature: Soil Erosion*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)* Caused by: alteration of run-off characteristics due to panel surfaces and access roads. Effects include loss and deterioration of soil resources. There is fairly low risk of erosion due to the very gentle slopes and mostly rocky soils which occur on the site.		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Low (5)	Minor (3)
Probability	Probable (3)	Very improbable (1)
Significance	**Medium (30)**	**Low (8)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Implement an effective system of run-off control which collects and disseminates run-off water from hardened surfaces and prevents potential down slope erosion. This should be in place and maintained during all phases of the development.		
Cumulative impacts: None		
Residual impacts: Low		

b) Comparative Assessment of Power Line Alternatives

Alternative power line connections to the Eskom grid are proposed, however because power lines have a negligible footprint and impact under the agricultural conditions on site, there are no significant differences between the alternatives in terms of their agricultural impact. Both Alternatives are acceptable from a soils perspective.

c) Implications for Project Implementation

» The development will have low to medium negative impact on agricultural resources and productivity, but it will also deliver low to medium positive impacts on agriculture.
» Grazing (current land use) will be able to continue unaffected on all other parts of the farm for the duration of the project.
» The significance of agricultural impacts is influenced by the fact that the solar panel sites have extremely limited agricultural potential. The farm has a land capability classification of class 7, non-arable, low potential grazing land.
» Soils are predominantly shallow Mispah soils on underlying rock with only small interspersed pockets of deeper Hutton soils between them.
» Measure to protect soils to be included in the EMPr.

7.1.3 Assessment of Potential Impacts on Water Resources

A number of sensitive areas within and adjacent to the proposed site were identified. From an aquatic systems point of view most these were associated with dry river beds and riparian zones. Therefore all the dry river beds and the associated riparian systems (refer to **Figure 7.3**) would be rated as extremely sensitive to development, in particular the mainstream systems such as Helbrandkloofspruit. Tributaries of the Helbrandkloofspruit does occur on the western edge of the PV panel area for Project Two.

When mapping these systems, it became evident that the active channel could not be used to define the lateral extent of the river system. Due to the nature of the soils and geomorphology, these systems are able to form various meanders within the greater landscape. Placing a buffer of, for example 100 m onto such a system, would still not capture the entire system and therefore not adequately ensure the protection of the riparian zone. It is therefore recommended, due to the number of channels and drainage lines within the area, that 1: 100 year floodline delineation be conducted, and if possible using Lidar data.

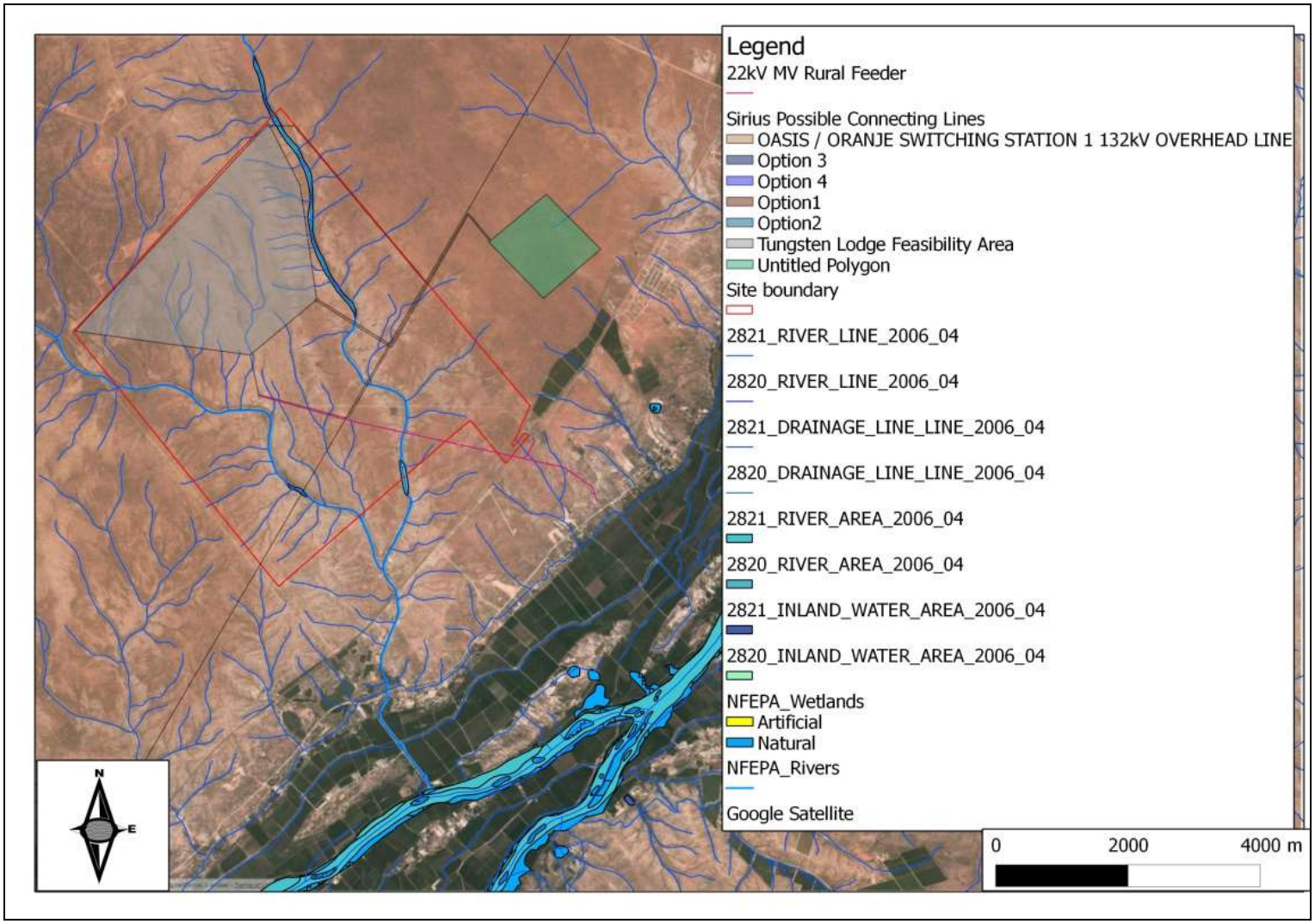

Figure 7.3: Water Resources sensitivity map for the proposed Sirius Solar Project and surrounding areas

d) Water Resources impacts associated with the construction and operation phase of the proposed facility

Riparian zones

The riparian zone component includes the functional or ecosystem services importance of the dry river beds and riparian zones on site and how the proposed development would affect the riparian environment.

Nature: Loss of riparian systems*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 18(i);GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)*

The physical removal of the narrow strips of woody riparian zones, being replaced by hard engineered surfaces. This biological impact would however be localised, as a large portion of the remaining farm and the Helbrandleegte and Helbrandkloofspruit catchment would remain intact.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:
The most significant form of mitigation would be to select a development area, which contained no dry river beds. The proposed layout should thus be developed where these areas are avoided.

Cumulative impacts:
None

Residual impacts:
Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

Nature: Impact on dry riverbeds and localised drainage systems*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 18(i);GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)*

The physical removal of narrow strips of woody riparian zones being replaced by hard engineered surfaces will alter the hydrological nature of the area, by increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils. This impact would however be localised, as a large portion of the remaining farm and the Helbrandleegte /Helbrandkloofspruit catchment would remain intact.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:
The most significant form of mitigation would be to select a development area, which contained no dry river beds. The proposed layout should thus be developed where these areas are avoided. Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments and reduce flow velocities.

Cumulative impacts:
The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels and however the annual rainfall figures are low.

Residual impacts:
Diversion of run-off away from downstream systems is unlikely to occur as the annual rainfall figures are low.

Nature: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 18(i);GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)*

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)

Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (19)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments, and reduce flow velocities (e.g. water used when washing the mirrors).		
Cumulative impacts: Downstream alteration of hydrological regimes due to the increased run-off from the area.		
Residual impacts: Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.		

Nature: Increase in sedimentation and erosion within the development footprint*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 18(i);GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)*		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (1)	Low (1)
Probability	Definite (5)	Probable (3)
Significance	**Medium (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins or other energy dissipation measures to capture large volumes of run-off, trap sediments and reduce flow velocities (e.g. water used when washing the mirrors).		
Cumulative impacts: Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream will then be washed into the Gariep River.		

Residual impacts: During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream will then be washed into the Gariep River.

Nature: Physical disturbance by the supporting infrastructure on the riparian environment*: GN 544, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 11(xi); GN 544, 18 June 2010 18(i);GN 544, 18 June 2010 activity 22(i); GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)* The proposed power lines will have limited to no impact on the functioning of any riparian systems.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (3)
Probability	Definite (5)	Probable (3)
Significance	**Medium (55)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: Care should however be taken that if any clearing is done, that this area is monitored for plant re-growth, firstly to prevent alien plant infestations and to ensure no erosion or scour takes place. All towers for the power lines should be outside of any flood lines or dry river beds		
Cumulative impacts: Additional downstream erosion and sedimentation of the Gariep River.		
Residual impacts: During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) will further increase the suspended sediment loads within the Gariep River system.		

Gariep River - Flow and quality issues

The flow and quality component focuses on the impact of the development on the availability of the water resources of the area, particularly from the regional context of the Lower Gariep River system.

The distance of the proposed facility from the Gariep River (approximately 3 km) will reduce the risk of contaminated run-off polluting the Gariep River. However the drainage lines or ephemeral streams such as the Helbrandleegte &

Helbrandkloofspruit within the site would increase this risk during rainstorms and local flash floods which normally occur during the summer months.

e) Comparative Assessment of Power Line Alternatives

Both the power lines alternatives cross the Helbrandleegte spruit and it may be possible to span the power line across the spruit to limit impact on it. It is assumed that pylons will be placed outside of any watercourse (dry river beds) and they would thus have a no direct impact on the aquatic environment, therefore both Alternative 1 and Alternative 2 can be developed.

f) Implications for Project Implementation

» With suitable mitigation and implementation of the proposed layout, the development should have limited impact on the overall status of the riparian systems on the site and immediate surrounds.
» A flood line calculation study (determination of the 1:100 year flood line) to be undertaken by the developer to inform the final development footprint.
» By excluding all riparian vegetation around natural vleis and large intermittent rivers and maintaining a 100 m buffer around them, important ecosystem services of these ecosystems can be maintained. Placing a buffer of, for example 100 m onto such a system, would still not capture the entire system and therefore not adequately ensure the protection of the riparian zone. It is therefore recommended, due to the number of channels and drainage lines within the area, that a 1:100 year floodline be conducted, and if possible using Lidar data. This will inform the detailed design of the project.
» All impacts on water courses that were assessed as being of moderate significance could readily be reduced to low significance by appropriate mitigation.

7.1.4 Assessment of Potential Impacts on Heritage Resources

The results of the Phase 1 AIA and heritage survey undertaken showed that there are four heritage sites:

» Site 001 - This is a small scattering of Late Stone Age microlithic stone tools located on the edge of a small pan which is currently being used as a loading ramp for a small livestock enclosure and watering trough. The location did not display any characteristics of being either a manufacturing or occupational site. It is possible that the site occurred as a result of the small pan although its occurrence might be ephemeral. Mostly fully formed re-worked microliths were recovered from a general density of around one tool per 3 m^2. One partial

blade was recovered while no cores could be seen. The concentration of tools seemed to be limited to an 8m X 5m.

» Site 002 - This site consists of two areas containing microlithic LSA tools. The one area produced a single prepared percussion level core although no further evidence of manufacturing could be identified. As with Site 001 the concentrations were 2-3m2 to one tool. Investigations of animal burrows showed no signs of sub-surface deposits. The area was characterised by quartz outcrops manifested in linear concentrations of quartz deposits. The rest of the site is characterised by low shrub and red sand substrates.

» Sit 003 - This site is located on the edge of a run-off ditch. It only consisted of a few LSA artefacts with no further deposits. This find is most likely the result of alluvial run-off.

» Site 004 - The remains of a holiday resort are located on the Farm Tungsten Lodge. Most of the buildings are in a state of decay. The site was the original Tungsten Lodge and forms part of the Built Environment. Although the site is not older than 60 years it is prominent enough to possible have some cultural significance.

a). Heritage impacts associated with the construction and operation phase of the proposed facility

Pre-Contact Sites: Due to the small amount of stone tools identified on these sites and the distinct absence of flakes and cores it is very possible that the finds here were displaced from another area as a result of the water flow action. These stone tool are neither unique nor concentrated enough to warrant preservation of these sites.

***Nature of Impact**:* Possible pre-contact Stone Age site could be damaged locally by excavation activities and associated activities*: GN 5444, 18 June 2010 activity 10(i); GN 544, 18 June 2010 activity 22(i) and GN 545, 18 June 2010 activity 1*		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (2)
Duration	Long term (5)	Long term (5)
Magnitude	Low (1)	Low (1)
Probability	Improbable (1)	Improbable (1)
Significance	**Low (8)**	**Low (8)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resource	No	No
Can impacts be mitigated	Yes	Yes
Mitigation	Should some appropriate tertiary institute need representative samples of the stone tools located on LSA sites they should be allowed to perform a surface	

	collection of materials located here.
Cumulative impacts	The growth of renewable energy plants in the Northern Cape could result in a compounding effect as to regards the loss of Stone Tools.
Residual impacts	Loss of low significance heritage related information.

b) Built Environment:

Site 004, the remains of a holiday resort are located on the Farm Tungsten Lodge is located on the north-western boundary of the study area. This was however found to be the remains of the Tungsten Lodge for which construction was initiated in 2000 and therefore it holds no heritage significance. Several other smaller built structures of recent nature, such as single room houses and concrete reservoirs are located in the study area, however according to the owner none of these are of historic nature or older than 60 years..

c) Palaeontology

The proposed project falls within the Kalahari sediments and calcretes have low fossil potential, but possibility of fossils being encountered in diggings cannot be totally excluded. The area is characterised by deep sands and sandy soil covering calcrete and very old non-fossiliferous igneous and metamorphic rocks. The area is characterised by deep sands and sandy soil covering calcrete and very old non-fossiliferous igneous and metamorphic rocks. The findings of the scoping study showed that there is a very low likelihood that fossils will be found in the study. An exemption letter to undertake further studies during the EIA phase was issued by the specialist and SAHRA refer to Appendix I.

d) Comparative Assessment of Power Line Alternatives

The two alternative power line alignments for Project Two were investigated. The alignments roughly follow the same route there is no preferred alignments as their impact will be similar. Alternative 2 connects to the existing infrastructure earlier than Alternative 1 and therefore the impact of Alternative 2 for Project Two should be conceivably less than the impact of Alternative 1. No important sites were identified in these alignment corridors or on the sub-station site.

e). Implications for Project Implementation

» Based on the Phase 1 Archaeological Impact Assessment (AIA) study and survey it was found that no significant heritage sites occur on the site.
» In some areas, four areas of light concentration of stone tools were recorded. These are however very common in the Northern Cape Province and the areas

contained on of the other defining characteristics of unique Stone Age sites. It was found that none of the tool concentration warranted protection or mitigation action. The occurrence of these Stone Tools strongly suggests that a better-defined site could be located nearby or very well sub-surface. Due to the area's close proximity to the Orange River, it is prone to alluvial deposits that could burry any Stone Age sites.

» It is recommended that a suitably qualified heritage practitioner be appointed by the developer to perform periodic inspections of excavated materials (preferably fortnightly) to ensure than no sub-surface sites be damaged.
» Due to the unlikelihood that fossils will be found in the study area it has been recommended that no additional Palaeontological studies is required and this has been considered by SAHRA.

7.1.5 Assessment of Potential Visual Impacts

The result of the cumulative viewshed analyses for Project One and Two of the proposed facility is shown in Figure 7.4. The proposed facility has a relatively contained core area of potential visibility (i.e. within a 2.5km radius of the site). This area of exposure is generally restricted to the farm earmarked for the development itself, the neighbouring solar energy facility developments and vacant natural land.

» Visibility in the 2.5km to 5km zone surrounding the proposed development site is scattered and generally interrupted due to the undulating nature of the topography, and the generally constrained vertical dimensions of the proposed structures. Most of this area of exposure falls within vacant land, with only a short section (approximately 2.7km in length) that may include exposure from the N14 national road.
» Visibility subsides drastically beyond a 5km radius with only limited exposure expected to the west and south-west of the site. The exception is where the facility may be exposed from the south-eastern banks of the Orange River and adjacent areas. This area includes a section of the R359 arterial road that may be exposed to the facility for almost 10km. Exposure may be possible from this road and adjacent residences, but is generally expected to be at distances exceeding 8km from the proposed development site.
» Visibility beyond a 10km radius from the development site is expected to be highly unlikely due to the distance between the object (development) and the observer.
» It is envisaged that the structures (where visible from shorter distances) may constitute a high visual prominence, potentially resulting in a high visual impact.

» It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CPV structures (solar troughs, heliostats and central receiver) of the Abengoa (!Khi) solar energy facility, is expected to generally dominate the observer's frame of view.

It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CPV structures (solar troughs, heliostats and central receiver) of the Abengoa (!Khi) solar energy facility and the Eskom CSP, are expected to generally dominate the observer's frame of view. The visual exposure maps of both these facilities are shown below, displaying much larger areas of potential visual exposure when compared to the Sirius Solar PV structures.

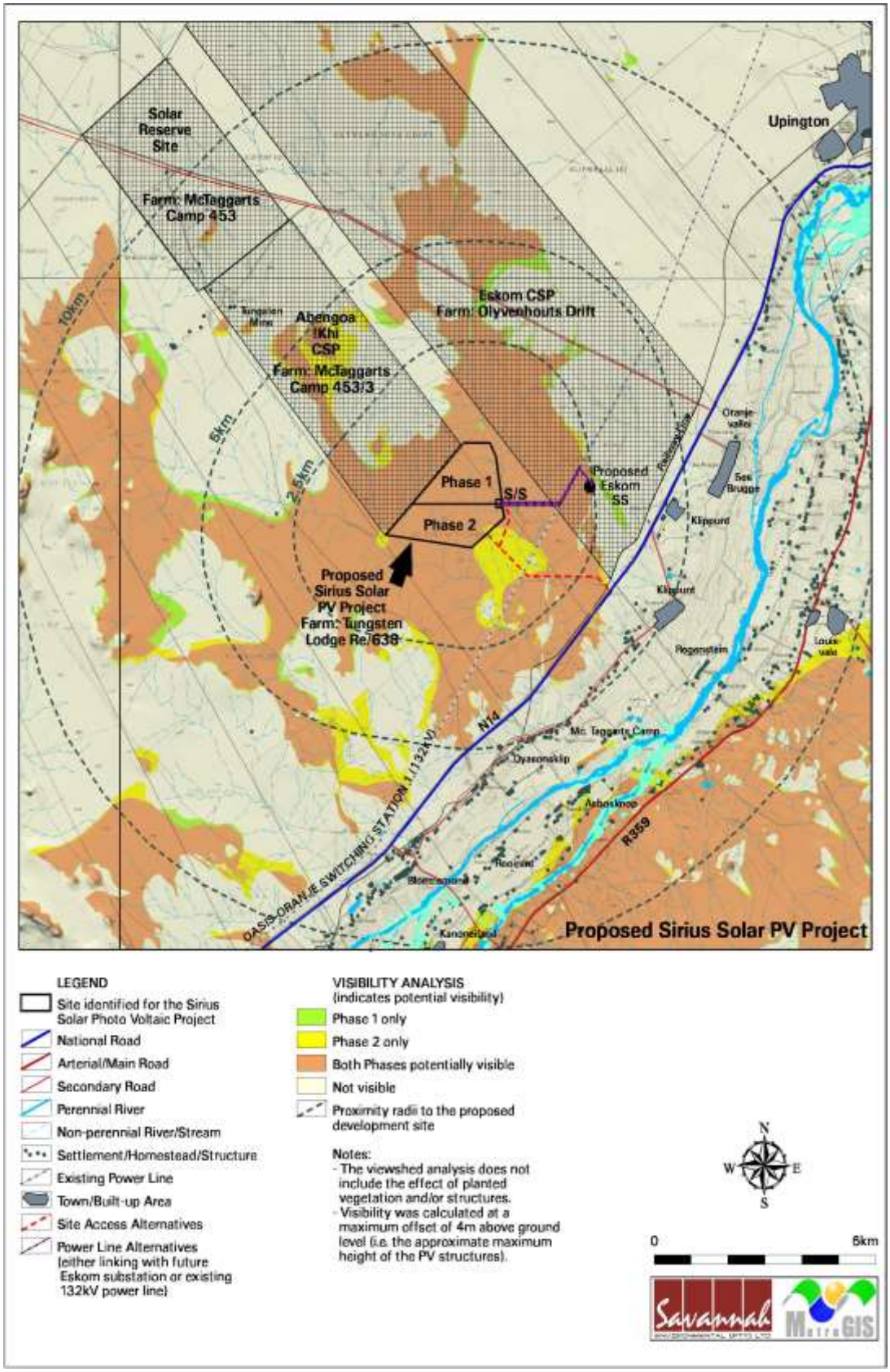

Figure 7.4: Potential visual exposure of the proposed Sirius Solar PV Project

Visual Impact Index

The combined results of the visual exposure, viewer incidence/perception and visual distance for Project One and Two of the proposed Sirius solar energy facility are displayed in **Figure 7.5** below.

The following is of relevance:

» The visual impact index map indicates a core zone of **moderate** visual impact within a 2.5km radius from the facility (both projects), where the facility may be visible from land generally devoid of sensitive visual receptors (i.e. vacant natural land). A large section of this area also falls within the farms earmarked for the Abengoa and Eskom solar energy facilities and associated infrastructure (e.g. the Eskom substation site).
» There are no homesteads or residences located within this zone.
» The potential visual exposure within the 2.5km to 5km zone from the solar energy facility (both projects) is expected to have a **low** visual impact, where sensitive visual receptors are generally absent, but may be **moderate** along a section of the N14 national road. The Sirius Solar PV facility may be visible from this section of road, although it is more likely that the power tower from the !Khi (Abengoa) CSP (situated behind the PV facility) would attract more attention.
» The visual impact beyond 5km and up to 10km from the solar energy facility, is expected to be **very low**, but may potentially be **low** where observers are present. There are a number of homesteads located within this zone (south-east of the Orange River), as well as a section of the R359 arterial road.
» Visibility beyond 10km from the proposed development is expected to have a **negligible** visual impact.

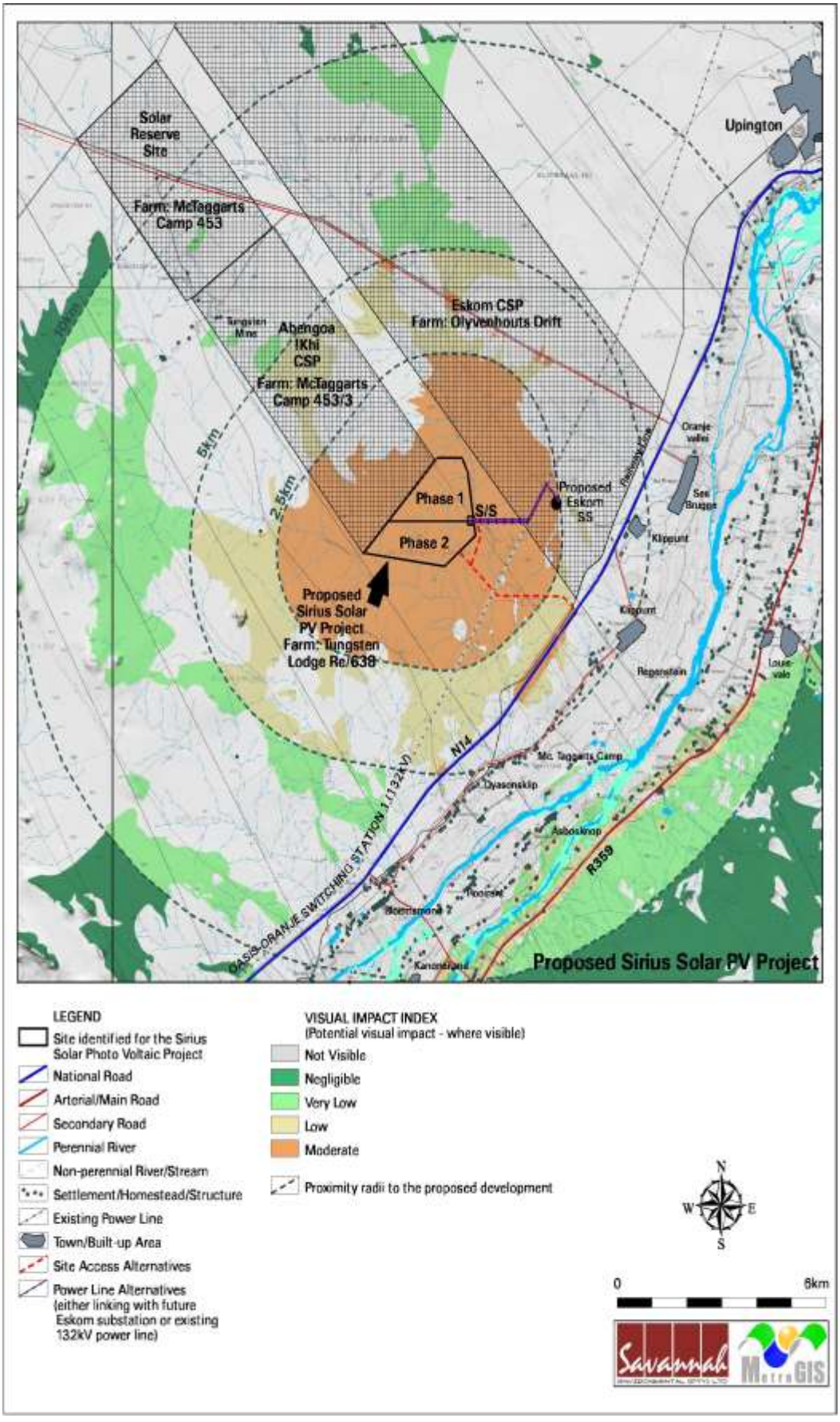

Figure 7.5: Visual impact index of the proposed Sirius Solar PV project

b) Impact tables summarising the significance of visual impacts of the PV facility during the construction and operation

During construction, there will be a noticeable increase in heavy vehicles utilising the national road and district road to the development sites (both projects). This increase in traffic and the construction activities on the site is expected to have a moderate visual impact on observers travelling along these roads.

Special programmes need to be followed to rehabilitate disturbed land after construction. It is therefore imperative that the unnecessary removal of vegetation during construction must be avoided at all cost. Appropriate measures to rehabilitate cleared areas after construction, must be carried out.

***Nature of Impact**:* Visual impact of construction on sensitive visual receptors*: GN 544, 18 June 2010 activity 10(i), GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i).*		
	Without Mitigation	***With Mitigation***
Extent	Local (4)	Local (4)
Duration	Short Term (2)	Short Term (2)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (42)**	**Moderate (36)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: » Ensure that vegetation is not unnecessarily cleared or removed during the construction period. » Reduce the construction period through careful logistical planning and productive implementation of resources. » Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. » Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. » Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. » Reduce and control construction dust through the use of approved dust suppression techniques as and when required, especially on the dirt road giving access to the site (i.e. whenever dust becomes apparent). » Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works.
Cumulative impacts: None.
Residual impacts: None

The solar energy facility could potentially have a moderate visual impact on road users travelling along the N14 national road traversing south-east of the facility.

Nature of Impact: Visual impact on users of the N14 national road in close proximity to the proposed solar energy facility*: GN 544, 18 June 2010 activity 10(i), GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i).*		
	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (42)**	**Low (24)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

General mitigation/management: Planning: » Retain and maintain natural vegetation in all areas outside of the development footprint. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the facility. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of the solar energy facility is expected to increase the cumulative visual impact within the immediate area, considering the visual exposure of the much taller structures associated with the approved solar energy facility at this locality. Alternatively, the close proximity of the proposed facilities to each other consolidates the potential visual exposure of solar energy generation infrastructure within a development node, thereby avoiding the proliferation of similar developments within the region. It further allows for the effective connection with the power grid without incurring any additional expanded visual impacts and generally encourages the sharing of infrastructure (e.g. the proposed Eskom substation).
Residual impacts: The visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.

Potential visual impact on residents of homesteads in close proximity to the proposed solar energy facility**: .**No homesteads of farm residences were identified within close proximity (4km radius) of the proposed solar energy facility. This visual impact is therefore expected to be of no consequence.

The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond the 5km radius) is expected to be **low** for the proposed solar energy facility, both before and after the implementation of mitigation measures.

Nature of Impact: Visual impact on sensitive visual receptors within the region*: GN 544, 18 June 2010 activity 10(i), GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i).*.		
	Without mitigation	***With Mitigation***
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (22)**	**Low (11)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)

Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

General mitigation/management:

Planning:

» Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the facility.

» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.

» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the solar energy facility is expected to increase the cumulative visual impact within the region, considering the visual exposure of the much taller structures associated with the approved solar energy facility at this locality. Alternatively, the close proximity of the proposed facilities to each other consolidates the potential visual exposure of solar energy generation infrastructure within a development node, thereby avoiding the proliferation of similar developments within the region. It further allows for the effective connection with the power grid without incurring any additional expanded visual impacts and generally encourages the sharing of infrastructure (e.g. the proposed Eskom substation).

Residual impacts:

The visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.

Lighting Impacts: Lighting impacts relate to the effects of glare and sky glow. The source of glare light is unshielded luminaries which emit light in all directions and which are visible over long distances.

Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. It is possible that the PV plant may contribute to the effect of sky glow within the environment which is currently undeveloped.

Mitigation of direct lighting impacts and sky glow entails the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for the solar energy facility and the ancillary infrastructure (e.g. workshop, storage facilities and substation) will go far to contain rather than spread the light.

Nature of Impact: Visual impact of lighting on sensitive visual receptors*: GN 544, 18 June 2010 activity 10(i), GN 545, 18 June 2010 activity 1 and GN 546, 18 June 2010 activity 14(i)..*		
	Without mitigation	***With Mitigation***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (42)**	**Low (24)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: » Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); » Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; » Making use of minimum lumen or wattage in fixtures; » Making use of down-lighters, or shielded fixtures; » Making use of Low Pressure Sodium lighting or other types of low impact lighting. » Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes		
Cumulative impacts: The development of two projects for the facility will contribute to an increase in light sources within the region, and as a result an increase in lighting impact at night.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

b) Comparative Assessment of Power Line Alternatives

The two overhead power line alternatives are expected to have a **negligible** visual impact when viewed against the backdrop of the much more prominent PV structures and the existing and future infrastructure (e.g. CSP facilities, Eskom substation, etc.) proposed for this area.

The alternatives proposed for the Sirius Solar PV facility are not expected to yield differing viewshed analyses results, due to their location immediately adjacent and parallel to each other. From a visual impact perspective the shortest route i.e. alternative 2. This is based purely on the premise that the shorter the line, the lower the potential visual impact. The area surrounding the proposed power line

infrastructure is also generally devoid of sensitive visual receptors, further lowering the risk of potential visual impact.

c). Implications for Project Implementation

The findings of the Visual Impact Assessment undertaken for Project One and Two of the Proposed Sirius Solar Photovoltaic Facility is that the visual environment surrounding the site, especially within a 2.5km - 5km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years).

The proposed facility would be visible within an area that may incorporate certain sensitive visual receptors. These primarily include users of the N14 national road traversing near the proposed development. The following is a summary of impacts remaining, assuming mitigation as recommended is exercised:

» The solar energy facility could potentially have a moderate visual impact on road users travelling along the N14 national road traversing south-east of the facility. This impact may be mitigated to low.
» The potential visual impact on residents of homesteads in close proximity to the solar energy facility is expected to be negligible due to the general absence of settlements and residences in close proximity (4km radius) of the proposed solar energy facility.
» The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond a 5km radius) is expected to be low for the proposed solar energy facility, both before and after the implementation of mitigation measures.
» The potential visual impact of construction activities on sensitive visual receptors within close proximity to the proposed solar energy facility is likely to be of moderate significance, both before and after the implementation of mitigation measures.
» The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of moderate significance and may be mitigated to low.
» Measures to limit visual impacts and lighting impacts/ scarring of the landscape are to be included in the EMPr.

The anticipated visual impacts listed above (post mitigation measures) are on average expected to be of **low** to **moderate** significance. The solar energy facility development is not considered to be fatally flawed from a visual perspective.

7.1.6 Assessment of Potential Social Impacts

The key social issues associated with the construction phase include:

Potential positive impacts

» Creation of employment and business opportunities and opportunity for skills development and on-site training

Potential negative impacts

» Impacts associated with the presence of construction workers on site
» Threat to safety and security of farmers associated with the presence of construction workers on site
» Increased risk of stock theft, poaching and damage to farm infrastructure associated with presence of construction workers on the site
» Increased risk of veld fires associated with construction-related activities
» Impact of heavy vehicles, including damage to roads, safety, noise and dust
» Potential loss of grazing land associated with construction-related activities.

The key social issues associated with the operational phase include:

» Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
» Benefits associated with the establishment of a Community Trust;
» The establishment of infrastructure to generate renewable energy.

b) Impact tables summarising the significance of Social impacts of the PV facility during the construction and operation

Nature of Impact: Creation of employment and business opportunities during the construction and operation phase*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*		
	Without Mitigation	***With Enhancement***
Extent	Local – Regional (2)	Local – Regional (3)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (36)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	
Enhancement : In order to enhance local employment and business opportunities associated with the		

construction phase the following measures should be implemented:

Employment

» Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
» Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;
» Before the construction phase commences the proponent and its contractors should meet with representatives from the KGLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.
» The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase.
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

» The proponent should seek to develop a database of local companies, specifically Broad Based Black Economic Empowerment (BBBEE) companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;
» The proponent, in consultation with the KGLM and the local Chamber of Commerce, should identify strategies aimed at maximising the potential benefits associated with the project.

Cumulative impacts: Opportunity to up-grade and improve skills levels in the area.

Residual impacts: Improved pool of skills and experience in the local area.

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*

	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STD's etc. (5)	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STD's etc. (5)

Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STD's etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STD's etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27) Moderate-High for specific individuals who may be affected by STD's etc. (57)**	**Low for the community as a whole (24) Moderate-High for specific individuals who may be affected by STD's etc. (51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Mitigation:

» Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks;

» The proponent should consider the establishment of a Monitoring Forum (MF) for the construction phase. The MF should be established before the construction phase commences and should include key stakeholders, including representatives from the local community, local councillors, farmers, and the contractor. The role of the MF would be to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should also be briefed on the potential risks to the local community associated with construction workers;

» The proponent and the contractors should, in consultation with representatives from the MF, develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation;

» The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;

» The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;

» The contractor should make necessary arrangements to enable workers from outside

the area to return home over weekends and or on a regular basis during the 18 month construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks;

» The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. This would reduce the risk posed by non-local construction workers to local family structures and social networks;

» As per the agreement with the local farmers in the area, no construction workers, will be permitted to stay overnight on the site. Security personnel will be housed in the vicinity of the site.

Cumulative impacts:

Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community. The development of other solar energy projects in the area may exacerbate these impacts.

Residual impacts:

Community members affected by STDs etc. and associated impact on local community and burden services etc.

Nature: Potential safety and security risk posed by presence of construction workers on site*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*

	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (21)**
Status	Negative	Negative
Reversibility	No, if local residents are murdered or physically harmed	No, if local residents are murdered or physically harmed
Irreplaceable loss of resources?	Yes, if family member is murdered	Yes, if family member is murdered
Can impact be mitigated?	Yes	Yes

***Mitigation*:**

» The proponent should liaise with the KGLM with regard the need to establish a Monitoring Forum (MF) for the construction phase. The MF should be established before the construction phase commences and should include key stakeholders, including representatives from local municipality, the local community, local

councillors, and the contractor. The role of the MF would be to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should also be briefed on the potential risks to the local community associated with construction workers; » The proponent and the contractors should, in consultation with representatives from the MF, develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation; » The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for ensuring that construction workers respect the rights of local farmers and do not pose safety and security threat to them and their families.
Cumulative impacts: No
Residual impacts: Include psychological effects associated with attacks or crime related events that may last for many years.

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*		
	Without Mitigation	***With Mitigation***
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate due to reliance on livestock for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and losses and damage etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: » Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas; » No smoking on the site, except in designated areas should be permitted;		

» Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include clearing working areas and avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months;
» Contractor should provide adequate fire fighting equipment on-site;
» Contractor should provide fire-fighting training to selected construction staff;
» As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms.
» The contractor should also compensate the fire fighting costs borne by farmers and local authorities.

Cumulative impacts: No, provided losses are compensated for.

Residual impacts: Potential loss of income and impact on livelihoods and economic viability of affected farms.

Nature: Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*

	Without Mitigation	***With Mitigation***
Extent	Local-Regional (2)	Local-Regional (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

» Drivers should be made aware of the potential risk posed to school children and other residents in Klipsloot. All drivers must ensure that speed limit of 60 km per hour is enforced along the section of the N14 that runs past Klipsloot;
» Abnormal loads along the N14 should be timed to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc.;
» The contractor must ensure that all damage caused to the internal access road by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be

borne by the contractor;
» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers;
» All vehicles must be road-worthy and drivers must be qualified, made aware of the potential road safety issues, and need for strict speed limits.

Cumulative impacts: If damage to roads is not repaired then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were no responsible for the damage.

Residual impacts: Reduced quality of road surfaces and impact on road users

Nature: Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*

	Without Mitigation	***With Enhancement***
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**High (65)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	

Enhancement:
» The proponent in consultation with the KGLM should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community;
» The proponent in consultation with the KGLM should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the community trust from the SEF are managed for benefit of the community as a whole and not individuals within the community.

Cumulative impacts: Promotion of social and economic development and improvement in the overall well-being of the community

Residual impacts: Investment in local economic development in the area that would benefit the community post operational phase

***Nature:* Development of** clean, renewable energy projects in South Africa*: GN 544, 18 June 2010 activity 1(i) and GN 545, 18 June 2010 activity 1*		
	Without Mitigation	***With Mitigation*** (The provision of renewable energy infrastructure is in itself a mitigation measure)
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	
Enhancement: • Use the project to promote and increase the contribution of renewable energy to the national energy supply; • Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.		
Cumulative impacts: Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: Not applicable after decommissioning		

b) Comparative Assessment of Power Line Alternatives

The social impacts associated with alternative 1 and 2 are likely to be low as they do not impact on residential structures. However, given the shorter distances associated with alternative 2, alternative 2 is the preferred power line option.

c). Implication for project implementation

» The findings of the SIA indicate that the development of the proposed Sirius solar energy facility will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The enhancement measures listed in the report should be implemented in order to enhance these benefits. In addition, the proposed establishment of a number of other renewable energy facilities in the area will create significant

socio-economic opportunities for the KGLM, which, in turn, will result in a positive social benefit.

» The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed solar energy facility also creates an opportunity to support local economic development in the area. Given the size of the proposed facility (150MW in total) this will represent a significant social benefit for an area where there are limited opportunities.

» The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. The establishment of the proposed Sirius solar energy facility is therefore supported by the findings of the SIA.

7.1.7 Impacts resulting from the Decommissioning Phase

Given the relatively small number of people employed during the operational phase (~ 120), the social impact on the local community associated with decommissioning is likely to be low. In addition, the potential impacts can be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative).

The proponent should also investigate the option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 25-30 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure.

7.2 Assessment of Potential Cumulative Impacts

Cumulative impacts, in relation to an activity, refer to the impact of an activity that in-itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area. For cumulative effects analysis to help the decision-maker and inform interested parties, it must be limited to effects that can be evaluated meaningfully (DEAT, 2004). Boundaries must be set so analysts are not attempting to measure effects on everything. Therefore, the cumulative impacts associated with the proposed Sirius PV solar Project have been viewed from two perspectives within this report:

» Cumulative impacts associated with the scale of the project i.e. two 75 MW plants on the farm portion,
» Cumulative impacts associated with other relevant approved or existing solar developments in the area.

Cumulative effects are commonly understood as the impacts which combine from different projects and which result in significant change, which is larger than the sum of all the impacts (DEAT, 2004). The complicating factor is that the projects that need to be considered are from past, present and reasonably foreseeable future development. Cumulative effects can be characterised according to the pathway they follow. One pathway could be the persistent additions from one process. Another pathway could be the compounding effect from one or more processes. Cumulative effects can therefore occur when impacts are:

» additive (incremental);
» interactive;
» sequential; or
» synergistic.

Canter and Sadler (1997) describe a three step process for addressing cumulative effects in an EIA:

» delineating potential sources of cumulative change (i.e. GIS to map the relevant renewable energy facilities in close proximity to one another.
» identifying the pathways of possible change (direct impacts)
» indirect, non-linear or synergistic processes; and
» Classification of resultant cumulative changes

The identified site for the proposed Sirius PV Project is situated approximately 20km by road south-west of Upington on the remaining extent of the Farm Tungsten Lodge 638. Several projects are being proposed in the area, authorised projects include the following:

Proposed projects include the following:

Project Name	Location	Project Status
Proposed establishment of the project Sonnenberg photovoltaic plant located approximately 30km west of Keimoes	Portion 11 of the farm Baviaanz Krantz 11	Authorised
Proposed establishment of the project S-Kol photovoltaic plant near Keimoes	Farm Geel Kop 456	Authorised
Proposed establishment of the Upington solar thermal	Farm McTaggarts Camp 453	EIA process underway

plant-Phase 2 & 3		
Proposed Rooipunt 19MW Photovoltaic Plant	Farm Rooipunt 617	Received Authorisation
Proposed Sasol Project Solis	Farm Van Roois Vley 443	Received Authorisation
Proposed Khi Solar One	Farm McTaggarts Camp 453	Under construction
Eskom CSP Project	Farm Olivenhouts Drift	Authorised

The **cumulative impacts** associated with Project One and Project Two of the Sirius solar energy facility at a site level are expected to be associated with the scale of the project (i.e. Project One and Two of the project, each requiring ~250 hectares in extent). The potential direct cumulative impacts associated with the project are expected to be associated predominantly with the potential ecology impact, potential soil impacts and potential impacts on visual and social in the surrounding area. Approximately 500 hectares of land will be cumulatively impacted upon by Project One and Two of the Sirius PV project.

In addition to cumulative impacts at a site level, cumulative impacts could be associated with this proposed development and other similar developments in the area. At this stage, only one is under construction, four solar energy facilities have been authorised and one is undergoing EIA process.

The cumulative impacts associated with the proposed Project One and Two of the Sirius facility primarily refer to those impacts associated with ecology, soil, hydrology, visual and social impacts, and are mainly associated with the existing and planned solar energy facilities in the area.

Potential cumulative impacts associated with numerous solar energy facility developments within the study area are expected to be associated with:

» ***Ecology –*** Excessive clearing of slow growing trees, especially *Boscia albitrunca* and *Acacia erioloba* could significantly impact local and regional population dynamics and microhabitats and resources associated with these species available to other fauna and flora species. Excessive clearing of vegetation can and will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains, small ephemeral to larger intermittent drainage lines, rivers and this could also have detrimental effects on the lower lying Orange River. Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands.
» ***Soil and Agricultural Potential -*** The only viable agricultural land use is the current one i.e. grazing. Because of the severe soil depth and aridity constraints, the site is not suitable for any other agricultural land use.

- ***Water Resources -*** Cumulative impacts due to artificial elevation of the river banks, embankment construction and earthmoving activities in the floodplain of the Gariep River has severely impacted on ecological functioning of the system. Further manipulation will exacerbate these impacts, but to a very limited degree with a localised impact. Man-induced erosion and sedimentation in this area from intensive farming activities along the Gariep River is expected to be unnaturally high. The cumulative impact on the Gariep River could thus exceed the tolerances of the aquatic biota, including sensitive fish species.
- ***Visual –*** The area already has a CSP project under construction and an Eskom CSP has been authorised which will have significant impact on the viewshed of the area. The most significant impact associated with these projects and associated infrastructure is the visual impact on the scenic resources and cultural landscape of this region imposed. It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CPV structures (solar troughs, heliostats and central receiver) of the Abengoa (!Khi) solar energy facility, is expected to generally dominate the observer's frame of view
- **Heritage** – several renewable energy facilities are being proposed with the proposed Sirius Solar PV Project. This could results to heritage materials being exposed during developmental stages of the projects. Therefore increased in loss of heritage materials and palaeontology.
- ***Social –*** The development of numerous solar energy facilities within the study area will have a cumulative impact on several existing issues within the area, predominately within rural settlements associated with the potential influx of workers and job seekers. With the increased population density, this may lead to a cumulative impact on housing requirements, services (i.e. water, electricity and sanitation), health issues, safety and security. New informal townships are unlikely to have the required infrastructure and services. With the existing rural settlements in the area this will have a cumulative impact on the environment and health (i.e. in terms of ablution facilities). The main social impact, however, will be in terms of visual impacts and associated impacts on sense of place.
- ***Positive impacts -*** Cumulative positive impacts are, however, also anticipated. Two CPS projects have been authorised; one is under construction this will results in job creation opportunities, business opportunities for local companies, skills development and training. The development of renewable energy facilities will have a positive impact at a national and international level through the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project would fit in with the government's aim to implement renewable energy projects as part of the country's energy generation mix over the next 20 years as detailed in the Integrated Resource Plan (IRP).

The Upington area is ear-marked as a hub for solar energy projects and for solar projects to be clustered in one area. In the case of the proposed Sirius Solar PV Project Two, there are other projects proposed around the site and in the broader Upington area (refer to **Figure 7.6** and **Table 7.1** below). The clustering of solar projects in this region near Upington is suitable from a technical and environmental perspective.

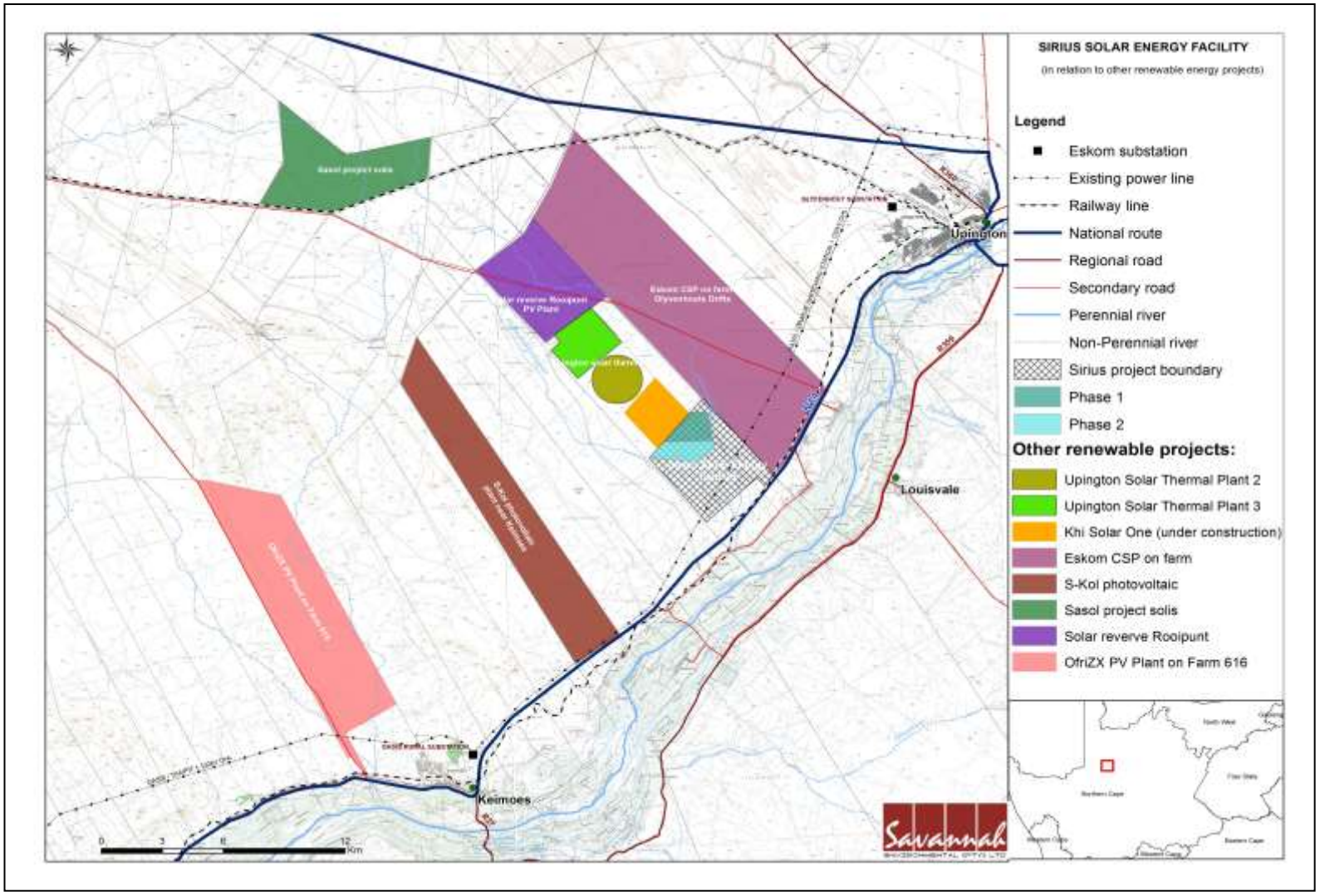

Figure 7.6: Cumulative Impacts map associated with the proposed Sirius Solar PV Project Two

7.3 Assessment of the Do Nothing Alternative

The 'do-nothing' alternative is the option of not constructing Project Two of the proposed Sirius Solar PV Project. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of a solar energy facility.

At a local level, the level of unemployment will remain the same and there will not be any transfer of skills to people in terms of the construction and operation of the solar energy facility. The landowners would have lost an opportunity of using his land in a sustainable manner. Furthermore, the community would lose the opportunity to improve and uplift their infrastructures through the community trust.

At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the facility is only proposed to contribute 75 MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

» **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability.

» ***Exploitation of our significant renewable energy resource:*** At present, valuable national resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.

» ***Pollution reduction:*** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions.

» ***Climate friendly development:*** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita carbon dioxide emissions.

» ***Support for international agreements:*** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.

» ***Employment creation:*** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.

» ***Acceptability to society:*** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

» ***Support to a new industry sector:*** The development of renewable energy offers the opportunity to establish a new industry within the South African economy.

The 'do nothing' alternative will not assist the South African government in addressing climate change, in reaching the set targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country. In addition the Northern Cape Province power grid will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid. The 'do nothing alternative is, therefore, not a preferred alternative.

7.4 Summary of Impacts

Table 7.1 summarises all potential impacts associated with the proposed Sirius Solar PV Project Two

Table 7.1: Summary of impacts associated with the proposed development

Construction / Decommissioning Impacts	Significance of Impact		
	Without mitigation	**With mitigation**	**Applicability to listed activities (GN 544,545,546 of 18 June 2010)**
Loss of vegetation	M (50)	M (35)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Increase in runoff and erosion	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible distribution and increased establishment of alien invasive species	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible disturbance and reduction of habitat or injury to burrowing vertebrates	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible change of natural runoff and drainage patterns,	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible loss of protected species,	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible permanent loss of revegetation	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Potential of soil surface, increase in dust levels	M (50)	M (35)☐	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Potential loss of individuals of keystone species and associated microhabitats	M (40)	L (20)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Possible mortality incidents of terrestrial fauna	M (40)	L (20)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Loss of topsoil	L (18)	L (5)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Degradation of veld vegetation	L (15)	L (8)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Loss of agricultural land use	M (30)	M (30)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Generation of alternative land use income	M (32)	M (32)	GN 545 activity 1

Soil Erosion	M (30)	L (8)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Loss of riparian systems	M (55)	M (45)	GN 544 activity 10(i); GN 544 activity 11(xi); GN 544 activity 18(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Impact on dry riverbeds and localised drainage systems	M (45)	L (24)	GN 544 activity 10(i); GN 544 activity 11(xi); GN 544 activity 18(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Impact on riparian systems through the possible increase in surface water runoff on riparian form and function	M (35)	L (19)	GN 544 activity 10(i); GN 544 activity 11(xi); GN 544 activity 18(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Increase in sedimentation and erosion within the development footprint	M(30)	L (18)	GN 544 activity 10(i); GN 544 activity 11(xi); GN 544 activity 18(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15 and GN 546 activity 14(i)
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires	M (36)	L (24)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	M (33)	L (24)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development	M.(36)	H (65)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Possible pre-contact Stone Age site could be damaged locally by excavation activities and associated activities	L (8)	L (8)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Visual impact of construction on sensitive visual receptors	M (42)	M (36)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Creation of employment and business opportunities during the construction and operation phase	M (32)	M (36)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15
Potential impacts on family structures and social networks associated with the presence of construction workers	L (27)	L (24)	GN 544 activity 10(i); GN 544 activity 22(i); GN 545 activity 1; GN 545 activity 15

Operational Impacts	Significance of Impact		
	Without mitigation	**With mitigation**	**Applicability to listed activities (GN 544,545,546 of 18 June 2010)**
Localised increase in runoff and accelerated erosion	H (60)	L (15)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Possible release of toxic substances and/or heavy metals and associated contamination of soil and groundwater	H (60)	L (15)	GN 544 activity 10(i); GN 545 activity 545 1
Reduced vegetation cover	H (60)	L (20)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Altered distribution of rainfall and resultant runoff patterns	H (60)	L (20)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion	H (60)	L (20)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Reduction of habitat and resource availability for terrestrial fauna during the construction of substation	M (60)	M (40)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Sediment input into the Gariep River	M (40)	L (10)	GN 544 activity 10(i); GN 545 activity 545 1
Chemical and other pollutants into the Gariep River	M (30)	L (10)	GN 544 activity 10(i); GN 545 activity 545 1
Operation of the reservoir and high pressure sand filtration plant	L (24)	L (21)	GN 544 activity 10(i); GN 545 activity 545 1
Visual impact on users of the N14 national road in close proximity to the proposed SEF	M (42)	L (24)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Visual impact on sensitive visual receptors within the region	L (22)	L (11)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Visual impact of lighting on sensitive visual receptors	M (42)	L (24)	GN 544 activity 10(i); GN 545 activity 545 1 and GN 546 activity 14(i)
Creation of employment and business opportunities during the construction and operation phase	M (32)	M (36)	GN 544 activity 10(i); GN 545 activity 545 1
Promotion of clean, renewable energy	M (48)	M (48)	GN 544 activity 10(i); GN 545 activity 545 1

L **Low** M **Medium** H **High**

CONCLUSIONS AND RECOMMENDATIONS:

PROJECT ONE CHAPTER 8

The Sirius Solar PV Project One is proposed to be developed as a commercial solar energy facility to be located on the remaining extent of the farm Tungsten Lodge 638, which falls within the Kai !Garib Local Municipality, Northern Cape Province (refer to Figure 8.1). The proposed facility will have an export capacity of up to 75MW and is intended to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of non-renewable resources. In order to meet the long-term goal of a sustainable renewable energy industry, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030. This is however dependent on the assumed learning rates and associated cost reductions for renewable options.

As such Sirius Solar PV Project One (Pty) Ltd, as an IPP, is investigating the establishment of a 75 MW photovoltaic solar energy facility and associated infrastructure for the purpose of commercial electricity generation.

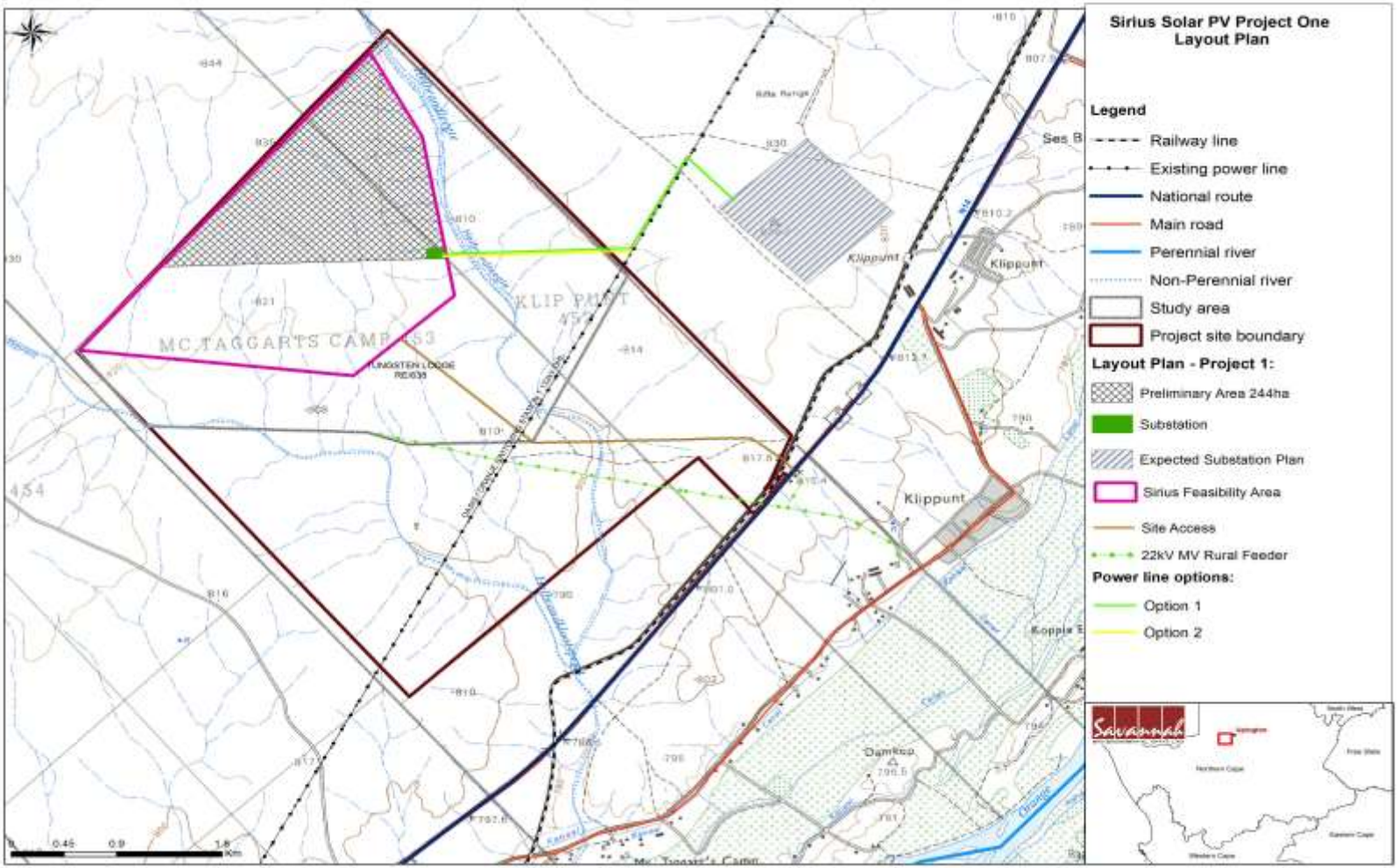

Figure 8.1: Layout map illustrating the location of the development site for the proposed Sirius Solar PV Project One

The Sirius Solar PV Project One will require a development area of up to 250 ha and will be comprised of the following primary elements (refer to Chapter 2 for more details):

» Arrays of photovoltaic (PV)/CPV panels.
» Mounting structure to support the PV panels.
» Cabling between the projects components, to be lain underground where practical.
» A new on-site substation to evacuate power from the PV panels to the Eskom grid.
» A 132 kV power line. The following power line alternatives where assessed in this EIA report for Project One:
  * Alternative 1: the power line is approximately 3.7 km in length and lies on the south eastern side of the site and runs parallel to the Oasis- Oranje 1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
  * Alternative 2: the power line is approximately 3.1 km in length and lies on the eastern side of the proposed site and power would feed into the Eskom electricity network via a 'turn in and turn out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
» Internal access roads and fencing.
» Workshop area for maintenance, storage, and offices.

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the feasibility phase of a project and informs the final design of a development. In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), Sirius Solar PV Project One (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Northern Cape Department of Environmental and Nature Conservation (DENC)) for the establishment of the proposed facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping and an EIA Phase have been undertaken for the proposed project. As part of this EIA process comprehensive, independent environmental studies have been undertaken in accordance with the EIA Regulations. The following key phases have been involved thus far in the EIA Process.

» *Notification Phase* - organs of state, stakeholders, and interested and affected parties (I&APs) were notified of the proposed project using adverts, site notices, background information documents, and stakeholder letters. Details of registered parties have been included within an I&AP database for the project.

» *Scoping Phase* – potential issues associated with the proposed project and environmental sensitivities (i.e. over the broader project development site), as well as the extent of studies required within the EIA Phase were identified.
» *EIA Phase* – potentially significant biophysical and social impacts[5] and identified feasible alternatives put forward as part of the project have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to **Appendix L**).

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area. A summary of the recommendations and conclusions are provided in this Chapter.

8.1 Evaluation of Sirius Solar PV Project One

The preceding chapters of this report together with the specialist studies contained within **Appendices E -K** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for the Sirius Solar PV Project One by providing a summary of the conclusions of the assessment of the proposed site for the development of the solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, it has been concluded that the proposed development area contains **sensitive areas** within the development footprint (discussed under Section 8.2), but that areas of high sensitivity can be easily avoided by the proposed development layout. Potential impacts which could occur as a result of the proposed project are summarised below:

8.1.1 Impacts on Ecology

The study area is covered by the Bushmanland Arid Grasslands merging into Kalahari Karroid Shrubland as described by Mucina and Rutherford (2006), with riverine vegetation on the banks of small ephemeral waterwashes that drains into the Orange River, about 7 km south-east of the study area. Although these vegetation types are regarded as least threatened, the relatively high biodiversity

[5] Direct, indirect, cumulative that may be either positive or negative.

of these undulating plains have medium to high conservation priority on a local scale, as described by the ZF Mgcawu Environmental Management Framework. Impacts on natural vegetation should therefore be minimised as far as possible.

Annual and geophytic species have highly variable emerging patterns, depending on the timing and amount of rainfall received during a season. It is thus expected that the diversity of geophytic and annual species within the study area will be higher than could be determined during the survey.

All riparian vegetation around natural vleis and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. The latter should cross where the lowest amount of indigenous trees are present. Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be taken.

Few alien invasive plants have been observed on the study site, but several grow in close proximity along major access routes. For all species, there is a very high risk of spread throughout the project area following disturbance. A detailed Invasive Plant Management Plan will have to be in place prior to commencement of activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.

It is not expected that the development will compromise the survival of any specific flora or terrestrial vertebrate species on the study area or beyond if mitigation measure are fully implemented. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented. Possible cumulative impacts are thus expected to be fully avoidable. The project will have **medium – low impacts on ecology**.

From an ecological perspective, power line Alternative 2 is nominated as the preferred option provided that the recommendations regarding the location of this line across the ephemeral stream on the site are followed.

8.1.2 Soil and Agricultural Potential Impacts

The development will have **low to medium negative impact on soils, agricultural resources and productivity**, but it will also deliver low to medium positive impacts on agriculture. Grazing, the only current land use will be able to continue unaffected on all other parts of the farm for the duration of the project. The significance of agricultural impacts is influenced by the fact that the solar panel sites have extremely limited agricultural potential. The farm has a land capability

classification of class 7, non-arable and low potential grazing land. Soils are predominantly shallow Mispah soils on underlying rock with only small interspersed pockets of deeper Hutton soils between them. Four potential negative impacts of the development on agricultural resources and productivity were identified as:

* Loss of agricultural land use caused by direct occupation of land by the energy facility footprint (medium significance with and without mitigation).
* Soil Erosion caused by alteration of the surface run-off characteristics (medium significance without, but low with mitigation).
* Loss of topsoil in disturbed areas, causing a decline in soil fertility (low significance with and without mitigation).
* Degradation of veld due to vehicle trampling and dust deposition (low significance with and without mitigation).

Both power line alternatives are considered acceptable from an agricultural potential and soils perspective. There is no preference in this regard.

8.1.3 Water Resources

With suitable mitigation and implementation of the proposed layout, the development should have limited impact on the overall status of the riparian systems on the site and immediate surrounds. A flood line calculation study (determination of the 1:100 year flood line) must be undertaken by the developer to inform the final development footprint. All riparian vegetation around natural vleis and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. All **impacts on water courses** that were assessed as being of **moderate significance** could readily be reduced to low significance by appropriate mitigation.

Both the power line alternatives investigated cross the Helbrandleegte spruit. It may be possible to span the power line across the spruit to limit impact on it. It is assumed that pylons will be placed outside of any watercourse (dry river beds) and they would thus have a no direct impact on the aquatic environment. Therefore both Alternative 1 and Alternative 2 can be developed.

8.1.4 Heritage Impacts

Based on the Phase 1 Archaeological Impact Assessment (AIA) study and survey it was found that no significant heritage sites occur on the site. Four areas of light concentration of stone tools were recorded. These four "heritage sites" are very common in the Northern Cape Province and are of low heritage significance. It was found that none of the tool concentration warranted protection or mitigation action. The occurrence of these Stone Tools suggests that sub-surface heritage sites could occur. In addition, due to the area's close proximity to the Orange River, it is prone

to alluvial deposits that could burry any Stone Age sites. Therefore, it is recommended that a suitably qualified heritage practitioner be appointed by the developer to perform periodic inspections (preferably fortnightly) of excavated materials during the construction phase to ensure than no sub-surface sites are damaged.

8.1.5 Visual Impacts

The findings of the Visual Impact Assessment undertaken for the Sirius Solar PV Project One indicated that the environment surrounding the site, especially within a 2.5km - 5km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years). The proposed facility would be visible within an area that may incorporate certain sensitive visual receptors. These primarily include users of the N14 national road traversing near the proposed development. The solar energy facility could potentially have a **moderate** visual impact on road users travelling along the N14 national road traversing south-east of the facility. This impact may be mitigated to **low**. The potential visual impact on residents of homesteads in close proximity to the solar energy facility is expected to be **negligible** due to the general absence of settlements and residences in close proximity (4km radius) of the proposed solar energy facility. The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond a 5km radius) is expected to be **low** for the proposed solar energy facility, both before and after the implementation of mitigation measures. The potential visual impact of construction activities on sensitive visual receptors within close proximity to the proposed solar energy facility is likely to be of **moderate** significance, both before and after the implementation of mitigation measures. The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of **moderate** significance and may be mitigated to **low**. The anticipated visual impacts listed above (post mitigation measures) are on average expected to be of **low** to **moderate** significance. The area already has a CSP project under construction and an Eskom CSP has been authorised which will have significant impact on the viewshed of the area. The most significant impact associated with these projects and associated infrastructure is the visual impact on the scenic resources and cultural landscape of this region imposed. It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CPV structures (solar troughs, heliostats and central receiver) of the Abengoa (!Khi) solar energy facility, is expected to generally dominate the observer's frame of view. The solar energy facility development is not considered to be fatally flawed from a visual perspective.

The two alternative power line alignments for the Sirius Project One development were investigated. The alignments roughly follow the same route there is no

preferred alignments as their impact will be similar. Alternative 2 requires a shorter power line to connect to the existing infrastructure than Alternative 1 and therefore the impact of Alternative 2 for Project One should be conceivably lower than the impact of Alternative 1. No important sites were identified in either power line corridor or on the substation site.

8.1.6 Impacts on the Social Environment

The findings of the SIA indicate that the development of the proposed Sirius solar energy facility will create employment and business opportunities for locals during both the construction and operational phase of the project. The enhancement measures listed in the report should be implemented in order to enhance these benefits. In addition, the proposed establishment of a number of other renewable energy facilities in the area will create significant socio-economic opportunities for the KGLM, which, in turn, will result in a positive social benefit. The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed solar energy facility also creates an opportunity to support local economic development in the area. Given the size of the proposed facility (75MW) this will represent a significant social benefit for an area where there are limited opportunities. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. The establishment of the proposed Sirius solar energy facility is therefore supported by the findings of the SIA. The **potential positive and negative social impacts** of the project will be of a **medium – low significance**.

The alternatives proposed for the Sirius Solar PV facility are not expected to yield differing viewshed analyses results, due to their location immediately adjacent and parallel to each other. From a visual impact perspective the shortest route, i.e. alternative 2, would be preferred. This is based purely on the premise that the shorter the line, the lower the potential visual impact. The area surrounding the proposed power line infrastructure is also generally devoid of sensitive visual receptors, further lowering the risk of potential visual impact.

8.2 Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Sirius Solar PV Project One, sensitive areas were identified (refer to **Figure 8.2)**. The following sensitive areas/environmental features have been identified on the site:

» Based on the Hydrology Assessment, all riparian vegetation associated with the Helbrandleegter spruit (100m Buffer applied)

» Based on the Ecology Assessment, the vegetation on site is regarded as having a medium sensitivity
» Based on the Soil Assessment, previously mined areas or excavations in the south western part of the proposed PV panel area. Parts of the site were previously mined for Tungsten resulting in mining excavations.

Only the riparian areas were identified as being of high sensitivity. These areas should be avoided. Impacts on other areas of sensitivity were concluded to be acceptable provided that appropriate mitigation measures, as recommended within this EIA, are implemented.

Planning of infrastructure location on the site needs to take some factors into account with respect to existing disturbance on site. The ecology study recommended the following deviations to the access road and the power line:

» Access road: should cross where the lowest number of indigenous trees are present
» Power line: should cross where the lowest number of indigenous trees are present

It is recommended that the detailed design and final design of the PV facility take the above mentioned recommendations into account.

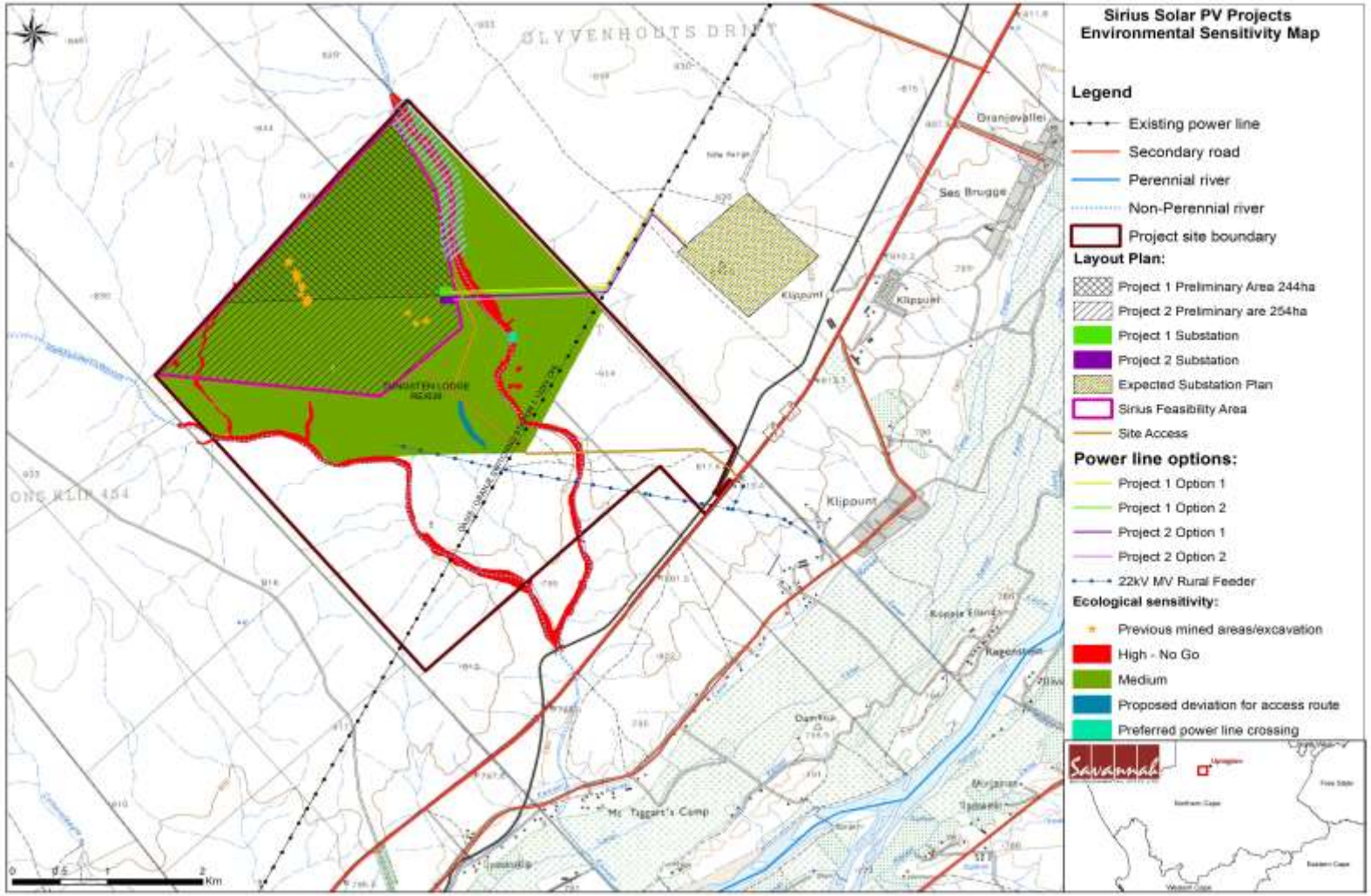

Figure 8.2: Environmental Sensitivity map of the proposed Sirius Solar PV Project One

8.3 Comparative Assessment of Power Line Alternatives

A summary of the comparative assessment of the two power line alternatives assessed in this EIA is provided below.

Specialist study	Power line alternatives	
	Alternative 1	**Alternative 2**
Ecology	Acceptable alternative (will be larger footprint) on condition that the route follows the ecologically recommended site for crossing the intermittent river	**Most Preferred**: on condition that the route follows the ecologically recommended site for crossing the intermittent river
Soil and Agriculture Potential	**No preferences**: Power lines have a negligible footprint and impact under the agricultural conditions on site, there are no significant differences between the alternatives in terms of their agricultural impact.	
Water Resources	**No preferences**: Both the power lines alternatives cross the Helbrandleegte spruit and it would be possible to span the power line across the spruit to limit impact on this area.	
Heritage and Palaeontology	**No preferences**: The power line alternative alignments roughly follow the same route. There are no preferred alignments as their impact will be similar. Alternative 2 connects to the existing infrastructure earlier than Alternative 1 and therefore the impact of Alternative 2 for Project One should be conceivably less than the impact of Alternative 1. No important heritage sites were identified in these alignment corridors or on the sub-station site.	
Visual	**No preferences**: alternatives power line routes proposed for the Sirius Solar PV facility are not expected to yield differing viewshed analyses results, due to their location. From a visual impact perspective the shortest route, i.e. alternative 2, would be preferred. This is based purely on the premise that the shorter the line, the lower the potential visual impact. The area surrounding the proposed power line infrastructure is also generally devoid of sensitive visual receptors, further lowering the risk of potential visual impact.	
Social	**No preference**: The social impacts associated with alternative 1 and 2 are likely to be low as they do not impact on residential structures. However, given the shorter distances associated with alternative 2, alternative 2 is the preferred power line option.	

The ecology study recommended a deviation to both power line alternatives at a lower point along the Helbrandleegte Spruit (as shown in Figure 8.2). Provided that the power line route is deviated to follow the ecologically recommended alignment for crossing the intermittent Helbrandleegte Spruit, both Alternative 1 and Alternative 2 for the 132 kV power line are acceptable options for implementation.

From the specialist perspective, power line alternative 2 is preferred whereas from the technical perspective all power lines are preferred. It is therefore the conclusion of the EAp that both power lines be authorised.

8.4 Assessment of Potential Cumulative Impacts

The identified site for the proposed Sirius Solar PV Project One is situated approximately 20km by road south-west of Upington on the remaining extent of the Farm Tungsten Lodge 638. Several projects are being proposed in the area. Proposed and authorised projects include the following:

Project Name	Location	Project Status
Proposed establishment of the project Sonnenberg photovoltaic plant located approximately 30km west of Keimoes	Portion 11 of the farm Baviaanz Krantz 11	Authorised
Proposed establishment of the project S-Kol photovoltaic plant near Keimoes	Farm Geel Kop 456	Authorised
Proposed establishment of the Upington solar thermal plant-Phase 2 & 3	Farm McTaggarts Camp 453	EIA process underway
Proposed Rooipunt 19MW Photovoltaic Plant	Farm Rooipunt 617	BA process underway
Proposed Sasol Project Solis	Farm Van Roois Vley 443	Authorised
Proposed Khi Solar One	Farm McTaggarts Camp 453	Under construction
Eskom CSP Farm	Olivenhouts Drift	Authorised
Proposed Sirius Project 2	Tungsten Lodge 638	EIA process underway

The **cumulative impacts** associated with the Sirius Solar PV Project One and Two at a site level are expected to be associated with the scale of the project (i.e. Project One and Two, each requiring ~250 hectares in extent). The potential direct cumulative impacts associated with the project are expected to be associated predominantly with the potential ecology impact, potential soil impacts and potential impacts on visual and social in the surrounding area. Approximately 500 hectares of land on the farm Tungsten Lodge 638 will be cumulatively impacted upon by the Sirius PV project One and Two.

In addition to cumulative impacts at a site level, cumulative impacts could be associated with this proposed development and other similar developments in the area. At this stage, only one is under construction, but there are a number which

have been authorised or are currently under investigation (as indicated in the table above).

The cumulative impacts associated with the proposed Sirius Solar PV project One and these other similar developments primarily refer to those impacts associated with ecology, soil, hydrology, visual and social impacts, and are mainly associated with the existing and planned solar energy facilities in the area.

Potential cumulative impacts associated with numerous solar energy facility developments within the study area are expected to be associated with:

» ***Ecology –*** Excessive clearing of slow growing trees, especially *Boscia albitrunca* and *Acacia erioloba* could significantly impact local and regional population dynamics and microhabitats and resources associated with these species available to other fauna and flora species. Excessive clearing of vegetation can and will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains, small ephemeral to larger intermittent drainage lines, rivers and this could also have detrimental effects on the lower lying Orange River. Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands.
» ***Soil and Agricultural Potential -*** The only viable agricultural land use is the current one i.e. grazing. As a result of the severe soil depth and aridity constraints, the site is not suitable for any other agricultural land use.
» ***Water Resources -*** Cumulative impacts due to artificial elevation of the river banks, embankment construction and earthmoving activities in the floodplain of the Gariep River has severely impacted on ecological functioning of the system. Further manipulation will exacerbate these impacts, but to a very limited degree with a localised impact. Man-induced erosion and sedimentation in this area from intensive farming activities along the Gariep River is expected to be unnaturally high. The cumulative impact on the Gariep River could thus exceed the tolerances of the aquatic biota, including sensitive fish species.
» ***Visual –*** The area already has a CSP project under construction and an Eskom CSP has been authorised which will have significant impact on the viewshed of the area. The most significant impact associated with these projects and associated infrastructure is the visual impact on the scenic resources and cultural landscape of this region imposed. It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CPV structures (solar troughs, heliostats and central receiver) of the Abengoa (!Khi) solar energy facility, is expected to generally dominate the observer's frame of view

» ***Heritage –*** several renewable energy facilities are being proposed with the proposed Sirius Solar PV Project. This could results to heritage materials being exposed during developmental stages of the projects. Therefore increased in loss of heritage materials and palaeontology.
» ***Social –*** The development of numerous solar energy facilities within the study area will have a cumulative impact on several existing issues within the area, predominately within rural settlements associated with the potential influx of workers and job seekers. With the increased population density, this may lead to a cumulative impact on housing requirements, services (i.e. water, electricity and sanitation), health issues, safety and security. New informal townships are unlikely to have the required infrastructure and services. With the existing rural settlements in the area this will have a cumulative impact on the environment and health (i.e. in terms of ablution facilities). The main social impact, however, will be in terms of visual impacts and associated impacts on sense of place.

» ***Positive impacts -*** Cumulative positive impacts are, however, also anticipated. Three CSP projects have been authorised; one is under construction this will results in job creation opportunities, business opportunities for local companies, skills development and training. The development of renewable energy facilities will have a positive impact at a national and international level through the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project would be in line with the government's aim to implement renewable energy projects as part of the country's energy generation mix over the next 20 years as detailed in the Integrated Resource Plan (IRP). In addition, the proposed project site falls within the Solar Corridor as identified by the Northern Cape SDP. The project will therefore assist the province in meeting their objectives with regards to the development of this corridor.

The clustering of solar projects in this region near Upington is suitable from a technical and environmental perspective, as recognised by the Northern Cape SDP. The **cumulative negative and positive impacts** of the Sirius project and the other authorised projects in the area (should they be developed) will be of a **medium, acceptable significance**.

8.5 Overall Conclusion (Impact Statement)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big

part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The technical viability of establishing the Sirius Solar PV Project One with an export capacity of 75 MW on a site located on the remaining extent of the farm Tungsten Lodge 638 has been established by Sirius Solar PV Project One (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Northern Cape Province include the following:

» The potential to harness and utilise solar energy resources within the Northern Cape Province
» The project would assist the South African government in reaching their set targets for renewable energy.
» The project would assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project would assist the Northern Cape Provincial Government in meeting their objective for the development of a Solar Corridor which includes the area around Upington.
» The project would assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business
» The National electricity grid in the Northern Cape Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

Based on findings of the specialist studies undertaken within this EIA and the sensitivity map (**Figure 8.2**), no environmental fatal flaws were identified to be associated with the Sirius Solar PV Project One that may prevent the proposed project from being developed. Any threat to ecologically sensitive areas can be successfully avoided by deviation of the proposed access road and power line and avoidance of the riparian areas on the site. The final layout can therefore be developed to avoid all environmental sensitive areas within the proposed site.

The significance levels of the majority of identified negative impacts can be reduced to acceptable levels through implementation of the recommended mitigation measures as contained in this EIA report and the draft EMPr. The Sirius Solar PV Project One is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix L**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

8.6 Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the developmental impacts of the Sirius Solar PV Project One can be avoided and/or mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

The following conditions would be required to be included within an authorisation issued for the project:

» The draft Environmental Management Programme (EMPr) as contained within Appendix L of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» All riparian vegetation around natural vleis (100m buffer) and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. The latter should cross where the lowest number of indigenous trees are present.
» Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be taken.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum. Aim to

maintain vegetation where it will not interfere with the construction or operation of the development.

» Disturbed areas should be rehabilitated as soon as possible once construction is complete in an area.
» Rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the EMPr.
» An Invasive Plant Management Plan to be in place prior to commencement of the activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase. All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended.
» Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.
» The occurrence of Stone Tools suggests that other sub-surface heritage sites could be located nearby or on the site. Due to the close proximity of the site to the Orange River, it is prone to alluvial deposits that could burry any Stone Age sites. A suitably qualified heritage practitioner to be appointed by the developer to perform periodic inspections (preferably fortnightly) of excavated materials during the construction phase.
» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.
» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
» Compile a comprehensive storm water management method statement, as part of the final design of the project and implement during construction and operation.
» An independent **Environmental Control Officer** (ECO) must be appointed by Sirius Solar PV Project One (Pty) Ltd prior to the commencement of any authorised activities.

CONCLUSIONS AND RECOMMENDATIONS:

PROJECT TWO CHAPTER 9

The Sirius Solar PV Project Two is proposed to be developed as a commercial solar energy facility to be located on the remaining extent of the farm Tungsten Lodge 638, which falls within the Kai !Garib Local Municipality, Northern Cape Province (refer to Figure 9.1). The proposed facility will have an export capacity of up to 75MW and is intended to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of non-renewable resources. In order to meet the long-term goal of a sustainable renewable energy industry, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030. This is however dependent on the assumed learning rates and associated cost reductions for renewable options.

As such Sirius Solar PV Project Two (Pty) Ltd, as an IPP, is investigating the establishment of a 75 MW photovoltaic solar energy facility and associated infrastructure for the purpose of commercial electricity generation.

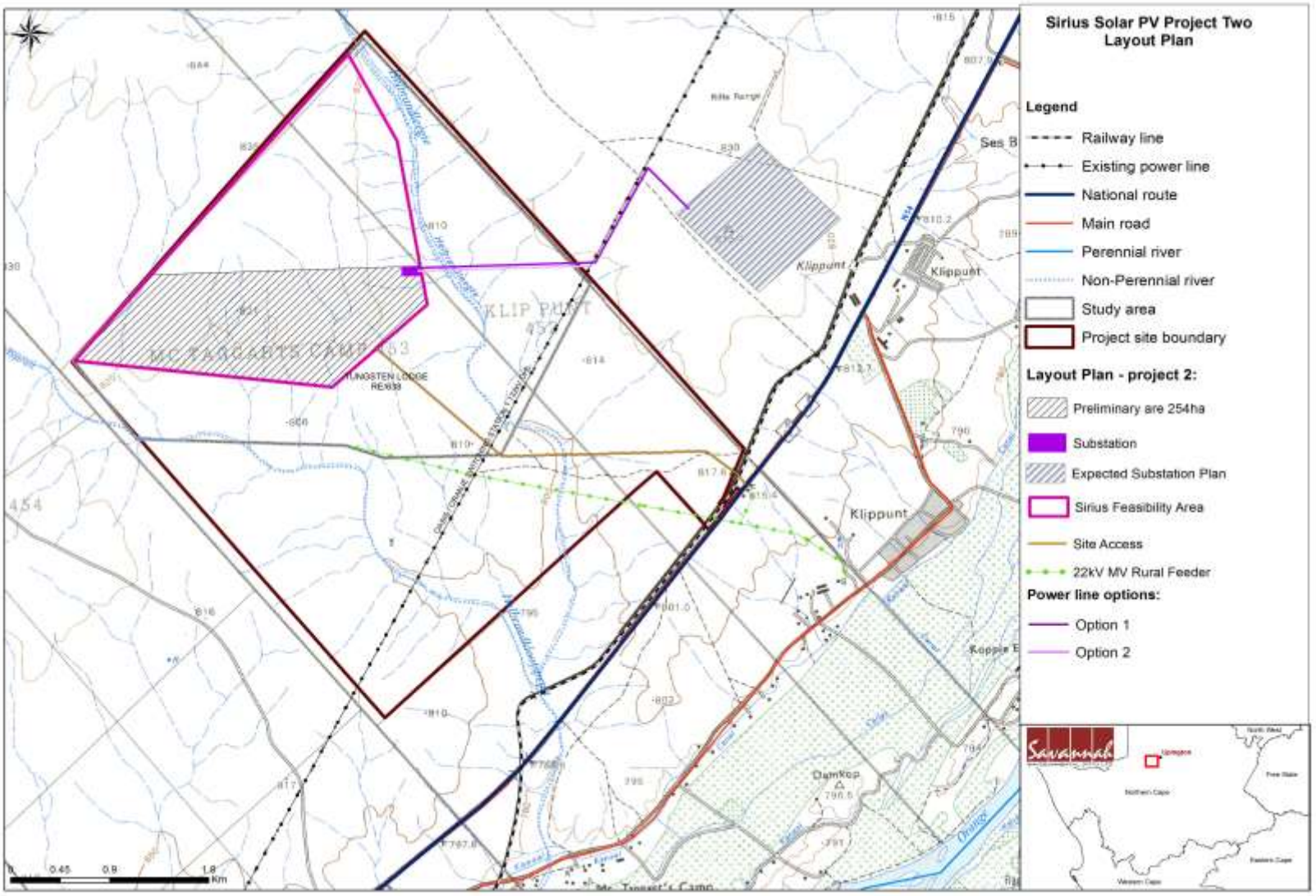

Figure 9.1: Layout map illustrating the location of the development site for the proposed Sirius Solar PV Project Two

The Sirius Solar PV Project Two will require a development area of up to 254 ha and will be comprised of the following primary elements (refer to Chapter 2 for more details):

- Arrays of photovoltaic (PV)/CPV panels.
- Mounting structure to support the PV panels.
- Cabling between the projects components, to be lain underground where practical.
- A new on-site substation to evacuate power from the PV panels to the Eskom grid.
- A 132 kV power line. The following power line alternatives where assessed in this EIA report for Project Two:
  - Alternative 1: the power line is approximately 5.4 km in length and lies on the southern side of the proposed site and runs parallel to the Oasis-Oranje 1 132 kV power line to connect to the proposed Eskom substation located adjacent to the proposed site.
  - Alternative 2: the power line is approximately 1.1 km in length and lies on the eastern side of the proposed site and power would feed into the Eskom electricity network via a 'turn in and turn out' configuration to the existing Eskom Gordonia-Oasis Rural 132 kV power line.
- Internal access roads and fencing.
- Workshop area for maintenance, storage, and offices.

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the feasibility phase of a project and informs the final design of a development. In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), Sirius Solar PV Project Two (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Northern Cape Department of Environmental and Nature Conservation (DENC)) for the establishment of the proposed facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping and an EIA Phase have been undertaken for the proposed project. As part of this EIA process comprehensive, independent environmental studies have been undertaken in accordance with the EIA Regulations. The following key phases have been involved thus far in the EIA Process.

- *Notification Phase* - organs of state, stakeholders, and interested and affected parties (I&APs) were notified of the proposed project using adverts, site notices, background information documents, and stakeholder letters. Details of registered parties have been included within an I&AP database for the project.

» *Scoping Phase* – potential issues associated with the proposed project and environmental sensitivities (i.e. over the broader project development site), as well as the extent of studies required within the EIA Phase were identified.
» *EIA Phase* – potentially significant biophysical and social impacts[6] and identified feasible alternatives put forward as part of the project have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to **Appendix M**).

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area. A summary of the recommendations and conclusions are provided in this Chapter.

9.1 Evaluation of Sirius Solar PV Project Two

The preceding chapters of this report together with the specialist studies contained within **Appendices E -K** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for the Sirius Solar PV Project Two by providing a summary of the conclusions of the assessment of the proposed site for the development of the solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, it has been concluded that the proposed development area contains **sensitive areas** within the development footprint (discussed under Section 9.2), but that areas of high sensitivity can be easily avoided by the proposed development layout. Potential impacts which could occur as a result of the proposed project are summarised below:

9.1.1 Impacts on Ecology

The study area is covered by the Bushmanland Arid Grasslands merging into Kalahari Karroid Shrubland as described by Mucina and Rutherford (2006), with riverine vegetation on the banks of small ephemeral waterwashes that drains into the Orange River, about 7 km south-east of the study area. Although these vegetation types are regarded as least threatened, the relatively high biodiversity

[6] Direct, indirect, cumulative that may be either positive or negative.

of these undulating plains have medium to high conservation priority on a local scale, as described by the ZF Mgcawu Environmental Management Framework. Impacts on natural vegetation should therefore be minimised as far as possible.

Annual and geophytic species have highly variable emerging patterns, depending on the timing and amount of rainfall received during a season. It is thus expected that the diversity of geophytic and annual species within the study area will be higher than could be determined during the survey.

All riparian vegetation around natural vleis and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. The latter should cross where the lowest amount of indigenous trees are present. Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be taken.

Few alien invasive plants have been observed on the study site, but several grow in close proximity along major access routes. For all species, there is a very high risk of spread throughout the project area following disturbance. A detailed Invasive Plant Management Plan must be compiled and implemented prior to commencement of activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.

It is not expected that the development will compromise the survival of any specific flora or terrestrial vertebrate species on the study area or beyond if mitigation measure are fully implemented. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented. Possible cumulative impacts are thus expected to be fully avoidable. The project will have **medium – low impacts on ecology**.

From an ecological perspective, power line Alternative 2 is nominated as the preferred option provided that the recommendations regarding the location of this line across the ephemeral stream on the site are followed.

9.1.2 Soil and Agricultural Potential Impacts

The development will have **low to medium negative impact on soils, agricultural resources and productivity**, but it will also deliver low to medium positive impacts on agriculture. Grazing, the only current land use will be able to continue unaffected on all other parts of the farm for the duration of the project. The significance of agricultural impacts is influenced by the fact that the solar panel sites have extremely limited agricultural potential. The farm has a land capability

classification of class 7, non-arable and low potential grazing land. Soils are predominantly shallow Mispah soils on underlying rock with only small interspersed pockets of deeper Hutton soils between them. Four potential negative impacts of the development on agricultural resources and productivity were identified as:

- Loss of agricultural land use caused by direct occupation of land by the energy facility footprint (medium significance with and without mitigation).
- Soil Erosion caused by alteration of the surface run-off characteristics (medium significance without, but low with mitigation).
- Loss of topsoil in disturbed areas, causing a decline in soil fertility (low significance with and without mitigation).
- Degradation of veld due to vehicle trampling and dust deposition (low significance with and without mitigation).
- One potential positive impact of the development on agricultural resources and productivity was identified as:
  - Generation of alternative land use income through rental for energy facility on agriculturally unproductive land. This will provide land owners with increased rural livelihood (medium significance with and without mitigation).

Both power line alternatives are considered acceptable from an agricultural potential and soils perspective. There is no preference in this regard.

9.1.3 Water Resources

With suitable mitigation and implementation of the proposed layout, the development should have limited impact on the overall status of the riparian systems on the site and immediate surrounds. A flood line calculation study (determination of the 1:100 year flood line) must however be undertaken by the developer to inform the final development footprint and ensure minimal impact on these systems. All riparian vegetation around natural vleis and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and the power line. All **impacts on water courses** that were assessed as being of **moderate significance** could readily be reduced to low significance by appropriate mitigation.

Both the power line alternatives investigated cross the Helbrandleegte spruit. It may be possible to span the power line across the spruit to limit impact on it. It is assumed that pylons will be placed outside of any watercourse (dry river beds) and they would thus have a no direct impact on the aquatic environment. Therefore both Alternative 1 and Alternative 2 can be developed.

9.1.4 Heritage Impacts

Based on the Phase 1 Archaeological Impact Assessment (AIA) study and survey it was found that no significant heritage sites occur on the site. Four areas of low concentration of stone tools were recorded. These four "heritage sites" are very common in the Northern Cape Province and are of low heritage significance. It was found that none of the tool concentration warranted protection or mitigation action. The occurrence of these Stone Tools suggests that sub-surface heritage sites could occur. In addition, due to the close proximity of the area to the Orange River, it is prone to alluvial deposits that could bury any Stone Age sites. Therefore, it is recommended that a suitably qualified heritage practitioner be appointed by the developer to perform periodic inspections (preferably fortnightly) of excavated materials during the construction phase to ensure than no sub-surface sites are damaged.

The two alternative power line alignments for the Sirius Project One development were investigated. The alignments roughly follow the same route there is no preferred alignments as their impact will be similar. Alternative 2 requires a shorter power line to connect to the existing infrastructure than Alternative 1 and therefore the impact of Alternative 2 for Project One should be conceivably lower than the impact of Alternative 1. No important sites were identified in either power line corridor or on the substation site.

9.1.5 Visual Impacts

The findings of the Visual Impact Assessment undertaken for the Sirius One Solar PV Project) indicated that the environment surrounding the site, especially within a 2.5km - 5km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years). The proposed facility would be visible within an area that may incorporate certain sensitive visual receptors. These primarily include users of the N14 national road traversing near the proposed development. The solar energy facility could potentially have a **moderate** visual impact on road users travelling along the N14 national road traversing south-east of the facility. This impact may be mitigated to **low**. The potential visual impact on residents of homesteads in close proximity to the solar energy facility is expected to be **negligible** due to the general absence of settlements and residences in close proximity (4km radius) of the proposed solar energy facility. The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond a 5km radius) is expected to be **low** for the proposed solar energy facility, both before and after the implementation of mitigation measures. The potential visual impact of construction activities on sensitive visual receptors within close proximity to the proposed solar energy facility is likely to be of **moderate** significance, both before and after the

implementation of mitigation measures. The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of **moderate** significance and may be mitigated to **low**. The anticipated visual impacts listed above (post mitigation measures) are on average expected to be of **low** to **moderate** significance. . The area already has a CSP project under construction and an Eskom CSP has been authorised which will have significant impact on the viewshed of the area. The most significant impact associated with these projects and associated infrastructure is the visual impact on the scenic resources and cultural landscape of this region imposed. It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CPV structures (solar troughs, heliostats and central receiver) of the Abengoa (!Khi) solar energy facility, is expected to generally dominate the observer's frame of view. The solar energy facility development is not considered to be fatally flawed from a visual perspective.

The two overhead power line alternatives are expected to have a **negligible** visual impact when viewed against the backdrop of the much more prominent PV structures and the existing and future infrastructure (e.g. CSP facilities, Eskom substation, etc.) proposed for the broader area.

The alternatives proposed for the Sirius Solar PV facility are not expected to yield differing viewshed analyses results, due to their location immediately adjacent and parallel to each other. From a visual impact perspective the shortest route, i.e. alternative 2, would be preferred. This is based purely on the premise that the shorter the line, the lower the potential visual impact. The area surrounding the proposed power line infrastructure is also generally devoid of sensitive visual receptors, further lowering the risk of potential visual impact.

9.1.6 Impacts on the Social Environment

The findings of the SIA indicate that the development of the proposed Sirius solar energy facility will create employment and business opportunities for locals during both the construction and operational phase of the project. The enhancement measures listed in the report should be implemented in order to enhance these benefits. In addition, the proposed establishment of a number of other renewable energy facilities in the area will create significant socio-economic opportunities for the KGLM, which, in turn, will result in a positive social benefit. The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed solar energy facility also creates an opportunity to support local economic development in the area. Given the size of the proposed facility (75MW) this will represent a significant social benefit for an area where there are limited opportunities. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate

change, represents a positive social benefit for society as a whole. The establishment of the proposed Sirius solar energy facility is therefore supported by the findings of the SIA. The **potential positive and negative social impacts** of the project will be of a m**edium – low significance**.

The social impacts associated with power line alternative 1 and 2 are likely to be low as they do not impact on residential structures. However, given the shorter distances associated with alternative 2, alternative 2 is the preferred power line option.

9.2 Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Sirius Solar PV Project Two, sensitive areas were identified (refer to **Figure 9.2)**. The following sensitive areas/environmental features have been identified on the site:

» Based on the Hydrology Assessment, all riparian vegetation associated with the Helbrandkloof spruit (100m Buffer applied)
» Based on the Ecology Assessment, the vegetation on site is regarded as having a medium sensitivity
» Based on the Soil Assessment, previously mined areas or excavations in the south western part of the proposed PV panel area. Parts of the site were previously mined for Tungsten resulting in mining excavations.

Only the riparian areas were identified as being of high sensitivity. These areas should be avoided. Impacts on other areas of sensitivity were concluded to be acceptable provided that appropriate mitigation measures, as recommended within this EIA, are implemented.

Planning of infrastructure location on the site needs to take some factors into account with respect to existing disturbance on site. The ecology study recommended the following deviations to the access road and the power line:

» Access road: should cross where the lowest number of indigenous trees are present
» Power line: should cross where the lowest number of indigenous trees are present

It is recommended that the detailed design and final design of the PV facility take the above mentioned recommendations into account.

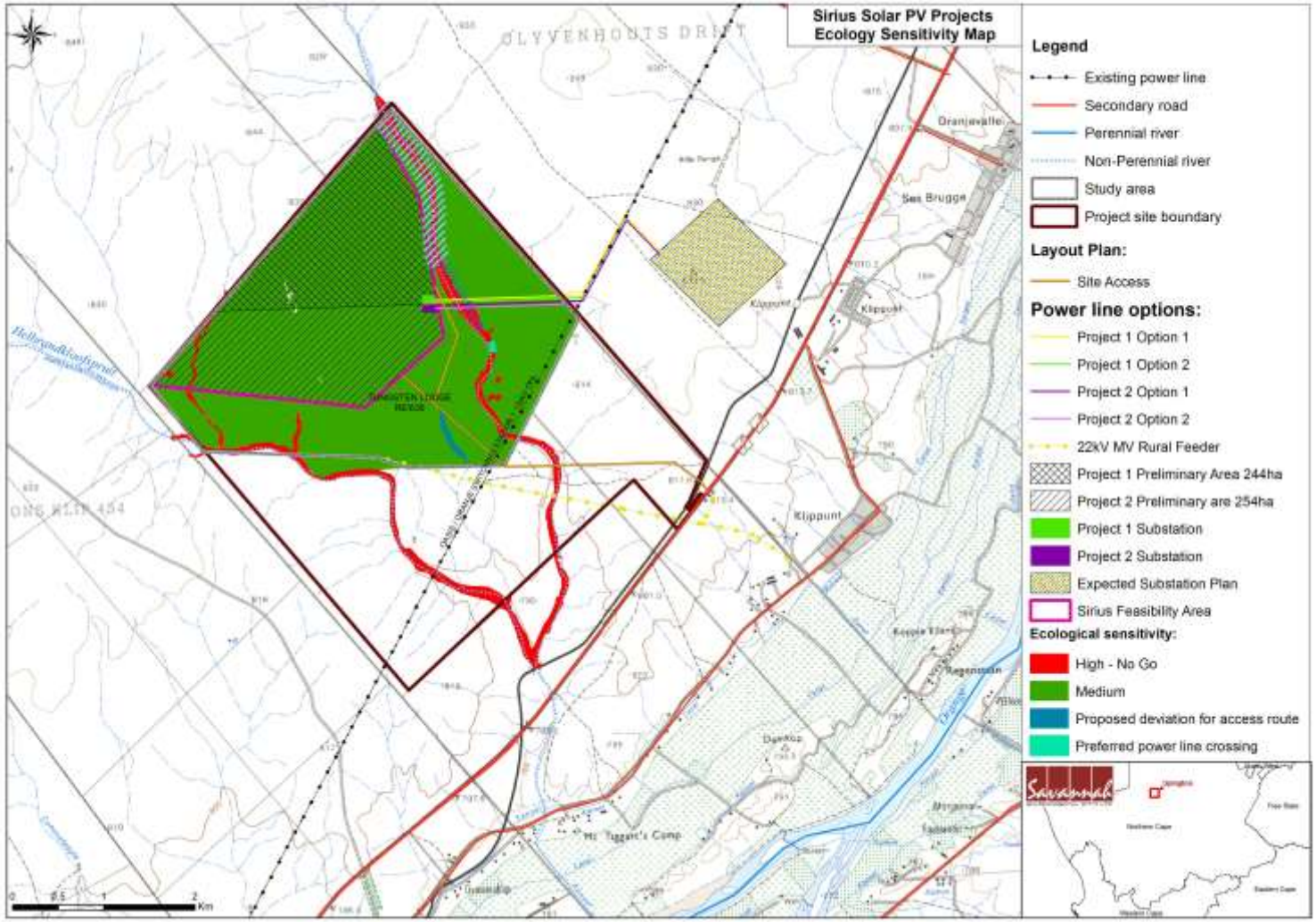

Figure 9.2: Environmental Sensitivity map of the proposed Sirius Solar PV Project Two

9.3 Comparative Assessment of Power Line Alternatives

A summary of the comparative assessment of the two power line alternatives assessed in this EIA is provided below.

Specialist study	Power line alternatives	
	Alternative 1	**Alternative 2**
Ecology	Acceptable alternative (will be larger footprint) on condition that the route follows the ecologically recommended site for crossing the intermittent river	**Most Preferred**: on condition that the route follows the ecologically recommended site for crossing the intermittent river
Soil and Agriculture Potential	**No preferences**: Power lines have a negligible footprint and impact under the agricultural conditions on site, there are no significant differences between the alternatives in terms of their agricultural impact.	
Water Resources	**No preferences**: Both the power lines alternatives cross the Helbrandleegte spruit and it would be possible to span the power line across the spruit to limit impact on this area.	
Heritage and Palaeontology	**No preferences**: The power line alternative alignments roughly follow the same route. There is no preferred alignments as their impact will be similar. Alternative 2 connects to the existing infrastructure earlier than Alternative 1 and therefore the impact of Alternative 2 for Project Two should be conceivably less than the impact of Alternative 1. No important heritage sites were identified in these alignment corridors or on the sub-station site.	
Visual	**No preferences**: alternatives power line routes proposed for the Sirius Solar PV facility are not expected to yield differing viewshed analyses results, due to their location. From a visual impact perspective the shortest route, i.e. alternative 2, would be preferred. This is based purely on the premise that the shorter the line, the lower the potential visual impact. The area surrounding the proposed power line infrastructure is also generally devoid of sensitive visual receptors, further lowering the risk of potential visual impact.	
Social	**No preference**: The social impacts associated with alternative 1 and 2 are likely to be low as they do not impact on residential structures. However, given the shorter distances associated with alternative 2, alternative 2 is the preferred power line option.	

The ecology stud recommended a deviation to both power line alternatives at a lower point along the Helbrandleegte Spruit (as shown in Figure 9.2). Provided that the power line route is deviated to follow the ecologically recommended alignment for crossing the intermittent Helbrandleegte Spruit, both Alternative 1 and Alternative 2 for the 132 kV power line are acceptable options for implementation.

9.4 Assessment of Potential Cumulative Impacts

The identified site for the proposed Sirius Solar PV Project Two is situated approximately 20km by road south-west of Upington on the remaining extent of the Farm Tungsten Lodge 638. Several projects are being proposed in the area. Proposed and authorised projects include the following:

Project Name	Location	Project Status
Proposed establishment of the project Sonnenberg photovoltaic plant located approximately 30km west of Keimoes	Portion 11 of the farm Baviaanz Krantz 11	Authorised
Proposed establishment of the project S-Kol photovoltaic plant near Keimoes	Farm Geel Kop 456	Authorised
Proposed establishment of the Upington solar thermal plant-Phase 2 & 3	Farm McTaggarts Camp 453	EIA process underway
Proposed Rooipunt 19MW Photovoltaic Plant	Farm Rooipunt 617	BA process underway
Proposed Sasol Project Solis	Farm Van Roois Vley 443	Authorised
Proposed Khi Solar One	Farm McTaggarts Camp 453	Under construction
Eskom CSP Farm	Olivenhouts Drift	Authorised
Proposed Sirius Solar PV Project Two	Farm Tungsten Lodge 638	EIA process underway

The **cumulative impacts** associated with Project One and Two of the Sirius solar energy facility at a site level are expected to be associated with the scale of the project (i.e. Project One (requires~250 hectares) and Project Two (requires~254 hectares). The potential direct cumulative impacts associated with the project are expected to be associated predominantly with the potential ecology impact, potential soil impacts and potential impacts on visual and social in the surrounding area. Approximately 500 hectares of land on the farm Tungsten Lodge 638 will be cumulatively impacted upon by Project One and Two of the Sirius PV project.

In addition to cumulative impacts at a site level, cumulative impacts could be associated with this proposed development and other similar developments in the area. At this stage, only one is under construction,
but there are a number which have been authorised or are currently under investigation (as indicated in the table above).

The cumulative impacts associated with the proposed Sirius Solar PV project Two and these other similar developments primarily refer to those impacts associated with ecology, soil, hydrology, visual and social impacts, and are mainly associated with the existing and planned solar energy facilities in the area.

Potential cumulative impacts associated with numerous solar energy facility developments within the study area are expected to be associated with:

» ***Ecology –*** Excessive clearing of slow growing trees, especially *Boscia albitrunca* and *Acacia erioloba* could significantly impact local and regional population dynamics and microhabitats and resources associated with these species available to other fauna and flora species. Excessive clearing of vegetation can and will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains, small ephemeral to larger intermittent drainage lines, rivers and this could also have detrimental effects on the lower lying Orange River. Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands.
» ***Soil and Agricultural Potential -*** The only viable agricultural land use is the current one i.e. grazing. Because of the severe soil depth and aridity constraints, the site is not suitable for any other agricultural land use.
» ***Water Resources -*** Cumulative impacts due to artificial elevation of the river banks, embankment construction and earthmoving activities in the floodplain of the Gariep River has severely impacted on ecological functioning of the system. Further manipulation will exacerbate these impacts, but to a very limited degree with a localised impact. Man-induced erosion and sedimentation in this area from intensive farming activities along the Gariep River is expected to be unnaturally high. The cumulative impact on the Gariep River could thus exceed the tolerances of the aquatic biota, including sensitive fish species.
» ***Visual –*** The area already has a CSP project under construction and an Eskom CSP has been authorised which will have significant impact on the viewshed of the area. The most significant impact associated with these projects and associated infrastructure is the visual impact on the scenic resources and cultural landscape of this region imposed. It should however be borne in mind that the Sirius Solar PV structures are highly unlikely to be viewed in isolation, as the much taller CPV structures (solar troughs, heliostats and central receiver) of the Abengoa (!Khi) solar energy facility, is expected to generally dominate the observer's frame of view
» **Heritage** – several renewable energy facilities are being proposed with the proposed Sirius Solar PV Project. This could results to heritage materials being exposed during developmental stages of the projects. Therefore increased in loss of heritage materials and palaeontology.

- ***Social –*** The development of numerous solar energy facilities within the study area will have a cumulative impact on several existing issues within the area, predominately within rural settlements associated with the potential influx of workers and job seekers. With the increased population density, this may lead to a cumulative impact on housing requirements, services (i.e. water, electricity and sanitation), health issues, safety and security. New informal townships are unlikely to have the required infrastructure and services. With the existing rural settlements in the area this will have a cumulative impact on the environment and health (i.e. in terms of ablution facilities). The main social impact, however, will be in terms of visual impacts and associated impacts on sense of place.
- ***Positive impacts -*** Cumulative positive impacts are, however, also anticipated. Three CPS projects have been authorised; one is under construction this will results in job creation opportunities, business opportunities for local companies, skills development and training. The development of renewable energy facilities will have a positive impact at a national and international level through the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project will be in line with the government's aim to implement renewable energy projects as part of the country's energy generation mix over the next 20 years as detailed in the Integrated Resource Plan (IRP). In addition, the proposed project site falls within the Solar Corridor as identified by the Northern Cape SDP. The project will therefore assist the province in meeting their objectives with regards to the development of this corridor

The clustering of solar projects in this region near Upington is suitable from a technical and environmental perspective as recognised by the Northern Cape SDP. The **cumulative negative and positive impacts** of the Sirius project and the other authorised projects in the area (should they be developed) will be of a **medium, acceptable significance**.

9.5 Overall Conclusion (Impact Statement)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an

energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The technical viability of establishing the Sirius Solar PV Project Two with an export capacity of 75 MW on a site located on the remaining extent of the farm Tungsten Lodge 638 has been established by Sirius Solar PV Project Two (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Northern Cape Province include the following:

» The potential to harness and utilise solar energy resources within the Northern Cape Province
» The project would assist the South African government in reaching their set targets for renewable energy.
» The project would assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project would assist the Northern Cape Provincial Government in meeting their objective for the development of a Solar Corridor which includes the area around Upington.
» The project would assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business
» The National electricity grid in the Northern Cape Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

Based on findings of the specialist studies undertaken within this EIA and the sensitivity map (**Figure 9.2**), no environmental fatal flaws were identified to be associated with the Sirius Solar PV Project Two that may prevent the proposed project from being developed. Any threat to ecologically sensitive areas can be successfully avoided by deviation of the proposed access road and power line and avoidance of the riparian areas on the site. The final layout can therefore be developed to avoid all environmental sensitive areas within the proposed site.

The significance levels of the majority of identified negative impacts can be reduced to acceptable levels through implementation of the recommended mitigation measures as contained in this EIA report and the draft EMPr. The Sirius Solar PV Project Two is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential

impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix M**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

9.6 Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the developmental impacts of the Sirius Solar PV Project Two can be avoided and/or mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

The following conditions would be required to be included within an authorisation issued for the project:

» A flood line calculation study (determination of the 1:100 year flood line) must be undertaken by the developer to inform the final development footprint.
» The draft Environmental Management Programme (EMPr) as contained within **Appendix M** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» All riparian vegetation around natural vleis (100m buffer) and large intermittent rivers should be avoided by all development-related activities, except the necessary crossing of access routes and power lines. The latter should cross where the lowest number of indigenous trees present. Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be taken.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum. Aim to maintain vegetation where it will not interfere with the construction or operation of the development.
» Disturbed areas should be rehabilitated as soon as possible once construction is complete in an area.

- Rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the EMPr.
- An Invasive Plant Management Plan to be in place prior to commencement of the activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase. All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended.
- Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.
- The occurrence of Stone Tools suggests that other sub-surface heritage sites could be located nearby or on the site. Due to the close proximity of the site to the Orange River, it is prone to alluvial deposits that could contain Stone Age sites. A suitably qualified heritage practitioner to be appointed by the developer to perform periodic inspections (preferably fortnightly) of excavated materials during the construction phase.
- Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.
- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
- Compile a comprehensive storm water management method statement, as part of the final design of the project and implement during construction and operation.
- An independent **Environmental Control Officer** (ECO) must be appointed by Sirius Solar PV Project Two (Pty) Ltd prior to the commencement of any authorised activities.