Environmental Impact Assessment Process
Draft Environmental Impact Report
Four Proposed Photovoltaic Solar Energy Facilities On The Remaining Extent Of Portion Three Of The Farm Zuurwater No.62 Within The Namakwa District, Northern Cape Province

DEA Ref. Nos:

Phase 1 - 14/12/16/3/3/2/470

Phase 2 - 14/12/16/3/3/2/471

Phase 3 - 14/12/16/3/3/2/472

Phase 4 - 14/12/16/3/3/2/473

DRAFT FOR PUBLIC REVIEW

NOVEMBER 2013

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PROJECT DETAILS

DEA Reference No.s	:	Phase 1 - 14/12/16/3/3/2/470 Phase 2 - 14/12/16/3/3/2/471 Phase 3 - 14/12/16/3/3/2/472 Phase 4 - 14/12/16/3/3/2/473
Title	:	Environmental Impact Assessment Process Draft Environmental Impact Assessment Report: Four Proposed Photovoltaic Solar Energy Facilities On The Remaining Extent Of Portion Three Of The Farm Zuurwater No.62 Within The Namakwa District, Northern Cape Province
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BACKGROUND TO THE PROJECT AND PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PVAfrica Development (Pty) Ltd is proposing to establish four commercial photovoltaic solar energy facilities on the remaining extent of Portion 3 of the Farm Zuurwater 62 near Aggeneys, in the Northern Cape Province. A larger facility (comprising of seven phases) on the same property was the subject of a previous Environmental Impact Assessment (EIA) undertaken in 2011/2012 for Sato Energy Holdings (Pty) Ltd (Sato), for which the EIA process was completed and individual environmental authorisations for each of the 7 phases issued in August 2012 (DEA Ref Nos 12/12/20/2334/1-7). The Scoping Report and EIA report were compiled for Sato by SRK Consulting. Subsequently, changes to the project have been effected due to technical considerations. In addition, the developer has changed from Sato to PVAfrica Development (Pty) Ltd.

The following changes regarding the Zuurwater PV project are of relevance:

» Units 1, 2, 3, 6 and 7 - The authorisations for these five authorised units have been lapsed. The developer (PVAfrica Development (Pty) Ltd has submitted new applications for environmental authorisation (EA) for four replacement projects on Portion 3 of the Farm Zuurwater 62, but with a new layout and technology (the subject of this EIA report).
» Unit 4 and Unit 5 – The environmental authorisations for these units are still valid and have been amended to now be held by PVAfrica Development (Pty) Ltd.

DEA have accepted the four new applications for environmental authorisation and granted permission for an EIA phase assessment and public participation process to be undertaken for the environmental assessment of the four new phases within the same site (i.e. on the Farm Zuurwater 62). The rationale behind the phased approach to the development is based on the Department of Energy (DoE) requirements of restricting the electricity generation capacity per project to 75 MW.

The broader Zuurwater Solar PV development is now as follows: 3 x 75 MW phases, 2 x 40 MW phases, and 1 x 60 MW phase, which together comprise a larger solar project of up to 365MW. Two of the original phases (Unit 4 and Unit 5) have already been authorised, and the balance of the phases (Phases 1 – 4) are the subject of this EIA phase report.

The approach for the EIA phase, as agreed with DEA, includes the compilation of a consolidated Environmental Impact Report (EIR), which considers Phases 1 – 4 of the Zuurwater PV Project. If authorised, DEA will provide four separate Environmental Authorisations (one for each Phase). This consolidated EIR assesses the following Phases of the Zuurwater PV Project:

- Phase 1 - 14/12/16/3/3/2/470
- Phase 2 - 14/12/16/3/3/2/471
- Phase 3 - 14/12/16/3/3/2/472
- Phase 4 - 14/12/16/3/3/2/473

PVAfrica Development (Pty) Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) phase for the above-mentioned four phases of the Zuurwater PV Project. The EIA process is being undertaken in accordance with the requirements of the DEA (EIA Phase study only) and the EIA Regulations of June 2010 (GNR543) promulgated in terms of the National Environmental Management Act (NEMA; Act No. 107 of 1998). This Draft EIA Report consists of fourteen 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 **Phase One** of the project.
Chapter 7: Presents the conclusions of the EIA, as well as an impact statement for **Phase One** of the project.
Chapter 8: Presents the assessment of environmental impacts associated with **Phase Two** of the project.
Chapter 9: Presents the conclusions of the EIA, as well as an impact statement for **Phase Two** of the project.
Chapter 10: Presents the assessment of environmental impacts associated with **Phase Three** of the project.
Chapter 11: Presents the conclusions of the EIA, as well as an impact statement for **Phase Three** of the project.
Chapter 12: Presents the assessment of environmental impacts associated with **Phase Four** of the project.
Chapter 13: Presents the conclusions of the EIA, as well as an impact statement for **Phase Four** of the project.
Chapter 14: Provides a list of references and information sources used in undertaking the studies for this EIA Report.

The Scoping Phase of the EIA process undertaken by SRK consulting identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. This EIA Phase assessment of Phase 1 – Phase 4 of the Zuurwater PV project addresses those identified potential environmental impacts and benefits associated with the project 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 the four proposed projects.

The release of this draft EIA Report provides 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 will incorporate all issues and responses and will be released for a 21 day public review period prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

INVITATION TO COMMENT ON THE DRAFT EIA REPORT

Members of the public, local communities and stakeholders are invited to comment on the draft EIA Report for Phase 1 – Phase 4 of the PV Facilities near Aggeneys which has been made available for 40-day public review and comment period at the following locations from **22 November 2013 – 20 January 2014**[1]:

» Pofadder Library (Hoofweg Street, Pofadder)
» Aggeneys Library (Havelock Street, Aggeneys)

The report is also available for download from www.savannahsa.com.

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 Draft EIA Report is 20 January 2014

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

[1] Please note that the period of 15 December 2013 – 02 January 2014, as well as public holidays during this period has been excluded from the reckoning of days for the 40-day public review period, in line with the EIA Regulations of June 2010.

PUBLIC FEEDBACK MEETING

In order to facilitate comments on the draft EIA report and provide feedback on the findings of the studies undertaken for Phase 1 – Phase 4 of the PV Facilities near Aggeneys, a public feedback meeting will be as follows:

- **Date:** Tuesday, 10 December 2013
- **Time:** 18:00
- **Venue:** The Recreational Club (Black Mountain Mine), Aggeneys

EXECUTIVE SUMMARY

Background and Project Overview

PVAfrica Development (Pty) Ltd is proposing to establish four commercial photovoltaic solar energy facilities on Portion 3 of the Farm Zuurwater 62 near Aggeneys, in the Northern Cape Province. A larger facility (comprising of seven phases) on the same property was the subject of a previous Environmental Impact Assessment (EIA) undertaken in 2011/2012 for Sato Energy Holdings (Pty) Ltd (Sato), for which the EIA process was completed and individual environmental authorisations for each of the 7 phases issued in August 2012 (DEA Ref Nos 12/12/20/2334/1-7). The Scoping Report and EIA report were compiled for Sato by SRK Consulting. Subsequently, changes to the project have been effected due to technical considerations. In addition, the developer has changed from Sato to PVAfrica Development (Pty) Ltd.

The broader Zuurwater Solar PV development is now as follows: 3 x 75 MW phases, 2 x 40 MW phases, and 1 x 60 MW phase, which together comprise a larger solar project of up to 365MW. Two of the original phases (Unit 4 and Unit 5) have already been authorised, and the balance of the phases (Phases 1 – 4) are the subject of this EIA phase report.

The project falls within the jurisdiction of the Khai Ma Local Municipality which in turn falls under the jurisdiction of the Namakwa District Municipality of the Northern Cape Province. The site (Portion 3 of the Farm Zuurwater No. 62) is located approximately 9 km south-west of Aggeneys. The farm portion covers an area of 4997 ha. The location of the site and each phase of the project are shown in **Figure 1**.

The scope of this EIA applies to the development footprint and associated infrastructure for Phase 1 – Phase 4, including access roads, power lines, substations, cables, offices, etc. Each of the four phases of the proposed project will accommodate several arrays of photovoltaic (PV) panels and associated infrastructure. Each phase is proposed to have stand-alone infrastructure, as each Phase will be bid to the DoE and developed separately. Each phase will comprise of the following typical infrastructure which is included in the scope of this EIA:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power lines to transport the

power from each Phase into the Eskom grid via the Aggeneis MTS Substation.
» Internal access roads.
» Office, workshop area for maintenance and storage.
» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

A temporary on-site water reservoir (with a capacity of ~49 995m^3) will be developed to provide water during the operational phase to all phases of the project. This water will be sourced from the nearby Zinc Mine. An existing pipeline between the Aggeneis Substation and the property boundary will be upgraded and utilised for this purpose. A new pipeline section will be constructed within the site boundaries. This infrastructure will be shared between all phases of the project.

The nature and extent of Phase 1 – Phase 4 of the Zuurwater PV Facility, as well as the potential environmental impacts associated with the construction, operation and decommissioning of each development phase of the projects are explored in more detail in this Draft EIA Report.

Environmental Impact Assessment

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 planning 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), PVAfrica Development (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 Phase 1 of the Zuurwater Solar Energy Facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping[2] 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 undertaken to date 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, and stakeholder letters. Details of registered

[2] The Scoping Phase was undertaken by SRK Consulting (SRK, December 2011) and DEA accepted the approach as proposed by Savannah Environmental to undertake an EIA phase assessment.

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 - entire extent of Portion 3 of the Farm Zuurwater 62), as well as the extent of studies required within the EIA Phase were identified under an EIA report by SRK Consulting (2012), which was accepted by DEA. DEA also accepted the approach / plan of study as proposed by Savannah Environmental to utilise the existing information from the SRK Consulting's Scoping Report and only conduct an EIA phase study for the project.
» *EIA Phase* – potentially significant biophysical and social impacts[3] 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 (EMPrs) for each phase.

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.

[3] Direct, indirect, cumulative that may be either positive or negative.

Impact Statement - Phase 1

From the assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws associated with the site proposed for Phase 1 of the Zuurwater Solar Energy Facility. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Phase 1 of the Zuurwater Solar Energy Facility, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Social and economic impacts.
» Cumulative impacts.

For Phase 1, Power Line Alternative 2 is the ecologically preferred option due to the power line being slightly further away from more sensitive habitat associated with the pans and Bushmanland Sandy Grassland vegetation.

Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option due to the location of Alternative 1 and Alternative 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

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 Phase 1 of the Zuurwater Solar Energy 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 impacts of Phase 1 of the Zuurwater Solar Energy Facility project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation. Refer to Chapter 7 for conditions to be included in the environmental authorisation.

Impact Statement - Phase 2

From the assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws were identified to be associated with the proposed for Phase 2 of the Zuurwater Solar Energy Facility. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Phase 2 of the Zuurwater Solar Energy Facility, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.)
» Social and economic impacts.
» Cumulative impacts.

Alternative 1 is the overall preferred alternative for the power line associated with Phase 2..

Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option due to the location of Alternatives 2 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

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 Phase 2 of the Zuurwater Solar Energy 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 impacts of Phase 2 of the

Zuurwater Solar Energy Facility project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation. Refer to Chapter 9 for conditions to be included in the environmental authorisation.

Impact Statement - Phase 3

From the assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws associated with the site proposed for Phase 3 of the Zuurwater Solar Energy Facility. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Phase 3 of the Zuurwater Solar Energy Facility, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Social and economic impacts.
» Cumulative impacts.

Alternative 1 is the overall preferred alternative for the power line associated with Phase 3.

Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option due to the location of Alternatives 2 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

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 Phase 3 of the Zuurwater Solar Energy 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 impacts of Phase 3 of the Zuurwater Solar Energy Facility project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation. Refer to Chapter 11 for conditions to be included in the environmental authorisation.

Impact Statement - Phase 4

From the assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws associated with the site proposed for Phase 4 of the Zuurwater Solar Energy Facility. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Phase 4 of the Zuurwater Solar Energy Facility, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Social and economic impacts.
» Cumulative impacts.

Alternative 2 is the overall preferred alternative for the power line associated with Phase 4.

Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option due to the location of Alternatives 2 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

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 Phase 4 of the Zuurwater Solar Energy 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 impacts of Phase 4 of the Zuurwater Solar Energy Facility project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

Refer to Chapter 13 for conditions to be included in the environmental authorisation.

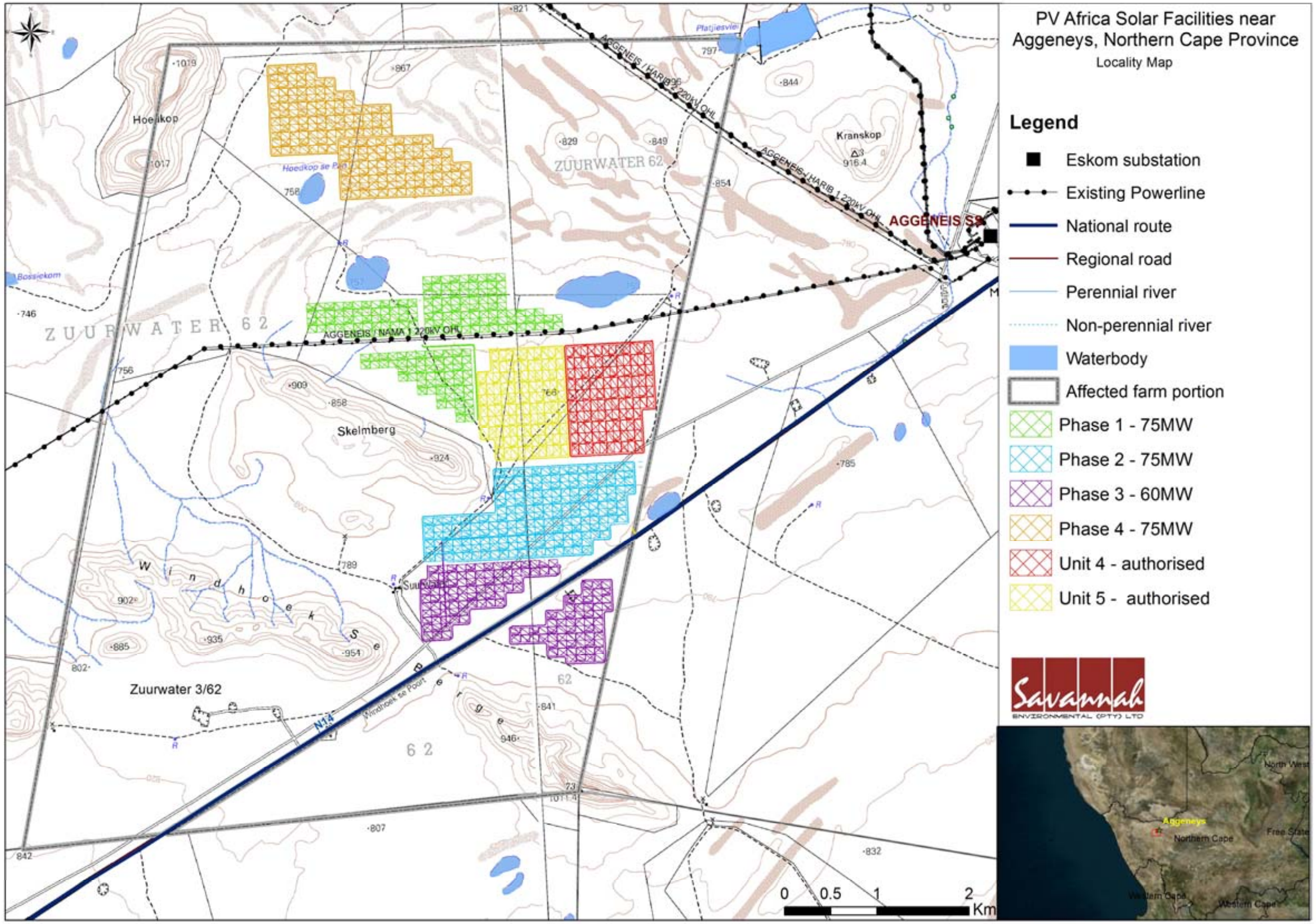

Figure 1: Locality Map Locality map illustrating the location of the assessed development site for Phase 1 – 4 of the Zuurwater PV Facility near Aggeneys, Northern Cape Province

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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 on-going 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
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
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
NC DENC	Northern Cape Department of Environment and Nature Conservation
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

1.1. Background to the Project

PVAfrica Development (Pty) Ltd is proposing to establish four commercial photovoltaic solar energy facilities on the remaining extent of Portion 3 of the Farm Zuurwater 62 near Aggeneys, in the Northern Cape Province. A larger facility (comprising of seven phases) on the same property was the subject of a previous Environmental Impact Assessment (EIA) undertaken in 2011/2012 for Sato Energy Holdings (Pty) Ltd (Sato), for which the EIA process was completed and individual environmental authorisations for each of the 7 phases issued in August 2012 (DEA Ref Nos 12/12/20/2334/1-7). The Scoping Report and EIA report were compiled for Sato by SRK Consulting. Subsequently, changes to the project have been effected due to technical considerations. In addition, the developer has changed from Sato to PVAfrica Development (Pty) Ltd.

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» Units 1, 2, 3, 6 and 7 - The authorisations for these five authorised units have been lapsed. The developer (PVAfrica Development (Pty) Ltd has submitted new applications for environmental authorisation (EA) for four replacement projects on Portion 3 of the Farm Zuurwater 62, but with a new layout and technology (the subject of this EIA report).
» Unit 4 and Unit 5 – The environmental authorisations for these units are still valid and have been amended to now be held by PVAfrica Development (Pty) Ltd.

DEA have accepted the four new applications for environmental authorisation and granted permission for an EIA phase assessment and public participation process to be undertaken for the environmental assessment of the four new phases within the same site (i.e. on the Farm Zuurwater 62). The rationale behind the phased approach to the development is based on the Department of Energy (DoE) requirements of restricting the electricity generation capacity per project to 75 MW. The broader Zuurwater Solar PV development is now as follows: 3 x 75 MW phases, 2 x 40 MW phases, and 1 x 60 MW phase, which together comprise a larger solar project of up to 365MW. Two of the original phases (Unit 4 and Unit 5) have already been authorised, and the balance of the phases (Phases 1 – 4) are the subject of this EIA phase report.

The approach for the EIA phase, as agreed with DEA, includes the compilation of a consolidated Environmental Impact Report (EIR), which considers Phases 1 – 4 of the Zuurwater PV Project. If authorised, DEA will provide four separate Environmental Authorisations (one for each Phase). This consolidated EIR assesses the following Phases of the Zuurwater PV Project:

Table 1.1: DEA Reference numbers for each Phase

Phase / Project Name	**DEA Reference Number**
75MW PV plant on the remaining extent of Portion 3 of the Farm Zuurwater 62 in the Namakwa District, Northern Cape Province – Phase 1	14/12/16/3/3/2/470
75MW PV plant on the remaining extent of Portion 3 of the Farm Zuurwater 62 in the Namakwa District, Northern Cape Province – Phase 2	14/12/16/3/3/2/471
60MW PV plant on the remaining extent of Portion 3 of the Farm Zuurwater 62 in the Namakwa District, Northern Cape Province - Phase 3	14/12/16/3/3/2/472
75MW PV plant on the remaining extent of Portion 3 of the Farm Zuurwater 62 in the Namakwa District, Northern Cape Province - Phase 4	14/12/16/3/3/2/473

PVAfrica Development (Pty) Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) phase for the above-mentioned four phases of the Zuurwater PV Project. The EIA process is being undertaken in accordance with the requirements of the DEA (EIA Phase study only) and the EIA Regulations of June 2010 (GNR543) promulgated in terms of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The nature and extent of Phase 1 – Phase 4 of the Zuurwater PV Facility, as well as the potential environmental impacts associated with the construction, operation and decommissioning of each development phase of the projects are explored in more detail in this Draft EIA Report.

1.2. Summary of the Proposed Development

The proposed site is considered suitable and favourable from a technical perspective due to the following site characteristics:

» **Climatic conditions:** Climatic conditions determine the economic viability of a solar energy facility as it is directly dependent on the annual direct solar irradiation values for a particular area.
» **Orographic conditions:** The site conditions are optimum for a development of this nature. For instance the site slope and aspect for the proposed site is predominantly flat. A level surface area (i.e. a gradient of 3% or less) is preferred for the installation of PV panels.
» **Extent of the site:** Significant land area is required for the proposed development. The site is larger than the area required for development which would allow for the avoidance of any identified environmental or technical constraints.

» **Proximity:** This site is in close proximity to an existing electricity grid connection, which minimises the need for a long connection power line.

The project falls within the jurisdiction of the Khai Ma Local Municipality which in turn falls under the jurisdiction of the Namakwa District Municipality of the Northern Cape Province. The site (Portion 3 of the Farm Zuurwater No. 62) is located approximately 9 km south-west of Aggeneys. The farm portion covers an area of 4997 ha. The location of the site and each phase of the project are shown in **Figure 1.1**.

The scope of the EIA will apply to the development footprint and associated infrastructure for Phase 1 – Phase 4, including access roads, power lines, substations, cables, offices, etc. Each of the four phases of the proposed project will accommodate several arrays of photovoltaic (PV) panels and associated infrastructure. Each phase is proposed to have stand-alone infrastructure, as each Phase will be bid to the DoE and developed separately. Each phase will comprise of the following typical infrastructure which is included in the scope of this EIA:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power lines to transport the power from each Phase into the Eskom grid via the Aggeneis MTS Substation.
» Internal access roads.
» Office, workshop area for maintenance and storage.
» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

A temporary on-site water reservoir (with a capacity of ~49 995m^3) will be developed to provide water during the operational phase to all phases of the project. This water will be sourced from the nearby Zinc Mine. An existing pipeline between the Aggeneis Substation and the property boundary will be upgraded and utilised for this purpose. A new pipeline section will be constructed within the site boundaries. This infrastructure will be shared between all phases of the project.

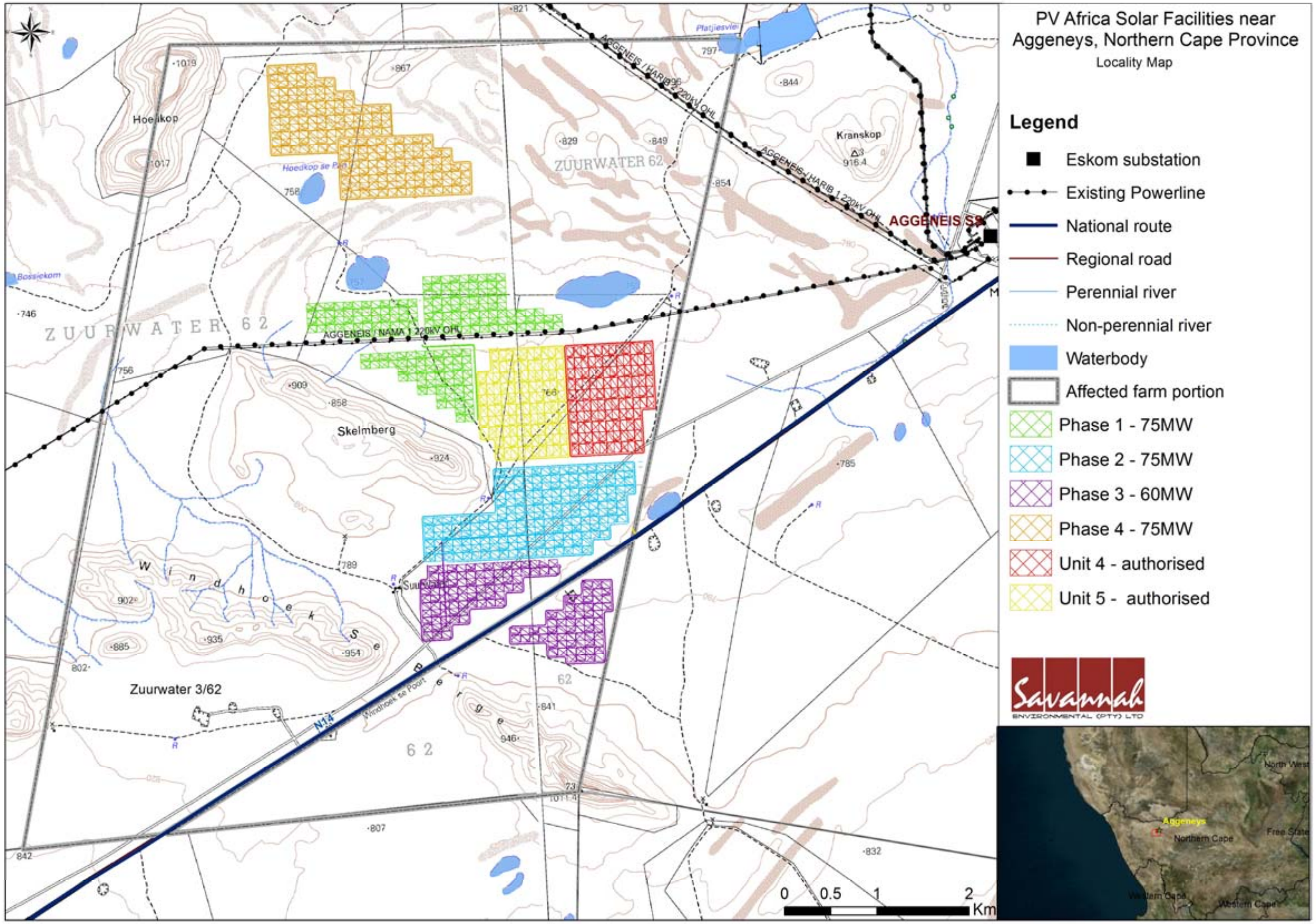

Figure 1.1: Locality map illustrating the location of the assessed development site for Phase 1 – 4 of the Zuurwater PV Facility near Aggeneys, Northern Cape Province

The scope of the proposed Zuurwater PV 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.**

1.3. Conclusions from the Scoping Phase

The full extent of Portion 3 of the Farm Zuurwater 62 was evaluated within the previous Scoping and EIA process and report compiled by SRK Consulting in 2011 – 2012. No environmental fatal flaws were identified to be associated with the broader site through this process. The Scoping Report compiled through this previous EIA process was accepted by DEA in 2012. Therefore, it is considered appropriate and agreed upon by the applicant, DEA and the EAP to utilise the information on the receiving environment and potential impacts identified in the SRK Consulting's Scoping Report and EIA Report in the EIA process to be undertaken by Savannah Environmental for the four revised phases of the project.

1.4. Requirement for an Environmental Impact Assessment Process

The proposed solar energy facility is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 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 authority and the Northern Cape Department of Environmental and Nature Conservation (DENC) will act as a commenting authority for the application. Separate applications for environmental authorisation have been accepted by DEA under application reference numbers as stated in Table 1.2.

Compliance with the requirements of the EIA Regulations ensures that decision-makers are provided with an 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.

An EIA is 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 developer with the opportunity of being fore-warned of potential environmental issues. Subsequently it may assist with the resolution of issues reported on in the Scoping and EIA Phases as well as promoting dialogue with interested and affected parties (I&APs) and stakeholders. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations R543, an EIA is required to be undertaken for this proposed project as the proposed project includes the following “listed activities” applicable to each of the four phases, in terms of GN R544, R545 and R546 (GG No 33306 of 18 June 2010 as amended).

Table 1.2: EIA Listed Activities Applicable to each of the Four Phases of the PV Projects on Portion 3 of the Farm Zuurwater 62

Number and date of the relevant notice:	**Activity No (s) (in terms of the relevant notice):**	**Describe each listed activity as per project description:**
GN544	9	The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water - (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more ***A water supply pipeline will be required to be constructed.***
GN544	10	The construction of facilities or infrastructure for the transmission and distribution of electricity – (a) Outside urban areas or industrial complexes with a capacity of more than 33kV but less than 275kV; or (b) Inside urban areas or industrial complexes with a capacity of 275kV or more. ***Overhead power line with a capacity up to of 275kV.***
GN544	11	The construction of: (iii) bridges; (x) buildings exceeding 50 square metres in size; or (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.

Number and date of the relevant notice:	Activity No (s) (in terms of the relevant notice):	Describe each listed activity as per project description:
		Pans on the development site could be affected by the proposed development.
GN544	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 watercourse. ***Pans on the development site could be affected by the proposed development.***
GN545	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 MW or more. ***Each PV facility / phase would be up to 75MW in capacity.***
GN545	8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex. ***Overhead power lines with a capacity of up to 275kV***
GN545	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. ***The development footprint for each phase (75MW each) would be in excess of 20ha.***
GN546[4]	2 (a) (iii) (dd)	The construction of reservoirs for bulk water supply with a capacity of more than 250 cubic metres. ***A reservoir is required for storage and supply of water to the facility. The site is located within a Critical Biodiversity Area.***
GN546	4 (a) (ii) (ee)	The construction of a road wider than 4 metres with a reserve less than 13,5 metres

[4] Details regarding the applicability of activities identified as being relevant in terms of GNR546 are provided in Chapters 5, 6, 8 and 10 of this report.

Number and date of the relevant notice:	**Activity No (s) (in terms of the relevant notice):**	**Describe each listed activity as per project description:**
		Access roads would be required to be constructed for the proposed facility. The site is located within a Critical Biodiversity Area.
GN546	10 (a) (ii) (ee)	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres ***Hazardous materials will need to be stored on site during construction and operation. The site is located within a Critical Biodiversity Area.***
GN546	12 (b)	The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. ***Vegetation will be cleared for the construction of the facility. The site is located within a Critical Biodiversity Area.***
GN546	13 (a)	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. ***Vegetation will be cleared for the construction of the facility. The site is located within a Critical Biodiversity Area.***
GN546	14 (a) (i)	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation ***Vegetation will be cleared for the construction of the facility. The site constitutes natural vegetation.***
GN546	16 (a) (ii) (ff)	The construction of: (iii) buildings with a footprint exceeding 10 square metres in size; or (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a

Number and date of the relevant notice:	**Activity No (s) (in terms of the relevant notice):**	**Describe each listed activity as per project description:**
		watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. ***Pans occur on the development site which could be affected by the proposed development.***
GN546	19 (a) (ii) (ee)	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. ***Existing roads may need to be widened or lengthened. The site is located within a Critical Biodiversity Area.***

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

1.5. Objectives of the EIA Process

The Scoping Phase for the Zuurwater PV Facility was completed by SRK Consulting in 2012. The scoping phase 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).

This EIA Phase (i.e. the current phase) and EIA report addresses 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 provides 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 will incorporate all issues and responses raised during the public review phase prior to submission to DEA.

1.6. Details of the Environmental Assessment Practitioner and Specialist Team

Savannah Environmental was appointed by PVAfrica Development (Pty) Ltd as the independent EAP to undertake the EIA process for the proposed project. Neither Savannah Environmental nor any of its specialist sub-consultants are subsidiaries of or are affiliated to PVAfrica Development (Pty) Ltd. 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 consultancy which provides a holistic environmental management service, including environmental assessment and planning to ensure compliance with relevant environmental legislation. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team that has been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa and neighbouring countries. Strong competencies have been developed in project management of environmental processes, as well as strategic environmental assessment and compliance advice, and the assessment of environmental impacts, the identification of environmental management solutions and mitigation/risk minimising measures.

The EAPs from Savannah Environmental who are responsible for this project are:

» Karen Jodas - a registered Professional Natural Scientist and holds a Master of Science degree. 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 and the EAP on this project.
» Ravisha Ajodhapersadh holds a Bachelor of Science degree with Honours in Environmental Management and has 5 years experience in environmental management and has undertaken EIAs for solar energy facilities in South Africa.

Savannah Environmental has developed a detailed understanding of impacts associated with the construction and operation of renewable energy facilities through their involvement in numerous EIA processes for these projects. In order to adequately identify and assess potential environmental impacts, Savannah Environmental has appointed specialist consultants as required.

The existing and relevant environmental specialist studies that were undertaken over the same property in the recent EIA for the Zuurwater PV solar plants by SRK Consulting included:

» Ecological specialist report by Prof. George Bredenkamp of EcoAgent.
» Soils and Agricultural Potential specialist report by Marinus de Beer of Echo Soil Solutions.
» Heritage specialist report by David Morris of the McGregor Museum.
» Visual specialist report by Keagan Allan of SRK.
» Socio-economic specialist report by Amina Ismail of SRK.
» Traffic specialist report by Michael Alan van Tonder of Aurecon.
» Palaeontology specialist opinion by Dr John Almond of Natura Viva.
» Air quality specialist opinion by Vis Reddy of SRK.
» Surface water and geotechnical specialist report by Murray Sim of SRK.

The above-mentioned specialist reports provide a comprehensive assessment of the potential impacts associated with the development of PV facilities on Portion 3 of the Farm Zuurwater 62. However, in order to ensure that the full extent of the affected footprint associated with the revised layout (i.e. the four phases) is adequately assessed, the following specialist studies have been amended to include and assess the specific development footprint associated with each Phase of the project:

» Ecological specialist report
» Soils and Agricultural Potential specialist report
» Heritage specialist report
» Visual specialist report
» Socio-economic specialist report
» Traffic specialist report

The following specialist studies do not require any changes and will be utilised as provided by SRK Consulting in their Final EIA Report to DEA.

» Palaeontology specialist opinion
» Air quality specialist opinion
» Surface water and geotechnical specialist report

Curricula vitae for the Savannah Environmental project team and its specialist sub-consultants are included in Appendix A.

DESCRIPTION OF THE PROPOSED PROJECT CHAPTER 2

This chapter provides an overview of Phases 1 – 4 of the proposed PV Facilities on Portion 3 of the Farm Zuurwater near Aggeneys, Northern Cape Province. Each phase will be a stand-alone project and up to 75MW in capacity in line with the DoE requirements under the Renewable Energy Independent Power Producer Programme (REIPPP). The project scope (relevant to each individual phase) includes the planning and design, construction, operation and decommissioning phases during which potential impacts will vary in terms of their nature and significance. This chapter also explores the "Do-Nothing" alternative - that is the alternative of not establishing each phase of the solar energy facility.

2.1. Purpose of the Proposed Project

Each phase of the proposed solar energy facility will be developed as a stand-alone commercial solar energy facility. The power generated from each solar energy facility will be sold to Eskom to feed into the national electricity grid. The purpose of each phase of the solar energy facility is to add new capacity for generation of 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 build 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.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, PVAfrica Development (Pty) Ltd is proposing the establishment of Phase 1 – Phase 4 of the proposed Zuurwater PV Facility on Portion 3 of the Farm Zuurwater near Aggeneys to add new capacity to the national electricity grid. PVAfrica Development (Pty) Ltd will be required to apply for a generation license from the National Energy Regulator of South Africa

(NERSA) for each Phase of the project, as well as sign a power purchase agreement with Eskom (typically for a period of 20 years) in order to build and operate each facility. As part of the agreement, the IPP 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, each solar energy facility can either be decommissioned, or the power purchase agreement may be renegotiated and extended for a further period.

It is considered viable that long-term benefits for the community and/or society in general can be realised should the four phases of the PV facility project prove to be acceptable from a technical and environmental perspective. The projects have the potential to contribute to national electricity supply and to increase the security of supply to consumers as well as supporting South Africa's commitment to reducing greenhouse gas emissions. Over 90% of South Africa's electricity generation is coal-based, resulting in annual per capita carbon emissions of approximately 8.9 tons per person, according to 2008 World Bank estimates. According to the Carbon Dioxide Information Analysis Centre, South Africa is the 13th largest carbon dioxide emitting country, based on 2008 fossil-fuel CO_2 emissions. The nation is also the largest emitting country on the continent of Africa, pinpointing the importance of introducing greener solutions to the energy mix. Furthermore, it may provide both economic stimulus to the local economy through the construction process and long term employment (i.e. management and maintenance) during the operation phase of each project.

2.2. Description of the Four Proposed Solar Energy Facilities

Each of the four PV facilities on Portion 3 of the Farm Zuurwater 62 near Aggeneys are intended to generate electricity by harnessing solar energy (from the sun) by utilising photovoltaic (PV) technology. The main components of each facility include:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power lines to transport the power from each Phase into the Eskom grid via the Aggeneis MTS Substation.
» Internal access roads.
» Office, workshop area for maintenance and storage.

» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

An on-site water reservoir (with a capacity of ~49 995m^3) will be developed to provide water during the operational phase to all phases of the project. This water will be sourced from the nearby Zinc Mine. An existing pipeline between the Aggeneis Substation and the property boundary will be upgraded and utilised for this purpose. A new pipeline section will be constructed within the site boundaries. This infrastructure will be shared between all phases of the project.

Phases 1, 2 and 4 of the facility are proposed to have a generating capacity of up to 75 MW. Phase 3 is proposed to have a generating capacity of up to 60MW. Portion 3 of the Farm Zuurwater No. 62 is located approximately 9 km south-west of Aggeneys. The farm portion covers an area of 4997 ha. A combined area of approximately 890 ha (of the 4997 ha) will be occupied by the PV module arrays and associated infrastructure associated with the four phases of development. The land area to be occupied by each phase shown in the Table below:

Table 2.1: Land Area and Centre Point for each Phase of the PV Facility on Portion 3 of the Farm Zuurwater 62

Phase Number	**Output**	**Area(Hectares)**	**Coordinates for Central Point of the Phase**	
			Latitude	***Longitude***
Phase 1	75MW	267ha	29°18'14.30"S	18°44'27.92"E
Phase 2	75MW	209ha	29°19'13.77"S	18°45'10.93"E
Phase 3	60MW	192ha	29°19'44.35"S	18°44'50.13"E
Phase 4	75MW	222ha	29°16'59.83"S	18°43'56.47"E

These proposed facilities form part of a larger development of up to 365MW in capacity (comprising six units in total, the “Project”).

A layout of each of the four phases of the proposed facility and associated infrastructure (such as access roads, water reservoir and pipeline, power lines and laydown areas) being considered within this EIA Report has been provided by the project developer, and is indicated in Figure 2.1. This is the layout which has been assessed within this EIA Report.

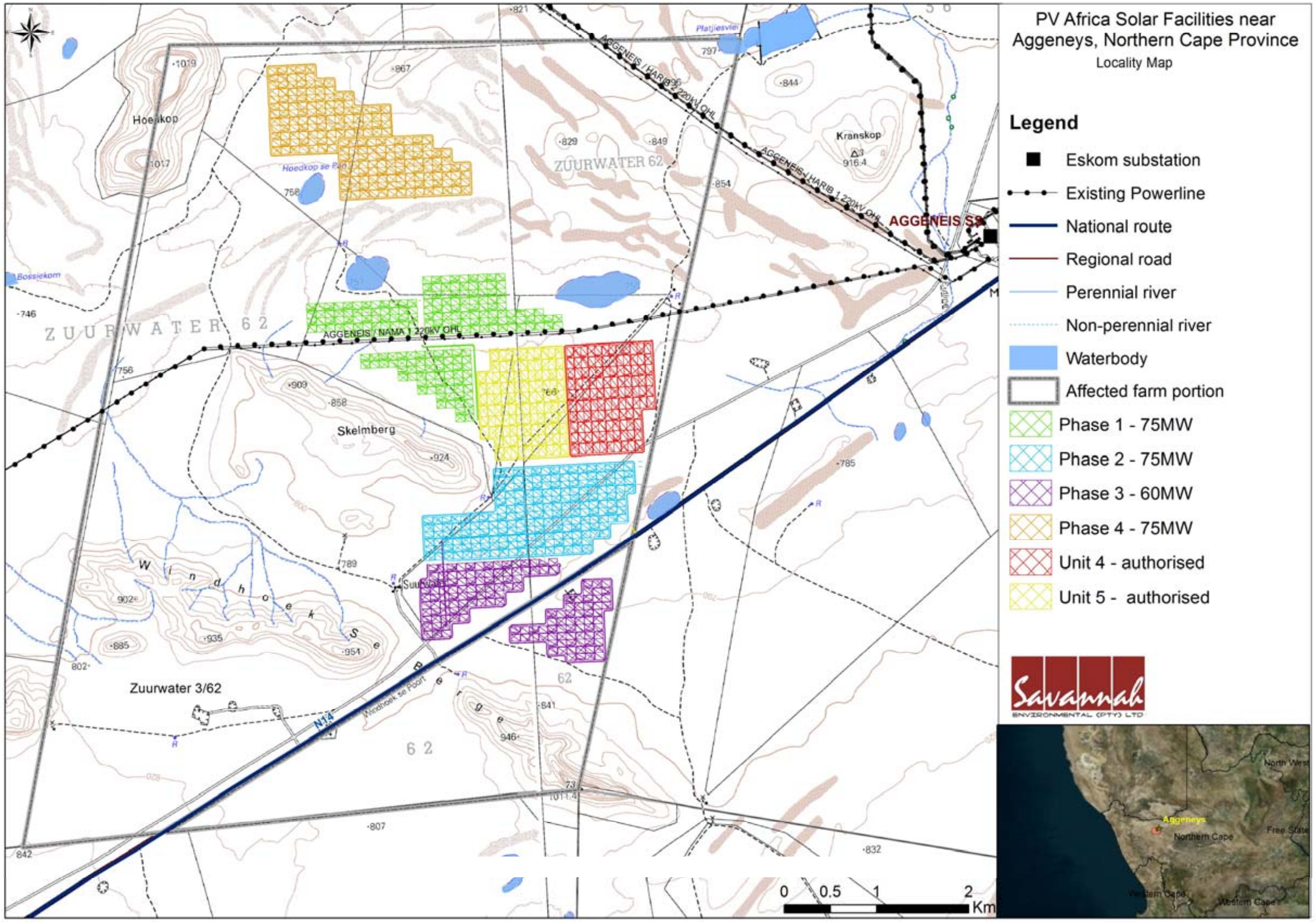

Figure 2.1: Layout for the proposed Zuurwater Solar Facility indicating the location of the four planned phases on Portion 3 of the farm Zuurwater (note that the authorised Units 4 and 5 are also indicated on the map)

2.2.1 Phase 1

The Phase 1 PV arrays are proposed to be located to the north-west of the authorised Unit 4 and Unit 5 (phase 1 is indicated in green in Figure 2.1). Phase 1 is located approximately 11.5km south-west of the town of Aggeneys (straight line distance). The proposed generating capacity for this phase is 75MW, covering an area of 267ha. An on-site substation is also proposed for this phase, as shown in Figure 2.1. A power line is also required and described in Section 2.7 below.

2.2.2 Phase 2

The Phase 2 PV arrays are proposed to be located to the south of authorised Unit 4 and Unit 5 (phase 2 is indicated in blue in Figure 2.1). Phase 2 is located approximately 12km south-south-west of the town of Aggeneys (straight line distance). The proposed generating capacity for this phase is 75MW, covering an area of 209ha. An on-site substation is also proposed for this phase, as shown in Figure 2.1. A power line is also required and described in Section 2.7 below.

2.2.3 Phase 3

The Phase 3 PV arrays are proposed to occupy the southern-most position within the larger facility layout (phase 3 is indicated in purple in Figure 2.1). Phase 3 is bisected by the N14 and is located approximately 13km south-south-west of the town of Aggeneys (straight line distance). The proposed generating capacity for this Phase is 60MW, covering an area of 192ha. An on-site substation is proposed to the south of Phase 2, adjacent to the upper section of Phase 3, alongside the N14. An on-site substation is also proposed for this phase, as shown in Figure 2.1. A power line is also required and described in Section 2.7 below.

2.2.4 Phase 4

The Phase 4 array is proposed to be located to the north of the Phase 1 PV array (phase 4 is indicated in orange in Figure 2.1). Phase 4 is located approximately 11km south-west of the town of Aggeneys (straight line distance). The proposed generating capacity for this phase is 75MW, covering an area of 222ha. An on-site substation is also proposed for this phase, as shown in Figure 2.1. A power line is also required and described in Section 2.7 below.

Table 2.2 summarises the dimensions of the project components.

Table 2.2: Dimensions of the components of Phase 1 – 4 of the Zuurwater Solar Energy Facility

<table>
<tr><th>Component</th><th colspan="2">Description / Dimensions</th></tr>
<tr><td>Location of the site</td><td colspan="2">Portion 3 of the Farm Zuurwater No. 62, located adjacent to the N14 between Springbok and Pofadder, approximately 9km west of the town of Aggeneys within the Khai Ma Local Municipality.</td></tr>
<tr><td>Municipal Jurisdiction</td><td colspan="2">The property is located within the Khai Ma Local Municipality which falls within the Namakwa District Municipality.</td></tr>
<tr><td>Electricity Generating capacity</td><td colspan="2">» Phase 1 – 75MW
» Phase 2 – 75MW
» Phase 3 – 60MW
» Phase 4 – 75MW</td></tr>
<tr><td>Extent of the proposed development footprint</td><td colspan="2">» Phase 1 - 267ha
» Phase 2 - 209ha
» Phase 3 - 192ha
» Phase 4 - 222ha</td></tr>
<tr><td>Extent of broader site</td><td colspan="2">4997 hectares (Portion 3 of the Farm Zuurwater 62)</td></tr>
<tr><td>Site access</td><td colspan="2">Main access to the site will be via a new access road from the N14. Internal access roads of up to 7m wide will also be required.</td></tr>
<tr><td>Proposed technology</td><td colspan="2">Solar photovoltaic technology (static, tracking or thin film)</td></tr>
<tr><td rowspan="5">Water use</td><td>Project</td><td>Construction volume per month</td></tr>
<tr><td>Phase 1</td><td>20 000 m^3</td></tr>
<tr><td>Phase 2</td><td>20 000 m^3</td></tr>
<tr><td>Phase 3</td><td>20 000 m^3</td></tr>
<tr><td>Phase 4</td><td>20 000 m^3</td></tr>
<tr><td>Panel Dimensions</td><td colspan="2">1 200mm x 600mm (0.72m^2)</td></tr>
<tr><td>Number of Panels</td><td colspan="2">» Phase 1 - 930 000
» Phase 2 - 930 000
» Phase 3 - 756 000
» Phase 4 - 930 000</td></tr>
<tr><td>Number of inverters</td><td colspan="2">» Phase 1 - 110
» Phase 2 - 110
» Phase 3 - 80
» Phase 4 - 110</td></tr>
<tr><td>Distribution transformers as part of inverters</td><td colspan="2">Transformer capacities will be selected based on cost and market availability prior to construction. A typical medium voltage transformer is 3m wide, 3m long, and 3m high.</td></tr>
<tr><td>Main transformer / substation capacity (maximum)* Up to 275kV</td><td colspan="2">» Phase 1 - 75 MW 33/275* kV; maximum area of 3720 m^2
» Phase 2 - 75 MW 33/275* kV; maximum area of 3720 m^2
» Phase 3 - 60 MW 33/275* kV; maximum area of 3720 m^2
» Phase 4 - 75 MW 33/275 kV; maximum area of 3720 m^2</td></tr>
<tr><td>Height of installed panels from ground level</td><td colspan="2">4m</td></tr>
<tr><td>Height of inverters</td><td colspan="2">3m</td></tr>
</table>

Component	Description / Dimensions
Height of Transformers	3.5m
Internal power collection system poles	~11m
Height of Buildings	4m
Height of Fencing	3.5m
Office / workshop (size)	1 100 m^2
New overhead power line between the site and Aggeneis Substation (up to 275kV)	Distance: » Phase 1 – 5.6km » Phase 2 – 5-6km, depending on the alternative selected » Phase 3 – 7-7.5km, depending on the alternative selected » Phase 4 – 6-8km, depending on the alternative selected Height of towers: 50m
Water reservoir (shared infrastructure for all phases)	Capacity – 49 995m^3 Footprint - 20 000m^2
Water pipeline between Aggeneis substation and site	» Maximum diameter of 203.2mm » Maximum water flow will be 3,000m^2/day (which is 351 litres per second) » 5-6km in length, depending on preferred alternative

During construction of each phase, temporary infrastructure housing for workers, construction trailers, temporary construction water storage ponds (10 000m^3) and a laydown area (10 hectares in extent) will be required. Should more than one facility be constructed at one time, it may be possible to consolidate this infrastructure. This would however only be determined at the time of construction.

2.3. Solar Energy as a Power Generation Technology

The generation of electricity can be easily explained as the conversion of energy from one form to another. Solar energy facilities operate by harnessing solar energy and converting it into a useful form (i.e. electricity). Solar technologies can be divided into two categories, those that harness solar energy to create thermal energy which in turn can be converted into electricity, and those that use the electromagnetic radiation of the sun and convert it directly into electricity. The latter is known as photovoltaic (PV) technology, which is proposed for this project, and is the direct conversion of sunlight into electricity without the use of water for power generation.

The use of solar energy for electricity generation is a non-consumptive use of a natural resource. Renewable energy is considered a ‘clean source of energy’ with the potential to contribute greatly to a more ecologically, socially, and economically sustainable future. The challenge now is ensuring solar energy projects are able to meet all economic, social, and environmental sustainability criteria in terms of NEMA.

2.4.1 How do Grid Connected Photovoltaic Facilities Function?

Solar energy facilities, such as those using PV technology use the energy from the sun to generate electricity through a process known as the Photoelectric Effect. A PV cell or solar cell is the semiconductor device that converts sunlight into electricity. These cells are interconnected to form panels which, in turn, are combined with associated structural and electrical equipment to create what are called arrays – the actual solar generation systems which connect to the energy grid. As sunlight hits the solar panel, photons can be reflected, absorbed, or pass through the panel. When photons are absorbed, they have the energy to knock electrons loose, which flow in one direction within the panel and exit through connecting wires as solar electricity.

There are several types of semiconductor technologies currently in use for PV solar panels. Two however, have become the most widely adopted: crystalline silicon and thin film. The former is constructed by first putting a single slice of silicon through a series of processing steps, creating one solar cell. These cells are assembled together in multiples to make a solar panel. The latter is made by placing thin layers, hence the name thin-film, of semiconductor material onto various surfaces, usually glass. This project proposes using a thin-film PV technology which encloses the semiconductor between two sheets of glass.

A solar energy facility typically uses the following components:

The **Photovoltaic Panels**
Solar photovoltaic (PV) panels consist primarily of glass and various semiconductor materials and in a typical solar PV project, will be arranged in rows to form solar arrays, as shown in Figure 2.3 and Figure 2.4. The PV panels are designed to operate continuously for more than 25 years with minimal maintenance required.

Figure 2.3: Picture of a PV Panel (courtesy of First Solar, Inc)

Figure 2.4: Picture of the installation of a typical PV array (courtesy of First Solar, Inc)

Figure 2.5: Picture of a typical PV array

Figure 2.6: Picture of a typical PV array

Figure 2.5: Illustration of a photovoltaic solar facility (courtesy of First Solar)

The **Support Structure**

The photovoltaic (PV) modules will be mounted to steel support structures called tables. These can either be mounted at a fixed tilt angle, optimised to receive the maximum amount of solar radiation and dependent on the latitude of the proposed facility, or a tracking mechanism where at a maximum tilt angle of 45° the lowest part of the panel 30cm from the ground.

The **Inverter**

The photovoltaic effect produces electricity in direct current (DC). Therefore an inverter must be used to change it to alternating current (AC) for transmission in the national grid. The inverters convert the DC electric input into AC electric output, and then a transformer steps up the current to 33 kV for on-site transmission of the power. The inverter and transformer are housed within the power conversion station (PCS). The PV combining switchgear (PVCS), which are dispersed among the arrays, collects the power from the arrays for transmission to the project's substation.

Figure 2.6: Image of a typical inverter

Figure 2.7: Photograph of a typical transformer (courtesy of First Solar)

Figure 2.8: Typical PV Combining Switchgear Cabinet

2.4. Water Requirements

An operational PV plant does not require water for the generation of electricity. Water is required for the construction of the facility and human uses during operation. In certain instances, water is also used for cleaning the panels to remove dust or dirt that builds up on the panels.

During the construction period, water will be used for site preparation, compaction of building pads, road preparation, and dust control where necessary. A 75MW plant will require approximately 900 m^3 of water per month during the construction phase, although a higher volume could be required in the hotter periods of the year. A volume of approximately 3600m^3 per annum would be required during the operational phase. Water will be obtained from the nearby Zinc mine via an existing pipeline, which will be upgraded between the Aggeneis Substation and the site. This has been discussed with the Pelladrift Water Board who has confirmed availability of the required water. The water will be stored temporarily in an on-site reservoir with an anticipated capacity of ~49 995 m^3. This temporary reservoir will supply water to all phases of the project.

The preferred option for this reservoir is to excavate a pond with an area of approximately 20 000 m^2 and up to 3m deep. The reservoir will be lined on the inside with either high density polyethylene (HDPE) or low density polyethylene (LDPE) as shown in Figure 2.9 below. In addition to being waterproof, these materials are also ultraviolet light (UV) resistant which decreases the probability of the liner degrading due to exposure to sunlight. Alternative liners exist and will be considered for the project. These include a tough geotextile membrane which is coated with a rubberized bitumen, Poly Vinyl Acetate (PVC), Geosynthetic clay linings (GCL), Anchor knob sheeting (AKS), Geonets or Geotextiles. A temporary perimeter fence will encircle the reservoir for health and safety reasons and to limit access to the location. At the completion of the construction of the project the stakes and the lining will be removed and the soils returned to the original topography.

Figure 2.9: A HDPE liner inserted into an excavated pond.

2.5. Project Alternatives

In accordance with the requirements of the EIA Regulations[5], alternatives are required to be considered within any environmental impact assessment (EIA) process, and may refer to any of the following:

- » Site alternatives
- » Design or layout alternatives
- » Technology alternatives
- » The No-go alternative

2.5.1 Site Alternatives

Due to the nature of the development (i.e. PV solar energy facilities), the location of the facilities are largely dependent on technical and environmental factors such as solar irradiation (i.e. the fuel source), climatic conditions, topography of the site, and access to the grid. 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 Namibian border has particularly high solar irradiation levels and is considered to be the most efficient location in the country for a solar energy project, as shown by the solar irradiation model below (see Figure 2.10).

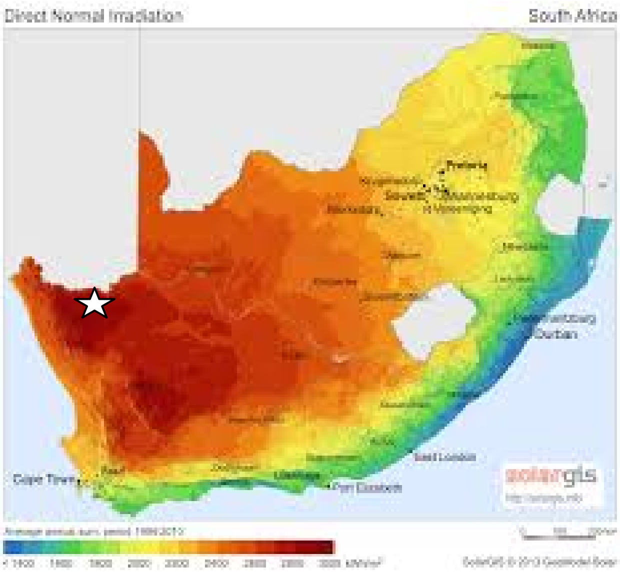

Figure 2.10: Solar irradiation map for South Africa (Source: adapted from GeoModel Solar, 2011)

The following characteristics were considered in determining the feasibility of the broader development site for the proposed development. Based on these

5 GNR543 27(e) calls for the applicant to identify feasible and reasonable alternatives for the proposed activity.

considerations, PVAfrica Development (Pty) Ltd considers the proposed site as their highly preferred site for the development of the Solar Energy Facility.

Site extent: Space is a constraining factor for a large-scale PV solar facility installation. The three PV facilities of 75 MW each (Phases 1, 2 and 4) require, on average, an area of approximately 235 ha and the 60MW facility (Phase 3) requires approximately 195 ha. There is sufficient space for the full extent of the proposed project within the area under consideration (Portion 3 of the Farm Zuurwater has a total size of ~4997 ha).

Site availability: The site is available for lease by the project developer for the proposed PV Facility development. In conversations with the farmer on Zuurwater (SRK, 2012), it was indicated that prospecting has previously occurred on the farm and that no mineral deposits of economic value have been found to date. Mining is thus an unlikely land use option for the area. Given the extremely remote, as well as arid nature of the environment of the project area, other land use alternatives other than tourism development are considered very unlikely.

Site access: The N14, a national road passes through the project site. Site access to the proposed four phases will be via a new access road from the N14 to the project site. For phases that do not have direct access via the N14, on-site access roads will be used to access the project sites from the N14. With the project sites having been optimised within the non-sensitive ecological spaces, site access is effectively optimised within the remaining spaces to allow sufficient access to each project site phase.

Climatic conditions: The economic viability of a PV facility is strongly dependent on the annual direct solar irradiation values. The Northern Cape receives the highest average daily direct normal and global horizontal irradiation in South Africa which indicates that the regional location of the project is appropriate to a solar energy facility. Factors contributing to the location of the project include the relatively high number of daylight hours and the low number of rainy days experienced in this region. A Global Horizontal Radiation (GHI)[6] of ~2352 kWh/m²/year is relevant for the area in which the site is located.

Site slope and aspect: A level surface area (i.e. a gradient of 3% or less) is preferred for the installation of PV panels (Fluri, 2009) and the most flat areas of the site are proposed for the PV panels.

Grid Connection: The proposed site is located within close proximity to the Aggeneis Substation where there is grid capacity available for the connection of the

[6] GHI is the total amount of shortwave radiation received from above by a surface horizontal to the ground. This value is of particular interest to photovoltaic installations and includes both Direct Normal Irradiance (DNI) and Diffuse Horizontal Irradiance (DIF).

proposed project. Primary grid connection routes and alternatives are proposed for each phase (refer to Section 2.5.4 below).

2.5.2 Layout Alternatives

Alternative sites within the Zuurwater farm boundary were considered during the site selection (screening) and scoping processes, and were excluded based on environmental sensitivity including biodiversity, hydrology and grazing potential. The location of the various phases therefore aims to avoid these identified sensitivities and the area available for the layout of the infrastructure is constrained on this basis. No feasible alternative locations within the broader site for any of the phases were identified for investigation.

2.5.3 Technology Alternatives

As it is the intention of the developer to develop renewable energy projects as part of the DoE's REIPPP, only renewable energy technologies are being considered. 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 (i.e. solar irradiation). Solar PV was determined as the most suitable option for the proposed site as large volumes of water are not needed for power generation purposes compared to concentrated solar power technology (CSP). PV is also preferred when compared to CSP technology because of the lower visual profile.

Fixed tilt or tracking thin film photovoltaic technology is being considered for the project. Photovoltaic solar panels point north at an optimal azimuth angle when located in the Southern Hemisphere. In order to increase the energy production of the photovoltaic facility the PV panels need to utilise as much of the solar energy available as possible. Static PV panels are fixed at an angle and do not "track" the sun. However, tracking PV systems enable the PV panels to follow the sun's longitudinal rotation path during the day, every day of the year giving it the best solar panel orientation, therefore maximizing energy production.

2.5.4. Grid Connection Alternatives

The four phases of the project site are located, approximately 5 km west of the Eskom Aggeneis Substation. The power generated from each of the four phases will be collected and transformed by the solar field at an on-site substation before transmission into the Aggeneis Substation. The power line could have a voltage of up to 275kV with a servitude width of up to 24m wide. Two power line alternatives have been identified for each phase. The length and specific routing of the power line for each Phase of the project is detailed in the section below. These alternatives are assessed within this EIA Report and a preferred option recommended for implementation.

i) <u>Power Line – Phase 1</u>

The two power line alternatives for Phase 1 are illustrated in Figure 2.11.

» Alternative 1: This alternative is proposed to follow the existing Aggeneis-Nama 220kV power line to the Aggeneis Substation. This alternative is proposed to the north of this power line and is ~5.6km in length.
» Alternative 2: This alternative is proposed to follow the existing Aggeneis-Nama 220kV power line to the Aggeneis Substation. This alternative is proposed to the south of this power line and is ~5.6 km in length.

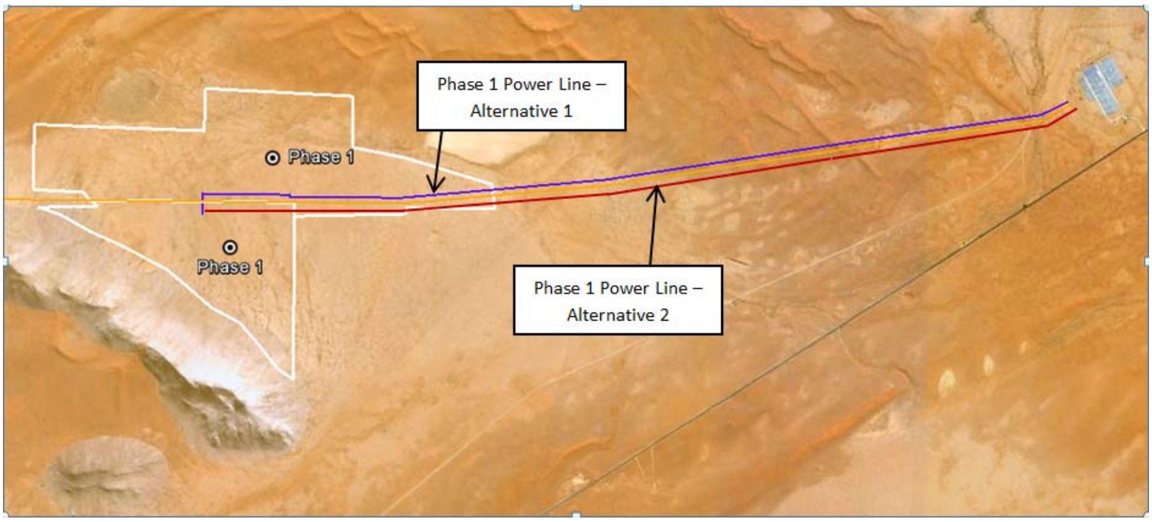

Figure 2.11: Grid Connection Routing Alternatives – Phase 1

ii) <u>Power Line – Phase 2</u>

The two power line alternatives for Phase 2 are illustrated in Figure 2.12.

» Alternative 1: This alternative is proposed in a north-west direction, adjacent to the property boundary up to the existing Aggeneis-Nama 220kV power line to the north of the site. The route then follows this power line to the Aggeneis Substation. The length of this power line alternative is ~6 km.
» Alternative 2: This alternative is proposed in a southern direction, adjacent to the property boundary up to the N14 located to the south of the site. The route then follows this road to the Aggeneis Substation. The length of this power line alternative is ~5 km.

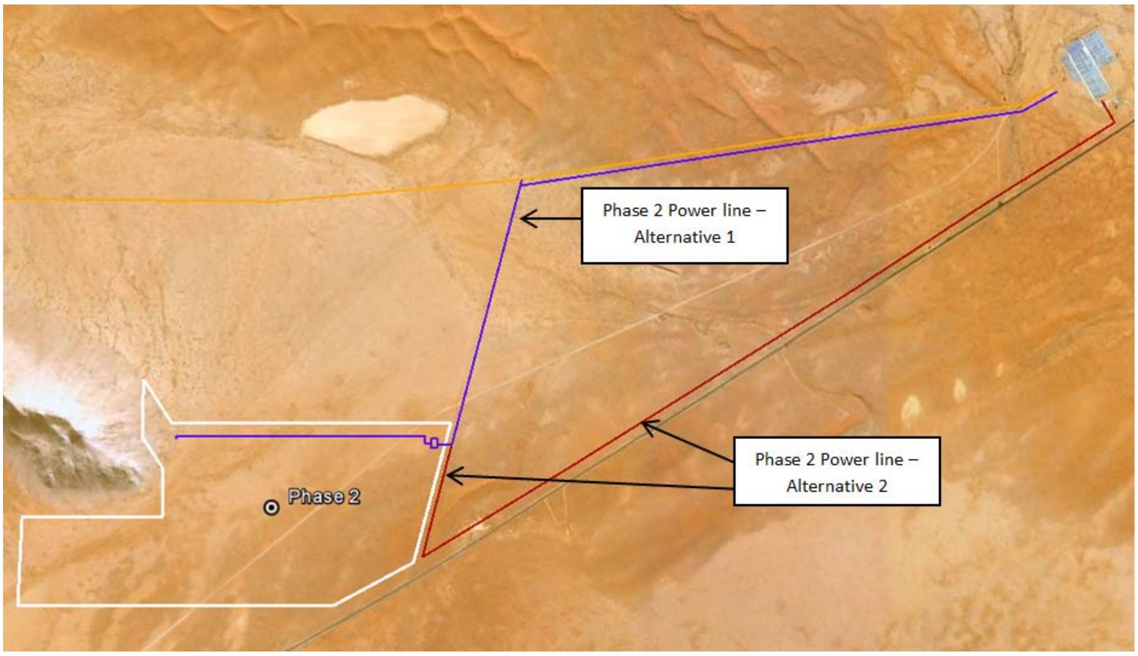

Figure 2.12: Grid Connection Routing Alternatives – Phase 2

iii) <u>Power Line – Phase 3</u>

The two power line alternatives for Phase 3 are illustrated in Figure 2.13.

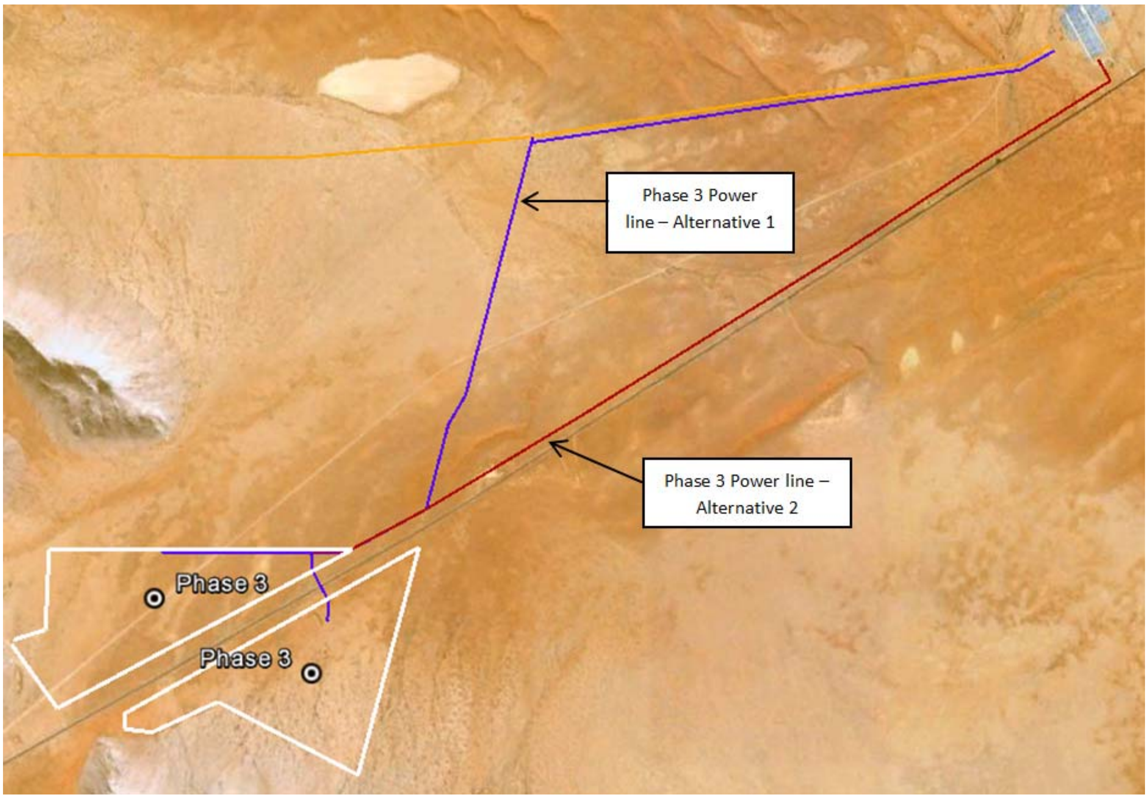

Figure 2.13: Grid Connection Routing Alternatives – Phase 3

» Alternative 1: This alternative is proposed from the on-site substation to the project boundary and then in a north-west direction, adjacent to the property boundary up to the existing Aggeneis-Nama 220kV power line to the north of the site. The route then follows this power line to the Aggeneis Substation. The length of this power line alternative is ~7.5 km.

» Alternative 2: This alternative is proposed directly adjacent to and to the north of the N14 running north-east towards the Aggeneis Substation. The length of the power line alternative is ~7.1 km.

iv) <u>Power Line – Phase 4</u>

The two power line alternatives for Phase 4 are illustrated in Figure 2.14.

» Alternative 1: This alternative is proposed in a southern direction up to the existing Aggeneis-Nama 220kV power line to the south of the site. The route then follows this power line to the Aggeneis Substation. The length of the power line alternative is ~7.7km.

» Alternative 2: This alternative is proposed in a south-eastern direction up to the existing Aggeneis-Nama 220kV power line to the south of the site. The route then follows this power line to the Aggeneis Substation. The length of the power line alternative is ~6.2 km.

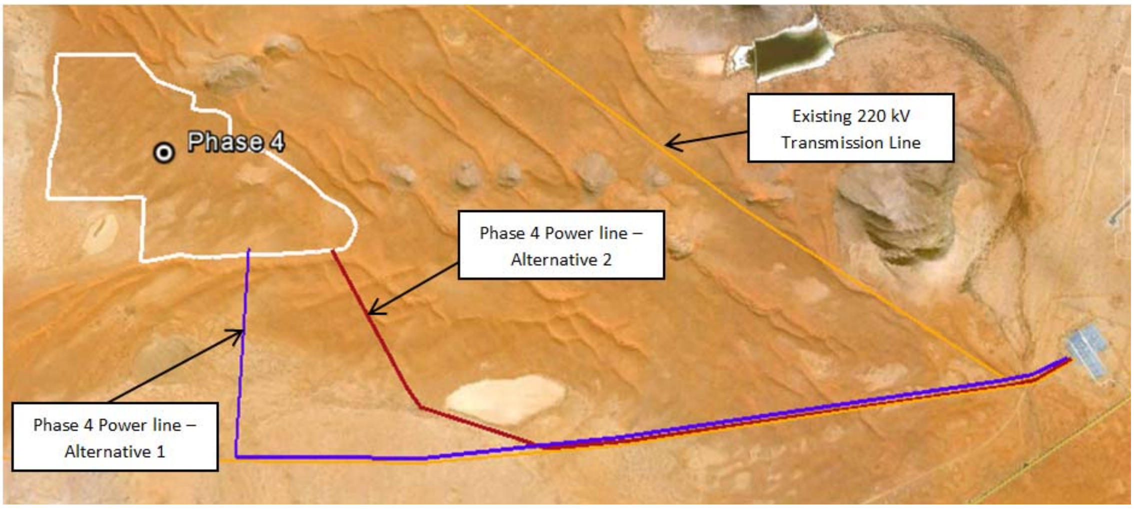

Figure 2.14: Grid Connection Routing Alternatives – Phase 4

2.5.5. Water Reservoir and Water Pipeline Alternatives

An on-site water reservoir (with a capacity of ~49 995m^3) will be developed to provide water during the operational phase to all phases of the project. This water will be sourced from the nearby Zinc Mine. An existing pipeline between the Aggeneis Substation and the property boundary will be upgraded and utilised for this purpose. A new pipeline section will be constructed within the site boundaries. This infrastructure will be shared between all phases of the project.

Three alternative locations for the reservoir have been identified for investigation. These, together with the associated pipeline route are indicated in Figures 2.15 and 2.17 below.

- Alternative 1: The reservoir is proposed to be located within the Phase 3 area adjacent to the N14. The water pipeline is proposed to follow the site boundary in a north-west direction until it joins with the existing water pipeline just north of the Phase 2 area (refer to Figure 2.15), a distance of approximately 2.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.
- Alternative 2: The reservoir is proposed to be located to the south of the Phase 1 PV Facility. The water pipeline is proposed to be routed in a south-western and then a western direction along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area (refer to Figure 2.16), a distance of approximately 3.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.
- Alternative 3: The reservoir is proposed to be located to the east of the Phase 2 PV Facility. The water pipeline is proposed to be routed in a northern direction for a short distance, and then along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area (refer to Figure 2.17), a distance of approximately 2.2km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.

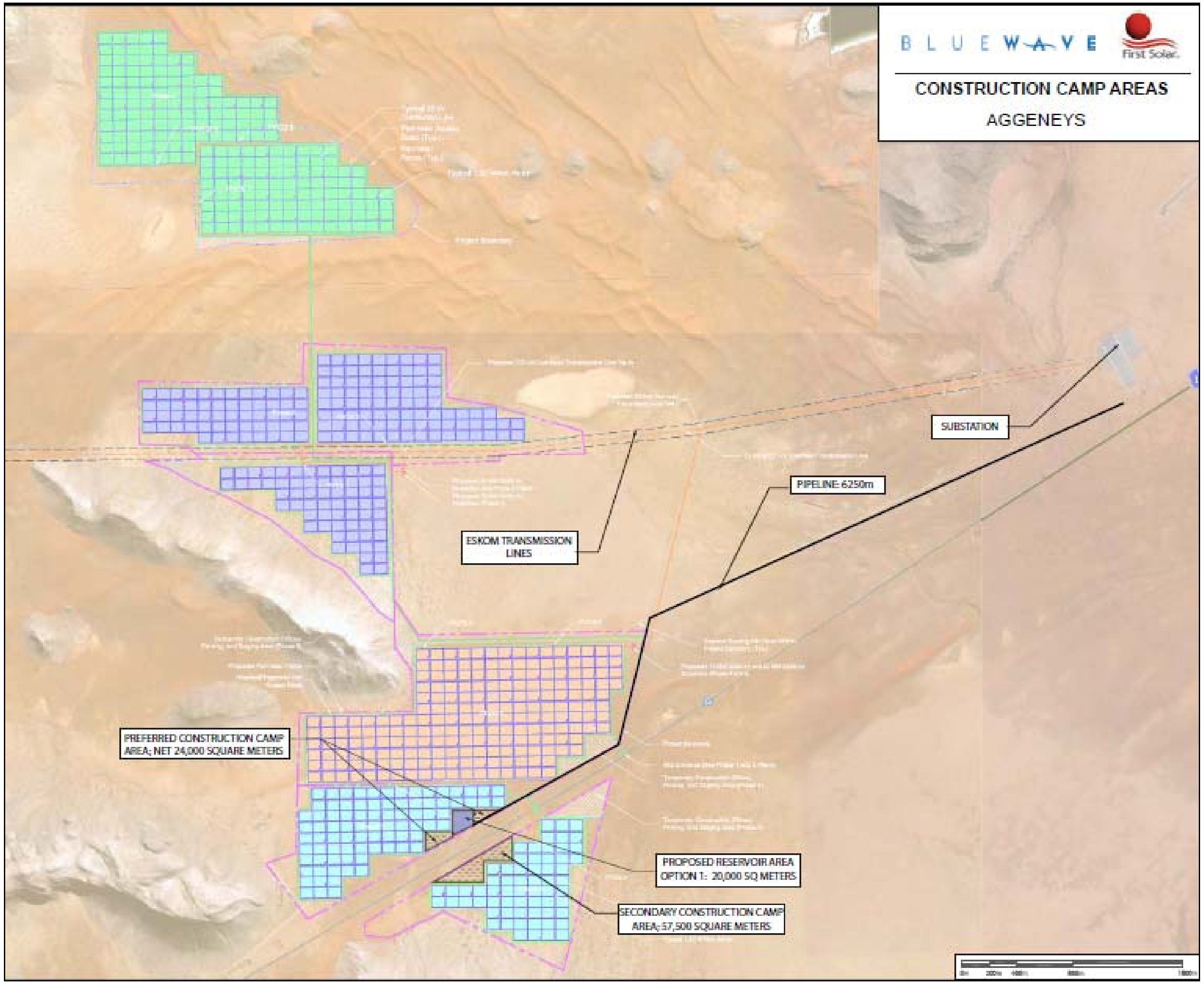

Figure 2.15: Water reservoir location and associated pipeline route from Aggeneis Substation – Alternative 1

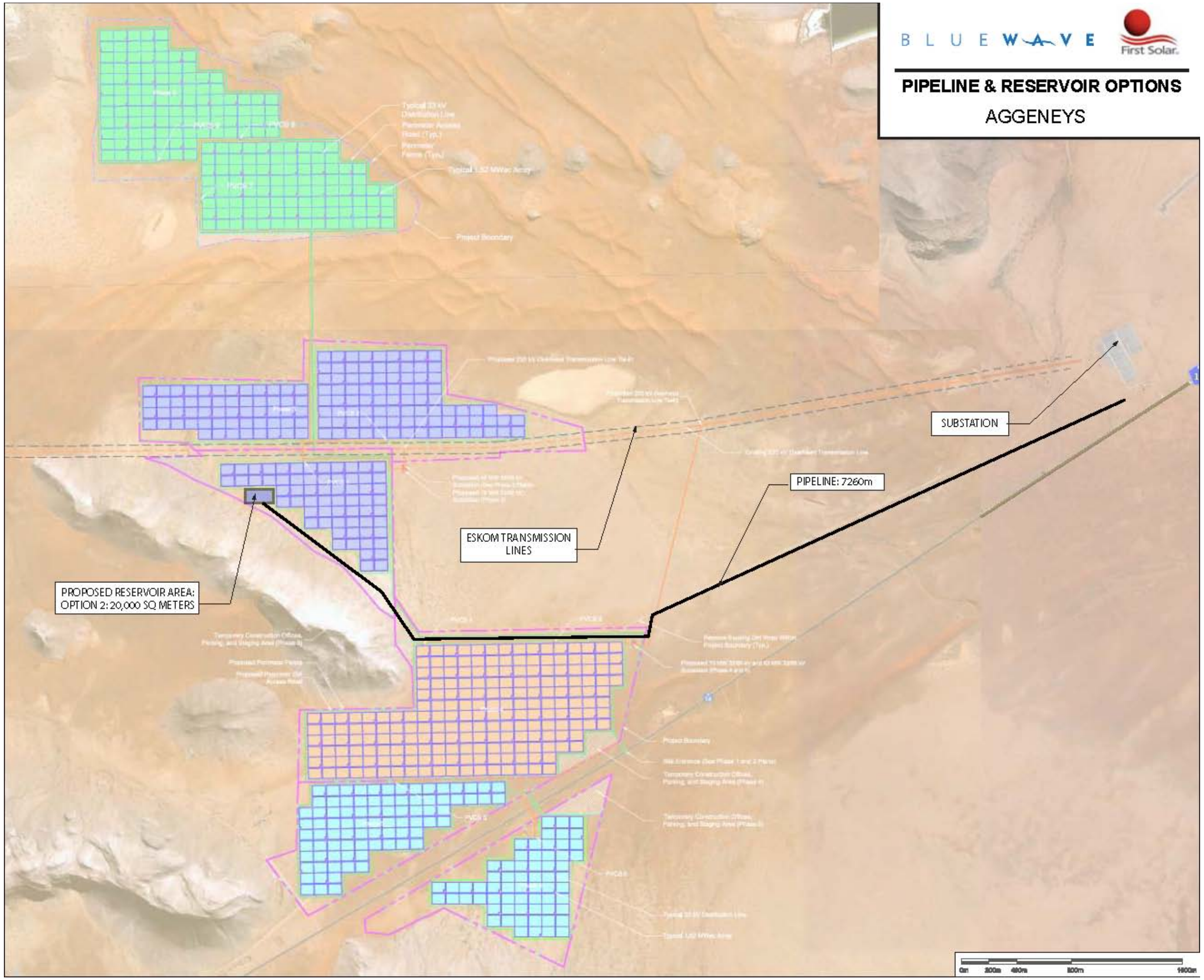

Figure 2.16: Water reservoir location and associated pipeline route from Aggeneis Substation – Alternative 2

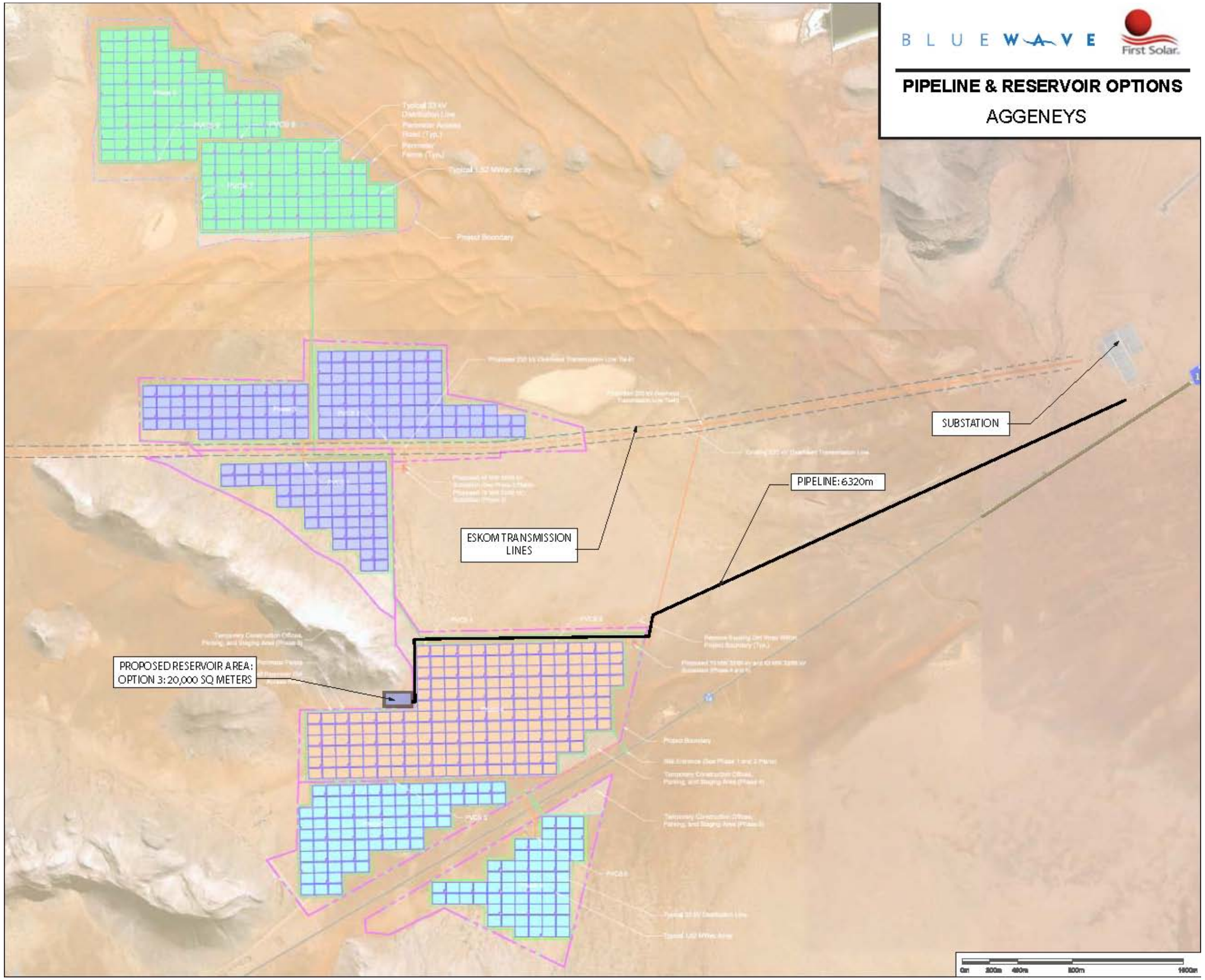

Figure 2.17: Water reservoir location and associated pipeline route from Aggeneis Substation – Alternative 3

2.5.6. Do Nothing Alternative

The no-go option would mean that the proposed development to install the four phases of the Zuurwater PV facility and associated infrastructure would not get implemented. Should this alternative be selected, there would be no impacts on the site due to the construction and operation activities of a solar energy facility. However, there will be impacts at a local and a broader scale.

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 the facility is only proposed to contribute 365 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.

At a broader scale, the benefits of this solar energy facility would not be realised. 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 grid will be deprived of an opportunity to benefit from the additional generated power being evacuated directly into the Province’s grid. The ‘do nothing alternative is assessed further within this report.

2.6. Proposed Activities during the Project Development Stages

In order to construct each solar energy facility and its associated infrastructure, a series of activities will need to be undertaken during the design, pre-construction, construction, operation, and decommissioning phases which are discussed in more detail below.

2.6.1. Design and Pre-Construction Phase

Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to confirmation of the micro-siting footprint (i.e. the precise location of the PV panels, substation and the plant’s associated infrastructure) and a geotechnical survey. Geotechnical surveys are executed by geotechnical engineers and geologists to acquire information regarding the physical characteristics of soil and rocks underlying a proposed site. The purpose is to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.

A power line servitude survey will also be conducted. If necessary, a walk through survey will be undertaken for ecological/heritage resources prior to construction.

2.6.2. Construction Phase

The construction of the complete facility will be undertaken in four phases. As each project will be bid as a seperate project under the DoE REIPPP, it is unknown at this stage whether the construction of more than one facility would be undertaken at one time. Should this be the case, there is the opportunity to combine some of the below-mentioned activities.

The construction of each phase is expected to extend over a period of approximately 15-18 months and create at least 250-300 employment opportunities at peak. The majority of the employment opportunities, specifically the low and semi-skilled opportunities, are likely to be available to local residents in the area. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community, representing a significant positive social benefit in an area with limited employment opportunities. The construction phase will entail a series of activities including:

Undertake Site Preparation

Site preparation involves construction of new access roads and improvement of existing on-site construction access roads with compacted native soil, installation of drainage crossings, setup of construction staging areas, storm water management work, preparation of land areas for array installation, and other activities needed before installation of the solar arrays can begin. The work would involve trimming of vegetation, agricultural rolling of PV array areas, selected compacting and grading, and setup of modular offices and other construction facilities. Site preparation would occur for each 2 to 20MW area at a time in order to minimise the area of ground exposed at any one time.

The PV arrays require a relatively level and stable surface for safe and effective installation. Topographic, geotechnical, and hydrologic studies will be used to determine the necessary grading and compaction. Next, an agricultural tool, such as a harrow or cultipacker, would be used to loosen and smooth the top 2.5 to 8 cm of soil. Finally, a smooth steel drum roller, or similar equipment, would be used to bring the top 10 to 15 cm of soil to a compaction value of up to 85%.

Trenching would occur within each array to bury the electrical cables. The trenches would be ~ 1m in width and 2m deep, and each array would be require ~610m to 762m of trenches, depending on the arrays proximity to the PVCS. Minimal ground disturbance may occur within the trenched corridors to restore them after soil has been replaced in the trenches, so that the corridor can conform to the existing surface contours.

Transport of Components and Construction Equipment to Site

The components for the proposed facility will be transported to site by road. Some of the substation components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[7] by virtue of the dimensional limitations (i.e. size and weight). The 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 the components required for the establishment of the substation and power line.

Establishment of Construction Equipment Camp and Construction Crew Accommodation Camp

Once the required equipment has been transported to site, a construction equipment camp will need to be established for each phase. The purpose of this camp is to confine activities and storage of equipment to one designated area to limit the potential ecological impacts associated with each phase of the project. The laydown area(s) will be used for assembly purposes and the general placement/storage of construction equipment. The storage of fuel for the on-site construction vehicles and equipment will need to be secured in a temporary bunded facility so as to prevent the possibility of leakages and soil contamination.

Due to the remote location of the site, it is most likely that a construction crew accommodation camp will be required to be established for the construction of each phase of the project. The location of this camp is required to be outside of identified sensitive areas and is to be agreed with the landowner. The following would be associated with this construction camp:

» Appropriate ablution facilities
» Cooking facilities
» Waste management infrastructure
» Electricity

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

Installation of the PV Power Plant

The construction phase involves installation of the solar PV panels and the entire necessary structural and electrical infrastructure to make the plant operational. In addition, preparation of the soil and improvement of the access roads would continue throughout the majority of the construction process. For array installation, typically vertical support posts are driven into the ground. Depending on the results of the geotechnical report a different foundation method, such as screw pile, helical pile, micropile or drilled post/pile could be used. The posts will hold the support structures (tables) on which PV modules would be mounted. Brackets attach the PV modules to the tables. Trenches are dug for the underground AC and DC cabling and the foundations of the inverter enclosures and transformers are prepared. While cables are being laid and combiner boxes are being installed, the PV tables are erected. Wire harnesses connect the PV modules to the electrical collection systems. Underground cables and overhead circuits connect the Power Conversion Stations (PCS) to the PVCS and from the PVCS to the onsite substation.

Establishment of Ancillary Infrastructure

Ancillary infrastructure for each phase will include; a workshop, laydown area and office. The laydown area will be a temporary structure. The establishment of these areas/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

New power line infrastructure will be developed to connect the new on-site substations to the Eskom Aggeneis MTS Substation. 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

Construction of the power line is required to be undertaken in accordance with the specifications of the Environmental Management Programme (EMPr), as well as in compliance with Eskom's technical requirements.

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: Issuing of tenders and award of contract to construction companies
» Step 5: Vegetation clearance and construction of access roads (where required)
» Step 6: Construction of foundations
» Step 7: Assembly and erection of infrastructure on site
» Step 8: Connect conductors
» Step 9: Rehabilitation of disturbed area and protection of erosion sensitive areas
» Step 10: Testing and commissioning
» Step 11: Continued maintenance

The expected lifespan of the proposed on-site substation associated with each PV facility is 35 – 50 years. During the life-span of the substation, on-going maintenance is performed. Inspections are undertaken.

Undertake Site Rehabilitation

As construction is completed in an area, and as all construction equipment is removed from the site, the site must be rehabilitated where practical and reasonable. Upon completion of commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.

2.6.3. Operational Phase

Each solar energy facility/phase is expected to be operational for a minimum of 25 years, with an opportunity for a lifetime of 50 years or more with equipment replacement and repowering. The project will operate continuously, 7 days a week, during daylight hours. While the project will be largely self-sufficient upon completion of construction, monitoring and periodic, as needed maintenance activities will be required. Key elements of the Operation and Maontenance plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security of the project. The operational phase (for one solar energy facility) will create 7-15 full-time employment positions. No large scale energy storage mechanisms for the facility which would allow for continued generation at night or on cloudy days are proposed.

2.6.4. Decommissioning Phase

Depending on the continued economic viability of the facility following the initial 25-year operational period, each solar energy facility will either be decommissioned or the operational phase will be extended. If it is deemed financially viable to extend the operational phase, existing components would either continue to operate or be dissembled and replaced with new, more efficient technology/infrastructure available at that time. However, if the decision is made to decommission the facility, the following activities will form part of the project scope.

When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. For example, depending on the power needs at the time of decommissioning, the on-site substations could remain for use by the utility or other industrial activity.

Below is a discussion of expected decommissioning activities.

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required decommissioning equipment.

Disassemble and Remove Existing Components

All above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will either be removed, or cut off 1m below the ground surface, and the surface restored to the original contours. Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials and would be recycled to the extent feasible. The components of the plant would be deconstructed and recycled or disposed of in accordance with regulatory requirements. The site will be rehabilitated and can be returned to the agricultural or other beneficial land-use.

REGULATORY AND LEGAL CONTEXT CHAPTER 3

3.1 National 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 Phase 1 to Phase 4 of the PV solar energy facilities on Portion 3 of the Farm Zuurwater No. 62.

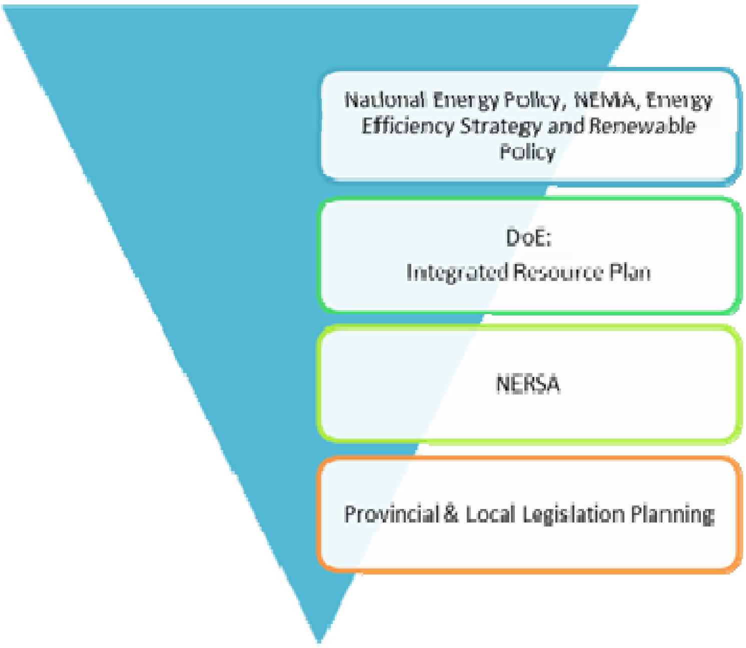

Figure 3.1: Hierarchy of electricity policy and planning documents

3.1.1 White Paper on the Energy Policy of South Africa, 1998

Development within the South African energy sector is governed by the White Paper on a National Energy Policy (DME, 1998). The White Paper identifies key objectives for energy supply, such as increasing access to affordable energy services, managing energy-related environmental impacts and securing energy supply through diversity.

As such, investment in renewable energy initiatives is supported, based on an understanding that renewable energy sources have significant medium - long-term commercial potential and can increasingly contribute towards a long-term sustainable energy future.

3.1.2 Renewable Energy Policy in South Africa, 1998

Internationally there is increasing development of the use of renewable technologies for the generation of electricity due to concerns such as climate change and exploitation of resources. In response, the South African government ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol, the enabling mechanism for the convention, in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed solar energy facility, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The White Paper on Renewable Energy (DME, 2003) supplements the Energy Policy, and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

The support for the 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 from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore 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.

In order to meet the long-term goal of a sustainable renewable energy industry, the South African Government has set the following 10-year target for renewable energy: "*10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013 to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1 667 MW) of the estimated electricity demand (41 539 MW) by 2013*" (DME, 2003).

The White Paper on Renewable Energy states "*It is imperative for South Africa to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet*."

3.1.3 Final Integrated Resource Plan, 2010 - 2030

The Energy Act of 2008 obligates the Minister of Energy to develop and publish an integrated resource plan for energy. Therefore, the Department of Energy (DoE), together with the National Energy Regulator of South Africa (NERSA) has compiled the Integrated Resource Plan (IRP) for the period 2010 to 2030. The objective of the IRP is to develop a sustainable electricity investment strategy for generation capacity and transmission infrastructure for South Africa over the next twenty years. The IRP is intended to:

- » Improve the long term reliability of electricity supply through meeting adequacy criteria over and above keeping pace with economic growth and development;
- » Ascertain South Africa's capacity investment needs for the medium term business planning environment;
- » Consider environmental and other externality impacts and the effect of renewable energy technologies; and
- » Provide the framework for Ministerial determination of new generation capacity (inclusive of the required feasibility studies).

The objective of the IRP is to evaluate the security of supply, and determine the least-cost supply option by considering various demand side management and supply-side options. The IRP also aims to provide information on the opportunities for investment into new power generating projects.

The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010.

The first and interim IRP was developed in 2009 by the Department of Energy. The initial four years of this plan was promulgated by the Minister of Energy on 31 December 2009, and updated on 29 January 2010. The Department of Energy released the Final IRP in March 2011, which was accepted by Parliament at the end of the same month. This Policy-Adjusted IRP is recommended for adoption by Cabinet and subsequent promulgation as the final IRP. 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 (including 8,4GW solar); and 8.9 GW of other generation sources.

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 Provincial Policy and Planning Context

3.1.1. Northern Cape Provincial Spatial Development Framework (2011)

Dennis Moss Partnership is currently preparing a Provincial Spatial Development Framework (PDSF) for the Northern Cape Province (NCP). The PSDF is a legal requirement in terms of Chapter 4 of the Northern Cape Planning and Development Act 7 of 1998.

Volumes 1 and 2 were finalised in December 2011. Volumes 1 and 2 are essentially introductory, status quo reports. Volume 2 provides a situation analysis of the NCP, mainly with the view of identifying key aspects for policy focus/ intervention. Volumes 3 (Spatial Directives) and 4 (Strategies) are currently in preparation, and no Draft documents are available at this stage.

Volume 2 (Situation Analysis and Key Aspects) indicates that the envisaged Spatial Directives and Strategies reports would be closely aligned to the 2004-2014 Northern Cape Provincial Growth and Development Strategy (PGDS) (currently in Draft 4)[8]. Volume 2 includes an overview of some key relevant aspects of the PGDS Draft 4, including with regard to the roles of renewable energy and tourism in the provincial economy.

[8] Draft 4 (2011) of the PGDS does not appear to have been made public yet.

The PSDF (Vol 2) notes that, at present, the Eskom Vanderkloof hydro station on the Orange River (240 MW) represents the only large renewable energy-generating facility in the NCP. The PSDF therefore notes that the NCP's major energy challenges include securing energy supply to meet growing demand, providing everybody with access to energy services and tackling the causes and impacts of climate change (as per PGDS). In this regard, the development of large-scale solar energy supply schemes is strategically important for increasing the diversity of domestic energy supplies for the NCP, and avoiding energy imports while minimising the environmental impacts.

The PSDF further notes that renewable energy has been identified in the Draft 4 PGDS (2011) as a mechanism to diversify the economy and thereby promote a green economy in the province. According to the PGDS, greening the economy is characterised by substantially increased investments in economic sectors (NCPG; 2011: F.1.4.1). Volume 2 of the PSDF indicates that the promotion of job creation in the green jobs industries (e.g. manufacturing of solar water heaters, maintenance of wind generators and solar energy infrastructure) would be promoted in the forthcoming spatial directives and strategies reports (Volumes 3-4). The PSDF notes that, according to the PGDS the NCP has considerable potential for renewable energy generation, including solar energy.

Tourism

The PSDF notes that the tourism sector is identified in the Draft 4 PGDS as one of the key sectors with the capacity to 'grow, transform and diversify the provincial economy'. According to the PGDS, the vision for tourism is underpinned by a number of broad, essential and specific drivers. The 'broad drivers' consider the 'big picture' focusing on tourism's contribution to a larger development purpose, including overall economic growth, addressing social upliftment and poverty alleviation through facilitating job creation, and striving for more equitable ownership and participation in tourism through transformation.

Comparative advantages of the NCP are identified as mainly eco-tourism opportunities, including unique sectoral or nature-based routes; National parks, nature reserves and game reserves, natural and cultural manifestations, as well as festivals and cultural events (PGNC; 2011b).

3.1.2. Namakwa District IDP

The Namakwa District (Namakwa District IDP, 2006 – 2011) identifies solar energy development as a potential source of development and income.

The 2012-2016 NDM Integrated Development Plan (IDP) is the third 5-year IDP of the NDM. The IDP is explicitly aligned with the applicable national and provincial policy and planning frameworks, including the 12 National Outcomes (2010) and

National Development Plan (2011), as well as the PGDS. Aspects of relevance to the proposed project are discussed below.

The IDP identifies a number of key socio-economic development constraints and challenges with regard to the NDM, including:

» The lack of surface and ground water resources to enable development;
» Generally poor soils, unsuited to cropping activities.
» For many of the smaller settlements, a settlements pattern largely unsupported by an adequate economic base.
» High unemployment, underemployment and economic non-participation levels, with only ~20% of the labour force permanently employed in 2010, and an increasingly larger part of the population becoming dependent on social grants.
» High poverty levels, with ~44% of households living below the poverty datum in 2010, and an overall increase in the number of poor households of 270% since 1996.
» A low growth rate in employment creation. From 1996 to 2010, only ~1 000 jobs were created in the NDM.
» A steady decline in employment provision by the NDM's traditionally key Agricultural and Mining sectors since 1996, with the former declining in 8% in relative significance in 2010, and Mining by 4.5%, resulting in a loss of ~3 100 opportunities during this period. The loss of primary sector opportunities significantly impacts on the lower skilled part of the population.
» Lack of adequate and sufficient tertiary institutions and skills training opportunities in the NCP and NDM.
» Extensive damage to the NDM's coastline and beaches by historic mining activities since the 1920s. The IDP notes that as diamond resources become fully exploited, and access to the coastline improves, the full extent of the damage, but also potential opportunities will become apparent.
» The potential impacts of climate change on the NDM. Generally hotter, drier, more fire-prone conditions, resulting in less predictable rainfall patterns, more frequent droughts, and an overall greater scarcity of water, are anticipated for the NDM.

Key identified development priorities therefore include the following:

» Employment creation, specifically including female-orientated employment opportunities, to address the current high rate of out-migration of women in the 20-34 age group.
» Skills training and reskilling opportunities, also including provision for people with low education levels.
» Economic diversification away from primary sector activities (agriculture and mining), and a greater focus on tourism as growth and employment sector.

» Realising any opportunities resulting from appropriate developments in the historically transformed coastal zone to counteract the decline of employment and other opportunities associated with a decline in the diamond mining industry.

Section 2.5 of the IDP includes a summary of a recent NDM research report on the "Possible effects and impact of climate change on human settlements and population development in the Northern Cape" (date unclear). Key findings of the report indicated that the Namakwa District, including its Atlantic fisheries, is in the direct path of extreme anticipated climate change impacts. Key recommendations include the NDM's need to mainstream climate change into planning activities and implement institutional arrangements that support integration of climate change across sectors. Renewable energy is not explicitly addressed in this section of the document.

Projects listed under Key Performance Area (KPA) 3 (Local Economic Development), of the 2010-2011 NDM IDP indicated current NCPG support for/ involvement with the following project in which the generation of renewable energy plays a major role, namely:

» Project no. LE02: Renewable Energy Sector: the development of a synergy between the energy resources within the Namakwa Region, which, in line with NDM's objective of establishing a competitive renewable energy sector, supports projects related to a variety of renewable energy generation.

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-sectorial 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.

3.3.1. Regulatory Hierarchy

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. This area of the Northern Cape is not generally authorised, so applications go through the National Department.
- *Eskom:* Commenting authority regarding Eskom infrastructure and grid connection.

At the Provincial Level, the main regulatory agencies are:

- *Provincial Government of the Northern Cape – Department of Environmental and Nature Conservation (NC DENC):* This Department is the commenting authority for these projects.
- *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 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 the local level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape, both the local and district municipalities play a role. The local municipality is the Khai Ma Local Municipality which forms part of the Namakwa District Municipality. There are also numerous non-statutory bodies such as environmental non-governmental organisations (NGOs) and community based organisations (CBO) working groups that play a role in various aspects of planning and environmental monitoring that will have some influence on proposed solar energy development in the area.

3.3.2 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 EIA Report:

» National Environmental Management Act (Act No 107 of 1998).
» EIA Regulations, published under Chapter 5 of the NEMA (GNR543, GNR544, GNR545, and GNR546 in Government Gazette 33306 of 18 June 2010).
» 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 addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in the **Table 3.1.** **Table 3.2** provides the relevant South African environmental legislation applicable to the project in terms of environmental quality.

Table 3.1: Relevant legislative permitting requirements applicable to the proposed solar energy facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	The EIA 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, a Scoping and EIA 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 EIA process being undertaken (i.e. Scoping and EIA). 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 Phase 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	Noise impacts are expected to be associated with the construction

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
		Department of Environmental and Nature Conservation (DENC)- Local Authorities	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. On-site activities should be limited to 6:00am - 6:00pm, Monday – Saturday (excluding public holidays). Should activities need to be undertaken outside of these times, the surrounding communities will need to be notified and appropriate approval will be obtained from DEA and the Local Municipality.
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 and storage - 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	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. Should water be extracted from groundwater/ a borehole on site for use within the facility, a water use license will be required in terms of Section 21(a) and 21 (b)

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	watercourse - Section 21i.		of the National Water Act. The storage of water in reservoirs may also require approval from DWA.
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 resource 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. However, National, provincial and local ambient air quality standards (S9 - 10 & S11) to be considered.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			Measures in respect of dust control (S32) and the National Dust Control Regulations of November 2013. 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.
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 palaeontological 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	South African Heritage Resources Agency	An HIA and PIA has been undertaken as part of the EIA Process to identify heritage sites (refer to Appendix I). Should a heritage resource be impacted upon, a permit may be required from SAHRA.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	SAHRA for the presentation of archaeological sites as part of tourism attraction (S44).		
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. » 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), 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	Department of Environmental Affairs	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. An ecological study has been undertaken as part of the EIA Phase. As such the potentially occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered. This report is contained in Appendix E.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	species.		
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 measures for alien and invasive plant species (Regulation 15E of GN R1048).	Department of Agriculture	This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas. There are none for the projects.
National Forests Act (Act No. 84 of 1998)	According to this Act, the Minister may declare 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	A licence is required for the removal of protected trees. There were protected tree species recorded during the ecological survey within the broader study area. Few *Acacia* species and other small trees and bushes are scattered in the dunes. In the mountains Quiver trees (*Aloe dichotoma)* are the largest and most obvious woody plants. Should protected trees need to be

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			removed, a permit will be required to be obtained from DAFF.
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 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	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 are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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.		
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. S(2-4) provide 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.
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), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities.	National Department of Water and Environmental Affairs (hazardous waste) 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. General 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 EMPs for each Phase (refer to Appendix K-M). The DWAF (1998) Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste will also need to be considered.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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. » 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.		The volumes of solid 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 contractor's camp will result in sewage and grey water handling. Sewage is regarded as hazardous waste in terms of this Act. However the volume of hazardous waste generated from the construction and operation of the facility will not exceed the specified threshold volumes within the Waste Act (i.e. an annual throughout capacity of $2000m^3$) and therefore a waste license from National DEA will not be required.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the Province	Department of Agriculture	Subdivision will have to be in place prior to any subdivision approval in terms of S24 and S17 of the Act.
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	» South African National Roads Agency Limited (national roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include route

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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.	» Provincial Department of Transport	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	Northern Cape Department of Environment and Nature Conservation	A collection/destruction permit must be obtained from Northern Cape Nature Conservation for the removal of any protected plant species found on site. Additionally, a permit for the disturbance or destruction of indigenous species must be applied for.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	to the current project: » Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto 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.		

Table 3.2: Standards applicable to the solar energy facility (SRK EIA Report for the Zuurwater PV Facility: 2012)

Theme	Standard	Summary
Air	South African National Standard (SANS) 69	Framework for setting and implementing national ambient air quality standards
	SANS 1929: Ambient Air Quality	Sets limits for common pollutants
Noise	SANS 10328:2003: Methods for Environmental Noise Impact Assessments	General procedure used to determine the noise impact
	SANS 10103:2008: The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication	Provides noise impact criteria
	National Noise Control Regulations	Provides noise impact criteria
	SANS 10210: Calculating and Predicting Road Traffic Noise	Provides guidelines for traffic noise levels
Waste	DWAF (1998) Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste	DWAF Minimum Requirements
Water	Best Practise Guideline (G1) Storm Water Management DWA 2006	Provides guidelines to the management of storm water
Water	South African Water Quality Guidelines	Provides water quality guidelines

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 4

The EIA process for the proposed PV facilities is regulated by the EIA Regulations of June 2010 (as amended), which involves the identification of 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 four proposed PV facilities has been undertaken in accordance with the EIA Regulations in terms of Sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR544; GNR545; and GNR546 of Section 24(5) of the National Environmental Management Act (NEMA Act No. 107 of 1998). In line with the EIA Regulations, an application for authorisation was lodged with the National DEA for each phase of the project. Due to the fact that a full Scoping Phase was recently conducted for the same activities on the same farm portion by SRK Consulting in 2012, the National Department of Environmental Affairs (DEA) accepted the scoping report previously compiled for the site. In terms of this acceptance of scoping, an EIA phase study was required to be undertaken for the four phases of the facility. The approach for the EIA phase, as agreed with DEA, includes the compilation of a consolidated Environmental Impact Report (EIR), which considers Phases 1 – 4 of the Zuurwater PV Project. If authorised, DEA will provide four separate Environmental Authorisations (one for each Phase).

4.1. Scoping Phase Undertaken by SRK Consulting in 2011

The entire extent of Portion 3 of the Farm Zuurwater 62 was evaluated within the previous Scoping and EIA process undertaken by SRK Consulting in 2012. No environmental fatal flaws were identified to be associated with the broader site through this process. This scoping report was accepted by the DEA in February 2012. Therefore, it was considered appropriate to utilise the information on the receiving environment and potential impacts contained in the SRK Consulting's Scoping Report and EIA Report in this EIA process to be undertaken by Savannah Environmental for the four new Phases of the same project.

The scoping phase undertaken by SRK Consulting served to identify potential issues associated with the proposed project, 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).

This EIA report serves as an EIA phase assessment of the four new phases on the Zuurwater project, as accepted by DEA (refer to Appendix B for correspondence with DEA in this regard).

4.2. Environmental Impact Assessment Phase by Savannah Environmental in 2013 (Current)

The EIA Phase for Phase 1 to Phase 4 of the Zuurwater project aims to achieve the following:

» Provide a comprehensive assessment of the social and biophysical environments affected by the proposed phases put forward as part of the project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facilities.
» Comparatively assess any alternatives put forward as part of the projects.
» 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[9] 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).

[9] "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).

» 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.
» 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.
» Prepare 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.

4.2.2 Authority Consultation

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

» Discussion meetings were held with DEA on 10 October 2012 and 13 November 2012.
» Applications for Environmental Authorisation for Phase 1 to Phase 4 together with a Plan of Study for the EIA phase, were submitted and accepted by DEA in April 2013.

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

» Submission of a final EIA Report to DEA following a public review period for the draft EIA (40 days) and final EIA report (21 days).
» If required, an opportunity for DEA and NC DENC representatives to visit and inspect the proposed site, and the study area.
» Notification and 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)

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

4.3.1 Public Involvement and Consultation

The aim of the public participation process is 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.
» Comments received from stakeholders and I&APs were recorded and incorporated into the EIA process.

All I&APs registered in the previous EIA process by SRK Consulting have been automatically included in the I&AP database. In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs regarding the project, various opportunities for stakeholders and I&APs to be involved in the EIA Phase of the process will be provided, as follows:

» Focus group meetings and a public meeting (pre-arranged and stakeholders invited to attend - for example with directly affected and surrounding landowners).
» Telephonic consultation sessions (consultation with various parties from the EIA project team, including the project participation consultant, lead EIA consultant as well as specialist consultants).
» Written, faxed or e-mail correspondence.
» The Draft EIA Report was released for a 40-day public review period from 22 November 2013 – 20 January 2014[10]: The comments received from I&APs will be captured within a Comments and Response Report, which will be included within the Final EIA Report, for submission to the authorities for decision-making.
» The Final EIA report will be released for a 21-day public review period.

In terms of the requirement of Chapter 6 of the EIA Regulations of June 2010, the following public participation tasks are required to be undertaken:

[10] Please note that the period of 15 December 2013 – 02 January 2014, as well as public holidays during this period has been excluded from the reckoning of days for the 40-day public review period, in line with the EIA Regulations of June 2010.

» Distribution of Letters of Notification to I&APs to inform them on the changes in the project and planned EIA phase.
» Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of—
  (i) the site where the activity to which the application relates is or is to be undertaken; and
  (ii) any alternative site mentioned in the application;
» Giving written notice to:
  (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
  (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iii) Owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
  (v) the municipality which has jurisdiction in the area;
  (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
  (vii) any other party as required by the competent authority.
» Placing an advertisement in:
  (i) one local newspaper; and
  (ii) in at least one provincial newspaper.
» Open and maintain a register/ database of interested and affected parties and organs of state (including all registered parties included in the previous EIA undertaken by SRK Consulting).
» Release of a Draft EIA Report for Public Review for a 40-day period.
» Hosting of a Public Meeting and Focus Group Meetings by the EAP to discuss and share information on the project.
» Preparation of a Comments and Responses Report which document all the comments received and responses from the project team.
» Apart from the 40 day commenting period on the Draft EIR, in order to give effect to Regulation 56(2), registered Interested and Affected parties will be given access to, and an opportunity to comment on the final report in writing within 21 days before submitting the final environmental impact assessment report to the DEA.

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

» **Placement of Site Notices**

  Site notices have been placed on-site and at relevant public places and proof of this is included in Appendix D.

» **Identification of I&APs and establishment of a database**

All I&APs registered in the previous EIA process by SRK Consulting have been automatically included in the I&AP 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 and Rural Development » Northern Cape - Public Works, Roads and Transport » Northern Cape - Water Affairs » South African Heritage Resources Agency » Department of Agriculture, Forestry and Fisheries » South African National Roads Agency » Department of Energy » Civil Aviation Authority » Square Kilometre Array (SKA) Project
Municipalities	» Khai Ma Local Municipality » Namakwa District Municipality
Public stakeholders	» Landowners, surrounding landowners, occupiers of land, farmer's unions.
Parastatals & service providers	» Eskom Transmission and Distribution » Ngwao Boswa ya Kapa Bokone (Northern Cape Provincial Heritage Authority)
NGOs/Business forums	» Wildlife Environment Society of South Africa » BirdLife South Africa

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 undertaken by Savannah Environmental, the identification and registration of I&APs has been on-going for the duration of the EIA phase of the process.

» **Newspaper Advertisements**

Newspaper adverts was placed to inform the public on the changed to the project and EIA process in the following newspapers:

* Volksblad (15 May 2013)

* Gemsbok (17 May 2013)

Refer to Appendix D for proof of advertisements which were placed.

» **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 invited to attend)
* Public meeting (advertised in the local press)
* 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, a public feedback meeting will be held on 10 December 2013 and interested and affected parties have been invited to attend the public meeting. Adverts informing the public on the availability of the draft EIA report for public comment and public meeting were advertised in the Volksblad and Gemsbok newspapers are as follows :

* **Date:** Tuesday, 10 December 2013
* **Time:** 18:00
* **Venue:** The Recreational Club (Black Mountain Mine), Aggeneys

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

4.3.2 Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process will be synthesised into a Comments and Response Reports. The Comments and Response Report will include responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

4.3.3 Assessment of Issues Identified through the Scoping Process

Issues which require investigation within the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 4.2 below.

Table 4.2: Specialist studies undertaken within the EIA Phase

Specialist	Area of Expertise	Refer Appendix
Ecological Impact Assessment	Marianne Strohbach of Savannah Environmental	Appendix E
Soils and Agricultural Potential Assessment	Martinus de Beer of Echo Soil Solutions	Appendix F
Visual Impact Assessment	Keagan Allan of SRK	Appendix G
Socio-Economic Impact Assessment	Amina Ismail of SRK	Appendix H
Heritage Impact Assessment	David Morris of the McGregor Museum	Appendix I
Palaeontology specialist opinion	Dr John Almond of Natura Viva	Appendix J
Traffic Impact Assessment	Mike Van Tonder of Aurecon	Appendix P

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the proposed PV Facilities on Portion 3 of the Farm Zuurwater 62.

The first stage of impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The above terms, used in relation to significance, are defined in Table 4.3. The cut-off points have been defined in relation to characteristics of the project, but those for Probability, Severity/Intensity and significance are subjective, based on rule-of-thumb and experience.

Table 4.3: Criteria for Assessing Significance of Impacts

SEVERITY OF IMPACT	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5

SPATIAL SCOPE OF IMPACT	RATING
Activity specific	1
Project specific (within the project boundary)	2
Local area (within 5 km of the activity boundary)	3
Regional	4
National	5

DURATION OF IMPACT	RATING
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post decommissioning / permanent	5

CONSEQUENCE

FREQUENCY OF ACTIVITY / DURATION OF	RATING
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5

FREQUENCY OF IMPACT	RATING
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

LIKELIHOOD

The significance of the impact is then assessed by rating each variable numerically according to defined criteria as outlined in Table 4.3. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix as shown in Tables 4.4 and Table 4.5.

Table 4.4: Significance Rating Matrix

	CONSEQUENCE (Severity + Spatial Scope + Duration)														
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 4.5: Positive/Negative Mitigation Ratings

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very high	126-150	Improve current management	Maintain current management
	High	101-125	Improve current management	Maintain current management
	Medium-high	76-100	Improve current management	Maintain current management
	Low-medium	51-75	Maintain current management	Improve current management
	Low	26-50	Maintain current management	Improve current management
	Very low	1-25	Maintain current management	Improve current management

The assessment of significance should be undertaken twice. Initial significance should be based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment should take into account the recommended management measures required to mitigate the impacts.

Some of the specialist consultants have used variations of these procedures tailored to their specialist area.

As the developer has the responsibility to avoid and/or minimise impacts as well as plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts will be discussed. Assessment of mitigated impacts will demonstrate the effectiveness of the proposed mitigation measures.

4.3.4 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 PV facility.

» It is assumed that the proposed connection to the National Grid is correct in terms of viability and need.

» The previous EIA report published by SRK Consulting formed the basis of the information utilised in this EIA report by Savannah Environmental, as accepted and agreed to by DEA.

» 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 – J** for specialist study specific limitations.

DESCRIPTION OF THE RECEIVING ENVIRONMENT CHAPTER 5

This section of the Draft EIA Report provides a description of the environment that may be affected by the four phases of the PV Facility on Portion 3 of the Farm Zuurwater 62 near Aggeneys (referred to as "the site"). Aspects of the biophysical, social and economic environment that could be directly or indirectly 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 site investigations, and aims to provide the context within which this EIA is being conducted. Use of baseline information from the previous EIA undertaken by SRK Consulting is acknowledged (SRK Consulting, Environmental Impact Assessment for Sato Energy Holdings Photovoltaic Project, Final EIA Report, April 2012). A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices E - J**. The entire project development area (i.e. all four phases) is described below as the sites for the four phases are fairly uniform (and are located within the same Farm (Portion 3 of the Farm Zuurwater 62). Where there are differences between the environments of the phases, this is highlighted. A summary of the environment of each of the four project development phases is provided at the end of this Chapter in Table 5.11.

The project falls within the jurisdiction of the Khai Ma Local Municipality, which in turn falls under the jurisdiction of the Namakwa District Municipality of the Northern Cape Province. Portion 3 of the Farm Zuurwater 62 is located approximately 9 km south-west of Aggeneys. The farm portion covers an area of 4997 ha. The proposed PV facilities form part of a larger development of up to 365MW in generating capacity (comprising six units in total, and referred to as the "Project"). The co-ordinates for the central point of each phase considered in this report is listed in Table 5.1.

Table 5.1: Details for each Phase of the PV Facility on the Farm Zuurwater 62

Phase Number	**Generating capacity**	**Area (Ha)**	**Co-ordinates for Central Point of the Phase**	
			Latitude	***Longitude***
Phase 1	75MW	267ha	29°18'14.30"S	18°44'27.92"E
Phase 2	75MW	209ha	29°19'13.77"S	18°45'10.93"E
Phase 3	60MW	192ha	29°19'44.35"S	18°44'50.13"E
Phase 4	75MW	222ha	29°16'59.83"S	18°43'56.47"E

5.1 Topography

The site is characterised by an expansive, undulating landscape. The site is generally flat with a gradient of less than 1:50, except for the few quartzite hills within the landscape. The inselbergs[11] rise steeply out of the plains (peneplain), with dune intrusions towards the north. Features surrounding the proposed development site include the Windhoek se Berge to the south, the Skelmberg to the east and low lying pans in the north. The mountains and hills on site generally have their steep sides facing south-west.

The area does form part of the palaeo-drainage system of the Gariep River basin, evident on and around the site as the rather ill-defined washes and pans. Given the low rainfall characteristic of the area, recent drainage lines are lightly incised and shallow.

A large portion of the study area is covered by quaternary alluvium and sand. Palaeozoic diamictites of the Dwyka Group and meta-sediments by Mokolian age outcrop in the area, forming the mountainous terrain and hills. The rocky slopes occur on the apron of the north-facing slopes of Windhoekberg and Kefeberg.

Figure 5.1: Typical inselbergs and hills in the study area

5.2 Geology

The general area is formed mainly of eroded Quaternary sediments, sands and calcretes, overlain in some areas with aeolian red Kalahari sands. The harder igneous intrusions of the Bushmanland quartzites protrude at scattered localities, eroded into the gravel patches found around their bases and spread along drainage lines. The study area has relatively flat terrain, situated between the scattered inselbergs to the southwest of the main Black Mountain Massif. These inselbergs are built of a wide range of resistant-weathering igneous, as well as high grade

[11] An inselberg is an isolated rock hill, knob, ridge, or small mountain that rises abruptly from a gently sloping or virtually level surrounding plain.

metamorphic rocks of Late Precambrian (Mokolian / Mid-Proterozoic) age. The various rock units are comprised mainly of gneisses, schists, quartzites and amphibolites (Cornell et al. 2006, Moen 2007, Almond & Pether 2008).

The underlying rock structure is Proterozoic Namaqua metamorphic rock. The area comprises of plains of varied rocky and shallow soil substrates and inselbergs that often contain rich concentrations of copper, lead and zinc. The plains are covered with an unconsolidated layer of sand that is generally thinly spread on a harder older crust. Properties in these sands reflect minimal pedogenesis. It is expected that the mineralogical composition of the sand is quartz, as it is little different from the parent deposit.

The flatter portions of the study area are underlain by a range of unconsolidated superficial sediments of Late Cainozoic age. These include Quaternary to recent sands and gravels of probable fluvial or sheet wash origin that are locally overlain, and perhaps also underlain, by unconsolidated aeolian (i.e. wind-blown) sands of the Quaternary Gordonia Formation (Kalahari Group). All these sediments can be placed with the Late Cretaceous to Recent Kalahari Group (Partridge et al, 2006). The Gordonia dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent.

5.3 Climate

The site occurs in an arid, semi-desert area and is characterised by a very low rainfall which generally falls in summer. Temperatures are generally hot in summer, with winters being characterised by warm days but particularly cold night-time temperatures. Average minimum and maximum temperatures in the area are 15°C to 38°C in summer and 0°C to 18°C in winter.

Aggeneys experiences summer rainfall patterns and has an average annual rainfall of ranging in the literature from 107-112mm, with the highest rainfall occurring between January and April. The lowest recorded annual rainfall was in 1992 at ±11mm, while the highest recorded rainfall was in 2006, at ±220mm. The maximum and minimum mean annual precipitation (MAP) was 272mm (1976) and 8mm (1999) respectively (Sim *et al,* 2011). Mean annual evaporation potential exceeds rainfall almost 30-fold, so mean annual soil moisture stress is high (87%). The area has 21 mean frost days annually.

The Gamsberg weather station experiences moderate winds with wind speeds ranging from 2m/s to 11m/s. The average wind speeds in the region range from 3.18m/s in Pofadder (east of the site) to 4.43 m/s in Springbok (west of the site). The exposed inselbergs would tend to experience higher wind speeds and less frequent calm conditions than the surrounding plains.

5.4 Conservation Planning - Critical Biodiversity Areas

Delineations of Critical Biodiversity Areas (CBAs) that are available for the study area show that some of the development would be situated on Important and Ecological Support Areas (Figure 5.2). The purpose of CBAs is simply to indicate spatially the location of critical or important areas for biodiversity in the landscape. The CBA, through the underlying land management objectives that define the CBA, prescribes the desired ecological state in which we would like to keep this biodiversity. Therefore, the desired ecological state or land management objective determines which land-use activities are compatible with each CBA category based on the perceived impact of each activity on biodiversity pattern and process which are as follows:

» CBA 1: Natural landscapes
» CBA 2: Near-natural landscapes
» Ecological Support Areas (ESA)

The presence of CBA 1 north of Aggeneys, and with CBA 2 in the vicinity (Figure 5.2), indicates that there are important biodiversity areas in that vicinity. An Ecological Support Area (ESA) forms a corridor south of Aggeneys (from Marsh *et al.* 2009). An ESA is an ecosystem that is moderately to significantly disturbed but still able to maintain basic functionality. From this data it is suggested that the proposed photovoltaic power generation facility should be located in an area which does not qualify for CBA 1 or CBA 2.

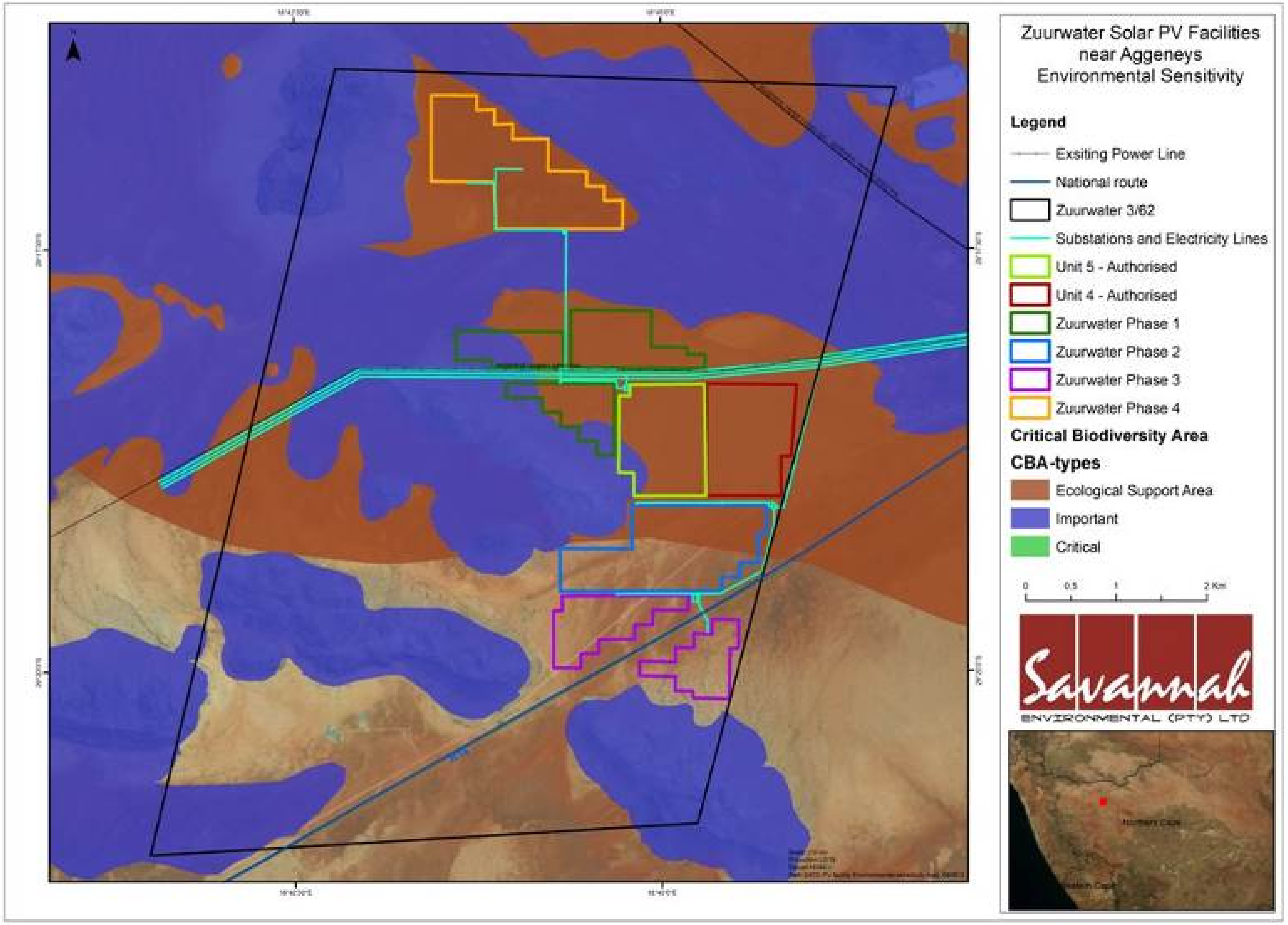

Figure 5.2: Important Biodiversity Areas and Ecological Support Areas as outlined by national conservation programs for the affected property

5.5 Conservation Planning - The Succulent Karoo Ecosystem Programme (SKEP)

Fine-scale biodiversity maps of the area were produced SKEP (2005). The biodiversity map indicates that proposed development is located in the “Plains sandy hummocky” and “Plains sandy flat”, which has relatively low biodiversity, in relation to the “Plains rocky” and “Mountains”. This data indicates that, from an ecological and biodiversity perspective, the development will be located on the least sensitive areas on the property. The SKEP (2005) biodiversity map indicates that the proposed site for development is not located within “Special Concern” or “Important” area, but is located in the Ecological Corridor, which is an area connecting Core Areas with each other or with surrounding areas (refer to Figure 5.3).

5.6 Land Cover / Land-Use

Figure 5.4 shows the land cover types for the study area. The predominant land use within the site and this region of the greater Namakwa District is livestock grazing at low densities (about 4 large stock units (LSU)/100 ha). A large number of subsistence farms as well as a few large commercial sheep/goat farmers cultivate the Nama-Karoo as a whole. Livestock farming on Zuurwater is predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring on the farm. Currently the site for development of the PV Facility is used for grazing. There are indications of some overgrazing on the site.

A major limiting factor in terms of agricultural potential is the availability of water for irrigation. The potential agricultural land uses identified (broad acre crops with irrigation; broad acre crops without irrigation, and hydroponics) for this area were determined to have a ‘poor’ to non-agricultural’ rating based on the adapted ‘Storie Index’. Contributing to this is the extremely long distances to markets. The most successful option for farming/agriculture is livestock farming (mainly sheep and goats), and classifies as ‘fair’ (refer to the Soils and Agricultural Specialist Report contained in Appendix F).

The proposed site supports natural vegetation interspersed with current and past grazing lands. The impacts of the latter are obvious around water points in particular. However, land degradation is generally limited not only on the farm but in the surrounding area as stocking rate (of both game and domestic stock) is kept low. The land capability as assessed in terms of agricultural potential is extremely low, although the Namakwa Integrated Development Plan (IDP) highlights the potential for enhancing tourism and the agricultural sectors in the district.

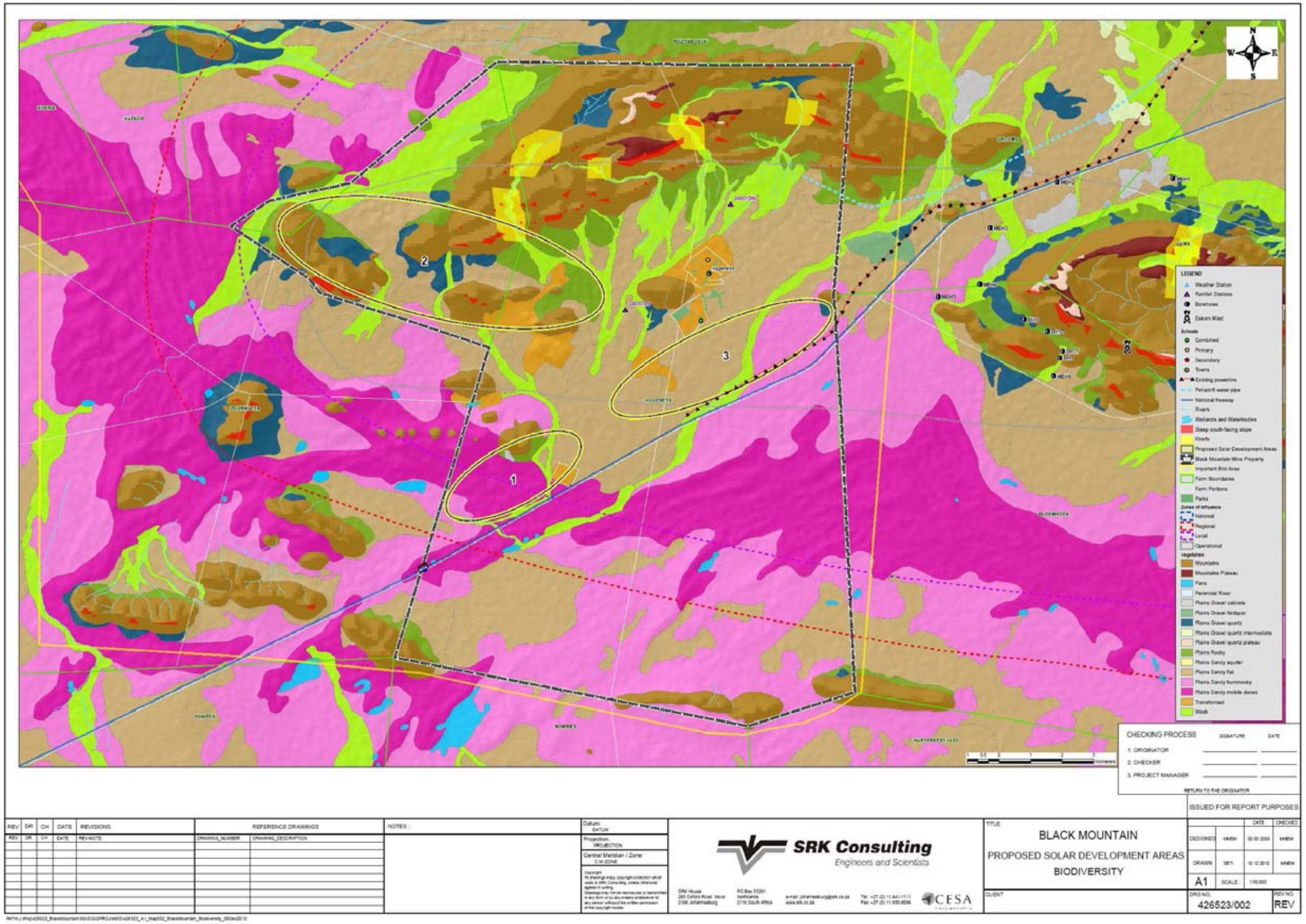

Figure 5.3: Map indicating biodiversity areas (SRK Consulting, 2012)

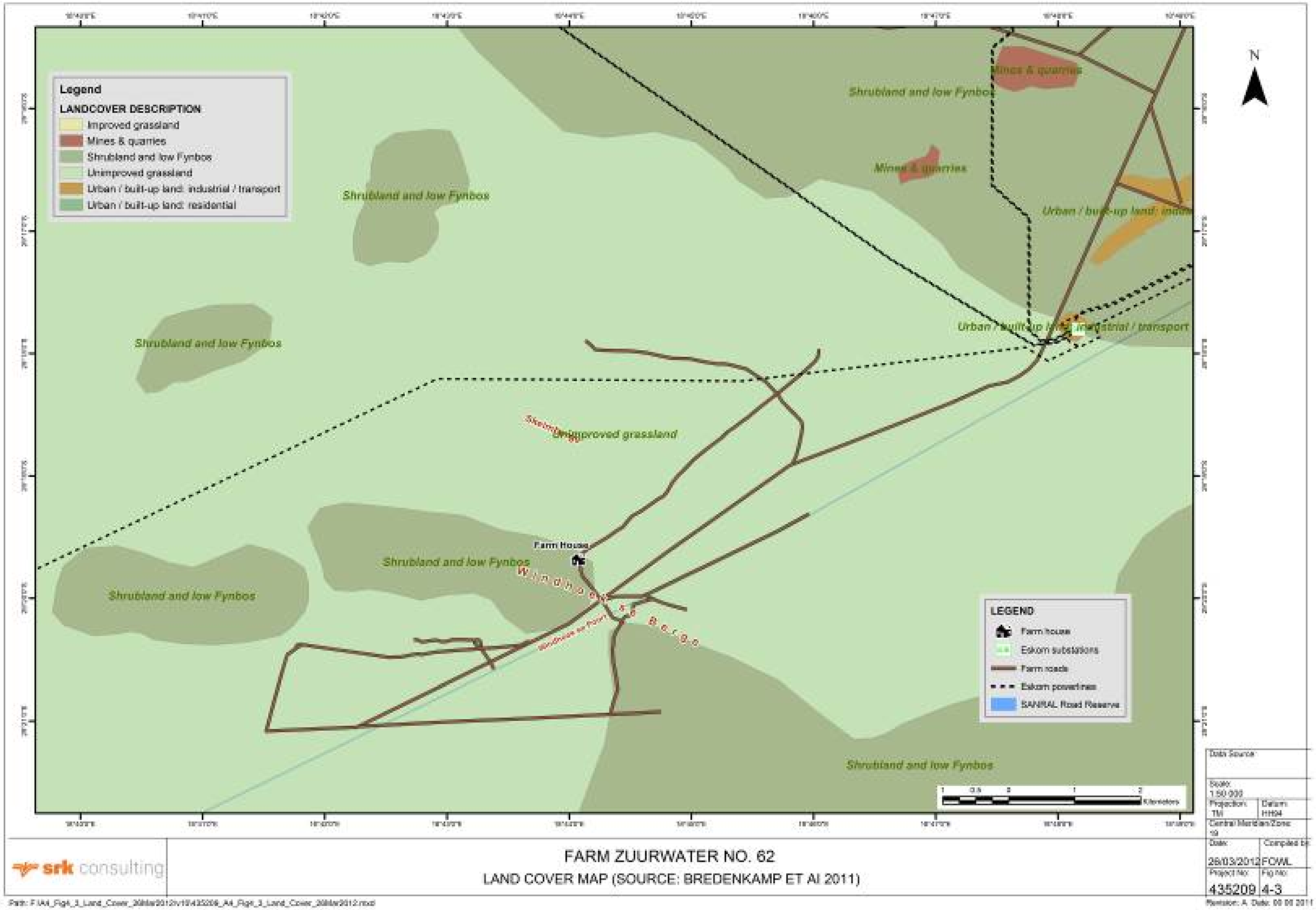

Figure 5.4: Land cover map for the study area (Source: SRK Consulting: Final EIA Report: 2012)

5.7 Flora

The site is dominated by a plain of dry grasslands with scattered ancient rocky outcrops, named Inselbergs. The main vegetation type on site is classified as the Bushmanland Sandy Grassland vegetation unit with the isolated mountains creating conditions for the Aggeneys Gravel Vygieveld (Mucina & Rutherford 2006). A vegetation map is shown in Figure 5.4. Several plant communities are present within the farm boundary with over 70% of communities being sensitive to environmental changes and are therefore of high conservation priority, as seen in Table 5.2 below.

Table 5.2: Plant communities identified within the Farm Zuurwater 62 (Source: Bredenkamp *et al* 2011)

Vegetation type / Plant Community	Sensitivity
Bushmanland Sandy Grassland (=Vegmap Unit Mucina & Rutherford 2006)	High
Bushmanland Arid Grassland (=Vegmap Unit Mucina & Rutherford 2006)	Low
Grassland on sandy hummocks	Low
Grassland on sandy plains	Low
Gravelly calcrete plains(=Vegmap Unit: Aggeneys Gravel Vygieveld, Mucina & Rutherford 2006)	High
Bushmanland Inselberg Shrubveld (Vegmap Unit Mucina & Rutherford 2006)	High
Shrubveld on mountains, hills slopes and crests	High
South facing slopes	High
South-facing scree slopes	High
Steep south-facing slopes	High
Rocky north-facing slopes	High
Azonal vegetation	High
Pans	High
Washes	High

The Khai Ma Local Municipality (KMLM) lies to the east of the Richtersveld and contains virtually the entire extent of the Bushmanland inselberg priority area - one of the nine zones identified through the SKEP process as important conservation areas in the Succulent Karoo (Marsh et al. 2009). It comprises the eastern part of the Gariep Centre of Plant Endemism. According to Marsh *et al*. (2009, p78) a total of 854 plant species have been recorded in the KMLM area. Figure 5.5 depicts the distribution of the various vegetation types for the entire Farm Zuurwater 62.

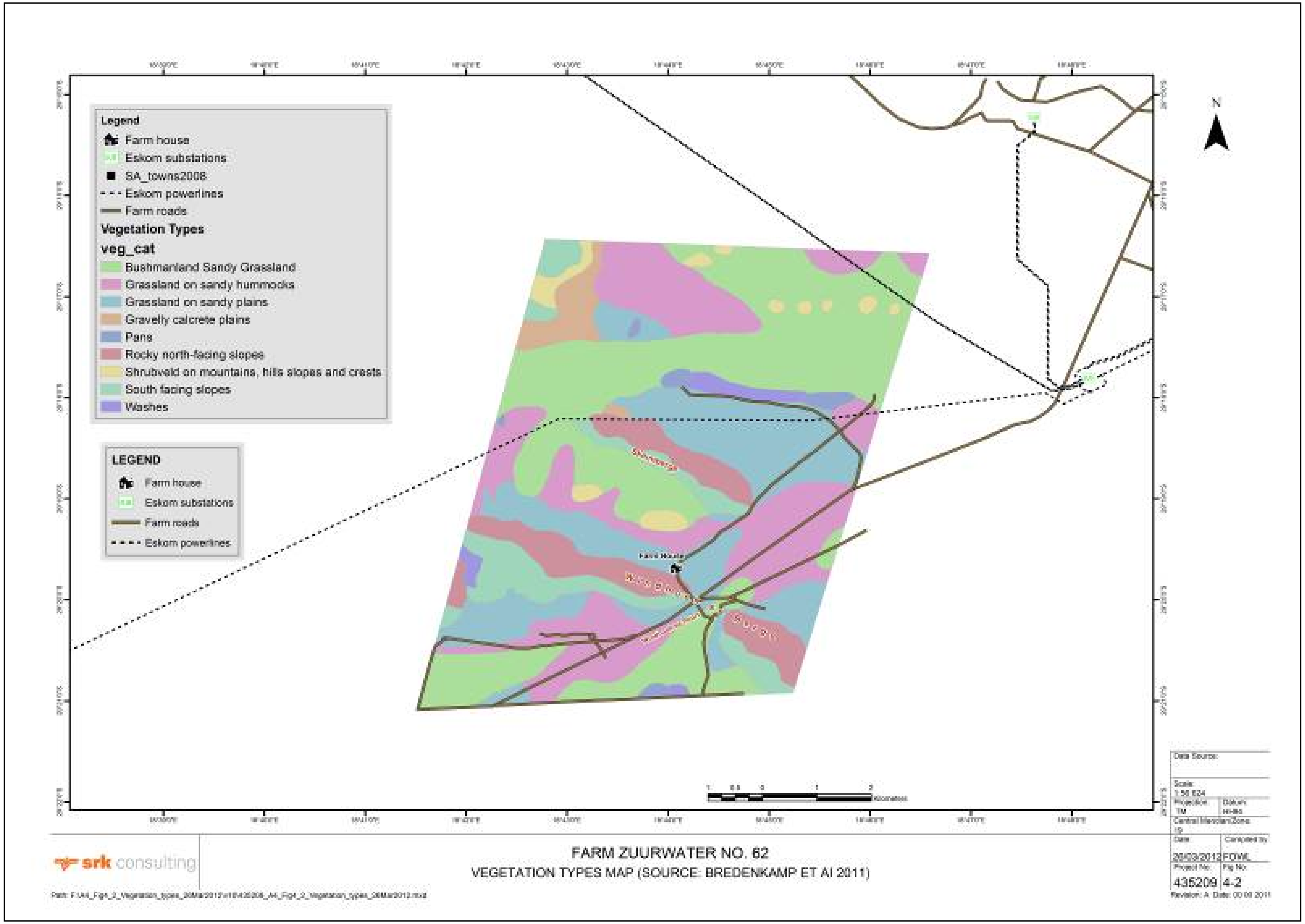

Figure 5.5: Vegetation types map for the farm Zuurwater 62 (Source: SRK Consulting: Final EIA Report: 2012)

The vegetation types dominant in each phase is indicated in Tables 5.3 to 5.6 below.

Table 5.3: Vegetation Types for Phase 1 of the PV Facility on the Farm Zuurwater 62

Vegetation	Sensitivity	Extent
Grassland on sandy plains	Low	About 75% of development on this vegetation
Washes	High	About 15% of development on this vegetation. Note: this area has been verified as a depression that can be waterlogged after an intensive rainstorm, but there is no physical indication of an actual waterwash. Thus, if drainage from this area to the pans on either side are not significantly affected, then development should be possible – all structures will just have to be of such nature that they will not be negatively affected by occasional short-term surface inundation
Gravelly calcrete plains	High	About 2% of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.
Rocky north-facing slopes	High	About 8% of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.

Table 5.4: Vegetation Types for Phase 2 of the PV Facility on the Farm Zuurwater No 62

Vegetation	Sensitivity	Extent
Grassland on sandy hummocks	Medium	About 75 % of development on this vegetation
Grassland on sandy plains	Low	About 15 % of development on this vegetation
Rocky north-facing slopes	High	About 2 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.
South facing slopes	High	About 1 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.
Bushmanland sandy grassland	High	About 7 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.

Table 5.5: Vegetation Types for Phase 3 of the PV Facility on the Farm Zuurwater No 62

Vegetation	Sensitivity	Extent
Grassland on sandy hummocks	Medium	About 50 % of development on this vegetation
Grassland on sandy plains	Low	About 45 % of development on this vegetation
Bushmanland sandy grassland	High	About 5 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.

Table 5.6: Vegetation Types for Phase 4 of the PV Facility on the Farm Zuurwater No 62

Vegetation	Sensitivity	Extent
Grassland on sandy hummocks	Medium	About 90 % of development on this vegetation
Bushmanland sandy grassland	High	About 5 % of development on this vegetation
Bushmanland sandy grassland	High	About 5 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.

Table 5.7: Vegetation Types for Substation and power line alignment for Phase 1 – Phase 4 of the PV Facility on the Farm Zuurwater No 62

Substation and Power Lines	Vegetation	Sensitivity	Actions
Phase 1:	Grassland on sandy plains	Low	Search and Rescue of species of conservation concern very important prior to commencement of activity.
	Grassland on sandy hummocks	Medium	Search and Rescue of species of conservation concern very important prior to commencement of activity.
Phase 2:	Grassland on sandy hummocks	Medium	Search and Rescue of species of conservation concern very important prior to commencement of activity.
Phase 3:	Grassland on sandy hummocks	Medium	Search and Rescue of species of conservation concern very important prior to commencement of activity.
Phase 4	Bushmanland sandy grassland	High	Search and Rescue of species of conservation concern very important prior to commencement of activity.
	Washes	High	Search and Rescue of species of conservation concern very

Substation and Power Lines	Vegetation	Sensitivity	Actions
			important prior to commencement of activity. Ensure access road does not influence natural drainage patterns to and from nearby pans.
	Grassland on sandy plains	Low	Search and Rescue of species of conservation concern very important prior to commencement of activity.

The farm Zuurwater is located in an area of vegetation and habitat transitions - the northern edge in the Nama-Karoo and Bushmanland habitat; the western edge in the Kalahari savanna habitat; the southern edge in the Gariep River drainage habitate; and the eastern edge in Namaqualand habitat. The larger area has at least thirteen plant species of conservation concern. The Bushmanland Arid Grassland is also present at the site. This vegetation type has a wide distribution, from Namaqualand in the west to Prieska in the east. In the vicinity of Aggeneys, the Bushmanland Arid Grassland is interrupted by Bushmanland Sandy Grassland and also by the Bushmanland Inselberg Shrubland that occurs on the scattered mountains and hills in the Aggeneys area, and the Aggeneys Gravel Vygieveld, which is considered to be a rare ecosystem, restricted to gravel patches. The soil is red-yellow, apedal freely drained but shallow. Rainfall is low, 70-110 mm per annum, mostly falling in late summer to autumn (Mucina & Rutherford 2006). A few Acacia species and other small trees and bushes are scattered in the dunes. In the mountains Quiver trees (*Aloe dichotoma*) are the largest and most obvious woody plants.

5.8 Plant species of Conservation Concern

The following red data plant species have been recorded from the area (2918) according to the new red data species list of SANBI. The threats to all these species is mostly habitat destruction and thus also destruction of specimens, as well as illegal collection and trading.

Species	Protection and RD Status	Suitable Habitat	Possibility of being present
Acacia erioloba	NFA, Declining	Deep sands with groundwater	Slight
Adromischus diabolicus	p 2, Rare	Rocky substrates	Observed
Aloe dichotoma	NEMA:BA, p1, VU	Rocky substrates	Observed
Avonia recurvata subsp. *minuta*	p 2, DDD	Rocky substrates	Slight
Brunsvigia herrei	p 2, VU	Variable habitats	Slight
Brunsvigia namaquana	p 2, DDT	Variable habitats	Slight

Species	Protection and RD Status	Suitable Habitat	Possibility of being present
Cephalophyllum staminodiosum	p 2, Rare	Rocky substrates	Likely
Conophytum blandum	p 2, NT	Rocky substrates	Slight
Conophytum limpidum	p 2, NT	Rocky substrates	Slight
Conophytum smorenskaduense	p 2, VU	Rocky substrates	Slight
Conophytum vanheerdei	p 2, Rare	Rocky substrates	Slight
Conophytum verrucosum	p 2, Rare	Rocky substrates	Slight
Crassula exilis subsp. *exilis*	p 2, Rare	Rocky substrates	Observed
Crassula sericea var. *velutina*	p 2, Rare	Rocky substrates	Observed
Crassula thunbergiana subsp. *minutiflora*	p 2, Rare	Rocky substrates	Slight
Crotalaria pearsonii	p 2, Rare	Variable habitats	Slight
Cyphia longiflora	NT	Variable habitats	Slight
Daubenya namaquensis	p 2, NT	Rocky substrates	Slight
Drosanthemum breve	p 2, DDT	Rocky substrates	Slight
Drosanthemum godmaniae	p 2, DDT	Rocky substrates	Observed
Eriospermum pusillum	Rare	Rocky substrates	Slight
Gladiolus salteri	p 2, Rare	Variable habitats	Slight
Helichrysum tricostatum	NT	Variable habitats	Slight
Hoodia gordonii	p 2, DDD	Rocky substrates	Observed
Lachenalia concordiana	p 2, Rare	Variable habitats	Slight
Lachenalia kliprandensis	p 2, Rare	Variable habitats	Slight
Lachenalia polypodantha	p 2, Rare	Variable habitats	Slight
Lampranthus amoenus	p 2, EN	Variable habitats	Slight
Lithops olivacea	p 2, VU	Rocky substrates	Observed
Moraea indecora	p 2, VU	Variable habitats	Slight
Othonna cyclophylla	Rare	Rocky substrates	Slight
Othonna euphorbioides	NT	Rocky substrates	Observed
Oxalis inconspicua	p 2, Rare	Variable habitats	Slight
Pelargonium grenvilleae	p 1, DDT	Rocky substrates	Slight
Ruschia aggregata	p 2, DDT	Rocky substrates	Slight
Ruschia sessilis	p 2, DDT	Rocky substrates	Slight
Ruschia tribracteata	p 2, DDT	Rocky substrates	Slight
Schwantesia pillansii	p 2, Rare	Rocky substrates	Observed
Strumaria massoniella	p 2, VU	Rocky substrates	Slight
Trichodiadema obliquum	p 2, DDT	Rocky substrates	Observed
Wahlenbergia divergens	DDT	Variable habitats	Slight
Wahlenbergia roelliflora	DDT	Variable habitats	Slight
Wahlenbergia sonderi	NT	Variable habitats	Slight
Zygophyllum divaricatum	EN	Variable habitats	Slight

Abbreviations for protection status:

» P 1: NCNCA Schedule 1
» P 2: NCNCA Schedule 2
» NFA
» NEMA: BA

» I: CITES Appendix 1
» II: CITES Appendix 2

The specific Red Data status is indicated for each species, and explained below.

Explanations of Red Data classes

Critically Endangered (CR): A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.

Endangered (EN): A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.

Vulnerable (VU): A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.

Near Threatened (NT): A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.

Critically Rare: A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.

Rare: A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria.

Declining: A species is Declining when it does not meet or nearly meet any of the five IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline of the species.

Data Deficient - Insufficient Information (DDD): A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.

Data Deficient - Taxonomically Problematic (DDT): A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.

The following plants encountered on the study site are protected:

- **NFA:** *Boscia albitrunca*
- **NEMA-BA:** *Hoodia gordonii*
- **NCNCA: Specially Protected Species – Schedule 1**
  - *Hoodia gordonii*
  - *Ozoroa dispar*
  - *Pelargonium spinosum*
- **NCNCA: Protected Species – Schedule 2**
  - *Adromischus alstonii*
  - *Adromischus diabolicus*
  - *Anacampseros karasmontana*
  - *Aridaria noctiflora*
  - *Avonia albissima*
  - *Avonia papyracea*
  - *Boscia foetida subsp. foetida*
  - *Bulbine mesembryanthoides*
  - *Conophytum fulleri*
  - *Cotyledon orbiculata*
  - *Crassula exilis*
  - *Crassula muscosa*
  - *Crassula sericea*
  - *Crassula subaphylla*
  - *Dianthus namaensis*
  - *Drosanthemum godmaniae*
  - *Drosanthemum karrooense*
  - *Ebracteola fulleri*
  - *Euphorbia avasmontana*
  - *Euphorbia gariepina*
  - *Euphorbia gregaria*
  - *Euphorbia mauritanica*
  - *Euphorbia rectirama*
  - *Haworthia venosa*
  - *Huernia campanulata*
  - *Lithops julii*
  - *Lithops olivacea*
  - *Mesembryanthemum guerichianum*
  - *Microloma incanum*
  - *Nymania capensis*
  - *Ornithogalum glandulosum*

- *Oxalis eckloniana*
- *Phyllobolus latipetalus*
- *Phyllobolus lignescens*
- *Psilocaulon subnodosum*
- *Ruschia divaricata*
- *Ruschia robusta*
- *Schwantesia pillansii*
- *Trichodiadema obliquum*
- *Tylecodon rubrovenosus*
- *Tylecodon sulphureus*

5.9 Fauna – Mammals

The broader study area is relatively species rich with respect to mammals, with 56 species typically being found within the western semi-arid region. Field observations suggested that mammal's population level were low during the site visit. The rest of the species richness is made up from common and robust mammals with wide distributional ranges such as aardvarks, springhares, four-striped grass mouse, porcupines, the caracal, the genet, the two mongoose species, the black-backed jackal, etc. Species likely to also occur on the site include elephant shrews, ground squirrels, the spectacled dormouse, a diversity of gerbil species, dassie rats, whistling rats, black-footed cats, bat-eared fox, Cape fox, gemsbok and springbok.

The role of insectivorous bats in an ecosystem is often under-estimated, whereas their susceptibility to reigning environmental conditions is under-appreciated. Bats are sensitive to adverse daytime environmental conditions and predation, and suitable daytime roosting sites are of cardinal importance. Especially the Bobbejaansgat Mountain has many boulders and rock faces forming many overhangs and deep crevices suitable for daytime roosts. The dammed water and marshland conditions to the north-east of the site are likely to support insect populations for hawking bats. Mammal occurrence and distribution is strongly linked to specific habitat types and botanically defined biomes, with terrestrial habitats proving favourable to a majority of the mammal species (Rautenbach 1978 & 1982).

5.10 Birds

Conservation of untransformed land, including mountains, pans, dunes and gravel skirts is the key objective in order to preserve several bird species on the site. Of the 169 bird species recorded and/or expected on the Farm Zuurwater 62, nine are threatened species, of which the resident, near-endemic, habitat-specific and range-restricted Ludwig's Bustard and Red Lark are both considered Vulnerable by International Union for Conservation of Nature (IUCN) criteria. About 167 bird species assessed have a high, medium or low probability of occurrence on site, based on the habitats available, and of these the presence of 44 species (27%) were confirmed.

Nine species of international and/or national conservation concern (Red Data species, IUCN/Birdlife International 2011, Barnes 2000), ranging from Near Threatened to Vulnerable, were considered as possible to occur on site, of which two were recorded during the survey (Ludwig's Bustard, Red Lark) and a third reported by the landowner (Kori Bustard). Most of these threatened species fall into a few obvious categories by habitat preference and their likelihood of occurrence on site.

Table 5.8: List of threatened species that will possibly make use of the habitats on and around Farm Zuurwater

Threatened Status	**Species**	**Probability of occurrence on site**			
		Regular resident	**Frequent visitor**	**Erratic visitor**	**Infrequent vagrant**
Near Threatened	Chestnut-banded Plover			X	
	Black Harrier			X	
	Lanner Falcon		X		
	Sclater's Lark			X	
Vulnerable	Ludwig's Bustard	X			
	Kori Bustard			X	
	Martial Eagle		X		
	Secretarybird			X	
	Red Lark	X			
TOTALS	**9**	**2**	**2**	**5**	**0**

These analyses indicate that by far the most important habitats to conserve for threatened species are the grassy plains and the red sand/dunes, with the bare washes and pans also important at the times when they are productive after rains. However, the grassy plains form part of extensive similar habitat in the area, while the red dunes are more restricted but also much more productive, for livestock and birds alike, including the Red Lark that is a restricted-range endemic to Bushmanland. The bare washes/pans (for Chestnut-banded Plover) and gravel fields (for Sclater's Lark) are only really productive after good rains, while the mountains have nest sites for the Lanner Falcon when good rains attract large numbers of nomadic insect- and seed-eating birds. Two Vulnerable species are expected to be regular breeding residents (Ludwig's Bustard and Red Lark). The Vulnerable Martial Eagle and Secretarybird, and the New Threatened Lanner Falcon are expected to be regular visitors to the area, when their prey animals are abundant, but while no sufficiently large trees were seen as likely nest sites for the Eagle or Secretarybird, the large south-facing cliffs, especially on Hoedkop, could well support nesting ledges for the falcon, as they apparently do for Verreaux's Eagle. The remaining four threatened species are expected to be erratic visitors when high rainfall creates productive conditions (plant cover, seeds, insects, small vertebrates). Some are resident species in the general area of the Northern Cape whose ephemeral habitats on the property are also only likely to become suitable after good rains, the Chestnut-banded Plover visiting and possibly feeding and breeding in/around the more saline pans and Sclater's Lark using large grass seeds on the few chalky gravel patches. The Kori Bustard generally prefers higher rainfall areas with more ground cover and productivity, so although they do sometimes visit the area it seems unlikely that they breed there. The Black Harrier is expected only as an erratic, non-breeding winter visitor to the area from the Western Cape, again most likely when good rains have produced abundant small animals.

5.11 Herpetofauna

Of the 66 herpetofauna[12] species recorded and/or expected on the Farm Zuurwater, three have threatened status. With reference to specific herpetological habitats, terrestrial habitats, rupiculous habitats (rock-dwelling) and wetlands were most prominent, accompanied by scarce arboreal habitat[13] types (Bredenkamp et al 2011). Terrestrial habitats prove to be most ecologically important, supporting a wide range of herpetofaunal species (Bredenkamp et al 2011). Over 56 reptile species are known to occur in the broader vicinity of the farm Zuurwater, although only six were observed during the site visit (see Table 5.9 below). None of the species observed fall on a red data list.

Table 5.9.: Reptile and amphibian species observed on site

Scientific Name	English Name	Observation Indicator	Habitat
Chondrodactylus angulifer	Giant Ground Gecko	Sight record	Under man-made rupiculous habitat
Chondrodactylus bibronii	Bibron's Tubercled or Thick-toed Gecko	Sight record	Under man-made rupiculous habitat

[12] Herpetology is the branch of zoology concerned with the study of amphibians (including frogs, toads, salamanders, newts, and gymnophiona) and reptiles (including snakes, lizards, amphisbaenids, turtles, terrapins, tortoises, crocodilians, and the tuataras).
[13] Pertaining to animals that are adapted to life in the tree tops, tree-dwelling

Scientific Name	English Name	Observation Indicator	Habitat
Trachylepis sulcata	Western Rock Skink	Sight record	Under and above rocks and man-made rupiculous habitat
Pedioplanis namaquensis	Namaqua Sand Lizard	Sight record	Red sand dunes
Agama anchietae	Anchieta's Agama	Sight record	Basking above huge boulders in the first rays of the sun and inside an old tyre.
Psammophis notostictus	Karoo Whip or Sand Snake	Sight record	Under man-made rupiculous habitat

The study site falls just outside of the natural range of red data reptile species, such as the speckled padloper, Namaqua day gecko, and the armadillo girdled lizard. The same is true of various red data list amphibians such as the giant bullfrog, the desert rain frog and Karoo caco whose distribution range falls outside the study (Bredenkamp et al 2011). Arboreal habitat is almost non-existent on the study site.

5.12 Soils

Much of the area is covered in deep (up to 30 cm) red sands, forming scattered and/or fields of red dunes in places most subject to the prevailing southwest wind and with structures that impede their movement. The quartzite gravels occur in three main forms, small fine-grained patches on the tops and foothills of the mountains, more variable and widespread sizes around the erosion zones below the mountains, and small feldspar patches (with pink Hoogoor Suite gneiss evident), with calcrete gravels also emerging in a few patches where exposed by erosion on the flats. The effects of the mountains, plus the prevailing winds, result in sand and dunes accumulating mainly on their southern foothills, or in channels between them, with more exposed and gravelly plains forming.

Soil Classification

Aeolian stratification is clearly visible, diagnostic of regic sands. The soil type on the entire study area is classified as a NAMIB Form –Nb of the family KALAHARI 2100. Although no calcretes were found on site within the diagnostic 1500mm, some loose calcrete rocks were found by the Agricultural specialist on the northern side of the study area. The only distinguished difference between the Soil Types/properties was that the Ortic A-horison was largely removed in the 'colluvium' part of the study area (refer to Agricultural Specialist Report contained in Appendix F).

» Colluviums: Colluviums can best be described as unconsolidated deposits of soil and rock fragments accumulated at the base of slopes as a result of gravitational action. From the site visit it was clear that the colour of the colluvium is slightly 'less red" than that of the wind transported regic sands, with the occurrence of small rock fragments clearly visible.

» Regic sand: The only soil type diagnosed on the 'proposed development site is regic sands. The term is used here to convey the idea of cover sands in which, by virtue of their youth or environment, little or no profile development has taken place. Such materials often represent an important geographic entity in desert and littoral regions.

Chemical Soil Analysis

Laboratory tests indicated normal levels of all the basic cations (Ca, Mg, K and Na). Phosphate (P) levels are very low as expected but as no commercial crops are grown on theses soils the low P levels has no influence on further discussions. P levels can easily be adjusted should any crop be planted here in future. Relatively high levels of Calcium (Ca), especially in the B-Horizon of the 'dune sample', are a further indication that the regic sands are underlain by calcrete and quartz.

Physical Soil Analysis

The texture classes yielded very high sand contents on all the samples tested. The low silt and clay fractions are also diagnostic to regic sand and the total absence or little development of pedogenesis. These sands are very young in geomorphological terms. The water holding capacity of these sands are very low, and places constrains towards any type of irrigation and irrigation scheduling planned on these soils.

5.13 Agricultural Potential and Land Use

The predominant land use within the Northern Cape, as well as within the greater Namakwa District is livestock grazing at low densities (about 4 large stock units (LSU)/100 ha). A large number of subsistence farms as well as a few large commercial sheep/goat farmers cultivate the Nama-Karoo as a whole. Livestock farming on the Farm Zuurwater is predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring. The entire 'proposed development area' of Zuurwater is used for grazing. There are indications of some overgrazing on the site.

A major limiting factor in terms of agricultural potential is the availability of irrigation water, with the proximity of the study area to the Orange River being approximately 42km. The potential agricultural land uses identified (broad acre crops with irrigation; broad acre crops without irrigation and hydroponics) were determined to have a 'poor' to non-agricultural' rating based on the adapted

'Storie Index'. Contributing to this is the extremely long distances to markets. The most successful option for farming/agriculture is livestock farming (mainly sheep and goats), and classifies as 'fair' (refer to the Agricultural Specialist Report contained in Appendix F).

A trend towards the development of solar energy installations has begun within the greater area, given the energy shortages in South Africa, favourable irradiation levels, as well as an enabling policy and implementation environment (REIPP programme and revisions to this programme). The solar energy land use broadly falls within the provincial planning framework, and is identified as a potential source of development and income in the Namakwa District (Namakwa District IDP, 2006 – 2011). The proposed site supports natural vegetation interspersed with current and past grazing lands. The impacts of the latter are obvious around water points in particular. However, land degradation is generally limited not only on the farm but in the surrounding area as stocking rate (of both game and domestic stock) is kept low. The land capability as assessed in terms of agricultural potential is extremely low, although the Namakwa Integrated Development Plan (IDP) highlights the potential for enhancing tourism and the agricultural sectors in the district.

5.14 Surface Water Resources

Drainage Patterns

The project development site is located between the main quaternary sub-catchment D82C that has an area of 690 km^2 and drains from the south towards Windhoek se Poort, east of the Skelmberg and across the proposed site into the low lying pans in the north (Sim et al 2011). This forms part of the Lower Orange Water Management Area No 14.

There are no perennial rivers or streams located at, or in the vicinity of, the proposed development site. The Orange River itself is situated more than 40km to the north of the site. There is a seasonal unnamed river that is situated in the south-east of the farm Zuurwater and a small perennial spring is located on the western boundary of the farm. This is situated on the eastern extremity of the inselberg which lies immediately to the west of the farm. The Gariep-Koa River Watershed marks the highest point in the Bushmanland. Most of the inselbergs make up this SE-NW orientated watershed. A number of drainage basins exist to the north and south of this watershed.

The various localised drainage lines associated with the Skelmberg rapidly dissipate and infiltrate the ground on reaching the flat open sandy soils. A drainage line (defined watercourse with associated ephemeral pans) runs from west to east, to the north of the proposed site. It drains under the N14 and gravel roads, but also discharges into the pans to the eastern side of the development site.

In an extreme rainfall event, the peak flow is estimated to be 150 – 200m^3/s. The surface water flowing towards the pans during a storm event can form temporary ponds, where-after they and evaporate or infiltrate before necessarily reaching the pans (Sim *et al* 2011). The low lying pans towards the north remain dry most of the time and when enough surface runoff is generated, temporary ponding of the pans occurs.

It should be noted that the only defined watercourse lies well to the northern side and does not cross the proposed development site itself, which is extremely flat. The majority of the surface water runoff from the site flows as sheetwash. The gravel road network on the farm has to some degree increased sheet run-off, resulting in channelled flow and increased erosion and ponding. However, due to the low rainfall in the area, this does not appear to play a major role.

The 1:100 year peak flow is estimated to be between 150 – 200m^3/s using the above empirical and calibrated rational methods. There is no well-defined channel and the surface water flows as sheet wash across the site to a depth of approximately 200mm - 300mm during an extreme event (1:100 year storm event). These flows are not expected to cause any significant damage due to the low velocities (less than 1m/s) associated with flat gradients and wide open channels (Sim *et al,* 2012).

Evaporation Levels

Evaporation levels are very high in the study area. S-pan evaporation figures (Sim *et al*, 2011) indicate a range from 99mm in June, to 346mm in January, with the annual average being around 2650mm.

Runoff Potential

The site can be summarised into two distinct hydrological soil groups which give an indication of the runoff potential:

» Group A (sands generally found on the plains with low stormflow potential, with high infiltration rates and rapid permeability
» Group D (situated on the Skelmberg and the Windhoek se Berge) with high stormflow potential. Soils in this group are characterised by very slow infiltration rates and severely restricted permeability. Very shallow soils and those of high shrink-swell potential are included in this group.

5.15 Groundwater

Situated in the drainage region D of the quaternary sub-catchment D82C, low rainfall and high evaporation of surface water are a key feature of the area. Consequently, groundwater systems via boreholes should form a key water source in the area. However, previous studies and discussions with officials from relevant departments indicate that the groundwater in the area is very deep and brackish. For this reason, there are few boreholes in the area and groundwater is not used extensively. Shallow groundwater flow (if any), is expected to imitate the surface water drainage patterns, travelling towards the topographic low situated to the north of the site (Sim *et al* 2011).

There is no defined watercourse within the study area, and therefore ‘flooding’ would be limited to sheet flow during an extreme rainfall event within the study site. Sheet flow can be defined as an overland flow or downslope movement of water taking the form of a thin, continuous film over relatively smooth soil or rock surfaces and not concentrated into channels larger than rills.

5.16 Air quality

It can be assumed that air quality in the area is good based on the extremely limited presence of industrial activity in the greater district. Due to the close proximity of the Black Mountain mine (mine fall-out) and N14 (vehicle emissions), the main contributors to decreased air quality can be expected to come from these sources. The low groundcover levels in the vicinity, and agricultural activities combined with relatively windy conditions for much of the year mean that dust is likely to affect air quality.

Dust deposition levels in the vicinity are slight based on the DEA dust deposition categories, with ‘moderate’ dustfall occurring during October. High evaporation rates, low precipitation rates and occurrence of high winds, combined with a comparatively high presence of erodible material are likely to contribute to ambient particulate matter concentrations (in SRK, 2010).

5.17 Heritage Resources

Previous studies in the vicinity have revealed an extremely low incidence of artefacts from either the Stone Age or colonial times. Artefacts that have been found in the area are generally ostrich eggshell remains and occur singly and are not considered “sites” in a conventional archaeological or heritage sense. Archaeological studies show that within the region, the number of heritage traces is scarce and therefore the heritage resources are of low significance (Morris, 2011).

5.18 Palaeontology

It is considered highly unlikely that paleontological resources or artefacts are present in the area. Paleontological studies illustrate that the Mid Proterozoic basement rocks found in Namaqua-Natal Province are not fossil bearing (Almond and Pether 2008), a result of porous dune sands that are not favourable for fossil preservation. The paleontological sensitivity is also relatively low for sediments such as the Precambrian basement rocks, Kalahari group rocks and younger sediments, meaning that the proposed developments will have minimal impact (Almond and Pether, 2008).

5.19 Noise Receptors in the Study Area

The undeveloped surroundings of the proposed development site mean that the background noise levels are very low 30 – 35 decibels (dBa). Noise sources in the immediate vicinity of the development site are restricted to low-density rough grazing of stock and associated activities, and the N14 freeway. Black Mountain Mine is situated under 10km away, but this seems to have little if any noise impact on the farm under normal conditions. Surrounding topography is likely to have the effect of minimising impacts of noise from the mine. Traffic volumes are low, and therefore noise emanating from the road is this relatively insignificant.

5.20 Visual Quality of the Study Area

The proposed site falls in an area which is very flat, the skyline is broken by the small inselbergs to the west of the site, however, these are the only major natural features in the landscape. The landscape is disturbed to the east of the site with a large Eskom substation and the mining activities at Black Mountain Mine, however these features are relatively far from the site. The Black Mountain Mine is located approximately 9km to the north-north-east of the site. Existing power lines run along the site. The site is located adjacent to the N14 highway, which runs west to east between the town of Springbok and Pofadder. An existing Eskom substation is located approximately 5km to the east of the site. Due to this, the visual quality rating for the area could be described as having a medium visual quality, due to the lack of natural features in the landscape and some disturbances to the landscape in the east.

Figure 5.6: View north from site, towards existing power lines

The study area can be divided into distinct 'land types' each with a dominant landscape character. These land types are:

» Agriculture (primarily grazing)
» Mining and utility (Black Mountain Mine and the Eskom Substation)
» Power lines
» National Road (N14)
» Semi-natural areas.

An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places. The broader farm portion is barren and sparse in terms of natural features. In terms of being distinct from other areas, this site falls along the main road between Springbok and Pofadder; the landscape between these two towns is flat and barren, with only inselbergs and small hills breaking the skyline. Therefore this site is not different from the surrounding landscape in its current form, altering the site through developing the PV arrays may change the sense of place for the site. The sense of place for the site could be seen as low.

Black Mountain Mine and the Eskom Aggeneis Substation are both visible from the N14 which is the primary road through the area and bisects the site. Therefore the sense of place has already been altered. Nevertheless, the overriding sense of place for the area is that of a largely wild and unspoiled environment. The inselbergs add a high level of beauty and splendour to the arid landscape (refer to the Visual specialist report contained in Appendix G).

5.21 Socio-Economic Environment

The Namakwa and Khai-Ma region and local municipality have 2.72 and 1.87 people respectively dependent on every employed person, with future deterioration anticipated. According to the NDM's Integrated Development Plan (IDP) infrastructure improvements instituted by the district in recent years has been accompanied with a gradual shift away from services provision to a focus on socio-economic development and the identification of geographical areas with development potential. Two features are particularly singled out for their major development potential, namely, the district's coastline and the Orange River. Critical actions identified by the district to promote local economic development were:

» To participate in the Growth and Development Summit of the 8th and 9th of March 2007
» Identify mega development projects and their implementation
» Implementation of PGDS and Accelerated Strategic Growth Initiative of South Africa (ASGISA) projects
» Beneficiation of raw minerals products
» Development of the West Coast gas fields and coastline
» Mariculture expansion
» Maximum utilisation of the Orange River (e.g. dam, water rights)
» Square Kilometre Array telescope project/ Deep Space Network Array (DSNA).

The Khai Ma IDP (2004) views the mining sector as potential injection for the local economy. Employment at Black Mountain is contributing towards upliftment in the area and the municipality is looking towards the Gamsberg mining project to do the same. Some small miners operating in the area struggle because of their limited co-ordination, capacity and access to markets. Livestock farming forms a large part of the agricultural business in Khai Ma and the meat is marketed mainly to local markets and in the Northern Cape. Table grapes and other crops grown along the Orange River are largely exported. Tourism opportunities, according to the municipality, are underdeveloped and efforts must be made to realise their potential.

The Namakwa District is one of five districts in the Northern Cape. The seat of the Namakwa District is Springbok. The Khai Ma Local Municipality is one of the least populated local municipalities in the Namakwa District. It includes the towns (with approximate population sizes in parentheses) of Pofadder (6 500), Aggeneys (2500), Pella (2 200), Onseepkans (2 000) and Witbank (500). In 2007, the Khai Ma Local Municipality had a population of approximately 13 500 which was just under 10% of the Namakwa District population.

Most employed people in Khai Ma have some secondary education or primary education with 15% of the employed having grade 12. The situation appears to be a mirror of the district status. Survey results from the Provincial Decision making Enabling Project (PROVIDE) Background Paper (2009) illustrate that most of the African and Coloured workforces are unskilled and most Whites who are working are semiskilled. Indian workers in the Northern Cape fall roughly equally into skilled, semiskilled or unskilled categories. Indians and Whites also have the highest percentages of skilled people amongst its working population in the Northern Cape.

The town itself consists of Aggeneys and Aggeneys South Larger towns in surrounding local municipalities include Springbok, Kakamas and Upington. The town of Aggeneys (place of water) is located approximately 65 km west of Pofadder, on the N14 highway to Springbok, which is approximately 120km to the west of Aggeneys. Although the town was established in conjunction with the Black Mountain Mine (which provides employment for most of the town) in around 1976, records show a close association with the Pella Mission station approximately 40km north east of Aggeneys. Most facilities, including a recreation club, the main shopping facilities, a clinic and the police station are in Aggeneys while both Aggeneys and Aggeneys South have schools.

It is noted that the total population in the district management area (DMA) dropped from 1450 persons in 1996 to 813 persons in 2001, while the population in Khai Ma rose from 9 348 persons in 1996 to 11 344 in 2001. Khai Ma therefore could effectively be the municipal area least affected by loss in employment in the period 1996 to 2001. The district attributes post-2001 losses in employment to decommissioning of mines in the district. It is however noted that approximately 820 people from Aggeneys are permanent employees of Black Mountain.

Most agricultural workers (61.75%) have elementary occupations in the industry. There is also a large proportion (20.69%) of skilled workers in the agricultural and fisheries sector and fair numbers of executive staff (6.39%) and machine operators (6.11%). Trade, sales, services and professional workers constitute minorities amongst those employed in farming and fisheries in the Northern Cape.

Data from the Northern Cape PROVIDE project shows that generally, larger proportions of the workforce aged 20 to 49 years are employed in the non-agricultural sector than in the agricultural sector. Employees under 19 years and over 50 years and more likely to be engaged in non-agricultural occupations.

5.22 Access

The N14 to be used for all access to the site falls under the auspices of SANRAL and is in excellent condition. Traffic volumes on the road are very low, given the remote location of the site. The two access points from the N14 to the northern and southern portions of the site are in an area where the N14 is straight, and with the flat nature of the topography at that point results in good visibility. Both of these access routes make use of the existing farm road entry points on to the N14.

5.23 Electricity

The percentage of household in Khai Ma using electricity for lighting, cooking and heating has increased from 2001 to 2007. Electricity use for heating in particular has increased dramatically, by 31.6%. The proportion of formal to informal households has decreased enormously from 78.9:1.5 (or 52.6:1.0) to 74.0:4.0 (or 18.5:1.0) in the period 2001 to 2007. This may be an indication of large numbers of people moving into the municipality who are unable to secure formal housing.

The percentage of people in Khai Ma owning fully paid off houses increased between 2001 and 2007. The data also suggests that a smaller proportion of households have entered the property market in the 6 year period, as a lower percentage own their homes without completely paying their bonds off. A smaller percentage of residents are renting but a larger proportion was occupying homes rent-free. Rent-free households have increased more than 100%, and may include those occupying informal housing structures.

5.24 Traffic

The National Route 14 (N14) is straight and virtually level as it passes the site, with a flat vertical curve located just to the west of the proposed location of the access to the facility. The following is relevant regarding this road in the vicinity of the site:

» The horizontal and vertical alignment of the N14 is straight with a flat crest vertical curve to the east and a slight sag vertical curve to the west
» The road level shows natural ground slopes from south to north and road constructed slightly above natural ground level both sides
» The road width is 10,0m made up of 3.5m lanes with 1,5m shoulders.
» Drainage is provided by pipes beneath accesses and flat open channel drainage along one or both sides
» The condition of the road surface is good to fair, with evidence of minor and major rehabilitation works
» Telephone lines are about 20m from edge of road on south side, there is no street lighting and street furniture is provided by delineators only. There is no public transport activity and no facilities in this regard are provided. No pedestrian activity was noted, and footpaths (either formal or informal) are absent
» The speed limit is 120km/h, and with vegetation being low level sparse visibility is good. Sight distances from the existing access point to the site is restricted to approximately 500m by a flat crest vertical curve to and from the east and in excess of 1,5km to and from the west.

The incident record at the Aggeneys Police Station showed that there were 6 accidents within 5km of the site during 2011 and 4 accidents during 2010. One of accidents that occurred just more than 1km to the east of the existing access point to the facility was the only fatal accident recorded in the incident book over the last 2 years in close proximity to the site. Discussions with the farm owner revealed that in the last 3 years there has been three accidents on the N14 more or less at the position of the existing access point to the site, none of which involved vehicles turning into the N14 from the access or turning from the N14 into the access or involved an actual collision of two vehicles. In all three cases a vehicle left the roadway.

5.25 Description of the Environment - Summary of the Environmental & Social characteristics of the four project development phases

The table below provides a summary of the environmental and social characteristics of Phase 1 to Phase 4 of the Zuurwater Solar Energy Facility.

Table 5.10: Summary of the Environmental and Social characteristics of the four project development phases

Environmental Characteristics	Phase 1	Phase 2 Farm	Phase 3	Phase 4
1. Land Use	Livestock Farming (sheep, cattle and goats)	Livestock Farming (sheep, cattle and goats)	Livestock Farming (sheep, cattle and goats)	Livestock Farming (sheep, cattle and goats)
2. Land Capability	Low	Low	Low	Low
3. Climate	Arid, semi-desert area	Arid, semi-desert area	Arid, semi-desert area	Arid, semi-desert area
4. Topography	Flat with a gradient of less than 1:50 and areas of undulating landscapes	Flat with a gradient of less than 1:50 and areas of undulating landscapes	Flat with a gradient of less than 1:50 and areas of undulating landscapes	Flat with a gradient of less than 1:50 and areas of undulating landscapes
5. Hydrology, Wetlands, Riparian Zones and Watercourses	Seasonal pans present in the broader farm portion, however not on the development footprint	Seasonal pans present in the broader farm portion, however not on the development footprint	Seasonal pans present in the broader farm portion, however not on the development footprint	Seasonal pans present in the broader farm portion, however not on the development footprint
6. Conservation Planning	» Majority of the site falls within an Ecological Support Area » Western boundary falls within the Succulent Karoo Ecosystem Programme (SKEP)	» Only northern half of the sit falls within an Ecological Support Area	» N/A	» Site falls within an Ecological Support Area
7. Land Types / Soils	» Regic Sands » NAMIB Form –Nb	» Regic Sands » NAMIB Form –Nb	» Regic Sands » NAMIB Form –Nb	» Regic Sands » NAMIB Form –Nb
8. Agricultural Potential	Low	Low	Low	
9. Vegetation types	Dry grasslands with scattered rocky outcrops, named Inselbergs	Dry grasslands with scattered rocky outcrops, named Inselbergs	Dry grasslands with scattered rocky outcrops, named Inselbergs	Dry grasslands with scattered rocky outcrops, named Inselbergs
10. Heritage and palaeo resources	» None	» None	» None	» None
11. Social Characteristics	» Khai Ma Local Municipality » Nearest town is Aggeneys » Sparsely populated » High unemployment » Visual character - The landscape is disturbed to the east of the site with a large Eskom substation and the mining activities at Black Mountain Mine, however these features are relatively far from the site.			

ASSESSMENT OF POTENTIAL IMPACTS: PHASE 1 OF THE SOLAR ENERGY FACILITY (DEA REF. NO.: 14/12/16/3/3/2/470) 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 **Phase One of the Zuurwater Solar Energy Facility (DEA Ref. No.: 14/12/16/3/3/2/470)**. This assessment is undertaken for the 75 MW facility and for all the facility's components including:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power lines to transport the power from each Phase into the Eskom grid via the Aggeneis MTS Substation.
» A new on-site water reservoir and associated water supply pipeline (shared infrastructure between all phases)
» Internal access roads.
» Office, workshop area for maintenance and storage.
» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

The Phase 1 PV arrays are proposed to be located to the north-west of the authorised Unit 4 and Unit 5 (refer to Figure 6.1). Phase 1 is located approximately 11.5km south-west of the town of Aggeneys (straight line distance). The proposed generating capacity for this phase is 75MW, covering an area of 267ha. An on-site substation is also proposed for this phase. A new overhead power line (up to a voltage of 275kV) is also required.

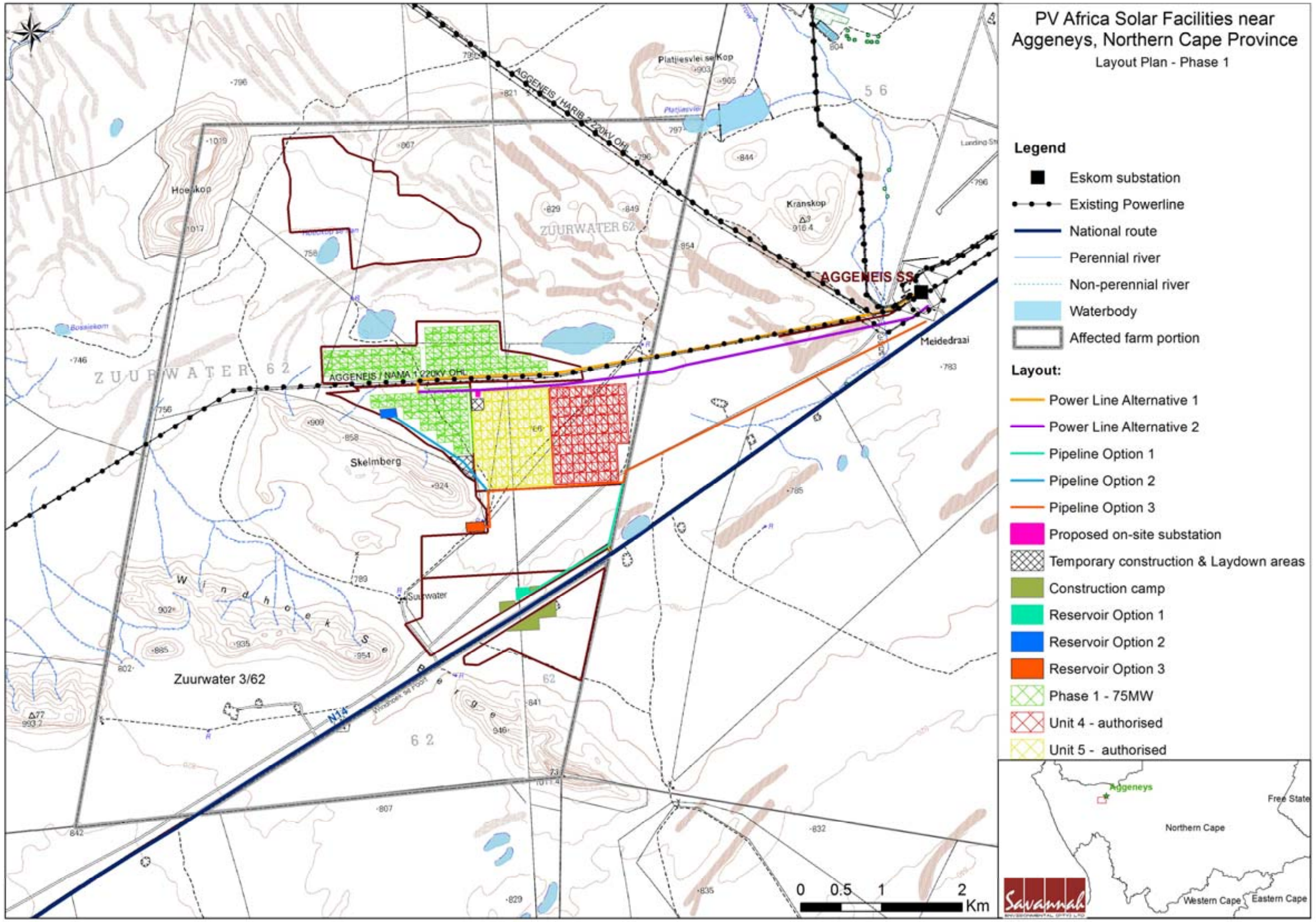

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Figure 6.1: Locality / Layout Map for the 75MW PV plant on Portion 3 of the Farm Zuurwater No 62 in the Namakwa District, Northern Cape Province - Phase 1

The development of Phase 1 of the Zuurwater project will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access roads, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; construction of power plant, and undertaking site rehabilitation and establishment and implementation of a storm water management plan. Construction is expected to take approximately 15-18 months.
» *Operation* – will include operation of the facility and the generation of electricity. The operational phase is expected to extend in excess of 20 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 and where feasible recycling of the components of the facility; clearance of the site and site 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. Alternatives

6.1.1. Power Line Alternatives

Two power line options are proposed for Phase 1 (refer to Figure 6.2).

» Alternative 1: This option is proposed to follow the existing Aggeneis-Nama 220kV power line to the Aggeneis Substation. This option is proposed to the north of this power line and is ~5.6km in length.
» Alternative 2: This option is proposed to follow the existing Aggeneis-Nama 220kV power line to the Aggeneis Substation. This option is proposed to the south of this power line and is ~5.6 km in length.

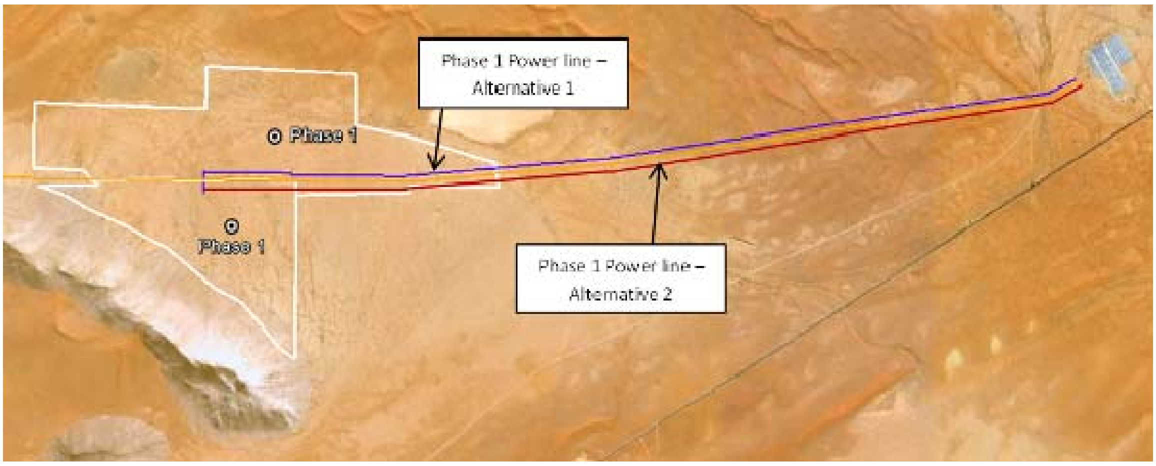

Figure 6.2: Grid Connection Routing Alternatives – Phase 1

6.1.2. Alternatives for on-site water reservoir and associated water supply pipeline

An on-site water reservoir (with a capacity of ~49 995m^3) will be developed to provide water during the operational phase to all phases of the project. This water will be sourced from the nearby Zinc Mine. An existing pipeline between the Aggeneis Substation and the property boundary will be upgraded and utilised for this purpose. A new pipeline section will be constructed within the site boundaries. This infrastructure will be shared between all phases of the project.

Two alternative locations for the reservoir have been identified for investigation (refer to Chapter 2 for more details):

» Alternative 1: The reservoir is proposed to be located within the Phase 3 area adjacent to the N14. The water pipeline is proposed to follow the site boundary in a north-west direction until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 2.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.
» Alternative 2: The reservoir is proposed to be located to the south of the Phase 1 PV Facility. The water pipeline is proposed to be routed in a south-western and then a western direction along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 3.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.
» Alternative 3: The reservoir is proposed to be located to the east of the Phase 2 PV Facility. The water pipeline is proposed to be routed in a northern direction for a short distance, and then along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 2.2km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.

6.2. Methodology for the Assessment of Potentially Significant Impacts

The broader study area - Portion 3 of the Farm Zuurwater No. 62 was identified by the project developer for the purpose of establishing the proposed Phase 1 of the Zuurwater Solar Energy Facility. The entire Farm Portion will not be utilised for Phase 1 of the solar energy facility, the development footprint (panels and associated infrastructure) will cover an extent of ~267ha of the 4997ha farm portion. This amounts to ~5% of the entire farm portion that will be utilised in the long-term and that would suffer long-term loss / disturbance (over 20 years).

The assessment of potential issues associated with Phase 1 of the solar energy facility and cumulative impacts of the multiple phases of the larger project has involved key input from specialist consultants, the project developer, key stakeholders, and interested and affected parties (I&APs). Cumulative impacts are discussed under Section 6.11.

6.3. 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 undertaken for potential impacts associated with the construction and operation of the Phase 1 of the proposed solar energy facility on the identified site. Issues were assessed in terms of the criteria detailed in Chapter 4 (Section 4.3.3). 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.

6.4. Potential Impacts on Ecology

Solar energy facilities require relatively large areas of land for placement of infrastructure. Phase 1 of the PV facility requires ~267ha. The main expected negative impacts on ecology will be due to loss of vegetation and habitat which may have direct or indirect impacts on individual flora and fauna species. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E - Ecological Impact Assessment Report** for more details). The ecological study undertaken under the previous EIA by SRK Consulting was supplemented by additional site work and a re-assessment report was completed by Savannah Environmental – refer to Appendix E.

The majority of impacts on ecology will occur during the construction of the proposed PV facility. Impacts on this habitat type could be severely harmful to the survival of threatened species with very limited distribution ranges. Potential impacts for the construction of the solar panels, substation, power line, and the access road were identified as follows:

» Impact on the natural vegetation.
» Impact on the spread of declared weedy and alien invasive plant species.
» Impact on fauna.

Portion 3 of the farm Zuurwater is situated in an area of vegetation and habitat transitions on the northern edge of the Nama-Karoo and Bushmanland habitat, the western edge of the Kalahari savanna, the southern edge of the Gariep River drainage and the eastern edge of Namaqualand. On the mountains, the Aggeneys Gravel Vygieveld is considered an isolated, rainfall-impoverished and most north-eastern form of true Succulent Karoo vegetation, worthy of special protection due to several rare plant species along with some of its bird inhabitants (e.g. Cinnamon-breasted Warbler). Almost none of this and the more widespread Bushmanland Sandy Grassland vegetation unit are formally conserved. The larger area has at least thirteen plant species of conservation concern, supports four main structural habitats for fauna (with a possibility of about five red data mammals species occurring on the site). The area is further expected to host nine threatened bird species, including the Vulnerable and near-endemic Ludwig's Bustard and Red Lark that are resident and breeding on and around the site. There is a remote possibility that 2 red data reptile species can be present, and a single red data frog may occur on the site.

The habitats considered most sensitive on the broader Farm (Portion 3 of the Farm Zuurwater 62) are the red dunes and areas of deep sand, the mountains and their gravel skirts, and the proximal washes and pans. This leaves the open grassy plains, with shallow soils of mixed gravels and sands, as the least sensitive and most widespread habitat on the farm and surrounding areas. It is proposed that any development should be on the most disturbed areas of the grassy plains, with as little overlap as possible into the drainage lines.

6.4.1. <u>Summary of Ecological Features and Potential Impacts</u>

» *Flora:* The footprint of the 75MW solar energy facility is unlikely to cause widespread loss of threatened flora and/or fauna taxa or change the ecological community structure. The plant species composition on the site will change. However, the area proposed for the Phase 1 development is within the least sensitive area on Portion 3 of the Farm Zuurwater from an ecological perspective, and therefore the project is not considered to have a great influence on any rare plant or animal species. The only protected tree that occurs in the area is *Acacia erioloba* (Camel Thorn), which may be present on the sandy plains. Threatened species and Species of Conservation Concern could occur on the rocky inselbergs and/or quartz plains (however these areas are largely avoided by the development footprint of the PV panels). The effect of shading may alter the vegetation, altering plant community composition, survivorship and/or structure. If shallow excavation is necessary to level the ground first and so alter its soil structure, a slight risk of permanent transformation is expected in the long term but natural adaptation of the vegetation to soil instability (e.g. wind erosion) may mean the effects are temporary or at least capable of rehabilitation.

» *Fauna and Mammals*: From a mammal habitat perspective, it was established that two of the four major habitats are very prominent on the study site, namely terrestrial and rupiculous (rock dwelling) habitat. Of the 56 mammal species expected to occur on the study site, no less than 22 were confirmed during the site visit. Only 3 mammal red data species may occur on the site (Rüppel's horseshoe bat, Geoffroy's horseshoe bat and the Honey badger (however low probability of utilising the site). No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s). The rest of the species richness is made up from common and robust mammals with wide distributional ranges such as aardvarks, springhares, four-striped grass mouse, porcupines, the caracal, the genet, the two mongoose species, the black-backed jackal etc. The development of Phase 1 of the solar energy facility is not considered a significant threat to any bird, reptile or amphibian species, given its limited impact in space (<1,000 ha) and time (<40 years) on the widespread grassy plain habitat.

» *Habitat Loss/ fragmentation*: The PV facility will result in localised habitat fragmentation or connectivity. An increase in weed species on the disturbed areas can be expected. It should further be noted that the greatest potential for impacts to ecology will be during preconstruction/construction, as well as during decommissioning when there is the most activity including levelling and truck movement on the site. The internal access roads within the development site will contribute to habitat loss. During operation, impacts can be expected to be reduced since activities will be restricted primarily to occasional maintenance including panel-cleaning/washing.
» *Birds*: Nine species[14] of international and/or national conservation concern (Red Data species, IUCN/Birdlife International 2011, Barnes 2000), ranging from Near Threatened to Vulnerable, were considered as possible to occur on site, of which two were recorded during the survey (Ludwig's Bustard, Red Lark) and a third reported by the landowner (Kori Bustard). Ludwig's Bustard and Red Lark are both considered Vulnerable by IUCN criteria. The PV array is not considered a direct threat to any bird species, however the new power line is a threat to regular breeding residents (Ludwig's Bustard and Red Lark) and regular visitors to the area (Vulnerable Martial Eagle and Secretarybird, and the Threatened Lanner Falcon). The power line may impact on birds through either collision or electrocution.
» *Herpetofauna (Amphibians and Reptiles)*: Three Red Data reptiles[15] may occur on the study site. Most of the species of the resident diversity are fairly

[14] Chestnut-banded Plover, Black Harrier, Lanner Falcon, Sclater's Lar, Ludwig's Bustard, Kori Bustard, Martial Eagle, Secretarybird and Red Lark. Two Vulnerable species are expected to be regular breeding residents (Ludwig's Bustard and Red Lark). The Vulnerable Martial Eagle and Secretarybird, and the Threatened Lanner Falcon are expected to be regular visitors to the area, when their prey animals are abundant, but while no sufficiently large trees were seen as likely nest sites for the Eagle or Secretarybird, the large south-facing cliffs, especially on Hoedkop, could well support nesting ledges for the falcon, as they apparently do for Verreaux's Eagle. The remaining four threatened species are expected to be erratic visitors when high rainfall creates productive conditions (plant cover, seeds, insects, small vertebrates).

[15] Namaqua plated lizard, Fisk's house snake and Namaqua stream frog.

common and widespread (viz. Karoo tent tortoise, brown house snake, common egg eater, puff adder, horned adder, Cape cobra, Bibron's tubercled gecko, giant ground gecko, Anchieta's agama and western rock skink). The high species richness expected on the study site (Portion 3 of the Farm Zuurwater 62) is due to the size of the farm portion (4997 ha) and the renowned endemic biodiversity of the Northern Cape and the presence of three of the four habitat types on the site.

» *Pans*: The broader farm portion does form part of the palaeo-drainage system of the Gariep River basin, evident on and around the site as the rather ill-defined washes and some of their pans. Phase 1 does not occur within any pans/ season washes/ watercourses, however any impacts on soils and vegetation will indirectly impact on these areas. This would cause change of surface and subsurface hydrology, decline of vegetation and fauna populations dependent on the seasonal recharge of the pans.

6.4.2. <u>Ecological Sensitivity Assessment for Phase 1</u>

Additional fieldwork to that completed in the SRK EIA process was conducted by an ecologist to survey and assesses the development area for Phase 1 of the PV Facility. This sensitivity assessment is based on a field evaluation of the site and analysis of aerial photography. The ecological sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance.

Ecological sensitivity is primarily based on vegetation composition, and has been classified by EcoAgent (2012). Using the information contained in the biodiversity and agricultural report, as well as observations during a field visit, the ecological sensitivity for Phase 1 was classified as follows:

Vegetation type / plant community as defined by EcoAgent	**Sensitivity as defined by EcoAgent**	**Re-classified sensitivity**
1. Bushmanland Sandy Grassland (=Vegmap Unit Mucina & Rutherford 2006)	High	High
2.1 Grassland on sandy hummocks	*Low*	*Medium (due to higher grazing potential)*
2.2 Grassland on sandy plains	Low	Low
3 Gravelly calcrete plains(=Vegmap Unit: Aggeneys Gravel Vygieveld, Mucina & Rutherford 2006)	High	High
4. Bushmanland Inselberg Shrubveld (Vegmap Unit Mucina & Rutherford 2006)	High	High
4.1 Shrubveld on mountains, hills slopes	High	High

Vegetation type / plant community as defined by EcoAgent	**Sensitivity as defined by EcoAgent**	**Re-classified sensitivity**
and crests		
4.2 South facing slopes	High	High
4.2.1 South-facing scree slopes	High	High
4.2.2 Steep south-facing slopes	High	High
4.3 Rocky north-facing slopes	High	High
5 Azonal vegetation	High	High
5.1 Pans	High	High
5.2 Washes	High	High

The sensitivity of the development footprint for Phase 1 is shown in the table below.

Phase 1 – Infrastructure	**Vegetation**	**Sensitivity**	**Extent**
New PV arrays and access roads	Grassland on sandy plains	Low	About 75 % of development on this vegetation
	Washes	High	About 15 % of development on this vegetation. Note: this area has been verified as a depression that can be waterlogged after an intensive rainstorm, but there is no physical indication of an actual waterwash. Thus, if drainage from this area to the pans on either side are not significantly affected, then development should be possible – all structures will just have to be of such nature that they will not be negatively affected by occasional short-term surface inundation
	Gravelly calcrete plains	High	About 2 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.

Phase 1 – Infrastructure	Vegetation	Sensitivity	Extent
	Rocky north-facing slopes	High	About 8 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.
Substation and Power Line	Grassland on sandy plains	Low	Search and Rescue of species of conservation concern very important prior to commencement of activity.

The ecological sensitivity of Phase 1 of the PV Facility is shown in Figure 6.2. The habitats considered most sensitive on Portion 3 of the Farm Zuurwater 62 are the red dunes and areas of deep sand, the mountains and their gravel skirts, and pans. Outliers of Important Biodiversity areas that fall within the proposed development footprint were investigated to ensure that no red data species occur within these areas and to ensure that these parts of the development do not cause unnecessary damage to biodiversity of conservation concern. Similarly, some of the proposed development footprint for Phase 1 falls onto areas designated as high sensitivity and ecological support areas. During the field visit it was verified that in these areas, the proposed development can proceed without significantly changing ecosystem processes or causing a significant loss to sensitive biodiversity, provided the recommended mitigation measures are followed.

As shown in Figure 6.2, the majority of the site for the development of Phase 1 of the PV Facility has been classified as having a low ecological sensitivity: Areas that provide limited ecosystem services and are also of low economic value to the land-owner. Species diversity may be low. Species of conservation concern may be present on such areas, but these are not restricted to these habitats and can be relocated with ease.

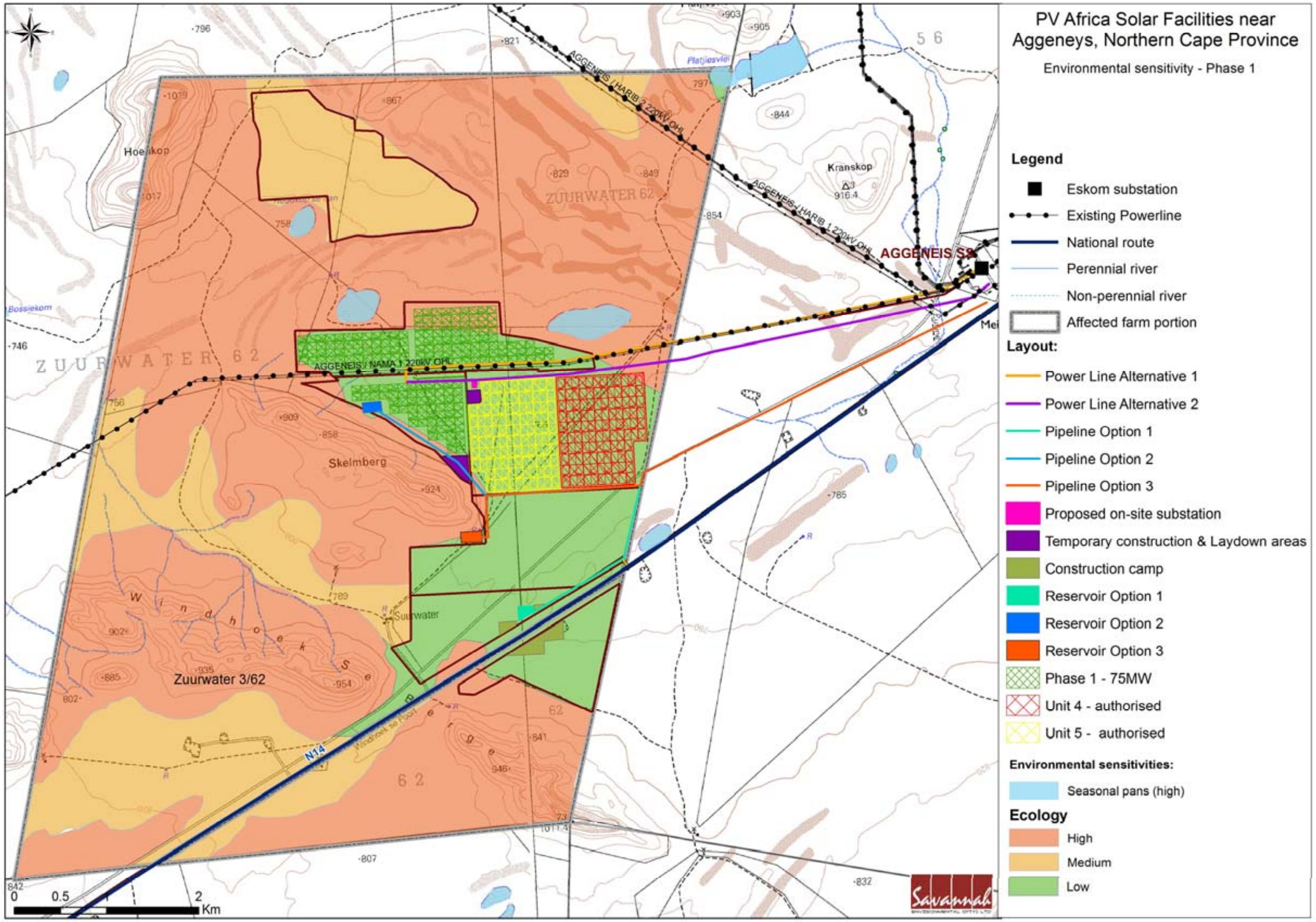

Figure 6.2: Map showing ecological sensitivity assessment ratings for the Phase 1 of the PV Facility

6.4.3. Impact tables summarising the significance of impacts on ecology (with and without mitigation)

Pre-construction/construction/decommissioning:

Impact of PV Facility and associated infrastructure on ecology without mitigation: The altered surface may significantly alter runoff patterns and associated seasonal recharge or filling of the two seasonal pans in close proximity of the Phase 1 PV arrays, which may also influence subsurface hydrology and subsistence of vegetation and associated biodiversity beyond the PV arrays that may depend on this seasonal recharge of moisture reserves. Fauna may depend on moisture contained within the plants and their roots around the pans and seasonal moisture in the pans. It is expected that with the necessary mitigation, the basic functionality of the area can be restored within a few years after construction, even if the biodiversity composition is altered.				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Local (3)	One month – One year (2)	Temporary (2)	Highly likely (5)
Result: Medium (63)				
Mitigation: » Harvesting of plant material or other damage to fauna and flora must be prevented and avoided, and disciplinary measures to be put in place » Chemical/petroleum/oil storage area to be bunded (using an impervious surface) » Introduction of alien plant species must be prevented, and on-going management of alien species control should be carried out » Disturb the surface as little as possible and only where necessary during construction » Construct all roads and fences in such a way that they do not significantly alter existing runoff patterns and allow for ample drainage where necessary » Undertake a rehabilitation plan of all surfaces affected immediately after construction to restore surface characteristics in such a way that it resembles the original and will allow a gradual natural re-vegetation where such has been cleared » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated » Strictly prevent leakage of oil or other chemicals or any other form of pollution, be clear about immediate remedial actions that must be taken should accidental spills occur » Make use of existing tracks as far as possible, where additional construction activities or maintenance is required, ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed				

sites or designated laydown areas are used for storing and handling materials and machinery » Ensure an adequate plant search and rescue program prior to commencement of activity, especially geophytes and succulents may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during occasional heavy 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 (storm water and erosion management plan required, together with revegetation of adjacent areas) » After decommissioning, if the access road or portion thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation » As soon as the areas affected have been demarcated, carry out a thorough search and rescue operation of all plant species of conservation concern by a horticultural specialist or suitably qualified staff and the ECO before any disturbance or heavy machinery in the area will be allowed. » Note: many of the species of conservation concern are very small or bulbous species may be dormant, necessitating follow-up work when topsoil will be removed. » Ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during occasional heavy rainfall events, yet preventing erosion of the track and surrounding areas				
Impact of PV Facility on ecology with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Slightly Harmful (3)	Local (3)	One month – One year (2)	Temporary (2)	Highly likely (2)
Result: Low (32)				

Operation

Impact of PV Facility on ecology without mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: High (110)				

Mitigation:

- Harvesting of plant material or other damage to fauna and flora must be prevented and avoided, and disciplinary measures to be put in place
- Chemical/petroleum/oil storage area to be bunded (using an impervious surface).
- Training and awareness programmes for employees on the significance of the ecology to be carried out at regular intervals
- Implement on-going management of alien species control
- Implement measures to ensure no living organisms can come into contact with or entangled by any electrical wiring that might cause short circuits, injury or death.
- Implement storm water management measures.
- Ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery
- Maintain vegetation cover in areas outside the PV arrays.

Impact of PV Facility on ecology with mitigation:

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Project Boundary (2)	Life of Operation (4)	Permanent (5)	Possible (4)

Result: Medium (72)

Impact of water reservoir on ecology without mitigation:

Impacts are expected to be restricted to the actual temporary construction areas only, and with the necessary mitigation measures implemented, surroundings should not be further affected. Rehabilitation of areas that have been disturbed should occur within 1-5 years of construction.

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Activity Specific (1)	Life of Operation (4)	Permanent (5)	Possible (4)

Result: Medium – High (81)

Mitigation:

- No temporary water tanks may be established on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater. Therefore, reservoir alternative 1 should be implemented as the preferred option.
- Keep areas affected to a minimum
- As soon as the areas affected have been demarcated, first carry out a thorough search and rescue operation of all plant species of conservation concern by a horticultural specialist or suitably qualified staff and the ECO before any disturbance or heavy machinery in the area will be allowed.

  - Note: many of the species of conservation concern are very small or bulbous species may be dormant, necessitating follow-up work by the ECO where topsoil will be removed
  - Remove all geophytes and succulents that can be transplanted, keep in a designated on- or off-site nursery and use as far as possible in rehabilitation efforts
- Prior to the disturbance of any area, the ECO must assess the area for any burrowing mammal, reptile or amphibian and relocate such to a similar habitat out of the footprint area
  - Ensure that all materials stored on this area are done in such a way that they do not attract and cannot entrap any fauna for the duration of the use of these areas
- If topsoil needs to be removed, volumes need to be estimated and adequate areas designated for the storage and/or rehabilitation of such topsoil. Such areas will also be subject to a detailed search and rescue operation as above prior to any disturbance taking place.
- Keep leveling earthworks and soil disturbance to the minimum practically possible, implement a comprehensive topsoil management, soil erosion control and rehabilitation plan once layouts have been finalised
- Utilise areas as close as possible to existing or future permanent infrastructure, keep buffer zone of the legally required 32 m as a minimum, preferably up to 100 m or more around significant ephemeral drainage lines and/or seasonal pans
- Remove as little indigenous vegetation as practically possible, rehabilitate and revegetate all areas not used further immediately after construction
  - Indigenous vegetation that is removed (except species that will be replanted) should be shred and re-applied as mulch or incorporated into re-applied topsoils.
- Monitor the area regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and revegetation efforts accordingly
- Strictly prevent leakage of oil or other chemicals and pollutants

» Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Impact of water reservoir on ecology with mitigation:

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Slightly Harmful (3)	Activity Specific (1)	Life of Operation (4)	Permanent (5)	Possible (4)

Result: Medium (72)

Impact of the power line and substation on threatened birds during

operations without mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: High (110)				
Mitigation: » Limit disturbance to the proposed substation site and power line site and ensure that minimum disturbance takes place in the surrounding area. » Power line construction should take fauna into account, especially birds and nesting sites. » A avifauna walk through survey to be conducted prior to construction to determine is power lines need to be fitted with 'flappers' to make the power lines more visible to the birds. » An avifauna specialist should ground-truth the power line construction areas before development commences in order to ensure no breeding pairs or chicks of conservation significant species are located in the areas and, if there are, how to mitigate the situation before construction begins. » No power line towers may be placed within 32 m of a pan				
Impact of the power line and substation on threatened birds with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: Medium-High (90)				

Alteration of seasonal recharge patterns of nearby pans and washes without mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: Medium (90)				
Mitigation: » Ensure all mitigation recommendations for PV arrays and access roads are implemented » Ensure that runoff to pans is adequately slowed down to prevent erosion, but not obstructed or deflected to such an extent that runoff patterns into the pans are changed » Monitor the area below the PV panels regularly after larger rainfall events to				

determine where erosion may be initiated and then mitigate by modifying the soil microtopography and re-vegetation efforts accordingly » Aim to maintain a reasonable cover of indigenous perennial vegetation throughout the operational phase within and on the periphery of the PV array, preferably low density perennial grasses that can be mowed as need be to reduce fuel loads » Monitor the establishment of alien invasive species around pans and remove as soon as detected, whenever possible before regenerative material can be formed				
Alteration of seasonal recharge patterns of nearby pans and washes with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Insignificant (1)	Project Specific Local (2)	Life of Operation (4)	Permanent (5)	Unlikely (4)
Result: Low (63)				

6.4.4. Impact Summary

Despite the harshness of the environment, a multitude of specially adapted species occur in the many niches provided by the variable landscapes of the area. Most of this biodiversity is concentrated on the mountains and on gravel plains. Vegetation on the less sensitive sandy plains is relatively dynamic and may change dramatically between different seasons, indicating that rehabilitation of disturbed land should be achievable if topsoils are disturbed as little as possible and maintained in a manner that enables the survival of the extensive seed banks within them.

Overall, the impacts can be summarised as follows:

» The proposed Phase 1 of the photovoltaic solar energy facility may have long-term detrimental impacts on the ecology of the land portion and landscape features within if mitigation measures are not strictly adhered to or implemented.
» Potential negative impacts on the ecological environment would be loss of biodiversity and associated soil degradation as a result of construction and operation of the facility, possible introduction of alien invasive plants and a long-term loss of vegetation.
» A loss of habitats for flora and fauna will occur with the alteration of large areas occupied by the proposed development. The placement of different components of the proposed development has been optimised according to ecological recommendations. This, coupled with the implementation of mitigating measures by the developer, contractors, and operational staff will

enable the retention of basic functionality of the ecosystems affected and hence greatly reduce the negative impact of the development.

» The impact on fauna is expected to be negligent. Animals that may be present within the development footprint are mobile and will move away during construction, possibly resettling after construction. No restricted or specific habitat of vertebrates will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas.
» Vegetation cover is expected to change due to the changed environment within and around the proposed development. Rehabilitation and continued monitoring must be carried out until the decommissioning phase to ensure that a stable and functional vegetation cover is established and maintained.
» Phase 1 does not occur within any pans/ seasonal washes/ watercourses, however any impacts on soils and vegetation will indirectly impact on these pans.

From an ecological perspective, it should therefore be feasible to develop the Phase 1 area as proposed, while retaining the conservation value and ecological function of the area.

6.4.5. Comparative Assessment of Power Line Alternatives

For Phase 1, **Power Line Alternative 2 is the ecologically preferred option** due to the power line being slightly further away from more sensitive habitat associated with the pans and Bushmanland sandy grassland vegetation.

6.4.6. Comparative Assessment of Water Reservoir and associated pipeline alternatives

For Phase 1, **Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option** due to the location of Alternatives 1 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

6.4.7. Implications for Project Implementation

» No temporary infrastructure (such as reservoir Alternatives 1 and 3) may be established on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater.
» If any protected plant or tree species will be removed/ destroyed by the developer, a collection/destruction permit is to be obtained from Northern Cape Department of Environment and Nature Conservation for the protected species found on site.

- Mitigation measures as contained in the EMP must be employed during construction and operations to manage impacts on ecology.
- Site rehabilitation of temporary laydown/ construction areas to be undertaken immediately after construction.
- Should the facility be decommissioned, the development footprint must be rehabilitated.
- Alien invasive vegetation to be managed/ removed (as required) during construction, operations, decommissioning and post-closure of the facility.
- A walk through survey to be undertaken by an ecologist prior to construction of the facility and the power line.
- A walk through survey of the power line to be undertaken by an avifauna specialist prior to construction of the power line.
- An Environmental Management Programme (EMPr) must be implemented during the development of the solar energy facility.

6.5. Potential Impacts on Soils and Agricultural Potential

6.5.1. Impacts on Soils

The regic sands which occur on the site are very prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. The extremely flat nature of the development site means that areas can be prone to widespread surface wash during occasional intense rainfall events. Increased erosion potential will result from scouring effect on drainage lines due to run-off from hard surface areas, as well as increased erosion from areas of exposed soils. Failure to avoid and minimise civil works in wash areas could result in erosion and sedimentation. Extensive removal of vegetation from the development site could also leave the area prone to both water- and wind erosion. Furthermore, unless stocking rates are well managed, temporary removal of a portion of the farm from available grazing (the proposed development site) could increase pressures on the remainder of the farm. The risk of erosion at a larger scale is minimised by the high infiltration rates of the soils, combined with the fact that surface drainage is associated with an endorheic pan (closed system with no outflow to neighbouring catchments). Dust, due to loose soil is also a potential impact, mainly during the construction phase.

Activities that may have an impact on soils include:

- Solar facility footprint (i.e. an array of PV panels, mounting structures, underground cabling between project components and fencing)
- Construction and positioning of internal access roads
- Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)
- Construction and operation of the on-site substation

» Construction and positioning of the on-site workshop area for maintenance, storage, and offices and temporary construction/ laydown areas.

The potential impacts on soil include:

» Soil loss/ erosion
» Soil contamination
» Loss of agricultural land

6.5.2. Impact tables summarising the significance of impacts on soils (with and without mitigation)

Pre-construction/construction

Potential soil erosion without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Permanent (5)	(Daily)4	(Likely)4
Result: Medium-High (96)				
Mitigation: » Avoid disturbance to pans/ seasonal washes. » Minimise the removal of vegetation and the disturbance of topography » Design and construct/install measures which will prevent erosion from panel-washing during operation, to ensure that this is adequately dissipated to sheet flow » Ensure adequate dissipation of concentrated flow to sheet flow from hard surfaces (including panels) to avoid and minimize erosion. This can be achieved by strategically placing stone downstream of hardened surface areas » Place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where appropriate. » Avoid construction during heavy rainfall events where possible. » Implement stormwater management and other erosion (including wind) prevention measures » Construction vehicles are to remain within the development area and avoid unnecessary disturbance.				
Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Project Specific (2)	Between one-ten years (3)	Temporary (3)	Unlikely (3)
Result: Low (42)				

Operation

Potential soil erosion without mitigation:

Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	(Local) 3	Life of operation (4)	Life of operation (4)	Possible (4)
Result: Medium (80)				
Mitigation: » Minimise the removal of vegetation and disturbance of topography » Place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where appropriate » Ensure timeous repair of erosion » Maintain measures which will prevent erosion from panel-washing during operation, to ensure that this is adequately dissipated to sheet flow » Maintain measures which will prevent erosion from water/waste treatment works to ensure that this is adequately dissipated to sheet flow » Ensure adequate dissipation of concentrated flow to sheet flow from hard surfaces (including panels) to avoid and minimize erosion. This can be achieved by strategically placing stone downstream of hardened surface areas » Ensure timeous repair of erosion, and place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where required				
Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Local (3)	One-Ten Years (3)	Temporary (2)	Unlikely (2)
Result: Low (32)				

Dust due to loose soils: Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (3)	Life of Operation (4)	Life of Operation (4)	Infrequent (3)
Result: Medium (63)				
Comment / mitigation: » Vehicles to utilise designated roads/tracks » Rehabilitate after construction and decommissioning. Where possible, re-vegetation of the land should be undertaken with indigenous vegetation immediately after construction is completed in areas that will not be used during the operational phase; » Soil stockpiles should be stored in sheltered areas at the site on the leeward side of hills and inselbergs and covered where possible; » Limit speed at the site to < 40 km/hr and enforce code of conduct for operation of vehicles				

» Should the prevailing wind speed increase to levels above 5.4 m/s (~20 km/hr), any land clearing activity should be stopped until wind speeds decrease to below the afore mentioned threshold level » Utilise dust suppression measures, particularly on access roads				
Dust due to loose soils: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Local (2)	Life of Operation (4)	Life of Operation (4)	Very Seldom (2)
Result: Low (42)				

Decommissioning

Potential soil erosion without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One Month – One Year (2)	Temporary (2)	Definite (5)
Result: Medium (56)				
Comment / mitigation: » Removal of PV panels and associated infrastructure » Soils surface to be graded to be free-draining » Rehabilitate disturbed areas to original agricultural potential and re-vegetate using appropriately chosen indigenous grasses » Ensure timeous repair of erosion, and place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where required » Continue monitoring until it can be demonstrated that vegetation is self-sustaining and no erosion channels exist (approximately 2 years following completion of decommissioning)				
Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Activity Specific (1)	One Month – One Year (2)	Temporary (2)	Likely (4)
Result: Low (30)				

Pre-construction/construction/operation/decommissioning

Soil Contamination: Impact Without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium- High (80)				

Comment / mitigation: » Conduct regular maintenance of vehicles to avoid and minimise leaks within a dedicated area. » Ensure legislative requirements are met for sanitation » Chemical/petroleum/oil storage area to be bunded (using an impervious surface). » Carry out regular maintenance of any on-site chemical/petroleum/oil storage tank » Implement disposal of e-Waste or hazardous waste at an appropriately licensed landfill site » Carry out rehabilitation following leaks and spills » Conduct removal of contaminated soils to suitable licenced landfill sites » During maintenance activities of the substation, used oils and old transformers must be disposed of correctly. Used transformers are classified as hazardous waste and should be disposed of at a hazardous landfill site.				
Soil Contamination: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	Life of Operation (4)	Infrequent (3)	Unlikely (3)
Result: Low (42)				

Pre-construction/construction/decommissioning

Dust due to loose soils: Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One to ten years (3)	Regularly (4)	Likely (4)
Result: Medium (72)				
Comment / mitigation: » Keep the amount of land that needs to be cleared (or development footprint) to a minimum at any given time thereby reducing the amount of erodible surface area; » Remain on designated roads/tracks » Rehabilitate after construction and decommissioning. Where possible, re-vegetation of the land should be undertaken with indigenous vegetation immediately after construction is completed in areas that will not be used during the operational phase » Soil stockpiles should be stored in sheltered areas at the site on the leeward side of hills and inselbergs and covered where possible » Limit speed at the site to < 40 km/hr and enforce code of conduct for operation of vehicles » Should the prevailing wind speed increase to levels above 5.4 m/s (~20				

km/hr), any land clearing activity should be stopped until wind speeds decrease to below the afore mentioned threshold level » Utilise dust suppression measures, particularly on access roads				
Dust due to loose soils: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (3)	One to ten years (3)	Regularly (4)	Seldom (4)
Result: Medium (64)				

6.5.3. Impacts on Land Capability and Agricultural Potential

Agricultural potential is primarily determined by the suitability of the soil profile to support crop production. The soil needs to be adequately thick to support root development and the drainage characteristics need to be good to prevent chemical crusting on the surface. In addition to the soil characteristics, climatic factors are also important because the annual rainfall needs to be adequate to sustain a viable crop production. A major limiting factor in terms of agricultural potential on the site is the availability of water for irrigation as the site is ~40km from the Orange River. The agricultural potential of the site is low and limited to extensive grazing due to the low rainfall in the area. Portion 3 of the Farm Zuurwater has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The current land use is livestock farming on the farm, predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring. The proposed site supports natural vegetation interspersed with current and past grazing lands.

No areas with arable potential occur and this is due to a lack of rainfall or irrigation potential. The carrying capacity is typically 4 large stock units (LSU)/100 ha. No grazing or agriculture will take place at the footprint of the solar panels and associated infrastructure (i.e. ~267ha of the 4997ha farm portion), which was sited considering the current agricultural activities. However, the remainder of the site will continue the current land use – i.e. grazing of livestock. At the end of the project life, it is anticipated that removal of the solar panels would enable the majority of the land to be rehabilitated and used for a suitable land-use or activity. Therefore, the impact of the PV Facility on land capability and agricultural potential is not significant and will not impact on food security of the country.

6.5.4. Impact tables summarising the significance of impacts on agricultural potential (with and without mitigation)

Preconstruction/Construction/Operation

Impact on agricultural potential without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Project Specific (2)	Life of operation (4)	(Life of Operation) 4	Likely (4)
Result: Medium (80)				
Comment / mitigation: » Avoid unnecessary removal of vegetation cover and soil » Rehabilitate disturbed areas to original agricultural potential and re-vegetate using appropriately chosen indigenous grasses » Allow access of livestock and wildlife to grazing on the broader farm portion (outside of the development footprint) » Maintain on-going interaction with the farmer regarding appropriate stocking rates on the development area, and the farm as a whole				
Impact on agricultural potential with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	Life of operation (4)	Life of operation (4)	Unlikely (3)
Result: Low (49)				

Decommissioning

Impact on agricultural potential without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One Month to One Year (2)	Life of operation (4)	Likely (4)
Result: Medium (64)				
Comment / mitigation: » Remove all PV panels and associated infrastructure » Rehabilitate disturbed areas to original agricultural potential and revegetate using appropriately chosen indigenous grasses.				
Impact on agricultural potential with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	One Month to One Year (2)	Temporary (2)	Unlikely (3)
Result: Low (25)				

6.5.5. Comparative Assessment of Power Line Alternatives

No preference made as the soils associated with both power line alternatives are fairly uniform.

6.5.6. Comparative Assessment of Water Reservoir and associated pipeline alternatives

No preference made as the soils associated with both alternatives are fairly uniform.

6.5.7. Implications for Project Implementation

» The regic sands and dunes which occur on the site are very prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines.
» It is therefore important that there should be strict adherence to the Environmental Management Programme and good soil management measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project.
» With the use of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

6.6. Assessment of Potential Impacts on Heritage & Palaeontology

6.6.1 Archaeology

Disturbance of the soil on the proposed development site could potentially have a destructive impact on heritage resources where these are present. The key risks to heritage resources are during the preconstruction and construction phases when site-clearing and preparation are undertaken. Disturbance of surfaces includes any construction including any *clearance* of, or *excavation* into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible).

The heritage study and palaeontology study did not reveal any significant heritage resources on the site. Very sparse heritage traces were found in the development footprint areas of Phases 1 and associated with ancillary infrastructure including power line route.

On the plains extremely minimal traces were found. A single quartz flake was noted in an erosion feature at 29.32997° S 18.74865° E; and, intriguingly, a single quartz biface (ESA) was found in a deflation area at 29.33123^{o} S 18.74606^{o} E. No other artefacts or notable features were found in association with these.

Such completely isolated single-artefact finds could not be considered as constituting “sites” in a conventional archaeological or heritage sense. These observations noted fall under Type 1 for Classes 1-7, again reflecting low heritage significance, low potential and absence of contextual and key types of evidence.

In all instances the impact of the PV Facility, if any, would be local. Impacts on heritage and archaeological resources may be mitigated and hence classed as ‘short term’ but the original in situ context is usually altered in a ‘permanent’ way. If the archaeological or heritage significance of the resources in question is considered to be low – which is the case here – then the significance of the permanent loss is low. The probability of impacts on heritage including archaeological resources is Improbable. Subject to pre-construction ground-truthing, no ‘Phase 2’ mitigation work is regarded as necessary in terms of present development layout.

However, in the event that any heritage feature (which may be sub-surface, such as an unmarked grave) is encountered during the development or operational life of the facility, work is to be halted immediately and contact made with SAHRA (Ms C. Scheermeyer at 021-4624502) and/or the Northern Cape Heritage Authority Ngwao Bošwa jwa Kapa Bokone (Mr A. Timothy) who would arrange for the evaluation of the find for possible mitigation.

From an archaeological perspective the observed heritage resources are of very low significance (low occurrence). Criteria used here for impact significance assessment rate the impacts as Low (even taking into consideration the fact that for heritage traces, unlike biological processes, impacts tend to be irreversible, of permanent duration and high magnitude).

6.6.2 Impact tables summarising the significance of impacts on heritage sites, or objects (with and without mitigation).

Pre-construction/construction/operation/decommissioning

Destruction of heritage resources/ sites – PV facility: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project Specific (2)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (48)				
Mitigation: » In the event that heritage resources are found, the South African Heritage Resources Agency and Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority) should be informed and necessary permits obtained				

» Although unlikely, where necessary, arrangements for in situ preservation should be made with the heritage authorities				
Destruction of heritage resources/sites – PV facility: impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Activity Specific (1)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (36)				

Destruction of heritage resources/ sites – power line: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (1)	Permanent (5)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (16)				
Mitigation: » Mitigation measures are not considered necessary.				
Destruction of heritage resources/sites – power line: impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (1)	Permanent (5)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (16)				

6.6.3 Impacts on Palaeontology

The Mid Proterozoic basement rocks of the Namaqua-Natal Province are entirely unfossiliferous (Almond & Pether 2008). The fossil record of the Kalahari Group as a whole is generally sparse and low in diversity; no fossils are recorded here in the recent Pofadder geology sheet explanation by Agenbacht (2007). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying Dwyka Group may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (e.g. Hodotermes, the harvester termite), ostrich egg shells (Struthio) and shells of land snails (e.g.

Trigonephrus) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (e.g. Corbula, Unio) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels. The younger fluvial and alluvial sands and gravels within the proposed development area are unlikely to contain any substantial fossil or subfossil remains.

The overall palaeontological sensitivity of the Precambrian basement rocks, as well as of the Kalahari Group and younger sediments mapped within the study region, ranges from zero to low (Almond & Pether 2008). The proposed development has a small footprint and deep excavations are not envisaged for photovoltaic installations. The paleontological sensitivity is also relatively low for sediments such as the Precambrian basement rocks, Kalahari group rocks and younger sediments, meaning that the proposed developments will have minimal impact (Almond & Pether, 2008). For these reasons, no further palaeontological specialist palaeontological studies or mitigation are recommended for this development.

However, should substantial fossil remains be exposed during construction; SAHRA should be alerted as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.

6.6.4 Impact tables summarising the significance of impacts on Palaeontology sites, or objects (with and without mitigation).

Pre-construction/construction/operation/decommissioning

Destruction of fossils: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project Specific (2)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (48)				
Mitigation:				

» In the event that fossils are found, the South African Heritage Resources Agency and Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority) should be informed and necessary permits obtained » Although unlikely, where necessary, arrangements for in situ preservation should be made with the heritage authorities. » Should human remains be uncovered during construction/ excavations, this must be reported to the nearest police station.				
Destruction of fossils with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Activity Specific (1)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (36)				

6.6.5 Comparative Assessment of Power Line Alternatives

With regard to magnitude and extent of the potential impacts of power lines, it has been noted that their erection generally has a relatively small impact on Stone Age sites. Sampson's (1985) observations show this from surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon). A more permanent road would tend to be far more destructive (modification of the landscape surface within a continuous strip), albeit relatively limited in spatial extent, i.e. width. On archaeological grounds there is no reason to prefer one alternative route for the power line for Phase 1 over the other.

6.6.6 Comparative Assessment of Water Reservoir and associated pipeline Alternatives

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure is not expected to pose additional impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary (common to all alternatives) would have localised impacts on the affected properties. This section of the route has however been previously disturbed through construction activities associated with the existing pipeline and it is therefore considered unlikely that heritage resources of significance would be found in this area. There is therefore no preferred alternative in terms of this infrastructure from a heritage perspective.

6.6.7 Implications for Project Implementation

» No "Heritage Sensitive Areas" were identified on the Phase 1 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Phase 1 but will not be impacted by the development footprint of the PV facility.
» It was concluded that there are no heritage "No Go Areas" within the site and that the development could go ahead as planned.
» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» Should substantial archaeological or paleontological (fossils) remains be exposed during construction, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
» No further palaeontological specialist palaeontological studies or mitigation are recommended for this development.

6.7. Assessment of Potential Visual Impacts

Potential visual impacts of Phase 1 of the PV Facility are discussed in this Section, with cumulative visual impacts of multiple phases of this project and approved projects in the area being dealt with separately under Section 6.10.

6.7.1. Visual Character and Quality of the Study Area

The Zuurwater site is located approximately 9km south-west from the town of Aggeneys in the Northern Cape Province of South Africa. The site is located in a sparsely populated and remote area. The Black Mountain Mine is located approximately 9km to the north-north-east of the site. The site is located adjacent to the N14 highway, which runs west to east between the town of Springbok and Pofadder. Eskom's existing Aggenies Subsation is located approximately 5km to the east of the site. The area is very flat, with large open plains. The skyline is broken by small rocky outctrops called inselbergs. The visual character of the area is characterised by a changing landscape character associated with the interface between natural areas and modified rural / pastoral or agricultural zones. The skyline is broken by the small inselbergs to the west of the site, which are the only major natural features in the landscape. The landscape is disturbed to the east of the site due to the presence of a large Eskom substation and the mining activities at Black Mountain; however these features are relatively far from the site. Due to this the visual quality rating for the area could be described as medium, due to the lack of natural features in the landscape and some disturbances to the landscape in the east.

6.7.2. Sense of Place

An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places. Lynch defines ‘sense of place’ as “the extent to which a person can recognise or recall a place as being distinct from other places – as having a vivid or unique, or at least a particular, character of its own” (Lynch, 1992:131). The area around the proposed Zuurwater site is barren and sparse in terms of natural features. In terms of being distinct from other areas, this site is situated along the main road between Springbok and Pofadder; the landscape between these two towns is flat and barren, with some small hills breaking the skyline. Thus this site is not different from the surrounding landscape in its current form. Altering the site through developing the PV arrays may change the sense of place for the site. This change could impact on the sense of place, as the sense of place of the site could allow for the site to be unique in the area. Currently, the sense of place for the site is low.

6.7.3. Visual Receptors

The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon. Sensitivity is also dependent on the viewer's perception of the area and their ability to adapt to changes in the environment. This can also include how frequently they are exposed to the view, i.e. static views from houses would have a higher sensitivity than transient views experienced by motorists. The following potentially sensitive areas exist in the study area:

» The farmers located adjacent to the site (landowners);
» Aggeneys residents; and
» Road users travelling west and east along the N14.

Based on the analysis undertaken, the following individuals could potentially be more sensitive to the development:
» Local residents; and
» Road users travelling along the N14.

It must be noted that whilst on site, traffic flow along the N14 was considered. Whilst a traffic count was not undertaken, it was noted that there were very few motorists travelling between Aggeneys and Springbok. However, it was not known if traffic volumes increase during holiday seasons. The viewer sensitivity are ranked from High (5) to Low (1) based on the probable perceptions of the viewers and their willingness to change.

6.7.4. Visual Exposure / Viewshed

Visual exposure is determined by the zone of visual influence or "the viewshed". A viewshed is a subset of a landscape unit (envelope) and is the topographically defined area that includes all the major observation sites from which the proposed development will be visible. The boundary of the viewshed demarcates the zone of visual influence. It must be noted for the study of the visual impact of the proposed activities at the Zuurwater Site, each of the activities were investigated separately. Each of the activities was modelled on a hypothetically flat surface. Areas on this surface, where the given activity may be visible, are highlighted. The viewshed is shown in Figure 6.3.

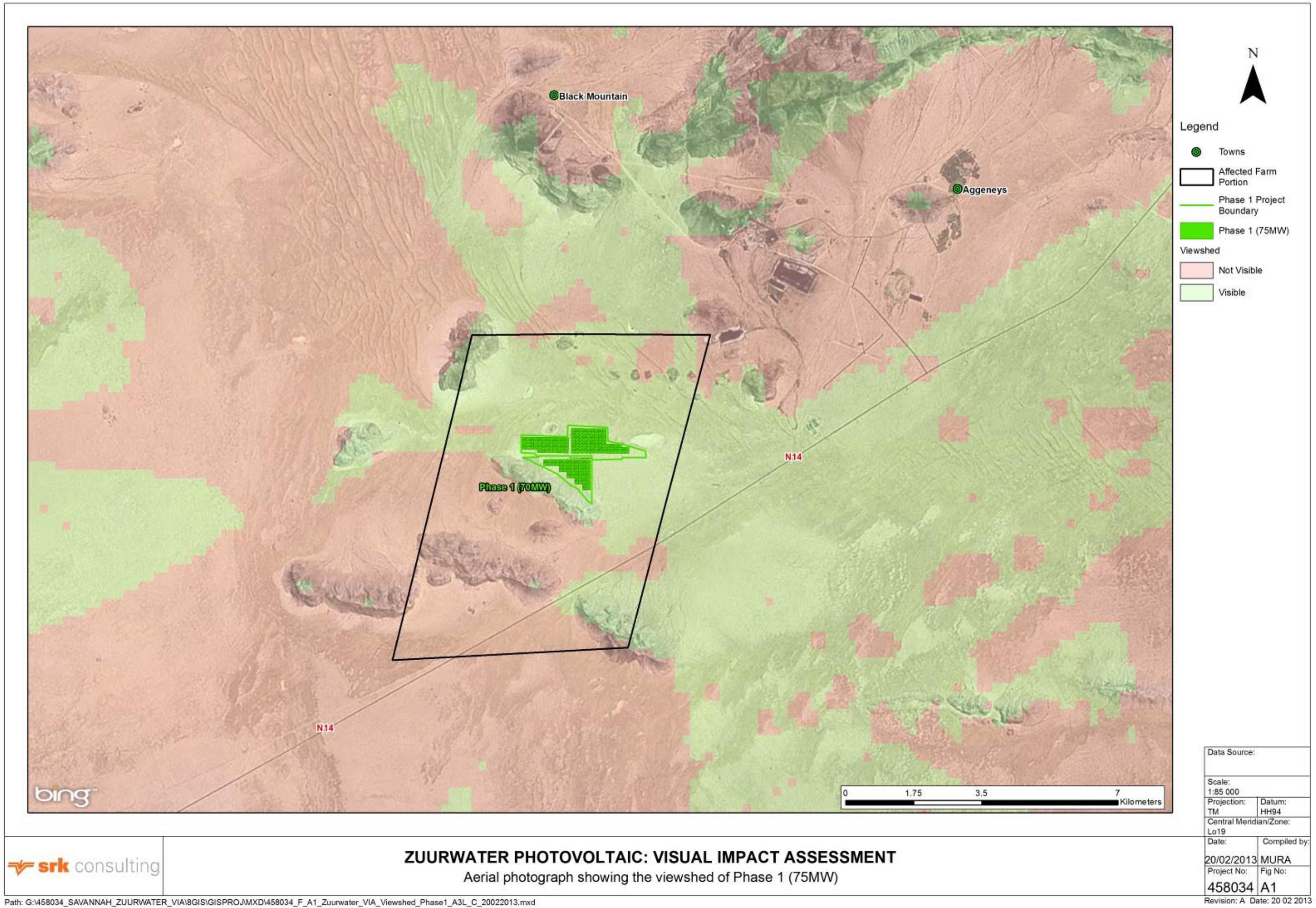

Figure 6.3: Viewshed for Phase 1 of the PV Facility on Portion 3 of the Farm Zuurwater

Phase 1 is positioned approximately 3 km from the N14 and 11.5 km from the town of Aggeneys. This places the N14 viewers into the middle-ground category of the visibility and distance rating, however these users can be considered to be transient, whilst the majority of potential viewers (Aggeneys residents) lie with the background category. Thus, the rating is calculated as Background (1). There are not a lot of natural or other types of features in the landscape to aid in shielding views of the overall Zuurwater site. Phase 1 however is nestled adjacent to an inselberg, which may provide some VAC to viewers to the south and west. The overall VAC for Phase 1 is therefore calculated as medium (3). The current site is vacant and used for grazing purposes. The landscape compatibility for the PV tables is therefore low (5). The landscape between Springbok and Pofadder comprises generally of flat, natural and agricultural land with small koppies intermittently rising from the flat landscape. The establishment of a clean renewable energy source (such as solar, wind or hydro power) in the area would be significantly different to what is there. This change, to a feature which is adding value to the landscape may reduce the viewer sensitivity. The sensitivity rating therefore is estimated to be Medium-Low (2).

During the pre-construction and construction phases of the development of the Zuurwater site, there is potential for a visual impact. This impact could stem from the clearing of sections of the landscape, as well as setting aside areas for the assembling of the infrastructure on the site. It is expected that these visual impacts will be localised to the N14 in the beginning, expanding to a larger area of influence as the size of the excavations increase. During the operational phase, as indicated in the viewshed, the PV panels would be visible from a large distance from the site. The nature of the natural vegetation (i.e. low growing) and the flat topography in the area allows for unobstructed views from various viewpoints in the landscape. It must however be noted that existing infrastructure – Eskom power lines and substation – do aid in reducing the impact of the PV panels in places.

During the decommissioning or post closure phase of the project, all of the infrastructure will be removed, recycled or re-used in other projects off-site. The visual impacts of the site are expected to be scarring of the landscape where the existing farm roads were used, as well as where the PV panels were placed. With correct management measures, this scarring and visual impact could be reduced.

6.7.5. Impact tables summarising the significance of visual impacts of the PV facility (with and without mitigation)

Preconstruction/construction/decommissioning

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	One to ten years (3)	Temporary (2)	Possible (4)
Result: Medium (60)				
Mitigation: » Minimise the size of the laydown area and work areas » Implement strict procedures for location and management of the construction site, laydown and work areas » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Minimise reflective surfaces » Appropriate choice of colour for buildings » Ensure the site is kept neat and tidy (free of litter and refuse) at all times » Any disturbance to the sparse vegetation on site should be kept to a minimum				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Project specific (2)	One to ten years (3)	Temporary (2)	Seldom (3)
Result: Low (40)				

Operation

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium-High (88)				
Mitigation: » Put in place measures for the efficient management of the facility » Avoid littering » Minimise the removal of vegetation				

» Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Ensure that the PV panels do not cause disruption of passing traffic on the N14. » Ensure fence boundaries and on-site buildings are maintained, in order to keep the site looking neat » Keep the site free of debris and litter, and alien invasive species				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Unlikely (3)
Result: Medium (70)				

6.7.6. Visual Impact of the Power line

It is proposed that the PV panels will be connected to the existing Eskom grid and so will entail the connection via an overhead power line to the existing substation. During the pre-construction and construction phases of the proposed new power line, there is a potential for a visual impact. This impact could stem from the clearing of sections of the landscape, as well as setting aside areas for the assembling of the infrastructure on the site. It should however be noted that the overall development footprint for the construction of the power line will be significantly smaller than that of the PV panels.

It is expected that these visual impacts will be localised to the N14 near the existing substation site, however due to the slight undulations in the topography as well as the distance of viewers from the majority of the proposed alignment, much of the preconstruction and construction activities should be shielded from view. During the operational phase, as was shown in the viewshed, the proposed power line is predicted to be visible over a large area. However, due to the presence of existing power line infrastructure, and the proposal that the power line from the Phase 1 area follow an existing power line to the substation, the change to the overall visual landscape is expected to be minimal.

During the decommissioning or post closure phase of the project, all of the infrastructure used could be removed, recycled or re-used in other projects off-site or integrated into the existing electrical reticulation system. If the infrastructure is removed, the overall visual impact could be seen to be minimal due to the overall footprint disturbed being limited to the servitude of the power line alignment.

6.7.7. Impact tables summarising the significance of visual impacts of the power Line (with and without mitigation)

Preconstruction/construction/decommissioning

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	One to ten years (3)	Temporary (2)	Possible (4)
Result: Medium (60)				
Mitigation: » Minimise the size of the laydown area and work areas » Implement strict procedures for location and management of the construction site, laydown and work areas » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Minimise reflective surfaces » Appropriate choice of colour for buildings » Ensure the site is kept neat and tidy (free of litter and refuse) at all times » Any disturbance to the sparse vegetation on site should be kept to a minimum				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Project specific (2)	One to ten years (3)	Temporary (2)	Seldom (3)
Result: Low (40)				

Operation

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium-High (88)				
Mitigation: » Put in place measures for the efficient management of the facility » Avoid littering » Minimise the removal of vegetation				

» Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Ensure fence boundaries and on-site buildings are maintained, in order to keep the site looking neat » Keep the site free of debris and litter, and alien invasive species				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Unlikely (3)
Result: Medium (70)				

6.7.8. Comparative Assessment of Power Line Alternatives

The visual impact of the Phase 1 power line Alternative 1 and Alternative 2 are expected to be low, as there are existing power lines in the area. As both alternatives follow an existing power line and pass through the same area, there is no preference from a visual perceptive on either power line alternatives.

6.7.9. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure would not pose additional visual impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is therefore no preferred alternative in terms of these alternatives from a visual perspective.

6.7.10. Mitigation of Visual Impacts

The role of mitigation is critical in finding a design / rehabilitation solution that will be visually acceptable. Potential mitigation measures have been taken into consideration during the design phase, as discussed above and is also provided by natural features in the area. Only effective, economically feasible, appropriate and visually acceptable mitigation measures should be considered and these should form part of an EMPr to be implemented should the project be approved. Sound planning and design techniques are essential to implement creative alternatives to meet the project's objectives. These techniques must be viewed as principles or objectives and not rigid standards with limited flexibility.

- During the pre-construction and construction phases of the project, assembly areas and work camps must be kept free of litter. These sites would be visible from the N14 and therefore in order to reduce the visual impact of these sites should be kept presentable and neat;
- Along the N14 are a series of man-made soil berms, these berms act as a visual barrier between sections of the N14 and the PV facility. If practical, these berms could be extended to run along the N14 boundary fence-line to act as a visual barrier between the motorists using the N14 and the PV Facility.
- Buildings on the site should be painted a colour which is consistent with the surrounding landscape. Colours which have a high contrast to the area around the site should be avoided. In order to avoid potential glare, which may cause a distraction to road users of the N14, all surfaces, if possible, should have a matte finish;
- Due to the relatively undisturbed and landscape lacking in vegetative cover, it is recommended that the sites, the sites should be kept neat (no stockpiles of soil or refuse) and litter free, as well as alien vegetation control measures put in place;
- With regards to lighting, the following should be considered:
  - Lighting on the fence line and security lighting should be faced inwards, except for nocturnal safety lighting; and
  - Lighting internally, if practical, should be low foot-level lighting, fitted with low intensity bulbs should be used.
- These lighting recommendations should be considered only if they do not pose a threat to site safety.
- In terms of post-closure rehabilitation it is important to restore the environment to a condition whereby the natural functioning of the ecosystem can take place;
- During construction activities, dust control measures should be implemented, i.e. have a water tanker available, and reduce onsite driving speeds;
- External signage should be kept to a minimum and where possible attached to existing buildings to avoid free-standing signs in the landscape.

6.7.11. Implications for Project Implementation

- Visual impacts associated with the PV facility and associated infrastructure (including the power line) are expected to be of low significance largely due to the absence of many visual sensitive receptors from the area as well as the presence of existing power line and the proposal that the power line to the substation be constructed in parallel to this existing power line.
- Visual Impacts are difficult to mitigate, however, possible mitigation measures are recommended in Section 6.8.8 above and are included in the EMP.

» In addition, to limit scarring of the landscape, rehabilitate disturbed construction areas and re-vegetate using appropriate indigenous grasses
» Ensure that the PV panels do not cause disruption of passing traffic on the N14.

6.8. Economic impacts

Potential economic (and social) impacts include:

» Disruption of grazing
» Disruption of N14 and other infrastructure
» Economic development
» Creation of employment
» Stability of energy supply
» Expansion of community development projects
» Impacts on public safety
» Noise during construction
» Increased traffic and road safety hazards
» Increased risk of crime, disease with influx of workers and opportunity seekers
» Social divisions over limited jobs and perceived preferential access
» Occupational health and safety
» Impacts from waste (construction, solid, domestic and e-Waste)
» Visual impact

These impacts associated with Phase 1 are discussed below. Cumulative impacts of multiple phases of this project and approved projects in the area are dealt with separately under Section 6.10.

During construction approximately 250-300 jobs will be created over a 15 - 18 month period for this phase of the PV Project. During the operation phase approximately 7-15 full-time employees will be employed during. PVAfrica Development (Pty) Ltd is committing 1.5% and 0.6% of its annual project revenues over 20 years to socio-economic development and enterprise development in local communities respectively. During construction, temporary camps will house construction staff. There are no communities in the immediate vicinity of the site and within the servitude (27.5 m on either side) of the power line.

6.8.1. Disruption of Grazing Activities

The farm as a whole has a relatively low grazing / agricultural potential in the national context, given the low rainfall and high evaporation rates experienced in the area. In this region of the country, commercial livestock ranches are generally large, often comprising tens of thousands of hectares. Net returns are negative for a given year depending on variables including feed costs, weather variables and livestock prices. Return on investments has been low for smaller land owners, and negative net returns can occur based on smaller farming units for three out of twenty years on average. The agricultural specialist report provides information on the extent to which the proposed project will decrease the stocking rate of the Portion 3 of the Farm Zuurwater. During construction, the preparation of the site and the presence of construction equipment will result in disruption of grazing. During the operational phase – the area occupied by the PV panels cannot be used for agriculture. Decommissioning is likely to result again in a temporary more intense disruption of grazing, owing to the presence of vehicles and equipment for the removal of infrastructure.

Pre-construction/construction

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Definitely(5)
Result: Medium-High (90)				
Mitigation: » Implement stormwater management and other erosion prevention measures » Construction vehicles are to remain within the proposed development area » Avoid and minimise the removal of natural vegetation/ grazing				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project Specific (2)	Life of Operation (4)	Infrequent (3)	Definitely (5)
Result: Low-medium (64)				

Operation

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Project Specific (2)	Life of Operation (4)	Life of Operation (4)	4
Result: Medium-high (80)				
Mitigation: » Rehabilitate disturbed land within the development area to original agricultural potential and consider allowing grazing (with conservative stocking rates) between the panels if and where possible.				

» Prevent disruption of natural vegetation/ grazing both within and around the development area » Maintain stormwater management and other erosion prevention measures » Operational vehicles are to remain within the proposed development area » Implement measures to prevent livestock coming into contact with or entangled by any electrical wiring that might cause short circuits, injury or death.				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Project Specific (2)	Life of Operation (4)	Life of Operation (4)	Infrequent (3)
Result: Medium (63)				

Decommissioning

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	Life of Operation (4)	Infrequent (3)	Definitely (5)
Result: Medium-high (80)				
Mitigation: » Maintain and enhance stormwater management and other erosion (including wind) prevention measures » Implement measures to rehabilitate compaction of soil resulting from the concrete footings, other PV infrastructure and vehicle access. » Undertake rehabilitation to original agricultural potential » Reinstitute conservative stocking rate within development footprint following rehabilitation				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Project Specific (2)	One year to ten years (3)	Temporary (2)	Likely (4)
Result: Low (42)				

6.8.2. Economic development

The Northern Cape is a region of marked economic underdevelopment and unemployment, and given the arid and remote nature of the environment, opportunities are limited. Mining, a key contributor to the regional economy, has a limited lifespan entirely dependent on life of mine. This project represents the chance of harnessing the underutilized high solar irradiation levels of this region of the Northern Cape, and the diversification of the local economy. The location within the immediate study area of the Eskom power lines forming part of the national grid feeding Namibia and Springbok also enhances the economic feasibility of the project. Solar power is also one of the development opportunities which have been identified by authorities at the national and regional levels.

Numerous positive economic spinoffs from the project are envisaged for all project stages. Job creation will be at its highest during the construction phase of the project (250-300 employees – required for construction of One Phase of 75MW). Permanent, highly skilled and semi-skilled jobs will be created in the operational phase which will contribute to economic stability of the area. Local sourcing of services and materials (where feasible), will contribute to secondary benefits of the project, and could potentially result in the creation of small enterprises and service providers who could in turn generate employment.

Decommissioning will result in some job creation, as well as opportunities through the reuse/ recycling of certain components from the dismantled facility. At the end of decommissioning, there will be job losses and loss of income to the local economy unless the life of the project can be extended such as through retrofitting. Job losses will arise at the end of decommissioning.

Pre-construction/construction

Impact on local economic development without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project specific (2)	One year to ten years (3)	Infrequent (3)	Seldom (3)
Result: Low (+42)				
Mitigation / enhancement: » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies and methods where practical				
Impact local economic development with mitigation/enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One year to ten years (3)	Likely (4)	Possible (4)

Result: Medium (+72)

Operation

Impact local economic development without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project specific (2)	One year to ten years (3)	Infrequent (3)	Seldom (3)
Result: Low (+42)				
Mitigation / enhancement: » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies where practical				
Impact on local economic development with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Project Specific (2)	Life of Operation (4)	Monthly (3)	Seldom (3)
Result: Medium (54)				

Decommissioning

Impact on local economic development without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Great (4)	Regional (4)	Post decommissioning(5)	Infrequent (3)	Possible (4)
Result: Medium-high (-63)				
Mitigation / enhancement: » Investigate opportunities for reuse of materials and extension of the life of the operation such as through retrofitting » Procure materials, goods and services from local/regional suppliers where feasible » Implement skills and career development through the decommissioning process » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				

Impact on local economic development with mitigation/enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Regional (4)	Post decommissioning(5)	Temporary (2)	Seldom (3)
Result: Low-medium (-60)				

6.8.3. Creation of employment

The Northern Cape experiences high levels of unemployment, contributed to by long distance to markets, the high aridity levels of the area. There is high dependence on mining operations which will have limited lifespans dependent on availability of mineral resources and international markets.

The greatest number of jobs are anticipated to be created during the construction phase of the project (± 250-300 jobs per phase and six phases), followed by decommissioning (100 jobs). Preconstruction will be of limited duration, but the operational phase (7 to 15 jobs) will give rise to long-term (approximately 20 years) highly skilled and semi-skilled jobs.

Decommissioning will result in temporary employment. Jobs will be lost unless the life of the project can be extended through refurbishment and/or retrofitting continued operation.

Pre-construction

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One month to one year (2)	Annually or less (1)	Highly likely (5)
Result: Low (+48)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**

Great (4)	Regional (4)	One month to one year (2)	Annually or less (1)	Highly likely (5)
Result: Medium (+60)				

Construction

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly harmful (3)	Regional (4)	One year to ten years (3)	Infrequent (3)	Possible (4)
Result: Medium (+70)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop skills of employees » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Great (4)	Regional (4)	Infrequent (3)	Infrequent (3)	Highly Likely (5)
Result: Medium-high (+88)				

Operation

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Great (4)	Regional (4)	One year to ten years (3)	Life of operation (4)	Possible (4)
Result: Medium-high (+96)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop skills of employees				

» Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Great (4)	Regional (4)	Life of operation (4)	Life of operation (4)	Definitely (5)
Result: High (+104)				

Decommissioning

Impact of job creation without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Extremely harmful (5)	Regional (4)	Post decommissioning (5)	Permanent (5)	Highly likely (5)
Result: Very high (140)				
Mitigation: » Investigate opportunities for reuse of materials and extension of the life of the operation such as through retrofitting » Procure materials, goods and services from local/regional suppliers where feasible » Implement skills and career development through the decommissioning process » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				
Impact of job creation with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Regional (4)4	One month to one year (2)	Infrequent (3)	Likely (4)
Result: Low-medium (70)				

6.8.4. Stability of energy supply

Eskom, South Africa's key power producer, has been under pressure in recent years to meet electricity demands which has impacted negatively on stability of power supply. The country has been experiencing power outages, exacerbated by the regular need for key coal-based power stations to undergo maintenance. The proposed project stands to make a positive contribution to South Africa's stability of power supply during its operational phase through diversification from reliance on coal-generated power and distribution to areas of high electricity utilisation. This positive impact will be enhanced through efficient management and operation of the PV facility. A negative aspect of power generated by PV is that it is limited to daylight hours.

Decommissioning of the PV facility after 20 years of operation will cause power generation to cease, which will result in negative impact on stability of power supply. This situation could be delayed should it be found that it is feasible to refurbish/ retrofit infrastructure to allow for either total or partial continued operation. Decommissioning should occur in a phased manner and in close communication with Eskom, so as to avoid and minimize instability of power supply.

Operation

Impact of the project on stability of energy supply without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	5	4	4	4
Result: Medium-high (+88)				
Mitigation / enhancement: » Conduct regular maintenance of the plant to avoid and minimise operational down-time » Maintain close liaison with Eskom regarding any possible scheduled or unscheduled down-time				
Impact on stability of energy supply with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	5	4	5	5
Result: High (+120)				

Decommissioning

Impact on stability of energy supply without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	5	5	5	5
Result: Very high (-140)				
Comment / mitigation: » Investigate the possibility of refurbishment and/or retrofitting for total and/or partial continued operation » Carry out careful planning of the phasing of the decommissioning process » Maintain communication with national energy regulator and power producer				

(Eskom)				
Impact on stability of energy supply with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	5	5	3	5
Result: High (-104)				

6.9. Social Impacts

6.9.1. Expansion of Community Development Projects

During preconstruction, construction, operation and decommissioning, there is potential to increase coordination with local projects and initiatives falling under provincial community development authorities, local authorities and other organisations encouraging community development. This process will ensure that project activities are harmonised with local spatial and development plans (e.g. Integrated Development Plans, Spatial Development Frameworks and Local Economic Development Plans). Building lines of communication will assist with such aspects as disruption of municipal and other services, and the maximisation of opportunities such as building on support programmes such as HIV/Aids prevention. PVAfrica Development (Pty) Ltd plans to ensure that there is liaison, cooperation and assistance provided to organisations such as community trusts functioning in the immediate vicinity of the proposed project.

Pre-construction/construction/operation

Impact on community development projects without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	4	3	3
Result: Low-medium (+54)				
Mitigation / enhancement: » Carry out early identification of existing community initiatives which can be expanded » Conduct consultation with stakeholders regarding community development projects requiring enhancement » Carry out targeted support to existing community development projects in line with identified needs				
Impact on community development projects with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**

4	4	4	4	4
Result: Medium-high (+96)				

Decommissioning

Impact on community development projects without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (-96)				
Mitigation / enhancement: » Carry out early identification of existing community initiatives which can be expanded » Conduct consultation with stakeholders regarding community development projects requiring enhancement » Carry out targeted support to existing community development projects in line with identified needs » Implement skills and career development through the decommissioning process where feasible » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				
Impact on community development projects with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	4	3	3
Result: Low-medium (54)				

6.9.2. Impacts on Public Safety

The proposed development site is situated far from neighbouring towns, with the town of Aggeneys (the closest settlement) being approximately 9km away. Although there are no communities in close proximity to these servitudes there is one farming family resident on the farm. There are further passers-by in the form of low-volume traffic on the N14. Potential safety hazards during preconstruction, construction and decommissioning include:

» Injury from machinery, equipment and construction vehicles through following unauthorized access to the construction area(s)
» Road accidents involving construction vehicles

» Electrocution from high voltage power lines and substations

The operational project technology is not known to pose any risks to the health of the public, although if not managed could pose a safety hazard should members of the public trespass on to the site. The hazards posed through unauthorized access during the operational phase potentially include electric shocks and/or electrocution through third party tampering with equipment and installations such as live wiring. Since 24 hour security and warning signage will be in place on site, the likelihood of incidents occurring is considered to be very remote.

Pre-construction / construction/ decommissioning

Impact on public safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	3	3	3
Result: Low (48)				
Comment / mitigation : » Institute and maintain 24 hour security and access control to the project site » Set up signage warning of on-site hazards » Clearly demarcate construction areas » Construct and maintain security fencing on the perimeter and around electrical substations » Develop and implement emergency response procedures				
Impact on public safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	3	2	2
Result: Very low (24)				

Operation

Impact on public safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: High (80)				
Comment / mitigation: » Institute and maintain 24 hour security and access control to the site » Set up signage warning of on-site hazards » Clearly demarcate operational areas » Construct and maintain security fencing on the perimeter and around electrical substations				

» Verify the technical competency of staff operating and managing the facility » Implement and carry out regular review of emergency response procedures				
Impact on public safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	1	4	2	2
Result: Low (32)				

6.9.3. Increased noise

The proposed development site is situated in a predominantly natural and remote area with very low ambient noise levels. The neighbouring Black Mountain Mine has limited if any influence on noise levels on the site, and the town of Aggeneys is also situated too far away to have significant influence on ambient noise levels. The relatively close proximity of the development site to the N14 will, however, assist with the attenuation of noise levels.

The primary source of noise during the preconstruction, construction and decommissioning phases will be through the operation of trucks and machinery associated with the construction process. These are the phases where noise impacts are anticipated to be most intense through the operation of trucks for clearing of vegetation (preconstruction), transportation of construction materials (construction) and dismantled materials (decommissioning). There will also be noise impacts generated from the operation of vehicles supplying logistics support, such as supply of water for domestic use. Noise impacts during the operational phase are anticipated to be lower the more limited use of vehicles and equipment for cleaning of panels, vehicles for transport of water and those for supply of services/logistical support. Ambient noise will also be contributed to by the presence of workers during preconstruction, construction, operation and decommissioning.

Pre-construction/ construction /decommissioning

Noise impacts without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	4	4
Result: Medium (80)				
Comment / mitigation : » Implement regular maintenance of vehicles » Minimise construction activities between 6pm and 6am in sites close to homestead » Ensure placement of accommodation/ construction camp away from the				

resident farmer's household » Enforce strict speed limits for vehicles moving on the property » Develop and put into effect a code of conduct for employees				
Noise impacts with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	3	3	3
Result: Medium (54)				

Operation

Noise impacts without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	2	4	4	4
Result: Low (56)				
Comment / mitigation: » Implement regular maintenance of vehicles » Minimise construction activities between 6pm and 6am in sites close to homestead » Enforce strict speed limits for vehicles moving on the property » Develop and put into effect a code of conduct for employees				
Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	2	3	4	3
Result: Low (49)				

6.9.4. Increased risk of crime, disease with influx of workers and opportunity seekers

A major outbreak of HIV/Aids has swept South Africa in recent decades, and communicable diseases also have a high incidence in the country. Desperation for sources of income can also draw people into prostitution. As with other new developments, the proposed project is likely to set up expectations of employment opportunities which could potentially result in in-migration of job-seekers. This could result in an increase in the crime rate and may exacerbate the risk of spread of disease unless measures are put in place to discourage risky behaviour by job-seekers, and employees and contractors. It is anticipated that the risk of spread of disease as well as crime will be highest during the preconstruction, construction and decommissioning phases of the project, and that during the operational phase when there is a stable workforce, the risks will be lowest. It is possible that crime could be linked to such activities as tampering with security features and theft of equipment.

Preconstruction/construction/decommissioning

Impact due to influx of workers without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	4	4
Result: Medium-high (88)				
Comment / mitigation: » Enhance and/or support local and provincial authority initiatives on HIV/Aids and communicable disease awareness » Employ local people where possible » Include conditions for contractors to provide HIV/Aids education and introduce rotation to enable contract workers not residing in the area to visit their homes regularly » Provide recreational facilities such as soccer fields for construction workers and facilitate access to nearby towns for shopping, religious gatherings, etc. » Manage expectations of job creation through the information and communication programme » Maintain close liaison with local and provincial law enforcement agencies » Incorporate into the code of conduct for employees including punitive measures for theft and related crimes				
Impact due to influx of workers with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	2
Result: Low (28)				

Operation

Impact due to influx without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	3	3
Result: Medium (60)				
Comment / mitigation: » Enhance and/or support local and provincial authority initiatives on HIV/Aids and communicable disease awareness » Employ local people where possible » Manage expectations of job creation through the information and communication programme				

» Maintain close liaison with local and provincial law enforcement agencies » Incorporate into the code of conduct for employees punitive measures for theft and related crimes				
Impact due to influx of workers with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

6.9.5. Social divisions over limited jobs and perceived preferential access

High unemployment rates within the vicinity of the study area are likely to increase expectations, and perhaps result in unrealistic anticipation, of job creation by the project. The public participation process highlighted the desire amongst community members that job creation should be maximised by the project. The requirement for highly technical and skilled employees during all project phases means that the number of jobs created at community level could be relatively limited. It is possible that divisions within communities could be sown should it be perceived that outsiders are preferentially obtaining jobs, and that employment opportunities are limited for local people. Should there be corruption and nepotism associated with employment, this will exacerbate the problems. The risk of these impacts arising is most likely during the preconstruction, construction and decommissioning project phases when employment levels are at their highest on the project. However, the DoE requirements include use of locally available skills and social beneficiation as part of the development and operation of the project. In addition, the developer should manage expectations from local communities by being transparent.

Preconstruction/ construction/ decommissioning

Social division/ impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	4	5
Result: Medium (99)				
Comment / mitigation: » Employ local people where possible » Establish and maintain transparency in recruitment procedure » Ensure transparency in recruitment procedures » Maintain effective communication with local community structures and stakeholders during all project phases to address potential and real tensions. » A communication and information programme should be used to maximise procurement from local service providers				

» Include management and enhancement measures for local and BBBEE employment in the EMP				
Social division/ impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	3	2	3
Result: Low (40)				

Operation

Social division/ impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	4	4	4
Result: Medium (56)				
Comment / mitigation: » Employ local people where possible » Establish and maintain transparency in recruitment procedures » Ensure transparency in recruitment procedures » Maintain effective communication with local community structures and stakeholders » A communication and information programme should be used to maximise procurement from local service providers » Include management and enhancement measures for local and BBBEE employment in the EMP				
Social division/ impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

6.9.6. Health and Safety Impacts

The development of the PV plant will involve activities that potentially could be unsafe to workers on the project. These activities include clearing of the development site, digging of trenches, laying of cables and backfilling. These activities all require the use of heavy duty vehicles, machinery and equipment. Additionally, there is a risk posed by road accidents during the transportation of components and materials, both on access routes and national/ provincial roads, as well as within the development site. There is furthermore the risk of exposure to diseases including HIV/Aids and communicable diseases such as tuberculosis (TB).

During the operational phase, occupational health and safety impacts could include injury (including electric shocks or electrocution) to workers from routine monitoring and maintenance, as well as when responding to emergencies such as fire, electrical malfunctions or structural failure of equipment such as the collapse of a PV panel during a wind storm. Dangerous conditions could result from corrosion of electrical components, erosion, flooding and third party damage. During decommissioning, there is the risk of injury caused by mishandling or malfunction of electrical components, injury during dismantling of equipment and movement of vehicles or collisions, and events such as suffocation from collapse of trench walls.

Preconstruction/construction/decommissioning

Health and safety impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	3	4	4
Result: Medium (64)				
Comment / mitigation: » Adhere to OHS legal requirements and measures contained in the EMP » Establish and implement OHS procedures for employees on site, including use of Personal Protection Equipment (PPE) » Conduct regular staff training on OHS » Implement an employee code of conduct which incorporates safety issues including prohibition of operating vehicles and machinery after use of substances which could impair reflexes				
Health and safety impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	3	4	3
Result: Low (42)				

Operation

Health and safety impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: Medium (80)				
Comment / mitigation: » Adhere to OHS legal requirements and measures contained in the EMP » Establish and implement OHS procedures for employees on site, including use of Personal Protection Equipment (PPE) » Conduct regular staff training on OHS » Implement an employee code of conduct which incorporates safety issues				

including prohibition of operating vehicles and machinery after use of substances which could impair reflexes				
Health and safety impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	4	4	3
Result: Low (49)				

6.9.7. <u>Impacts from waste (construction, solid, domestic and e-Waste)</u>

Several categories of waste will be generated in each of the project phases (preconstruction; construction; operation and decommissioning). If not appropriately managed, waste generated could result in impacts on air, soil and water quality, as well as visual (aesthetic) quality. Sanitation and wastewater facilities will cater for the anticipated employees during preconstruction; construction; operation and decommissioning. Domestic solid waste generation can be expected to be proportional to the number of workers during each project phase, and thus the highest volumes are likely to be generated during the construction phase. During preconstruction and construction, domestic solid and liquid waste will be the primary source. The volumes of non-domestic and domestic waste will be at their lowest during the operational phase of the project, although on-going PV plant maintenance is likely to result in limited quantities of components requiring replacement. Waste will be disposed of at a suitably registered municipal landfill site.

Decommissioning is anticipated to commence around 20 years after the initial commencement of construction. It is at this stage of the project that the greatest volume of waste is anticipated to be generated. Reuse of materials will be prioritised, and failing this being an option, will be recycled and only as a last resort discarded in licensed landfills. Recyclable materials (glass, metals and certain grades of plastics) will be recycled via existing recycling operations. Non-solid waste will be disposed of at an appropriately registered landfill site. Concrete slabs forming the foundation for the PV modules are planned to be crushed, for use as fill on construction site/road-building projects. Alternatively, crushed concrete will be used for rehabilitation of the disused quarry on the site (such as in the form of gabions). Waste rock (if any), will also be used for the rehabilitation of the disused quarry on the site. e-Waste will be disposed of in a suitably registered landfill site. It is expected that the value received for recyclable waste will be used to subsidise the cost of decommissioning.

Preconstruction/construction

Impact due to waste without mitigation:				
Severity	**Spatial**	**Duration of**	**Duration of**	**Frequency of**

	extent	**impact**	**activity**	**impact**
4	3	5	4	4
Result: Medium-high (96)				
Comment / mitigation: » Implement measures to ensure that disposal at appropriately licenced landfill sites is carried out » Use construction waste rock/soil for rehabilitation of the disused quarry on the Farm Zuurwater » Apply the hierarchy of waste management to project activities » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard » Consider the NEM: Waste Act				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	5	3	3
Result: Low (48)				

Operation

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	4	3	2
Result: Low (35)				
Comment / mitigation: » Implement measures to ensure that disposal of waste, including e-waste, is carried out at appropriately licensed landfill sites » Use construction waste rock/soil for rehabilitation of the disused quarry on the farm Zuurwater » Apply the hierarchy of waste management to operational activities » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard » Implement measures to ensure the efficient maintenance of infrastructure to maximise the lifespan of components » Consider the NEM: Waste Act				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	1	4	3	2
Result: Low (30)				

Decommissioning

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	3	4
Result: Low-medium (70)				
Comment / mitigation: » Apply the hierarchy of waste management to decommissioning activities, thus minimizing waste volumes generated » Clear the development site of all waste generated during decommissioning » Implement measures to ensure disposal to appropriately licensed landfill sites. Dispose e-Waste at a suitably registered landfill site » Use construction waste rock/soil for rehabilitation of disused quarry » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	2	2	3
Result: Very low (25)				

6.9.8. Comparative Assessment of Power Line Alternatives

There is no difference in social / economic impacts from either power line options, therefore there is no preference from a social perspective on either power line alternatives.

6.9.9. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and would therefore not pose additional impacts on the social environment. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is no preference regarding the reservoir location and associated water pipeline route.

6.9.10. Implications for Project Implementation

» The social benefits of the project outweigh the potential negative and localised social impacts / disturbances due to the project.

- Potential negative impacts include the threats to public safety from construction and traffic activity, increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. It is important that potential negative effects are managed as per the mitigations provided and contained in the EMP to prevent them developing into unacceptable cumulative impacts.
- Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements described in the impact assessment are instituted.
- Construction and operational noise, traffic and waste to be well-managed to prevent negative social impacts.
- The DoE requirement for suitable social beneficiation schemes is supported for the development of the project.

6.10. Impact on Traffic

The study area is serviced by a national road (the N14) which is in good condition, and which links the major centres (notably Upington to the east, and Springbok to the west). The N14 further links with traffic travelling to and from Namibia situated to the north of the site. All of the smaller municipalities and communities are further situated either adjacent, or close to the N14. This road is thus of extremely high importance in ensuring economic and social linkages are maintained in this region of the Northern Cape.

The baseline traffic volumes have been found to be very low, and the projected number of project vehicles for all project phases are further regarded by the traffic specialist in the previous report by SRK Consulting as being very low. It was determined that services are at a very good Level of Service "A", even with the project-generated traffic. SANRAL requested a buffer on either side of the N14. A buffer of 60m on the N14 has been applied by the developer. Construction activities will increase traffic on the N14, if that is well managed the impact of the facility on traffic can be manageable.

6.10.1. Traffic Implications of the Proposed Development

The existing traffic flows plus added traffic / road users related to the Zuurwater solar energy facility are expected to generate low traffic flows on the N14. The N14 will still operate at a Level of Service A road, even with this additional traffic. The new, left- and right-turning traffic from the N14 into the formal accesses to the facility is not considered to be of high volumes and no exclusive right-turn lanes or left-turn deceleration lanes will be required to accommodate the facility generated traffic. The access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic.

6.10.2. Location of Access Roads to the Site

From a geometric and road safety perspective, the location of the existing and proposed access road to the facility on the N14 at km92,227 and at km94,072 is considered to be acceptable although there are numerous potential alternative locations should this existing access not be acceptable to the developer, the landowner or SANRAL for any reason.

6.10.3. Road Safety

Road safety conditions along the N14 in the vicinity of the site are considered to be good with an accident rate that is not noticeably higher than the average for the N14. The speed limit on the N14 in the vicinity of the Zuurwater site is 120 km/h and sight distance conditions to and from both directions at the location of the proposed access is considered to be acceptable for this speed limit. There is no evidence of pedestrian or public transport activity nor wild or domestic animal activity within the road reserve in the vicinity of the site. As the volume of traffic that enters and leaves this existing access point is expected to increase, particularly when there will be both construction and operational activities occurring at the same time, advanced warning of this side road activity will be required.

6.10.4. Driver Distraction Due to the PV Panels

Probably one of the biggest potential impacts of this photovoltaic power generation facility is driver distraction, firstly from the novelty impact of the facility as there are not many such facilities currently in South Africa and secondly from potential glare and / or reflection off the panels which may distract drivers as they are travelling past the facility at 120km/h. Setting the arrays back by 60m from the road reserve will reduce the potential impact of the panels. The majority of the PV panels will be located to the north of the N14 and will be north facing away from the N14 and therefore it will not be possible for the panels to reflect onto the N14. On the basis of the above, it will not be possible for any reflection from the panels to occur onto the N14 from the north or south.

It is recommended that temporary high visibility advanced warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 in both directions approaching the position of the two accesses to the facility during construction and that permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 at both accesses once construction is completed and the facility is fully operational. Whilst theoretically there is no potential for reflections from the panels and infrastructure to affect passing motorists on the N14, it is recommended that reflections from the arrays are monitored from the first installation to confirm this. No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed Zuurwater solar energy facility, cumulatively.

6.10.5. Impact Tables Summarising Impacts on Traffic

Pre-construction/construction/decommissioning

Impact on traffic without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	3	4
Result: Low-medium (70)				
Comment / mitigation: » Implement efficient scheduling of goods delivery and water » Implement measures for conduct of employee and contractor drivers » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences » Maintain communication with SANRAL regarding their requirements for measures to be instituted » Implement a 60m buffer on the N14. » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic				
Impact on traffic with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	2

Result: Low (35)

Operation

Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	4	4	3
Result: Low-medium (63)				
Mitigation: Implement efficient scheduling of goods delivery and water » Implement measures for conduct of employee and contractor drivers » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences » Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic				
Impact on traffic with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	3	2
Result: Low (40)				

Pre-construction / construction /decommissioning

Impact on road safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	3	4	4
Result: Medium-High (80)				
Comment / mitigation : » Implement efficient scheduling of goods and water delivery » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed				

necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic » Implement measures for conduct of employee and contractor drivers » Establish and enforce a strict code of conduct for employees and contractors which includes adherence to traffic rules				
Impact on road safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	2
Result: Low (28)				

Operation

Impact on road safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	4	4	4
Result: Medium-high (88)				
Comment / mitigation: » Enforce a strict code of conduct for employees and contractors which includes adherence to traffic rules » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic » Implement efficient scheduling of goods and water delivery » Maintain communication with SANRAL regarding their requirements for measures to be instituted				
Impact on road safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

6.10.6. Implications for Project Implementation

» It is recommended that temporary high visibility advanced warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 in both directions approaching the position of the two accesses to the facility during construction and that permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 at both accesses once construction is completed and the facility is fully operational.

» Whilst theoretically there is no potential for reflections from the panels and infrastructure to affect passing motorists on the N14, it is recommended that reflections from the arrays are monitored from the first installation to confirm this. No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed Zuurwater solar energy facility, cumulatively.

6.11. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers 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 undertakings in the area[16]. Based on information available at the time of undertaking the EIA, the impact of solar facilities on the landscape is therefore likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of solar plant applications. The Northern Cape is earmarked as a potential solar energy hub for South Africa. In the case of the proposed Phase 1 of the Zuurwater Solar Energy Facility, there are other phases to the project and other solar energy facilities proposed in the Khai Ma Local Municipality. Other phases/ projects on Portion 3 of the Farm Zuurwater under the same applicant (PVAfrica Development (Pty) Ltd) and other proposed projects in the area are listed in Table 6.1 and 6.2 and are shown in Figure 6.4.

Project	Applicant / Developer	DEA Ref. No	Location	Status
1. Proposed Photovoltaic Plant on the Farm Zuurwater near Aggenys - Unit 4 (75MW)	PVAfrica Development (Pty) Ltd (previously SATO Holdings)	14/12/16/3/2334/4	Section of Farm Zuurwater No. 62	Authorised in August 2012
2. Proposed Photovoltaic Plant on the Farm Zuurwater near Aggenys - Unit 5 (75MW	PVAfrica Development (Pty) Ltd (previously SATO Holdings)	14/12/16/3/2334/5	Section of Farm Zuurwater No. 62	Authorised in August 2012
3. Phase 2 of the Zuurwater PV Facility	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/471	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 8

16 Definition as provided by DEA in the EIA Regulations.

Project	Applicant / Developer	DEA Ref. No	Location	Status
4. Phase 3 of the Zuurwater PV Facility (60MW)	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/472	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 10
5. Phase 4 of the Zuurwater PV Facility (75MW)	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/473	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 12

The other authorised / proposed projects/ developments in the Khai Ma Local Municipality are listed in Table 6.2.

Table 6. 1: Projects/ Developments Proposed in the Khai Ma Local Municipality

Project	Applicant / Developer	DEA Ref. No	Location	Status
1. Aggeneys Solar Photovoltaic (PV) power plant (84MW)	Orlight SA (Pty) Ltd	12/12/20/2630	Portion 1 of Aroams 57 RD	Environmental Authorisation (EA) issued
2. 10MW Photovoltaic Plant at Black Mountain Mine	Aurora Power Solutions (Pty) Ltd in partnership with Black Mountain Mining	12/12/20/2151	At Black Mountain Mine	Final Basic Assessment Report Submitted to DEA
3. Boesmanland Solar Farm	Boesmanland Solar Farm (Pty) Ltd.	12/12/20/2602	Next to Black Mountain Mine (Portion 6, a portion of Portion 2 of the Farm 62 Zuurwater)	Final EIA submitted to DEA in 2013 Decision – pending
4. Pofadder Wind and Solar Energy Facility	South Africa Mainstream Renewable Power Development (Pty) Ltd	» 14/12/16/3/3/2/348 (Wind) » 14/12/16/3/3/2/347 (Solar)	Near Pofadder	Scoping Phase complete, EIA in process
5. Eskom Aggeneis – Oranjemond 400kV power line	Eskom	12/12/20/2041	From Aggeneis Substation to – Oranjemond Substation	Environmental Authorisation (EA) issued in May 2012.
6. Proposed Gamsberg Zinc Mine and Associated Infrastructure	Black Mountain Mining	» DENC Reference Number: NC/EIA/NAM/KHAI/AGG/2012-NCP/EIA/0000155/2012 » DEA Reference Number: 12/9/11/L955/8	To the east of the Farm Zuurwater No. 62 on farms Bloemhoek 61 Portion 1,	EIA in process

Project	Applicant / Developer	DEA Ref. No	Location	Status
		» DMR Reference Number: NCS 30/5/1/2/2/1/518	Gams 60 Portion 1, Aroams 57 RE and Gams 60 Portion 4	

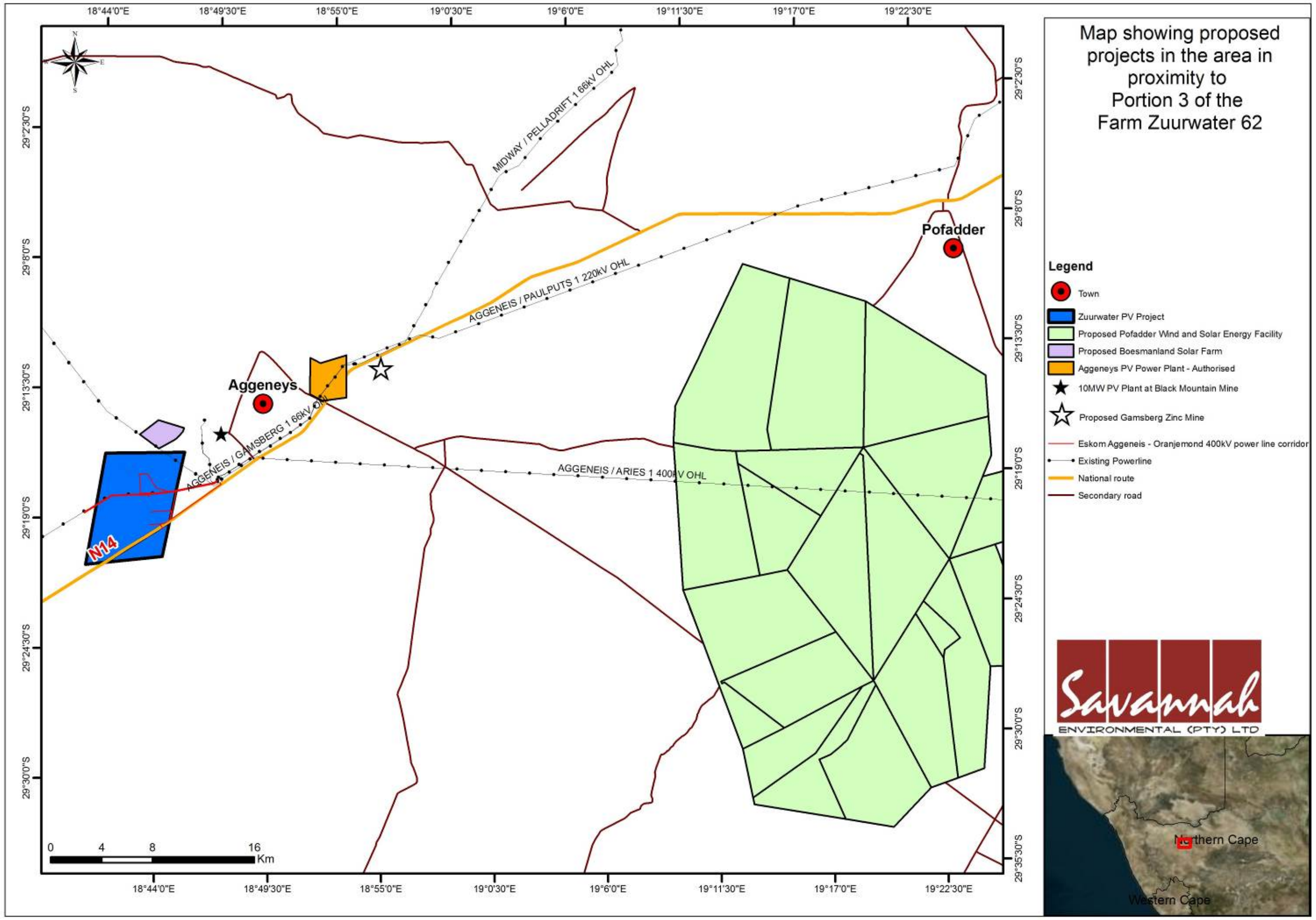

Figure 6.4: Map showing Phase 1 – Phase 4 and two authorized phases and other proposed projects in the region

None of the above-mentioned solar projects have been awarded preferred bidders status at the time of writing this EIA report. Cumulative impacts discussed below and have been considered within the detailed specialist studies, where applicable (refer to Appendices F - J).

The potential ***cumulative impacts*** as a result of the proposed Phase 1 of the Zuurwater Project and other projects in the area are expected to be associated predominantly with:

» *Visual impact* - The visual impact associated with the proposed Phase 1 of the Zuurwater Project and 5 other Phases of the Zuurwater project will be sequential and additive, due to the visibility of solar panels from 6 or more solar energy facilities on Portion 3 of the Farm Zuurwater No. 62. From a visual perspective, the overlapping viewsheds can be considered favourable, as it represents the consolidation and concentration of potential visual impacts within a clustered region (i.e. the development of a solar energy facility node, rather than dispersing the impact to other areas). A cumulative viewshed in shown in Figure 6.4. The development of numerous similar facilities in the broader area could impact on the visual character and sense of place of the region. The cumulative impact will however to some extent be moderate due to the relatively low incidence of visual receptors in the region.

» *Flora, fauna, and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of avifauna may become cumulative if other renewable energy facilities are developed in the region. Should Phase 1 of the Zuurwater project and 5 other phases of the project and other solar projects in the Namaqualand region be developed, cumulative negative ecological impacts may occur. The significance of this impact is expected to be of a moderate significance and can result in a cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion). However, if negative impacts on ecology are effectively mitigated and managed for each project, through sound environmental management during construction and operation and by formal conservation and active management of the natural areas on site, then the negative impacts on ecosystems on each site can be within acceptable levels, and therefore in keeping with the principles of sustainable development.

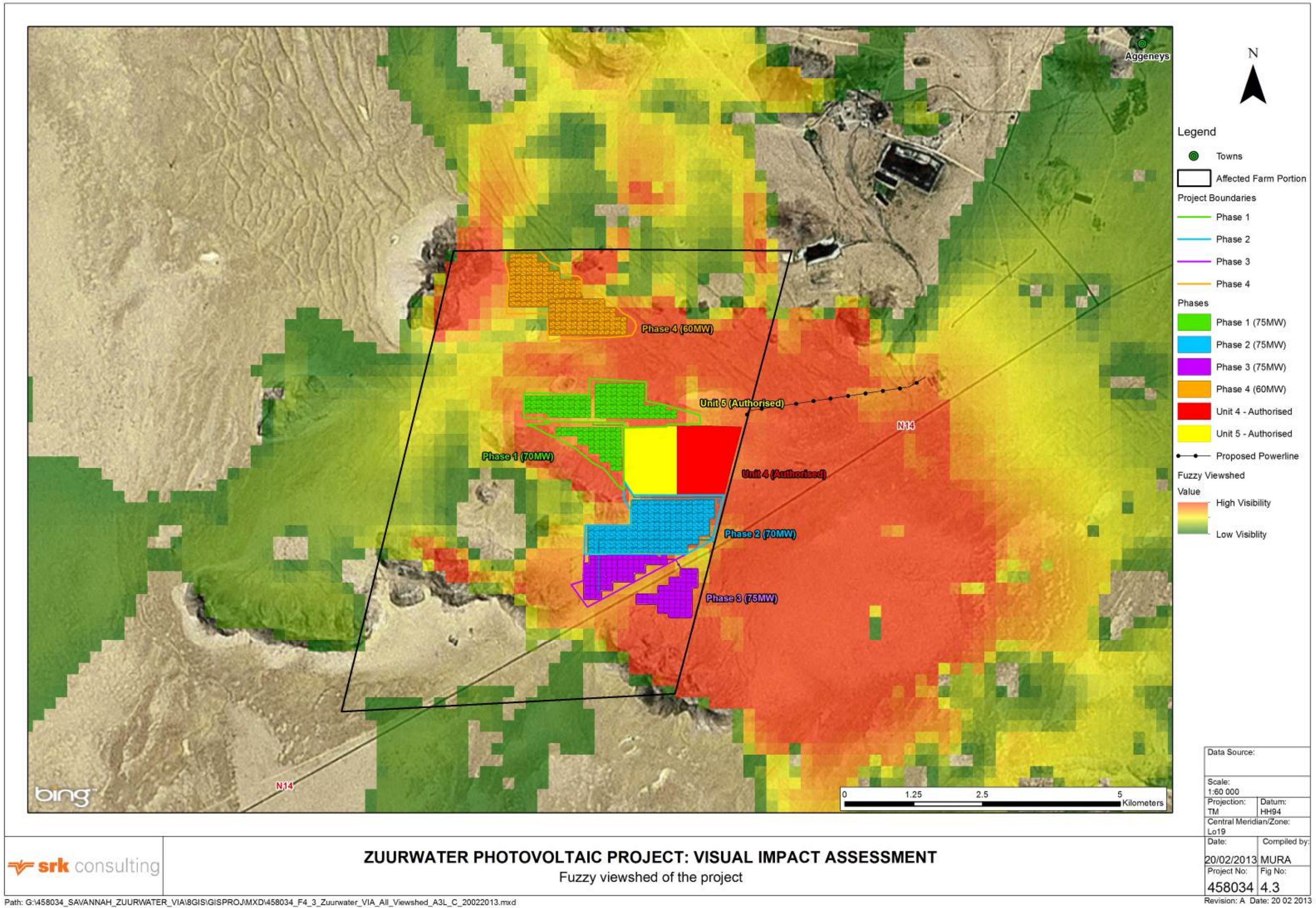

Figure 6. 5: Cumulative Viewshed for the various Phases of the Zuurwater Solar Energy Facility

» *Land-Use and agricultural potential* – The broader farm portion is 4997ha. Development of 6 phases on the broader farm will result in the loss of ~24% of Portion 3 of the farm Zuurwater 62. The remainder of the farm portion can be continued to be utilised for agricultural activities. Due to the limited crop production in the wider study area, the development of multiple solar energy facilities within the Khai Ma Local Municipality will not affect food security in the region. . Due to the vast amounts of land available in the Northern Cape Province, as well as the low agricultural potential and carrying capacity of the land, cumulative impacts on land-use or agricultural potential are of acceptable levels.

» *Cumulative geology, soil and erosion potential* - although the impact of soil removal for the proposed activity has a moderate – low significance, the cumulative impact of soil removal in the area is considered low due to undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate. The cumulative impact of siltation and dust in the area is considered low, with the legal obligation of good soil management for each project.

» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Current mining such as the Black Mountain Mine, presents a noise source, however the potential for cumulative impacts related to noise is low largely due to the low occurrence of sensitive receptors in the area.

» *Infrastructure* - Increased pressure on existing roads and other infrastructure may occur due to various projects being developed. This will require consultation with parties such as Eskom and SANRAL to prevent significant impacts on existing infrastructure in the area/ with the local municipality.

» *Heritage* –Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to 'sense of place' will occur from various projects in the region. The potential for the loss of or discovery of heritage artefacts in the Namaqualand region will also increase.

» *Impact on the Social and Economic Environment* - The establishment of a number of solar energy facilities in the area may impact negatively on the social environment as a result of issues associated with, for example, influx of people to the area and increased traffic volumes. Cumulative positive socio-economic impacts from a number of renewable energy facilities in terms of job creation and economic growth and development of infrastructure will occur at a local and district municipality level that is in need of this growth and development. This would be a significant positive impact. The adoption of

management measures will maximise the cumulative impact for local communities. Each project developed will contribute a percentage of annual profits from the solar project to social beneficiation in the local community, as required by the Department of Energy. Over at least 20 years, there will be a cumulative social benefit from multiple phases and likely from other renewable development in the surrounding areas. It is important that the social development efforts are managed effectively and efficiently in co-operation with key stakeholders over time so that they contribute progressively to enhancing the lives of surrounding communities.

6.12. Assessment of the Do Nothing Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Phase 1 of the Zuurwater Solar Energy Facility. Should this alternative be selected, there would be no 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 won't be any transfer of skills to people in terms of the construction and operation of the solar energy facility. 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.

At a broader scale, the benefits of this solar energy facility would not be realised. 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 power supply 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.

6.13. Summary of Impacts

The following table provides a summary of the impact rating of the potential impacts identified and assessed through the EIA. As can be seen from this table, there are positive and negative impacts of high significance expected to be associated with the construction, operation and decommissioning of the proposed facility. With the used of mitigation measures impacts can be mitigated. All identified impacts can therefore be mitigated to acceptable levels.

Table 6.2: Summary of Impact Ratings For Potential Impacts Associated with Phase 1 of the Zuurwater PV Facility

Impact	**Significance Rating**					
	Preconstruction /Construction		**Operational**		**Decommissioning**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Ecological Impacts						
Ecological impacts on fauna and flora and ecosystems	Medium (63)	Low (32)	High (110)	Medium (72)	Medium (63)	Low (32)
Impact of water reservoir on ecology	Medium – High (81)	Medium (72)	Medium – High (81)	Medium (72)	Medium – High (81)	Medium (72)
Impact of the power line and substation on threatened birds during operations	-	-	High (110)	Medium-High (90)	-	-
Alteration of seasonal recharge patterns of nearby pans and washes	Medium (90)	Low (63)	Medium (90)	Low (63)	Medium (90)	Low (63)
Soils and Agricultural Potential						
Potential soil erosion	Medium-High (96)	Low (42)	Medium (80)	Low (32)	Medium (56)	Low (30)
Contamination of soils	Medium-High (80)	Low (42)	Medium-High (80)	Low (42)	Medium-High (80)	Low (42)
Dust due to loose soils	Medium (72)	Medium (64)	Medium (63	Low (42)	Medium (72)	Medium (64)
Impacts on Land Capability and Agricultural Potential	Medium (80)	Low (49)	Medium (80)	Low (49)	Medium (64)	Low (25)
Impacts on Heritage & Palaeontology						
Destruction of heritage resources/ sites	Low (48)	Low (36)	Low (48)	Low (36)	Low (48)	Low (36)
Destruction of fossils	Low (48)	Low (36)	Low (48)	Low (36)	Low (48)	Low (36)
Visual impacts						

Impact	Significance Rating					
	Preconstruction /Construction		Operational		Decommissioning	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Visual impact of the PV Panels	Medium (60)	Low (40)	Medium-High (88)	Medium (70)	Medium (60)	Low (40)
Visual Impact of the Power line	Medium (60)	Low (40)	Medium-High (88)	Medium (70)	Medium (60)	Low (40)
Economic Impacts						
Disruption of grazing	Medium-High (90)	Low-medium (64)	Medium-high (80)	Medium (63)	Medium-high (80)	Low (42)
Impact on local economic development	Low (+42)	Medium (+72)	Low (+42)	Medium (54)	Medium-high (63)	Low-medium (-60)
Creation of employment	Medium (+70)	Medium-high (+88)	Medium-high (+96)	High (+117)	Very high (140)	Low-medium (70)
Impact of the project on stability of energy supply	-	-	Medium-high (+88)	High (+120)	Very high (-140)	High (-104)
Social						
Impact on community development projects	Low-medium (+54)	Medium-high (+96)	Low-medium (+54)	Medium-high (+96)	Medium-high (96)	Low-medium (54)
Impact on public safety	Low (48)	Very low (24)	High (80)	Low (32)	Low (48)	Very low (24)
Noise	Medium (80)	Medium (54)	Low (56)	Low (49)	Medium-high (80)	Medium (54)
Increased traffic and road safety hazards	Medium-High (80)	Low (28)	Medium-high (88)	Low (32)	Medium-High (80)	Low (28)
Impact due to influx of workers	Medium-high (88)	Low (28)	Medium (60)	Low (32)	Medium-high (88)	Low (28)
Social divisions over limited jobs and perceived preferential access	Medium (99)	Low (40)	Medium (56)	Low (32)	Medium (99)	Low (40)
Health and safety impact	Medium (64)	Low (42)	Low (35)	Low (30)	Medium (64)	Low (42)

Impact	**Significance Rating**					
	Preconstruction /Construction		**Operational**		**Decommissioning**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Waste (construction, solid, domestic and e-Waste)	Medium-high (96)	Low (48)	Medium-high (80)	Low (48)	Low-medium (70)	Very low (25)
Impact on Traffic	Low-medium (70)	Low (35)	Low-medium (63)	Low (40)	Low-medium (70)	Low (35)

CONCLUSIONS AND RECOMMENDATIONS: PHASE 1 OF THE ZUURWATER SOLAR ENERGY FACILITY (DEA REF. NO.: 14/12/16/3/3/2/470) CHAPTER 7

PVAfrica Development (Pty) Ltd is proposing to establish four commercial photovoltaic solar energy facilities on Portion 3 of the Farm Zuurwater 62 near Aggeneys, Northern Cape Province. The site is located within the Khai Ma Local Municipality (approximately 9 km south-west of Aggeneys. in the Northern Cape Province). ***This Chapter of the EIA report deals only with the conclusions and recommendations of the EIA for the Phase 1 of the larger "Zuurwater PV Facility"***. The purpose of the proposed facility is 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).

The Phase 1 PV arrays are located to the north-west of the authorised Unit 4 and Unit 5. The proposed electricity generating capacity for this phase is 75MW, covering an area of 267ha. A substation is also proposed for this phase. A power line is also required.

The infrastructure associated with the project includes:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power line to transmit the power from Phase 1 into the Eskom grid via the Aggeneis MTS Substation. Two alternative power line routes were identified for investigation.
» A new temporary on-site water reservoir and associated water supply pipeline (shared infrastructure between all phases). Three alternative locations and associated pipeline routes were identified for investigation.
» Internal access roads.
» Office, workshop area for maintenance and storage.

» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

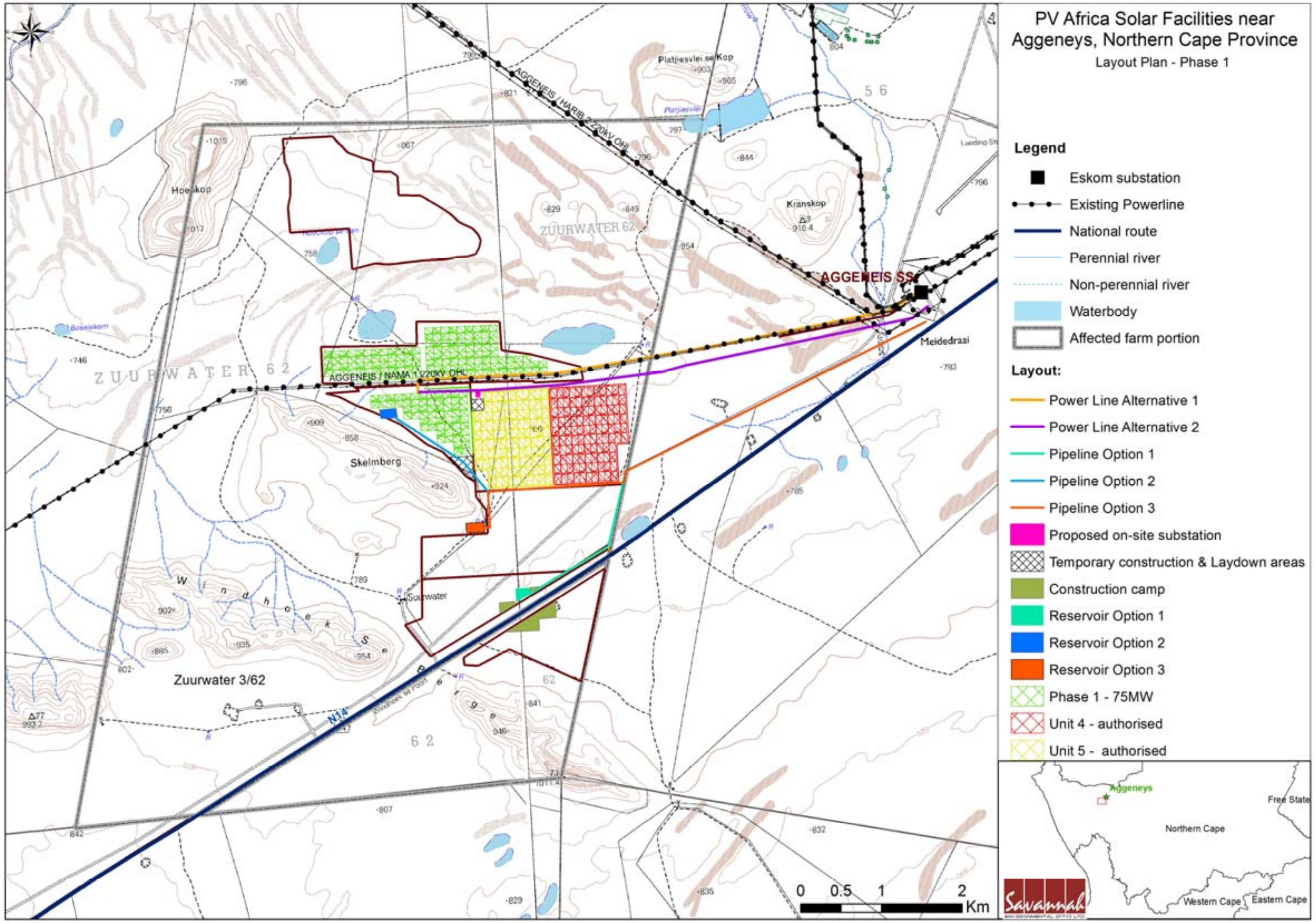

Figure 7.1: Locality map illustrating the location of the development site for Phase 1 (and other phases) of the Zuurwater PV Facility and layout of the proposed facility

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 planning 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), PVAfrica Development (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 Phase 1 of the Zuurwater Solar Energy Facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping[17] 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 undertaken to date 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, 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 - entire extent of Portion 3 of the Farm Zuurwater 62), as well as the extent of studies required within the EIA Phase were identified under an EIA report by SRK Consulting (2012), which was accepted by DEA. DEA also accepted the approach / plan of study as proposed by Savannah Environmental to utilise the existing information from the SRK Consulting's Scoping Report and only conduct an EIA phase study for the project.
» *EIA Phase* – potentially significant biophysical and social impacts[18] 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 K).

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 for the proposed Phase 1 project are provided in this Chapter.

[17] The Scoping Phase was undertaken by SRK Consulting (SRK, December 2011) and DEA accepted the approach as proposed by Savannah Environmental to undertake an EIA phase assessment.
[18] Direct, indirect, cumulative that may be either positive or negative.

7.1. Evaluation of Phase 1 of the Zuurwater Solar Energy Facility and Associated Infrastructure

The preceding chapters of this report together with the specialist studies contained within Appendices E-J and Appendix P provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Phase 1 of the Zuurwater Solar Energy Facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the 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 assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws associated with the site proposed for Phase 1 of the Zuurwater Solar Energy Facility. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Phase 1 of the Zuurwater Solar Energy Facility, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Social and economic impacts.
» Cumulative impacts.

7.1.1. Impacts on Ecology

The entire extent of portion 3 of the Farm Zuurwater 62 will not be utilised for Phase 1 of the Zuurwater solar energy facility. The development footprint (panels and associated infrastructure) will cover an extent of ~267ha of the total 4997ha farm portion. This amount to ~5% of the entire farm portion that will be utilised in the long-term and that would suffer long-term loss / disturbance (over 20 years), although a much larger area would be affected by all phases of the Zuurwater Solar Energy Facility. Permanently affected areas include the area for the PV panels and associated infrastructure, as well as the power line and water pipeline route. Areas of ecological sensitivity within the proposed development site for Phase 1 were identified through the EIA process. The ecological sensitivity map of Phase 1 of the PV Facility is shown in Figure 7.2. The ecological sensitivity assessment identified those parts of the farm (Portion 3 of the farm Zuurwater 62) that have high conservation value or that may be sensitive to disturbance. The habitats considered most sensitive on the farm (Portion 3 of the farm Zuurwater 62) iinclude:

» The red dunes;
» Areas of deep sand;
» Mountains and their gravel skirts, and
» Washes and pans.

Note that Phase 1 does not occur within any pans/ seasonal washes/ watercourses, however any impacts on soils and vegetation will indirectly impact on these pans. Outliers of Important Biodiversity areas that fall within the proposed development footprint were investigated to confirm that no red data species occur within these areas in order to ensure that these parts of the development do not cause unnecessary damage to biodiversity of conservation concern. The majority of the site for development of Phase 1 of the Zuurwater Solar Energy Facility falls within areas of low ecological sensitivity. Only the northern section of the proposed development footprint for Phase 1 falls onto areas designated as high sensitivity and ecological support areas. During the field visit it was verified that in these areas the proposed development can proceed without significantly changing ecosystem processes or causing a significant loss to sensitive biodiversity, provided the recommended mitigation measures as contained in the draft EMPr and ecological impact assessment are implemented. The impacts on **ecology** as a result of the construction of the PV panels and associated infrastructure have been rated as being of **medium significance** with the implementation of appropriate mitigation measures.

The power line may **impact on birds** due to collision or electrocution. Nine bird species of international and/or national conservation concern (Red Data species, IUCN/Birdlife International 2011, Barnes 2000), ranging from Near Threatened to Vulnerable, were considered as possible to occur on site. This impact is rated to be of **medium-high significance** and can be mitigated with the implementation of mitigation measures such as the installation of bird diverters on the power line. It is also recommended that a walk through survey of the power line be undertaken by an avifauna specialist prior to construction of the power line in order to confirm any additional mitigation which may be required to be implemented. For Phase 1, **Power Line Alternative 2 is the ecologically preferred option** due to the power line being slightly further away from more sensitive habitat associated with the pans and Bushmanland Sandy Grassland vegetation.

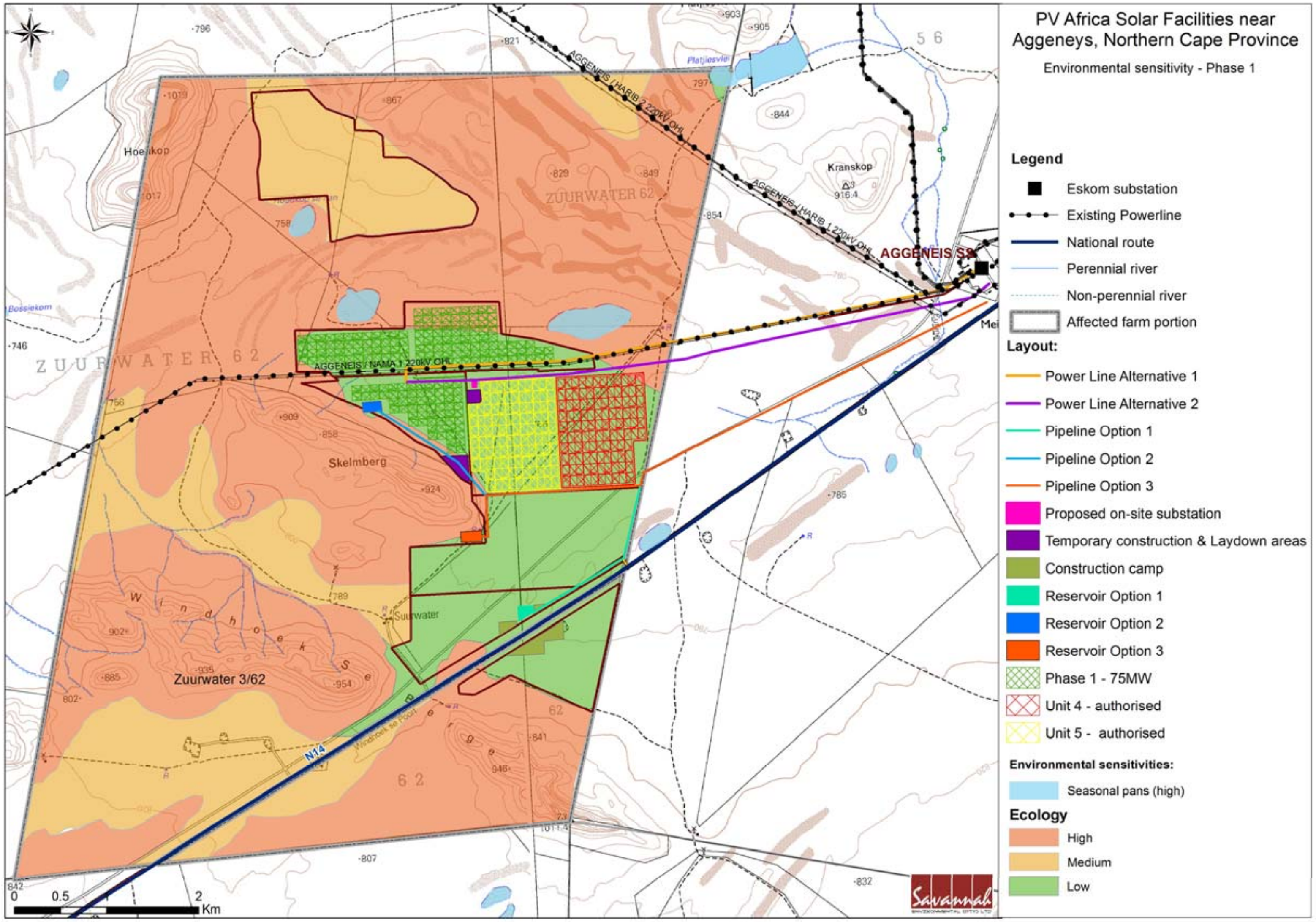

Figure 7.2: Sensitivity map for Phase 1 of the Zuurwater Solar Energy Facility

The reservoir and associated water pipeline infrastructure is proposed in close proximity to the PV panel areas and the impacts on ecological resources are expected to be similar to those identified for this area. It is recommended that the proposed development avoids the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity. Therefore, **Alternative 1** is recommended as the preferred alternative in this regard.

7.1.2. Impact on Soils, Land Capability and Agricultural Potential

The regic sands and dunes which occur on the broader farm (Portion 3 of the Farm Zuurwater 62) are highly prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. It is, therefore, important that there should be strict adherence to the Environmental Management Programme and good soil management measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project. With the implementation of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

The study area has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The current land use is livestock farming on the farm, predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring.

The impacts on **soils and agricultural potential** have been rated as being of **medium significance**, with the implementation of mitigation measures. No preference is given to the alternative power line routes or reservoir and associated pipeline routes as soils in the area are relatively uniform.

7.1.3. Visual Impacts

The proposed development site is located approximately 9km south-west of the town of Aggeneys in the Northern Cape Province. The site is located in a sparsely populated and remote area. The Black Mountain Mine is located approximately 9km to the north-east of the site. The following potentially sensitive areas exist in the study area:

- The farmers located adjacent to the site (landowners);
- Aggeneys residents; and
- Road users travelling west and east along the N14.

The visual impact of the PV panels and associated infrastructure (including power line) for Phase 1 has been rated as **medium significance**. During the operational phase, the PV panels would be visible within 2 – 3 km from the site. The nature of the natural vegetation (i.e. low growing) and the flat topography in the area allows for unobstructed views from various viewpoints in the landscape. It must however be noted that existing infrastructure such as the Eskom power lines and the Aggeneis Substation do aid in reducing the impact of the PV panels and associated infrastructure in places. Due to the presence of existing power line infrastructure, and the proposal that the power line from the Phase 1 area follow an existing power line to the substation, the change to the overall visual landscape associated with both alternatives under consideration is expected to be minimal.. In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and in close proximity to the proposed PV panel areas. Therefore additional visual impacts are not expected. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives.

During the decommissioning or post closure phase of the project, all of the infrastructure will be removed, recycled or re-used off-site. The residual visual impacts of the site are expected to include scarring of the landscape in the areas affected by infrastructure. With the implementation of appropriate management measures such as rehabilitation of disturbed areas and planting of vegetation and visual screening methods at receptors / key viewpoints, this scarring and visual impact could be reduced and removed in the long-term.

7.1.4. Impacts Heritage on Heritage Resources

There were no “Heritage Sensitive Areas” identified on the Phase 1 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Phase 1 and will not be impacted by the development footprint of the PV facility. There are no heritage “no go areas” within the site development footprint for Phase 1.

With regard to magnitude and extent of the potential impacts of power lines, it has been noted that their erection generally has a relatively small impact on Stone Age sites. Sampson’s (1985) observations show this from surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon). A more permanent road would tend to be far more destructive (modification of the landscape surface within a continuous strip), albeit relatively limited in spatial extent, i.e. width. On archaeological grounds there is no reason to prefer one alternative route for the power line for Phase 1 over the other.

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure is not expected to pose additional impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary (common to all alternatives) would have localised impacts on the affected properties. This section of the route has however been previously disturbed through construction activities associated with the existing pipeline and it is therefore considered unlikely that heritage resources of significance would be found in this area. There is therefore no preferred alternative in terms of this infrastructure from a heritage perspective.

The impact of the project on **heritage resource** is rated as **low significance**. However, a preconstruction walk-through survey by an archaeologist is to be undertaken for the PV facility and associated infrastructure. Should substantial archaeological or paleontological (fossils) remains be exposed during construction, SAHRA should be alerted as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional archaeologist or palaeontologist. No further specialist palaeontological studies or mitigation were recommended for this development.

7.1.5. Social and Economic Impacts

The proposed project could have negative and positive **social and economic impacts** of **medium significance**. Phase 1 of the Zuurwater Solar Energy Facility will provide opportunities for employment and skills development in the local area. Another potential spin-off from the development is the stimulation of the local economy, including development of industries specifically to provide services and goods for solar power production, and general retail businesses. Potential negative impacts include the threats to public safety from construction and traffic activity, increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. Other impacts on the social environment include impacts associated with noise during construction, as well as impacts on traffic and infrastructure (such as local roads). It is important that potential negative effects are managed as per the recommended mitigation measures to prevent these from developing into unacceptable cumulative impacts. Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements measures (as contained in the socio-economic specialist study and draft EMPr) are utilised.

As the power line alternatives both follow the same route parallel to the existing Aggeneis-Nama 220kV power line to the Aggeneis Substation and cross the same area, there is no preference regarding these alternatives. In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and would therefore not pose additional impacts on the social environment. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is no preference regarding the reservoir location and associated water pipeline route.

7.1.6. Cumulative Impacts

The proposed Phase 1 of the Zuurwater Solar Energy Facility forms part of a larger solar energy facility comprising 6 phases with a total capacity of up to 365MW. In addition, there are other solar energy facilities proposed in the Khai Ma Local Municipality. None of these solar projects have been awarded preferred bidders status at the time of writing this EIA report.

The potential ***cumulative impacts*** as a result of the proposed Phase 1 of the Zuurwater Project and other projects in the area are expected to be associated predominantly with:

» *Visual impact* - The development of numerous similar facilities in the broader area could impact on the visual character and sense of place of the region. The cumulative impact will however to some extent be moderate due to the relatively low incidence of visual receptors in the region.

» *Flora, fauna, and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of avifauna may become cumulative if other renewable energy facilities are developed in the region. Should Phase 1 of the Zuurwater project and 5 other phases of the project and other solar projects in the Namaqualand region be developed, cumulative negative ecological impacts may occur. The significance of this impact is expected to be of a moderate significance and can result in a cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion). However, if negative impacts on ecology are effectively mitigated and managed for each project, through sound environmental management during construction and operation and by formal conservation and active management of the natural areas on site, then the negative impacts on ecosystems on each site can be within acceptable levels, and therefore in keeping with the principles of sustainable development.

» *Land-Use and agricultural potential* – The broader farm portion is 4997ha. Development of 6 phases on the broader farm will result in the loss of ~24% of Portion 3 of the farm Zuurwater 62. The remainder of the farm portion can be continued to be utilised for agricultural activities. Due to the limited crop production in the wider study area, the development of multiple solar energy facilities within the Khai Ma Local Municipality will not affect food security in the region. Due to the vast amounts of land available in the Northern Cape Province, as well as the low agricultural potential and carrying capacity of the land, cumulative impacts on land-use or agricultural potential are of acceptable levels.

» *Cumulative geology, soil and erosion potential* - although the impact of soil removal for the proposed activity has a moderate – low significance, the cumulative impact of soil removal in the area is considered low due to the undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate. The cumulative impact of siltation and dust in the area is considered low, with the legal obligation of good soil management for each project.

» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Current mining such as the Black Mountain Mine, presents a noise source, however the potential for cumulative impacts related to noise is low largely due to the low occurrence of sensitive receptors in the area.

» *Infrastructure* - Increased pressure on existing roads and other infrastructure may occur due to various projects being developed. This will require consultation with parties such as Eskom and SANRAL to prevent significant impacts on existing infrastructure in the area/ with the local municipality.

» *Heritage* –Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to 'sense of place' will occur from various projects in the region. The potential for the loss of or discovery of heritage artefacts in the Namaqualand region will also increase.

» *Impact on the Social and Economic Environment* - The establishment of a number of solar energy facilities in the area may impact negatively on the social environment as a result of issues associated with, for example, influx of people to the area and increased traffic volumes. Cumulative positive socio-economic impacts from a number of renewable energy facilities in terms of job creation and economic growth and development of infrastructure will occur at a local and district municipality level that is in need of this growth and development. This would be a significant positive impact. The adoption of management measures

will maximise the cumulative impact for local communities. Each project developed will contribute a percentage of annual profits from the solar project to social beneficiation in the local community, as required by the Department of Energy. Over at least 20 years, there will be a cumulative social benefit from multiple phases and likely from other renewable development in the surrounding areas. It is important that the social development efforts are managed effectively and efficiently in co-operation with key stakeholders over time so that they contribute progressively to enhancing the lives of surrounding communities.

7.2 Comparison of Alternatives

7.2.1. Power Line Alternatives

In terms of the specialist studies undertaken, only the ecological assessment recommended a preferred power line alternative for implementation. In this regard, **Power Line Alternative 2 is recommended as the preferred alternative** (refer to Figure 7.3) due to the power line being slightly further away from more sensitive habitat associated with the pans and Bushmanland Sandy Grassland vegetation.

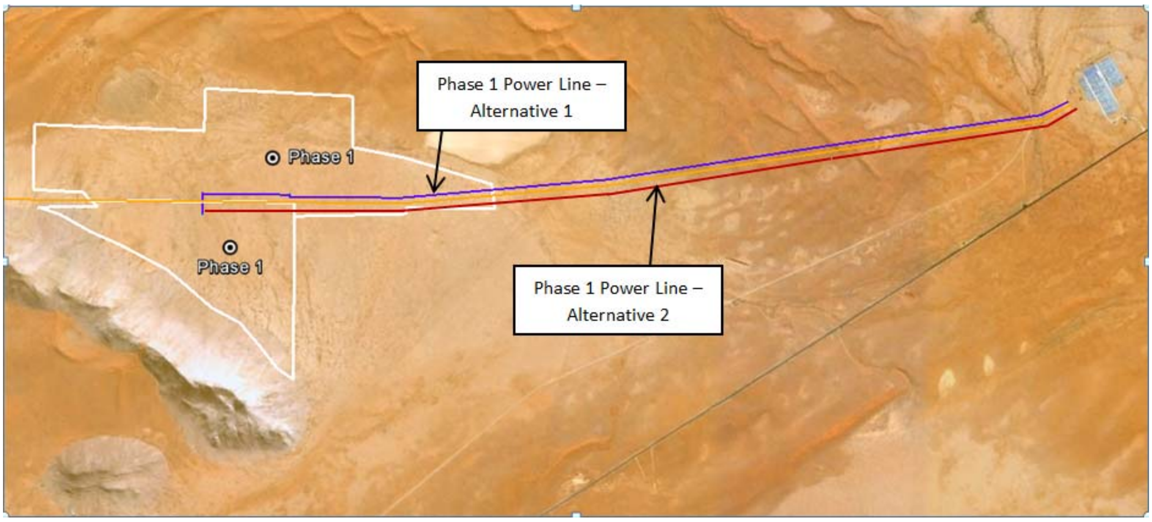

Figure 7.3: Grid Connection Routing Alternatives – Phase 1

7.2.2. Water Reservoir and Associated Pipeline Alternatives

In terms of the specialist studies undertaken, only the ecological assessment recommended a preferred reservoir and water pipeline alternative for implementation. In this regard, **Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option** due to the location of Alternative 1 and Alternative 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

7.3 Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise from the project proceeding. This could include:

- » Loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the PV project (which is limited to the development footprint of 267 hectares). The loss of biodiversity has been minimised by the careful location of the development to avoid key areas supporting biodiversity of particularly high conservation importance.
- » Visual impacts associated with the PV panels and power line.
- » Change in land-use and loss of agricultural land on the development footprint. The loss of agricultural land has been minimised through the careful placement of the development to avoid key grazing areas located in dune areas on the site.

These costs are expected to occur at a local level.

Benefits of the project include the following:

- » Given the very high level of poverty, unemployment and remoteness as well as the limited range of economic opportunity presented in this arid region, the project is poised to bring about important economic benefit at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will transpire during the preconstruction/ construction and operational phases.
- » The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix.
- » South Africa's per capita greenhouse gas emissions being amongst the highest in the world due to reliance on fossil fuels, the proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW PV project, on a like for like basis.

The benefits of the project are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project.

7.4. 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 a solar energy facility with a generating capacity of 75 MW on a site located on portion 3 of the Farm Zuurwater 62, has been established by PVAfrica Development (Pty) Ltd. The positive implications of establishing Phase 1 of the Zuurwater Solar Energy Facility on the identified site include the following:

» The potential to harness and utilise solar energy resources within the Northern Cape.
» 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 National electricity grid in the Northern Cape 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.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project 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) for Phase 1 which is included within Appendix K.

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**.

7.5. 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 Phase 1 of the Zuurwater Solar Energy 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 impacts of Phase 1 of the Zuurwater Solar Energy Facility project can be 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:

» Power Line Alternative 2 must be implemented as the preferred power line alternative.
» Reservoir and pipeline Alternative 1 must be implemented as the preferred alternative.
» The draft Environmental Management Programme (EMPr) as contained within Appendix K of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed 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 key in achieving the appropriate environmental management standards as detailed for this project. This EMPr should be viewed as a dynamic document that should be updated throughout the life cycle of the facility, as appropriate.
» All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices E to J and Appendix P must be implemented.
» An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMPr for the duration of the construction period.
» The regic sands and dunes which occur on the site are highly prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. It is, therefore, important that there should be strict adherence to the EMPr and good soil management measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project. Therefore, a

detailed stormwater management plan must be developed and implemented for the facility following final design.

» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» If any protected plant or tree species will be removed/destroyed by the developer, a collection/destruction permit to be obtained from Northern Cape Department of Environment and Nature Conservation and/or DAFF for the protected species found on site. A walk-through survey of the site development footprint (facility and the power line) will be required prior to construction commencing.
» A walk-through survey of the power line to be undertaken by an avifauna specialist prior to construction of the power line in order to highlight spans requiring bird diverters.
» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» Should substantial archaeological or paleontological (fossils) remains be exposed during construction, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
» Site rehabilitation of temporary laydown and construction areas to be undertaken immediately after construction.
» Should the facility be decommissioned, the development footprint must be rehabilitated.
» Alien invasive vegetation to be managed or removed (as required) during construction, operations, decommissioning and post-closure of the facility.
» The DoE requirement for suitable social beneficiation schemes is supported.
» Following the final design of the facility, a final layout must be submitted to DEA for review and approval prior to commencing with construction.
» Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

ASSESSMENT OF POTENTIAL IMPACTS: PHASE 2 OF THE SOLAR ENERGY FACILITY (DEA REF. NO.: 14/12/16/3/3/2/471) CHAPTER 8

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 **Phase Two** of the Zuurwater Solar Energy Facility (DEA Ref. No.: 14/12/16/3/3/2/471). This assessment is done for a 75 MW facility and for all the facility's components including:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power lines to transport the power from each Phase into the Eskom grid via the Aggeneis MTS Substation.
» A new on-site water reservoir and associated water supply pipeline (shared infrastructure between all phases)
» Internal access roads.
» Office, workshop area for maintenance and storage.
» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

The Phase 2 PV arrays are proposed to be located to the south of authorised Unit 4 and Unit 5 (refer to Figure 8.1). Phase 2 is located approximately 12km south-south-west of the town of Aggeneys (straight line distance). The proposed generating capacity for this phase is 75MW, covering an area of 209ha. An on-site substation is also proposed for this phase. A new overhead power line (up to a voltage of 275kV) is also required

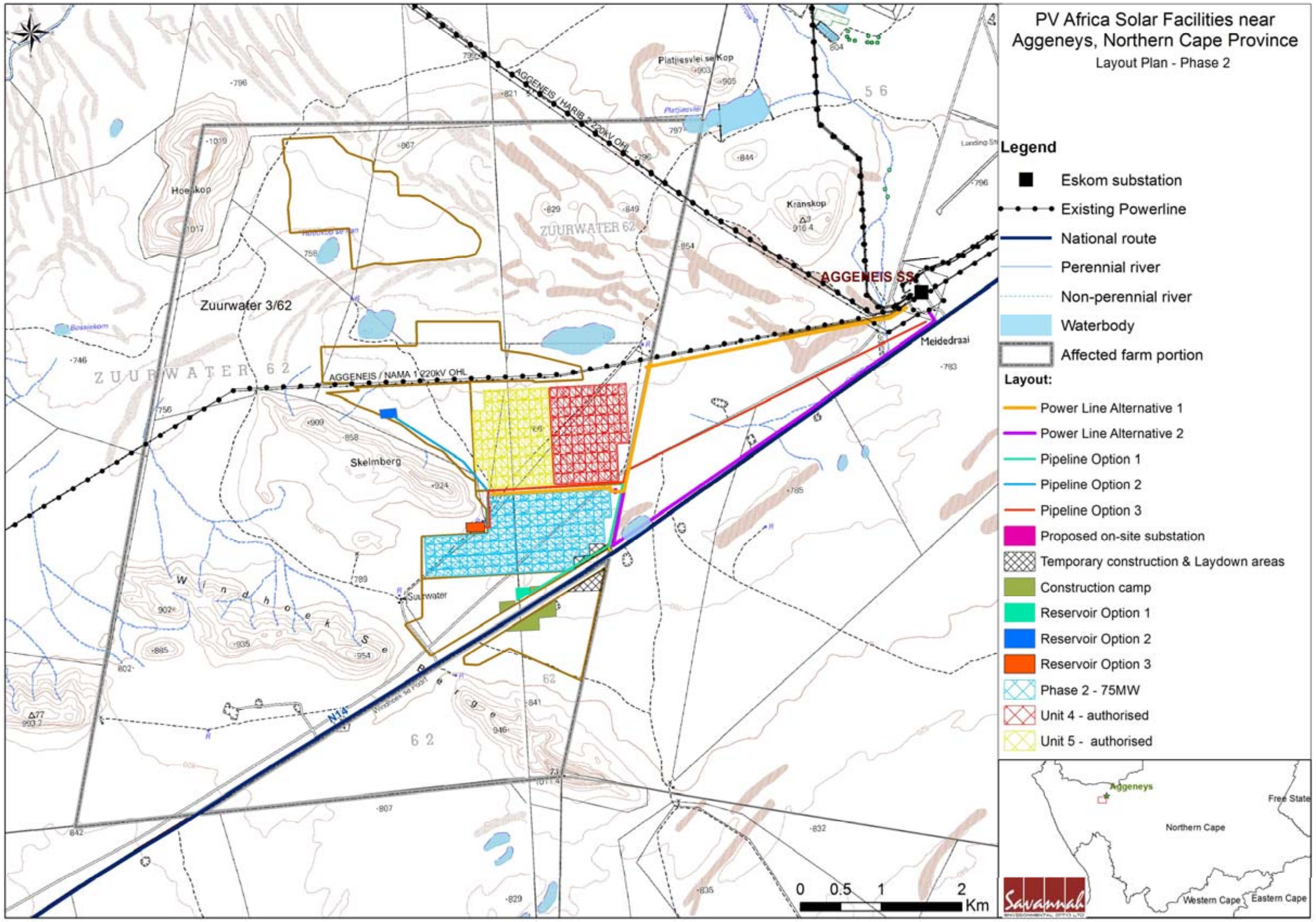

Figure 8.6: Locality / Layout Map for the 75MW PV plant on Portion 3 of the Farm Zuurwater No 62 in the Namakwa District, Northern Cape Province - Phase 2

The development of Phase 2 of the Zuurwater project will comprise the following phases:

- *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access roads, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; construction of power plant, and undertaking site rehabilitation and establishment and implementation of a storm water management plan. Construction is expected to take approximately 15-18 months.
- *Operation* – will include operation of the facility and the generation of electricity. The operational phase is expected to extend in excess of 20 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 and where feasible recycling of the components of the facility; clearance of the site and site rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

6.14. Alternatives

8.1.1. Power Line Alternatives

Two power line options are proposed for Phase 2 (refer to Figure 8.2).

- Alternative 1: This alternative is proposed in a north-west direction, adjacent to the property boundary up to the existing Aggeneis-Nama 220kV power line to the north of the site. The route then follows this power line to the Aggeneis Substation. The length of this power line alternative is ~6 km.
- Alternative 2: This alternative is proposed in a southern direction, adjacent to the property boundary up to the N14 located to the south of the site. The route then follows this road to the Aggeneis Substation. The length of this power line alternative is ~5 km.

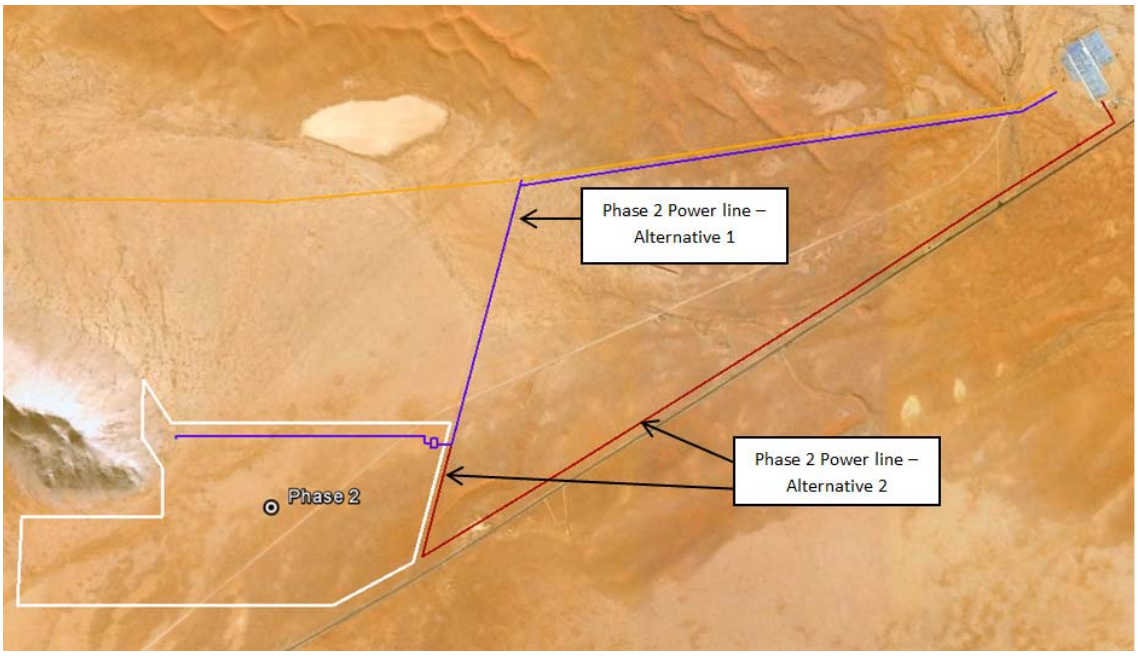

Figure 8.2: Grid Connection Routing Alternatives – Phase 2

8.1.2. Alternatives for on-site water reservoir and associated water supply pipeline

An on-site water reservoir (with a capacity of ~49 995m^3) will be developed to provide water during the operational phase to all phases of the project. This water will be sourced from the nearby Zinc Mine. An existing pipeline between the Aggeneis Substation and the property boundary will be upgraded and utilised for this purpose. A new pipeline section will be constructed within the site boundaries. This infrastructure will be shared between all phases of the project.

Two alternative locations for the reservoir have been identified for investigation (refer to Chapter 2 for more details):

» Alternative 1: The reservoir is proposed to be located within the Phase 3 area adjacent to the N14. The water pipeline is proposed to follow the site boundary in a north-west direction until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 2.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.

» Alternative 2: The reservoir is proposed to be located to the south of the Phase 1 PV Facility. The water pipeline is proposed to be routed in a south-western and then a western direction along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 3.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.

» Alternative 3: The reservoir is proposed to be located to the east of the Phase 2 PV Facility. The water pipeline is proposed to be routed in a northern direction for a short distance, and then along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 2.2km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.

8.2. Methodology for the Assessment of Potentially Significant Impacts

A broader Portion 3 of the Farm Zuurwater 62 was identified by the project developer for the purpose of establishing the proposed Phase 2 of the Zuurwater solar energy facility. The entire Farm Portion will not be utilised for Phase 2 of the solar energy facility, the developmental footprint (panels and associated infrastructure) will cover an extent of ~209ha of the 4997ha farm portion. This amount to ~4% of the entire farm portion that will be utilised in the long-term and that would suffer long-term loss / disturbance (over 20 years).

The assessment of potential issues associated with Phase 2 of the solar energy facility and cumulative impacts of the multiple phases of the larger project has involved key input from specialist consultants, the project developer, key stakeholders, and interested and affected parties (I&APs). Cumulative impacts are discussed under Section 8.11.

8.3. 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 undertaken for potential impacts associated with the construction and operation of the Phase 2 of the proposed solar energy facility on the identified site near Aggeneys. Issues were assessed in terms of the criteria detailed in Chapter 4 (Section 4.3.3). 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.

8.4. Potential Impacts on Ecology

Solar energy facilities require relatively large areas of land for placement of infrastructure. Phase 2 of the PV facility requires ~209ha. The main expected negative impacts on ecology will be due to loss of vegetation and habitat which may have direct or indirect impacts on individual flora and fauna species. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E - Ecological Impact Report** for more details). The ecological study undertaken under the previous EIA by SRK Consulting was supplemented by additional site work and a re-assessment report was completed by Savannah Environmental – Refer to Appendix E.

The majority of impacts on ecology will occur during the construction of the proposed PV facility. Impacts on this habitat type could be severely harmful to the survival of threatened species with very limited distribution ranges. Potential impacts for the construction of the solar panels, substation, power line, and the access road were identified as follows:

» Impact on the natural vegetation.
» Impact on the spread of declared weedy and alien invasive plant species.
» Impact on fauna.

The site is situated in an area of vegetation and habitat transitions on the northern edge of the Nama-Karoo and Bushmanland habitat, the western edge of the Kalahari savanna, the southern edge of the Gariep River drainage and the eastern edge of Namaqualand. On the mountains, the Aggeneys Gravel Vygieveld is considered an isolated, rainfall-impoverished and most north-eastern form of true Succulent Karoo vegetation, worthy of special protection due to several rare plant species along with some of its bird inhabitants (e.g. Cinnamon-breasted Warbler). Almost none of this and the more widespread Bushmanland Sandy Grassland vegetation unit are formally conserved. The larger area has at least thirteen plant species of conservation concern, supports four main structural habitats for fauna (with a possibility of about five red data mammals species occurring on the site). The area is further expected to host nine threatened bird species, including the Vulnerable and near-endemic Ludwig's Bustard and Red Lark that are resident and breeding on and around the site. There is a remote possibility that 2 red data reptile species can be present, and a single red data frog may occur on the site.

The habitats considered most sensitive on the farm are the red dunes and areas of deep sand, the mountains and their gravel skirts, and the proximal washes and pans. This leaves the open grassy plains, with shallow soils of mixed gravels and sands, as the least sensitive and most widespread habitat on the farm and surrounding areas. It is proposed that any development should be on the most disturbed areas of the grassy plains, with as little overlap as possible into the drainage lines.

8.4.1. <u>Summary of Ecological Features and Potential Impacts</u>

» *Flora:* The footprint of the 75MW solar energy facility is unlikely to cause widespread loss of threatened flora and/or fauna taxa or change the ecological community structure. The plant species composition on the site will change.

However the area proposed for the Phase 2 development is within the least sensitive area on Portion 3 of the Farm Zuurwater from an ecological perspective, and therefore the project is not considered to have a great influence on any rare plant or animal species. The only protected tree that occurs in the area is *Acacia erioloba* (Camel Thorn), which may be present on the sandy plains. Threatened species and Species of Conservation Concern could occur on the rocky inselbergs and/or quartz plains (however these areas are largely avoided by the development footprint of the PV panels). The effect of shading may alter the vegetation, altering plant community composition, survivorship and/or structure. If shallow excavation is necessary to level the ground first and so alter its soil structure, a slight risk of permanent transformation is expected in the long term but natural adaptation of the vegetation to soil instability (e.g. wind erosion) may mean the effects are temporary or at least capable of rehabilitation.

» *Fauna and Mammals*: From a mammal habitat perspective, it was established that two of the four major habitats are very prominent on the study site, namely terrestrial and rupiculous (rock dwelling) habitat. Of the 56 mammal species expected to occur on the study site, no less than 22 were confirmed during the site visit. Only 3 mammal red data species may occur on the site (Rüppel's horseshoe bat, Geoffroy's horseshoe bat and the Honey badger (however low probability of utilising the site). No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s). The rest of the species richness is made up from common and robust mammals with wide distributional ranges such as aardvarks, springhares, four-striped grass mouse, porcupines, the caracal, the genet, the two mongoose species, the black-backed jackal etc. The development of Phase 2 of the solar energy facility is not considered a significant threat to any bird, reptile or amphibian species, given its limited impact in space (<1,000 ha) and time (<40 years) on the widespread grassy plain habitat.

» *Habitat Loss/ fragmentation*: The PV facility will result in localised habitat fragmentation or connectivity. An increase in weed species on the disturbed areas can be expected. It should further be noted that the greatest potential for impacts to ecology will be during preconstruction/construction, as well as during decommissioning when there is the most activity including levelling and truck movement on the site. The internal access roads within the development site will contribute to habitat loss. During operation, impacts can be expected to be reduced since activities will be restricted primarily to occasional maintenance including panel-cleaning/washing.

» *Birds:* Nine species[19] of international and/or national conservation concern (Red Data species, IUCN/Birdlife International 2011, Barnes 2000), ranging

[19] Chestnut-banded Plover, Black Harrier, Lanner Falcon, Sclater's Lar, Ludwig's Bustard, Kori Bustard, Martial Eagle, Secretarybird and Red Lark. Two Vulnerable species are expected to be regular

from Near Threatened to Vulnerable, were considered as possible to occur on site, of which two were recorded during the survey (Ludwig's Bustard, Red Lark) and a third reported by the landowner (Kori Bustard). Ludwig's Bustard and Red Lark are both considered Vulnerable by IUCN criteria. The PV array is not considered a direct threat to any bird species, however the new power line is a threat to regular breeding residents (Ludwig's Bustard and Red Lark) and regular visitors to the area (Vulnerable Martial Eagle and Secretarybird, and the Threatened Lanner Falcon). The power line may impact on birds – through either collision or electrocution.

» *Herpetofauna* (Amphibians and Reptiles): Three Red Data reptiles[20] may occur on the study site. Most of the species of the resident diversity are fairly common and widespread (viz. Karoo tent tortoise, brown house snake, common egg eater, puff adder, horned adder, Cape cobra, Bibron's tubercled gecko, giant ground gecko, Anchieta's agama and western rock skink). The high species richness expected on the study site (4997 ha) is due to the size of the study site, the renowned endemic biodiversity of the Northern Cape and the presence of three of the four habitat types on the broader Portion 3 of the Farm Zuurwater 62.
» *Pans:* The broader farm portion does form part of the palaeo-drainage system of the Gariep River basin, evident on and around the site as the rather ill-defined seasonal washes and some of their pans. Phase 2 does not occur within any pans/ season washes/ water courses, however any impacts on soils and vegetation will indirectly impact on these areas. This would cause change of surface and subsurface hydrology, decline of vegetation and fauna populations dependent on the seasonal recharge of the pans.

8.4.2. Ecological Sensitivity Assessment for Phase 2

Additional fieldwork to that completed in the SRK EIA process was conducted by an ecologist to survey and assess the development area for Phase 2 of the PV Facility. This sensitivity assessment is based on a field evaluation of the site and analysis of aerial photography. The ecological sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance.

Ecological sensitivity is primarily based on vegetation composition, and has been classified by EcoAgent (2012). Using the information contained in the biodiversity

breeding residents (Ludwig's Bustard and Red Lark). The Vulnerable Martial Eagle and Secretarybird, and the Threatened Lanner Falcon are expected to be regular visitors to the area, when their prey animals are abundant, but while no sufficiently large trees were seen as likely nest sites for the Eagle or Secretarybird, the large south-facing cliffs, especially on Hoedkop, could well support nesting ledges for the falcon, as they apparently do for Verreaux's Eagle. The remaining four threatened species are expected to be erratic visitors when high rainfall creates productive conditions (plant cover, seeds, insects, small vertebrates).

[20] Namaqua plated lizard, Fisk's house snake and Namaqua stream frog.

and agricultural report, as well as observations during a field visit, the ecological sensitivity for the Phase 2 development footprint was classified as follows:

Vegetation type / plant community as defined by EcoAgent	Sensitivity as defined by EcoAgent	Re-classified sensitivity
1. Bushmanland Sandy Grassland (=Vegmap Unit Mucina & Rutherford 2006)	High	High
2.1 Grassland on sandy hummocks	*Low*	*Medium (due to higher grazing potential)*
2.2 Grassland on sandy plains	Low	Low
3 Gravelly calcrete plains(=Vegmap Unit: Aggeneys Gravel Vygieveld, Mucina & Rutherford 2006)	High	High
4. Bushmanland Inselberg Shrubveld (Vegmap Unit Mucina & Rutherford 2006)	High	High
4.1 Shrubveld on mountains, hills slopes and crests	High	High
4.2 South facing slopes	High	High
4.2.1 South-facing scree slopes	High	High
4.2.2 Steep south-facing slopes	High	High
4.3 Rocky north-facing slopes	High	High
5 Azonal vegetation	High	High
5.1 Pans	High	High
5.2 Washes	High	High

The sensitivity of the development footprint for Phase 2 is shown in the table below.

Phase 2	Vegetation	Sensitivity	Extent
New PV Arrays and access roads	Grassland on sandy hummocks	Medium	About 75 % of development on this vegetation
	Grassland on sandy plains	Low	About 15 % of development on this vegetation
	Rocky north-facing slopes	High	About 2 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.
	South facing slopes	High	About 1 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.

	Bushmanland sandy grassland	High	About 7 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.

The ecological sensitivity of Phase 2 of the PV Facility is shown in Figure 8.3. The habitats considered most sensitive on the farm are the Rocky north-facing slopes, south facing slopes and Bushmanland sandy grassland. Outliers of Important Biodiversity areas that fall within the proposed development footprint were investigated to ensure that no red data species occur within these areas and to ensure that these parts of the development do not cause unnecessary damage to biodiversity of conservation concern. Similarly, some of the proposed development footprint for Phase 2 falls onto areas designated as high sensitivity and ecological support areas. During the last field visit it was verified that in these areas, the proposed development can proceed without significantly changing ecosystem processes or causing a significant loss to sensitive biodiversity, provided the recommended mitigation measures are followed.

As shown in Figure 8.3, the majority of the site for the development of Phase 2 of the PV Facility has been classified as having a low ecological sensitivity: Areas that provide limited ecosystem services and are also of low economic value to the land-owner. Species diversity may be low. Species of conservation concern may be present on such areas, but these are not restricted to these habitats and can be relocated with ease.

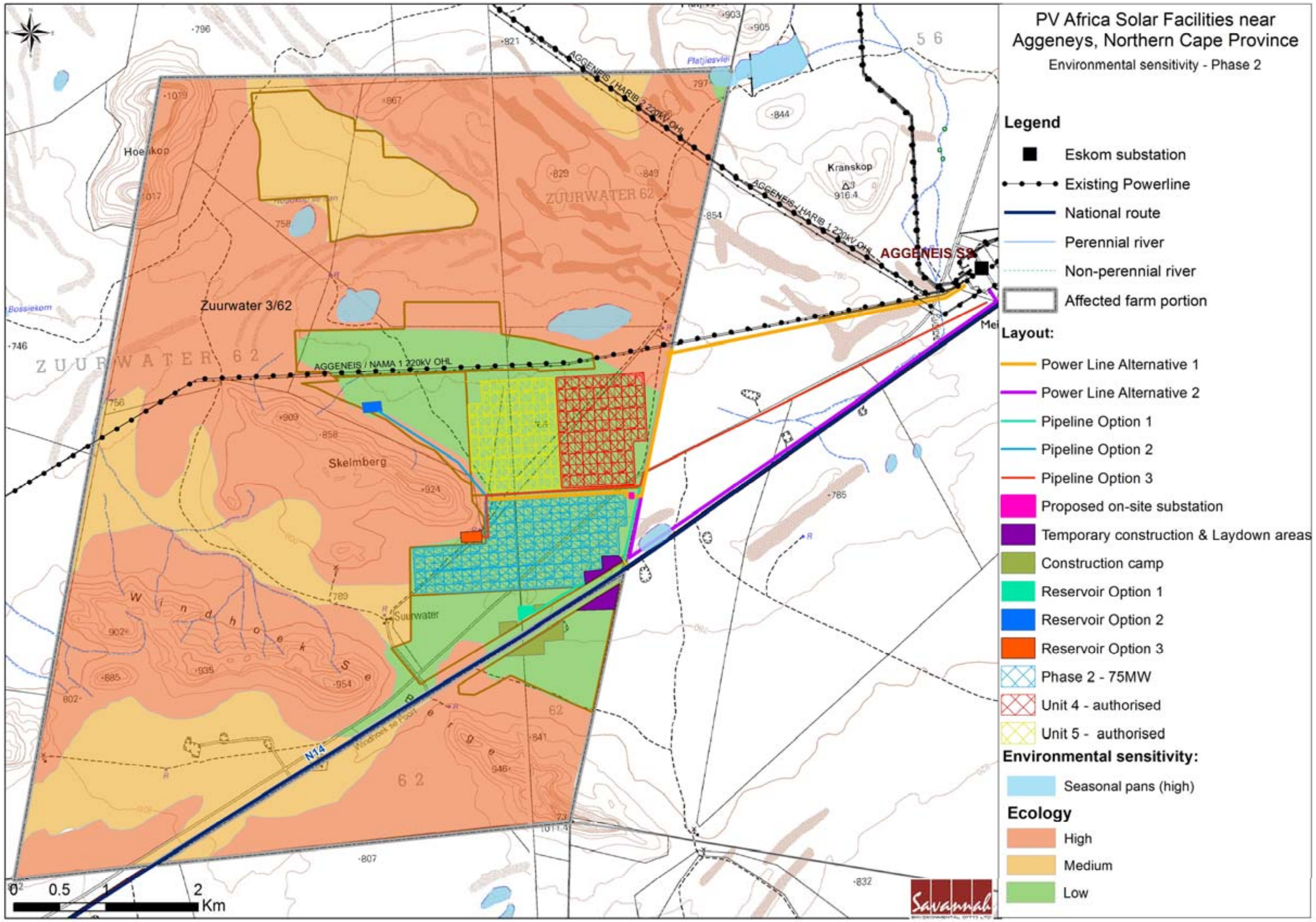

Figure 8.3: Map showing ecological sensitivity assessment ratings for the Phase 2 of the PV Facility

8.4.3. Impact tables summarising the significance of impacts on ecology (with and without mitigation)

Pre-construction/construction/decommissioning:

Impact of PV Facility on ecology without mitigation:

Impact on the functioning of affected Ecological Support Areas (ESA) by the possible change of the desired ecological state or functioning will lead to indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway, e.g. removing a corridor or altering flow of runoff, associated habitat fragmentation. The altered surface may alter runoff and biodiversity migration and composition patterns, but is not expected to significantly alter the functioning of the ESA if mitigation measures are implemented.

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Local (3)	One month – One year (2)	Temporary (2)	Highly likely (5)

Result: Medium (63)

Mitigation:

- Harvesting of plant material or other damage to fauna and flora must be prevented and avoided, and disciplinary measures to be put in place
- Chemical/petroleum/oil storage area to be bunded (using an impervious surface).
- Introduction of alien plant species must be prevented, and on-going management of alien species control should be carried out
- Disturb the surface as little as possible and only where necessary during construction
- Construct all roads and fences in such a way that they do not significantly alter existing runoff patterns and allow for ample drainage where necessary
- Undertake a rehabilitation plan of all surfaces affected immediately after construction to restore surface characteristics in such a way that it resembles the original and will allow a gradual natural re-vegetation where such has been cleared
- Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated
- Strictly prevent leakage of oil or other chemicals or any other form of pollution, be clear about immediate remedial actions that must be taken should accidental spills occur
- Make use of existing tracks as far as possible, where additional construction activities or maintenance is required, ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery
- Ensure an adequate plant search and rescue program prior to commencement

of activity, especially geophytes and succulents may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during occasional heavy 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 (storm water and erosion management plan required, together with revegetation of adjacent areas) » After decommissioning, if the access road or portion thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation » As soon as the areas affected have been demarcated, carry out a thorough search and rescue operation of all plant species of conservation concern by a horticultural specialist or suitably qualified staff and the ECO before any disturbance or heavy machinery in the area will be allowed. » Note: many of the species of conservation concern are very small or bulbous species may be dormant, necessitating follow-up work when topsoil will be removed. » Ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during occasional heavy rainfall events, yet preventing erosion of the track and surrounding areas				
Impact of PV Facility on ecology with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Project Specific (2)	One month – One year (2)	Temporary (2)	Unlikely (3)
Result: Low (30)				

Operation

Impact of PV Facility on ecology without mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: Medium (90)				
Mitigation:				

» Harvesting of plant material or other damage to fauna and flora must be prevented and avoided, and disciplinary measures to be put in place » Chemical/petroleum/oil storage area to be bunded (using an impervious surface). » Training and awareness programmes for employees on the significance of the ecology to be carried out at regular intervals » Implement on-going management of alien species control » Implement measures to ensure no living organisms can come into contact with or entangled by any electrical wiring that might cause short circuits, injury or death. » Implement storm water management measures. » Ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery » Maintain vegetation cover in areas outside the PV arrays.				
Impact of PV Facility on ecology with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: Medium (90)				

Impact of the power line and substation on threatened birds during operations without mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Slightly Harmful (4)	Local (3)	Life of Operation (4)	Permanent (5)	Possible (4)
Result: Medium (99)				
Mitigation: » Limit disturbance to the proposed substation site and power line site and ensure that minimum disturbance takes place in the surrounding area. » Power line construction should take fauna into account, especially birds and nesting sites. » A avifauna walk through survey to be conducted prior to construction to determine is power lines need to be fitted with 'flappers' to make the power lines more visible to the birds. » An avifauna specialist should ground-truth the power line construction areas before development commences in order to ensure no breeding pairs or chicks of conservation significant species are located in the areas and, if there are, how to mitigate the situation before construction begins. » No power line towers may be placed within 32 m of a pan.				

Impact of the power line and substation on threatened birds with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Unlikely (2)
Result: Low (63)				

Impact of water reservoir on ecology without mitigation: Impacts are expected to be restricted to the actual temporary construction areas only, and with the necessary mitigation measures implemented, surroundings should not be further affected. Rehabilitation of areas that have been disturbed should occur within 1-5 years of construction.				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Activity Specific (1)	Life of Operation (4)	Permanent (5)	Possible (4)
Result: Medium – High (81)				
Mitigation: ▪ No temporary water tanks may be established on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater. Therefore, reservoir alternative 1 should be implemented as the preferred option. ▪ Keep areas affected to a minimum ▪ As soon as the areas affected have been demarcated, first carry out a thorough search and rescue operation of all plant species of conservation concern by a horticultural specialist or suitably qualified staff and the ECO before any disturbance or heavy machinery in the area will be allowed. o Note: many of the species of conservation concern are very small or bulbous species may be dormant, necessitating follow-up work by the ECO where topsoil will be removed o Remove all geophytes and succulents that can be transplanted, keep in a designated on- or off-site nursery and use as far as possible in rehabilitation efforts ▪ Prior to the disturbance of any area, the ECO must assess the area for any burrowing mammal, reptile or amphibian and relocate such to a similar habitat out of the footprint area o Ensure that all materials stored on this area are done in such a way that they do not attract and cannot entrap any fauna for the duration of the use of these areas ▪ If topsoil needs to be removed, volumes need to be estimated and adequate areas designated for the storage and/or rehabilitation of such topsoil. Such areas will also be subject to a detailed search and rescue operation as above				

prior to any disturbance taking place.

- Keep leveling earthworks and soil disturbance to the minimum practically possible, implement a comprehensive topsoil management, soil erosion control and rehabilitation plan once layouts have been finalised
- Utilise areas as close as possible to existing or future permanent infrastructure, keep buffer zone of the legally required 32 m as a minimum, preferably up to 100 m or more around significant ephemeral drainage lines and/or seasonal pans
- Remove as little indigenous vegetation as practically possible, rehabilitate and revegetate all areas not used further immediately after construction
  - Indigenous vegetation that is removed (except species that will be replanted) should be shred and re-applied as mulch or incorporated into re-applied topsoils.
- Monitor the area regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and revegetation efforts accordingly
- Strictly prevent leakage of oil or other chemicals and pollutants

» Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Impact of water reservoir on ecology with mitigation:

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Slightly Harmful (3)	Activity Specific (1)	Life of Operation (4)	Permanent (5)	Possible (4)

Result: Medium (72)

Alteration of seasonal recharge patterns of nearby pans and washes without mitigation:

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)

Result: Medium (90)

Mitigation:

» Ensure all mitigation recommendations for PV arrays and access roads are implemented

» Ensure that runoff to pans is adequately slowed down to prevent erosion, but not obstructed or deflected to such an extent that runoff patterns into the pans are changed

» Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and re-vegetation efforts accordingly

» Aim to maintain a reasonable cover of indigenous perennial vegetation throughout the operational phase within and on the periphery of the PV array, preferably low density perennial grasses that can be mowed as need be to reduce fuel loads » Monitor the establishment of alien invasive species around pans and remove as soon as detected, whenever possible before regenerative material can be formed				
Alteration of seasonal recharge patterns of nearby pans and washes with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Insignificant (1)	Project Specific Local (2)	Life of Operation (4)	Permanent (5)	Unlikely (4)
Result: Low (63)				

8.4.4. Impact Summary

Despite the harshness of the environment, a multitude of specially adapted species occur in the many niches provided by the variable landscapes of the area. Most of this biodiversity is concentrated on the mountains and on gravel plains. Vegetation on the less sensitive sandy plains is relatively dynamic and may change dramatically between different seasons, indicating that rehabilitation of disturbed land should be achievable if topsoils are disturbed as little as possible and maintained in a manner that enables the survival of the extensive seed banks within them.

Overall, the impacts can be summarised as follows:

- The proposed Phase 2 of the photovoltaic solar energy facility may have long-term negative impacts on the ecology of the land portion / development footprint and landscape features within it if mitigation measures are not strictly adhered to or implemented
- Potential negative impacts on the ecological environment would be loss of biodiversity and associated soil degradation as a result of construction and operation of the facility, possible introduction of alien invasive plants and a long-term loss of vegetation.
- A loss of habitats for flora and fauna will occur with the alteration of large areas occupied by the proposed development. The placement of different components of the proposed development has been optimised according to ecological recommendations. This, coupled with the implementation of mitigating measures by the developer, contractors, and operational staff will enable the retention of basic functionality of the ecosystems affected and hence greatly reduce the negative impact of the development.

- The impact on fauna is expected to be negligent within the development footprint. Animals that may be present are mobile and will move away during construction, possibly resettling after construction. No restricted or specific habitat of vertebrates will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas.
- Vegetation cover is expected to change due to the changed environment within and around the proposed development. Rehabilitation and continued monitoring must be carried out until the decommissioning phase to ensure that a stable and functional vegetation cover is established and maintained.
- Phase 2 does not occur within any pans/ season washes/ water courses, however any impacts on soils and vegetation will indirectly impact on these pans.

From an ecological perspective, it should therefore be feasible to develop the Phase 2 PV facility and associated infrastructure as proposed whilst retaining the conservation value and ecological function of the area.

8.4.5. Comparative Assessment of Power Line Alternatives

For Phase 2, **Power Line Alternative 1 is the ecologically preferred option** as this power line will run adjacent to the PV arrays and an existing Eskom power line, thus keeping the entire footprint more compact, which will limit further habitat and vegetation fragmentation.

8.4.6. Comparative Assessment of Water Reservoir and associated pipeline alternatives

For Phase 2, **Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option** due to the location of Alternatives 1 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

8.4.7. Implications for Project Implementation

- No temporary infrastructure (such as reservoir Alternatives 1 and 3) may be established on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater.
- If any protected plant or tree species will be removed/ destroyed by the developer, a collection/destruction permit is to be obtained from Northern Cape Department of Environment and Nature Conservation for the protected species found on site
- Mitigation measures as contained in the EMP must be employed during construction and operations to manage impacts on ecology.

- Site rehabilitation of temporary laydown/ construction areas to be undertaken immediately after construction.
- Should the facility be decommissioned, the development footprint must be rehabilitated.
- Alien invasive vegetation to be managed/ removed (as required) during construction, operations, decommissioning and post-closure of the facility.
- A walk through survey to be undertaken by an ecologist prior to construction of the facility and the power line.
- A walk through survey of the power line to be undertaken by an avifauna specialist prior to construction of the power line.
- An Environmental Management Programme (EMP) must be implemented during the development of the solar energy facility.

8.5. Potential Impacts on Soils and Agricultural Potential

8.5.1. Impacts on Soils

The regic sands which occur on the site are very prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. The extremely flat nature of the development site means that areas can be prone to widespread surface wash during occasional intense rainfall events. Increased erosion potential will result from scouring effect on drainage lines due to run-off from hard surface areas, as well as increased erosion from areas of exposed soils. Failure to avoid and minimise civil works in wash areas could result in erosion and sedimentation. Extensive removal of vegetation from the development site could also leave the area prone to both water- and wind erosion. Furthermore, unless stocking rates are well managed, temporary removal of a portion of the farm from available grazing (the proposed development site) could increase pressures on the remainder of the farm. The risk of erosion at a larger scale is minimised by the high infiltration rates of the soils, combined with the fact that surface drainage is associated with an endorheic pan (closed system with no outflow to neighbouring catchments). Dust, due to loose soil is also a potential impact, mainly during the construction phase.

Activities that may have an impact on soils include:

- Solar facility footprint (i.e. an array of PV panels, mounting structures, underground cabling between project components and fencing)
- Construction and positioning of internal access roads
- Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)
- Construction and operation of the on-site substation

» Construction and positioning of the on-site workshop area for maintenance, storage, and offices and temporary construction/ laydown areas.

The potential impacts on soil include:

» Soil loss/ erosion
» Soil contamination
» Loss of agricultural land

8.5.2. Impact tables summarising the significance of impacts on soils (with and without mitigation)

Pre-construction/construction

Potential soil erosion without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Permanent (5)	(Daily)4	(Likely)4
Result: Medium-High (96)				
Mitigation: » Avoid disturbance to pans/ seasonal washes. » Minimise the removal of vegetation and the disturbance of topography » Design and construct/install measures which will prevent erosion from panel-washing during operation, to ensure that this is adequately dissipated to sheet flow » Ensure adequate dissipation of concentrated flow to sheet flow from hard surfaces (including panels) to avoid and minimize erosion. This can be achieved by strategically placing stone downstream of hardened surface areas » Place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where appropriate. » Avoid construction during heavy rainfall events where possible. » Implement stormwater management and other erosion (including wind) prevention measures » Construction vehicles are to remain within the development area and avoid unnecessary disturbance.				
Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Project Specific (2)	Between one-ten years (3)	Temporary (3)	Unlikely (3)
Result: Low (42)				

Operation

Potential soil erosion without mitigation:				
Severity	**Spatial**	**Duration of**	**Duration of**	**Frequency of**

	extent	**impact**	**activity**	**impact**
Harmful (4)	(Project Specific) 2	Life of operation (4)	Life of operation (4)	Possible (4)
Result: High (99)				
Mitigation: » Minimise the removal of vegetation and disturbance of topography » Place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where appropriate » Ensure timeous repair of erosion » Maintain measures which will prevent erosion from panel-washing during operation, to ensure that this is adequately dissipated to sheet flow » Maintain measures which will prevent erosion from water/waste treatment works to ensure that this is adequately dissipated to sheet flow » Ensure adequate dissipation of concentrated flow to sheet flow from hard surfaces (including panels) to avoid and minimize erosion. This can be achieved by strategically placing stone downstream of hardened surface areas » Ensure timeous repair of erosion, and place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where required				
Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Project Specific (2)	Life of operation (4)	Life of operation (4)	Unlikely (3)
Result: Medium (63)				

Decommissioning

Potential soil erosion without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One Month – One Year (2)	Temporary (2)	Definite (5)
Result: Medium (56)				
Comment / mitigation: » Removal of PV panels and associated infrastructure » Soils surface to be graded to be free-draining » Rehabilitate disturbed areas to original agricultural potential and re-vegetate using appropriately chosen indigenous grasses » Ensure timeous repair of erosion, and place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where required » Continue monitoring until it can be demonstrated that vegetation is self-sustaining and no erosion channels exist (approximately 2 years following completion of decommissioning)				

Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Activity Specific (1)	One Month – One Year (2)	Temporary (2)	Likely (4)
Result: Low (30)				

Pre-construction/construction/operation/decommissioning

Soil Contamination: Impact Without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium- High (80)				
Comment / mitigation: » Conduct regular maintenance of vehicles to avoid and minimise leaks within a dedicated area. » Ensure legislative requirements are met for sanitation » Chemical/petroleum/oil storage area to be bunded (using an impervious surface). » Carry out regular maintenance of any on-site chemical/petroleum/oil storage tank » Implement disposal of e-Waste or hazardous waste at an appropriately licensed landfill site » Carry out rehabilitation following leaks and spills » Conduct removal of contaminated soils to suitable licenced landfill sites » During maintenance activities of the substation, used oils and old transformers must be disposed of correctly. Used transformers are classified as hazardous waste and should be disposed of at a hazardous landfill site.				
Soil Contamination: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	Life of Operation (4)	Infrequent (3)	Unlikely (3)
Result: Low (42)				

Pre-construction/construction/decommissioning

Dust due to loose soils: Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One to ten	Regularly (4)	Likely (4)

		years (3)		
Result: Medium (72)				

Comment / mitigation:

» Keep the amount of land that needs to be cleared (or development footprint) to a minimum at any given time thereby reducing the amount of erodible surface area;
» Remain on designated roads/tracks
» Rehabilitate after construction and decommissioning. Where possible, re-vegetation of the land should be undertaken with indigenous vegetation immediately after construction is completed in areas that will not be used during the operational phase
» Soil stockpiles should be stored in sheltered areas at the site on the leeward side of hills and inselbergs and covered where possible
» Limit speed at the site to < 40 km/hr and enforce code of conduct for operation of vehicles
» Should the prevailing wind speed increase to levels above 5.4 m/s (~20 km/hr), any land clearing activity should be stopped until wind speeds decrease to below the afore mentioned threshold level
» Utilise dust suppression measures, particularly on access roads

Dust due to loose soils: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (3)	One to ten years (3)	Regularly (4)	Seldom (4)
Result: Medium (64)				

Operation

Dust due to loose soils: Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (3)	Life of Operation (4)	Life of Operation (4)	Infrequent (3)
Result: Medium (63)				

Comment / mitigation:

» Vehicles to utilise designated roads/tracks
» Rehabilitate after construction and decommissioning. Where possible, re-vegetation of the land should be undertaken with indigenous vegetation immediately after construction is completed in areas that will not be used during the operational phase;
» Soil stockpiles should be stored in sheltered areas at the site on the leeward side of hills and inselbergs and covered where possible;
» Limit speed at the site to < 40 km/hr and enforce code of conduct for

operation of vehicles » Should the prevailing wind speed increase to levels above 5.4 m/s (~20 km/hr), any land clearing activity should be stopped until wind speeds decrease to below the afore mentioned threshold level » Utilise dust suppression measures, particularly on access roads				
Dust due to loose soils: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Local (2)	Life of Operation (4)	Life of Operation (4)	Very Seldom (2)
Result: Low (42)				

8.5.3. Impacts on Land Capability and Agricultural Potential

Agricultural potential is primarily determined by the suitability of the soil profile to support crop production. The soil needs to be adequately thick to support root development and the drainage characteristics need to be good to prevent chemical crusting on the surface. In addition to the soil characteristics, climatic factors are also important because the annual rainfall needs to be adequate to sustain a viable crop production. A major limiting factor in terms of agricultural potential on the site is the availability of water for irrigation as the site is ~40km from the Orange River. The agricultural potential of the site is low and limited to extensive grazing due to the low rainfall in the area. Portion 3 of the Farm Zuurwater has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The current land use is livestock farming on Portion 3 of the Farm Zuurwater, predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring. The proposed site supports natural vegetation interspersed with current and past grazing lands.

No areas with arable potential occur and this is due to a lack of rainfall or irrigation potential. The carrying capacity is typically 4 large stock units (LSU)/100 ha. No grazing or agriculture will take place at the footprint of the solar panels and associated infrastructure (i.e. ~209ha of the 4997ha farm portion), which was sited considering the current agricultural activities. However the remainder of the site will continue the current land use – i.e. grazing of livestock. At the end of the project life, it is anticipated that removal of the solar panels would enable the majority of the land to be rehabilitated and used for a suitable land-use or activity. Therefore, the impact of the PV Facility on land capability and agricultural potential is not significant and will not impact on food security of the country.

8.5.4. Impact tables summarising the significance of impacts on agricultural potential (with and without mitigation)

Preconstruction/Construction/Operation

Impact on agricultural potential without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Project Specific (2)	Life of operation (4)	(Life of Operation) 4	Likely (4)
Result: Medium (80)				
Comment / mitigation: » Avoid unnecessary removal of vegetation cover and soil » Rehabilitate disturbed areas to original agricultural potential and re-vegetate using appropriately chosen indigenous grasses » Allow access of livestock and wildlife to grazing on the broader farm portion (outside of the development footprint) » Maintain on-going interaction with the farmer regarding appropriate stocking rates on the development area, and the farm as a whole				
Impact on agricultural potential with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	Life of operation (4)	Life of operation (4)	Unlikely (3)
Result: Low (49)				

Decommissioning

Impact on agricultural potential without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One Month to One Year (2)	Life of operation (4)	Likely (4)
Result: Medium (64)				
Comment / mitigation: » Remove all PV panels and associated infrastructure » Rehabilitate disturbed areas to original agricultural potential and revegetate using appropriately chosen indigenous grasses.				
Impact on agricultural potential with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	One Month to One Year (2)	Temporary (2)	Unlikely (3)
Result: Low (25)				

8.5.5. Comparative Assessment of Power Line Alternatives

No preference made as the soils associated with both power line alternatives are fairly uniform.

8.5.6. Comparative Assessment of Water Reservoir and associated pipeline alternatives

No preference made as the soils associated with both alternatives are fairly uniform.

8.5.7. Implications for Project Implementation

- The regic sands and dunes which occur on the site are very prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines.
- It is therefore important that there should be strict adherence to the Environmental Management Program and good soil management measures regarding the management of storm water runoff and water erosion control should be implemented during all phases of the project.
- With the use of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

8.6. Assessment of Potential Impacts on Heritage & Palaeontology

8.6.1. Archaeology

Disturbance of the soil on the proposed development site could potentially have a destructive impact on heritage resources where these are present. The key risks to heritage resources are during the preconstruction and construction phases when site-clearing and preparation are undertaken. Disturbance of surfaces includes any construction including any *clearance* of, or *excavation* into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible).

The heritage study and palaeontology study did not reveal any significant heritage resources on the site. Very sparse heritage traces were found in the development footprint areas and broader farm portion.

On the plains extremely minimal traces were found. A single quartz flake was noted in an erosion feature at 29.32997º S 18.74865º E; and, intriguingly, a single quartz biface (ESA) was found in a deflation area at 29.33123° S 18.74606° E. No other artefacts or notable features were found in association with these. Such completely isolated single-artefact finds could not be considered as constituting "sites" in a conventional archaeological or heritage sense. These observations noted fall under Type 1 for Classes 1-7, again reflecting low heritage significance, low potential and absence of contextual and key types of evidence.

In all instances the impact of the PV Facility, if any, would be local. Impacts on heritage and archaeological resources may be mitigated and hence classed as 'short term' but the original in situ context is usually altered in a 'permanent' way. If the archaeological or heritage significance of the resources in question are considered to be low – which is the case here – then the significance of the permanent loss is low. The probability of impacts on heritage including archaeological resources is Improbable. Subject to pre-construction ground-truthing, no 'Phase 2' mitigation work is regarded as necessary in terms of present development layout.

However, in the event that any heritage feature (which may be sub-surface, such as an unmarked grave) is encountered during the development or operational life of the facility, work is to be halted immediately and contact made with SAHRA (Ms C. Scheermeyer at 021-4624502) and/or the Northern Cape Heritage Authority Ngwao Bošwa jwa Kapa Bokone (Mr A. Timothy) who would arrange for the evaluation of the find for possible mitigation.

From an archaeological perspective the observed heritage resources are of very low significance (low occurrence). Criteria used here for impact significance assessment rate the impacts as Low (even taking into consideration the fact that for heritage traces, unlike biological processes, impacts tend to be irreversible, of permanent duration and high magnitude).

8.6.2. Impact tables summarising the significance of impacts on heritage sites, or objects (with and without mitigation

Pre-construction/construction/operation/decommissioning

Destruction of heritage resources/ sites – PV facility: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project Specific (2)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (48)				
Mitigation:				

» In the event that heritage resources are found, the South African Heritage Resources Agency and Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority) should be informed and necessary permits obtained » Although unlikely, where necessary, arrangements for in situ preservation should be made with the heritage authorities				
Destruction of heritage resources/sites – PV facility: impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Activity Specific (1)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (36)				

Destruction of heritage resources/ sites – power line: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (1)	Permanent (5)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (16)				
Mitigation: » Mitigation measures are not considered necessary.				
Destruction of heritage resources/sites – power line: impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (1)	Permanent (5)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (16)				

8.6.3. Impacts on Palaeontology

The Mid Proterozoic basement rocks of the Namaqua-Natal Province are entirely unfossiliferous (Almond & Pether 2008). The fossil record of the Kalahari Group as a whole is generally sparse and low in diversity; no fossils are recorded here in the recent Pofadder geology sheet explanation by Agenbacht (2007). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying Dwyka Group may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (e.g. Hodotermes, the harvester termite), ostrich egg shells (Struthio) and shells of land snails (e.g. Trigonephrus) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (e.g. Corbula, Unio) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels. The younger fluvial and alluvial sands and gravels within the proposed development area are unlikely to contain any substantial fossil or subfossil remains.

The overall palaeontological sensitivity of the Precambrian basement rocks, as well as of the Kalahari Group and younger sediments mapped within the study region, ranges from zero to low (Almond & Pether 2008). The proposed development has a small footprint and deep excavations are not envisaged for photovoltaic installations. The paleontological sensitivity is also relatively low for sediments such as the Precambrian basement rocks, Kalahari group rocks and younger sediments, meaning that the proposed developments will have minimal impact (Almond & Pether, 2008). For these reasons, no further palaeontological specialist palaeontological studies or mitigation are recommended for this development.

However, should substantial fossil remains be exposed during construction; however, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.

8.6.4. Impact tables summarising the significance of impacts on Palaeontology sites, or objects (with and without mitigation).

Pre-construction/construction/operation/decommissioning

Destruction of fossils: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project	Life of	Life of	Highly Unlikely

	Specific (2)	Operation (4)	Operation (4)	(2)
Result: Low (48)				
Mitigation: » In the event that fossils are found, the South African Heritage Resources Agency and Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority) should be informed and necessary permits obtained » Although unlikely, where necessary, arrangements for in situ preservation should be made with the heritage authorities. » Should human remains be uncovered during construction/ excavations, this must be reported to the nearest police station.				
Destruction of fossils with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Activity Specific (1)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (36)				

8.6.5. Comparative Assessment of Power Line Alternatives

With regard to magnitude and extent of the potential impacts of powerlines, it has been noted that their erection generally has a relatively small impact on Stone Age sites. Sampson's (1985) observations show this from surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon). A more permanent road would tend to be far more destructive (modification of the landscape surface within a continuous strip), albeit relatively limited in spatial extent, i.e. width. On archaeological grounds there is no reason to prefer one alternative route for the power line for Phase 2 over the other.

8.6.6. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure is not expected to pose additional impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary (common to all alternatives) would have localised impacts on the affected properties. This section of the route has however been previously disturbed through construction activities associated with the existing pipeline and it is therefore considered unlikely that heritage resources of significance would be found in this area. There is therefore no preferred alternative in terms of this infrastructure from a heritage perspective.

8.6.7. Implications for Project Implementation

» No "Heritage Sensitive Areas" were identified on the Phase 2 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Phase 2 and will not be impacted by the development footprint of the PV facility.
» It was concluded that there are no heritage "No Go Areas" within the site and that the development could go ahead as planned.
» A preconstruction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» Should substantial archaeological or paleontological (fossils) remains be exposed during construction, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
» No further palaeontological specialist palaeontological studies or mitigation are recommended for this development.

8.7. Assessment of Potential Visual Impacts

Potential visual impacts of Phase 2 of the PV Facility are discussed in this Section, with cumulative visual impacts of multiple phases of this project and approved projects in the area being dealt with separately under Section 8.10.

8.7.1. Visual Character and Quality of the Study Area

The Zuurwater site is located approximately 20km south-west from the town of Aggeneys in the Northern Cape Province of South Africa. The site is located in a sparsely populated and remote area. The Black Mountain Mine is located approximately 9km to the north-north-east of the site. The site is located adjacent to the N14 highway, which runs west to east between the town of Springbok and Pofadder. Eskom's existing Aggenies Substation is located approximately 5km to the east of the site. The area is very flat, with large open plains. The skyline is broken by small rocky outcrops called inselbergs. The visual character of the area is characterised by a changing landscape character associated with the interface between natural areas and modified rural / pastoral or agricultural zones. The skyline is broken by the small inselbergs to the west of the site, which are the only major natural features in the landscape. The landscape is disturbed to the east of the site due to the presence of a large Eskom substation and the mining activities at Black Mountain; however these features are relatively far from the site. Due to this the visual quality rating for the area could be described as medium, due to the lack of natural features in the landscape and some disturbances to the landscape in the east.

8.7.2. Sense of Place

An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places. Lynch defines 'sense of place' as "the extent to which a person can recognise or recall a place as being distinct from other places – as having a vivid or unique, or at least a particular, character of its own" (Lynch, 1992:131). The area around the proposed Zuurwater site is barren and sparse in terms of natural features. In terms of being distinct from other areas, this site is situated along the main road between Springbok and Pofadder; the landscape between these two towns is flat and barren, with some small hills breaking the skyline. Thus this site is not different from the surrounding landscape in its current form. Altering the site through developing the PV arrays may change the sense of place for the site. This change could impact on the sense of place, as the sense of place of the site could allow for the site to be unique in the area. Currently, the sense of place for the site is low.

8.7.3. Visual Receptors

The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon. Sensitivity is also dependent on the viewer's perception of the area and their ability to adapt to changes in the environment. This can also include how frequently they are exposed to the view, i.e. static views from houses would have a higher sensitivity than transient views experienced by motorists. The following potentially sensitive areas exist in the study area:

» The farmers located adjacent to the site (landowners);
» Aggeneys residents; and
» Road users travelling west and east along the N14.

Based on the analysis undertaken, the following individuals could potentially be more sensitive to the development:

» Local residents; and
» Road users travelling along the N14.

It must be noted that whilst on site, traffic flow along the N14 was considered. Whilst a traffic count was not undertaken, it was noted that there were very few motorists travelling between Aggeneys and Springbok. However, it was not known if traffic volumes increase during holiday seasons. The viewer sensitivity are ranked from High (5) to Low (1) based on the probable perceptions of the viewers and their willingness to change.

8.7.4. Visual Exposure / Viewshed

Visual exposure is determined by the zone of visual influence or “the viewshed”. A viewshed is a subset of a landscape unit (envelope) and is the topographically defined area that includes all the major observation sites from which the proposed development will be visible. The boundary of the viewshed demarcates the zone of visual influence. It must be noted for the study of the visual impact of the proposed activities at the Zuurwater Site, each of the activities were investigated separately. Each of the activities was modelled on a hypothetically flat surface. Areas on this surface, where the given activity may be visible, are highlighted. The viewshed is shown in Figure 8.4.

The Phase 2 PV arrays are proposed to be located towards the southern section of the larger property, to the south of authorised Unit 4 and Unit. Phase 2 is located approximately 12km south-south-west of Aggeneys (straight line distance). Phase 2 is positioned ~12km from the town of Aggeneys. Phase 2 is positioned approximately 130m from the N14 road. This places the N14 viewers into the adjacent category of the visibility and distance rating, however these users can be considered to be transient, whilst the majority of potential viewers (Aggeneys residents) lie with the background category. Thus, the rating is calculated as Background (1).

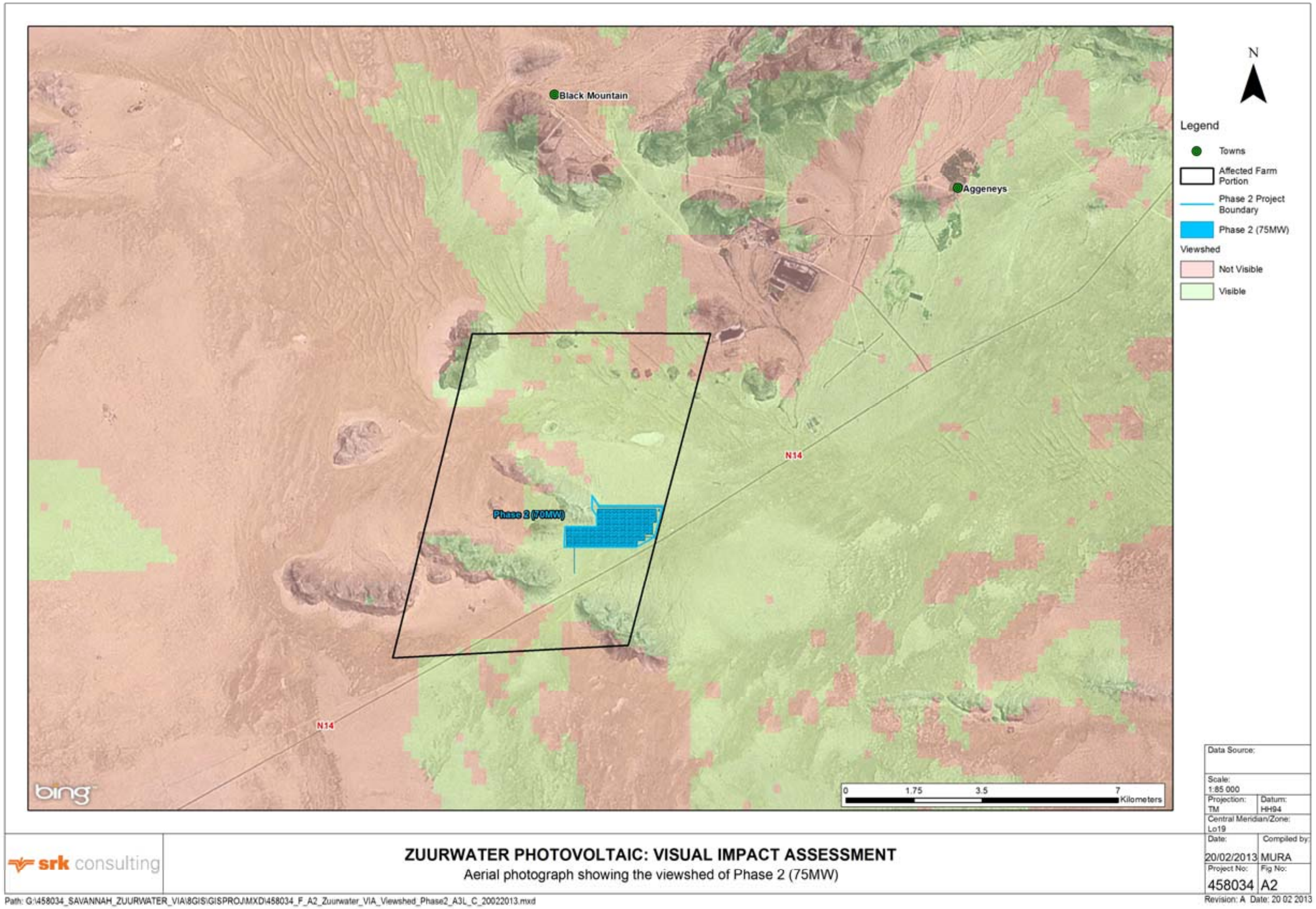

Figure 8.4: Viewshed for Phase 2 of the PV Facility on Portion 3 of the Farm Zuurwater

During the pre-construction and construction phases of the development of the Zuurwater site, there is potential for a visual impact. This impact could stem from the clearing of sections of the landscape, as well as setting aside areas for the assembling of the infrastructure on the site. It is expected that these visual impacts will be localised to the N14 in the beginning, expanding to a larger area of influence as the size of the excavations increase. During the operational phase, as indicated in the viewshed, the PV panels would be visible from a large distance from the site. The nature of the natural vegetation (i.e. low growing) and the flat topography in the area allows for unobstructed views from various viewpoints in the landscape. It must however be noted that existing infrastructure – Eskom power lines and substation – do aid in reducing the impact of the PV panels in places.

During the decommissioning or post closure phase of the project, all of the infrastructure will be removed, recycled or re-used in other projects off-site. The visual impacts of the site are expected to be scarring of the landscape where the existing farm roads were used, as well as where the PV panels were placed. With correct management measures, this scarring and visual impact could be reduced.

8.7.5. Impact tables summarising the significance of visual impacts of the PV facility (with and without mitigation)

Preconstruction/construction/decommissioning

Visual impact without mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Local (3)	One to ten years (3)	Temporary (2)	Possible (4)
Result: Medium (60)				
Mitigation: » Minimise the size of the laydown area and work areas » Implement strict procedures for location and management of the construction site, laydown and work areas » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Minimise reflective surfaces » Appropriate choice of colour for buildings » Ensure the site is kept neat and tidy (free of litter and refuse) at all times » Any disturbance to the sparse vegetation on site should be kept to a minimum				
Visual impact with mitigation:				

Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Project specific (2)	One to ten years (3)	Temporary (2)	Seldom (3)
Result: Low (40)				

Operation

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium-High (88)				
Mitigation: » Put in place measures for the efficient management of the facility » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Ensure that the PV panels do not cause disruption of passing traffic on the N14. » Ensure fence boundaries and on-site buildings are maintained, in order to keep the site looking neat » Keep the site free of debris and litter, and alien invasive species				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Unlikely (3)
Result: Medium (70)				

8.7.6. Visual Impact of the Power line

It is proposed that the PV panels will be connected to the existing Eskom grid and so will entail the connection via an overhead power line to the existing substation. During the pre-construction and construction phases of the proposed new power line, there is a potential for a visual impact. This impact could stem from the clearing of sections of the landscape, as well as setting aside areas for the assembling of the infrastructure on the site. It should however be noted that the overall development footprint for the construction of the power line will be significantly smaller than that of the PV panels.

It is expected that these visual impacts will be localised to the N14 near the existing substation site, however due to the slight undulations in the topography as well as the distance of viewers from the majority of the proposed alignment, much of the preconstruction and construction activities should be shielded from view. During the operational phase, as was shown in the viewshed, the proposed power line is predicted to be visible over a large area. However, due to the presence of existing power line infrastructure, and the proposal that the power line from the Phase 2 area follow an existing power line to the substation for a portion of the length, the change to the overall visual landscape is expected to be minimal. The visual impact of the Phase 2 power line is therefore expected to be low, largely due to the presence of existing power lines in the area.

During the decommissioning or post closure phase of the project, all of the infrastructure used could be removed, recycled or re-used in other projects off-site or integrated into the existing electrical reticulation system. If the infrastructure is removed, the overall visual impact could be seen to be minimal due to the overall footprint disturbed being limited to the servitude of the power line alignment.

8.7.7. Impact tables summarising the significance of visual impacts of the power Line (with and without mitigation)

Preconstruction/construction/decommissioning

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	One to ten years (3)	Temporary (2)	Possible (4)
Result: Medium (60)				
Mitigation: » Minimise the size of the laydown area and work areas » Implement strict procedures for location and management of the construction site, laydown and work areas » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Minimise reflective surfaces » Appropriate choice of colour for buildings » Ensure the site is kept neat and tidy (free of litter and refuse) at all times » Any disturbance to the sparse vegetation on site should be kept to a minimum				

Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Project specific (2)	One to ten years (3)	Temporary (2)	Seldom (3)
Result: Low (40)				

Operation

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium-High (88)				
Mitigation: » Put in place measures for the efficient management of the facility » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Ensure fence boundaries and on-site buildings are maintained, in order to keep the site looking neat » Keep the site free of debris and litter, and alien invasive species				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Unlikely (3)
Result: Medium (70)				

8.7.8. Comparative Assessment of Power Line Alternatives

The Phase 2 Alternative 2 power line alignment is located in close proximity to the N14, thus being more exposed to views from this road than Alternative 1. Alternative 2 follows the existing Aggeneis-Nama 220kV power line for a portion of the route, thereby consolidating infrastructure of a similar nature to some extent. The Phase 2 **Alternative 1** power line alignment is therefore considered as the **preferred option from a visual perspective**.

8.7.9. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure would not pose additional visual impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is therefore no preferred alternative in terms of these alternatives from a visual perspective.

8.7.10. Mitigation of Visual Impacts

The role of mitigation is critical in finding a design / rehabilitation solution that will be visually acceptable. Potential mitigation measures have been taken into consideration during the design phase, as discussed above and is also provided by natural features in the area. Only effective, economically feasible, appropriate and visually acceptable mitigation measures should be considered and these should form part of an EMPr to be implemented should the project be approved. Sound planning and design techniques are essential to implement creative alternatives to meet the project's objectives. These techniques must be viewed as principles or objectives and not rigid standards with limited flexibility.

» During the pre-construction and construction phases of the project, assembly areas and work camps must therefore be kept free of litter. These sites would be visible from the N14 and thus in order to reduce the visual impact of these sites should be kept presentable and neat;
» Along the N14 are a series of soil berms, these berms act as a visual barrier between sections of the N14 and the PV facility. If practical, these berms could be extended to run along the N14 boundary fence-line to act as a visual barrier between the motorists using the N14 and the PV Facility.
» Buildings on the site should be painted a colour which is consistent with the surrounding landscape. Colours which have a high contrast to the area around the site should be avoided. In order to avoid potential glare, which may cause a distraction to road users of the N14, all surfaces, if possible, should have a matte finish;
» Due to the relatively undisturbed and landscape lacking in vegetative cover, it is recommended that the sites, the sites should be kept neat (no stockpiles of soil or refuse) and litter free, as well as alien vegetation control measures put in place;
» With regards to lighting, the following should be considered:
    o Lighting on the fence line and security lighting should be faced inwards, except for nocturnal safety lighting; and

  - o Lighting internally, if practical, should be low foot-level lighting, fitted with low intensity bulbs should be used.
- » These lighting recommendations should be considered only if they do not pose a threat to site safety.
- » In terms of post-closure rehabilitation it is important to restore the environment to a condition whereby the natural functioning of the ecosystem can take place;
- » During construction activities, dust control measures should be implemented, i.e. have a water tanker available, and reduce onsite driving speeds;
- » External signage should be kept to a minimum and where possible attached to existing buildings to avoid free-standing signs in the landscape.

8.7.11. Implications for Project Implementation

- » Visual impacts associated with the PV facility and associated infrastructure (including the power line) are expected to be of low significance largely due to the absence of many visual sensitive receptors from the area as well as the presence of existing power line and the proposal that a portion of the preferred power line to the substation be constructed in parallel to this existing power line.
- » Visual Impacts are difficult to mitigate, however, possible mitigation measures are recommended in Section 8.6.8 above and are included in the EMP.
- » In addition, to limit scarring of the landscape, rehabilitate disturbed construction areas and re-vegetate using appropriate indigenous grasses
- » Ensure that the PV panels do not cause disruption of passing traffic on the N14

8.8. Economic impacts

Potential economic (and social) impacts include:

- » Disruption of grazing
- » Disruption of N14 and other infrastructure
- » Economic development
- » Creation of employment
- » Stability of energy supply
- » Expansion of community development projects
- » Impacts on public safety
- » Noise during construction
- » Increased traffic and road safety hazards
- » Increased risk of crime, disease with influx of workers and opportunity seekers
- » Social divisions over limited jobs and perceived preferential access
- » Occupational health and safety
- » Impacts from waste (construction, solid, domestic and e-Waste)

» Visual impact

These impacts associated with Phase 2 are discussed below. Cumulative impacts of multiple phases of this project and approved projects in the area are dealt with separately under Section 8.10.

During construction approximately 250-300 jobs will be created over a 15 - 18 month period for this phase of the PV Project. During the operation phase approximately 7-15 full-time employees will be employed during. PVAfrica Development (Pty) Ltd is committing 1.5% and 0.6% of its annual project revenues over 20 years to socio-economic development and enterprise development in local communities respectively. During construction, temporary camps will house construction staff. There are no communities in the immediate vicinity of the site and within the servitude (27.5 metres on either side) of the power line.

8.8.1. <u>Disruption of Grazing Activities</u>

The farm as a whole has a relatively low grazing / agricultural potential in the national context, given the low rainfall and high evaporation rates experienced in the area. In this region of the country, commercial livestock ranches are generally large, often comprising tens of thousands of hectares. Net returns are negative for a given year depending on variables including feed costs, weather variables and livestock prices. Return on investments has been low for smaller land owners, and negative net returns can occur based on smaller farming units for three out of twenty years on average. The agricultural specialist report provides information on the extent to which the proposed project will decrease the stocking rate of the Portion 3 of the Farm Zuurwater. During construction, the preparation of the site and the presence of construction equipment will result in disruption of grazing. During the operational phase – the area occupied by the PV panels cannot be used for agriculture. Decommissioning is likely to result again in a temporary more intense disruption of grazing, owing to the presence of vehicles and equipment for the removal of infrastructure.

Pre-construction/construction

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	4	5
Result: Medium-High (90)				
Mitigation: » Implement storm water management and other erosion prevention measures » Construction vehicles are to remain within the proposed development area				

» Avoid and minimise the removal of natural vegetation/ grazing				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	3	5
Result: Low-medium (64)				

Operation

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: Medium-high (80)				
Mitigation: » Rehabilitate disturbed land within the development area to original agricultural potential and consider allowing grazing (with conservative stocking rates) between the panels if and where possible. » Prevent disruption of natural vegetation/ grazing both within and around the development area » Maintain storm water management and other erosion prevention measures » Operational vehicles are to remain within the proposed development area » Implement measures to prevent livestock coming into contact with or entangled by any electrical wiring that might cause short circuits, injury or death.				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	4	4	3
Result: Medium (63)				

Decommissioning

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	3	5
Result: Medium-high (80)				
Mitigation: » Maintain and enhance storm water management and other erosion (including wind) prevention measures » Implement measures to rehabilitate compaction of soil resulting from the concrete footings, other PV infrastructure and vehicle access.				

» Undertake rehabilitation to original agricultural potential » Reinstitute conservative stocking rate within development footprint following rehabilitation				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	4
Result: Low (42)				

8.8.2. <u>Economic development</u>

The Northern Cape is a region of marked economic underdevelopment and unemployment, and given the arid and remote nature of the environment, opportunities are limited. Mining, a key contributor to the regional economy, has a limited lifespan entirely dependent on life of mine. This project represents the chance of harnessing the underutilized high solar irradiation levels of this region of the Northern Cape, and the diversification of the local economy. The location within the immediate study area of the Eskom power lines forming part of the national grid feeding Namibia and Springbok also enhances the economic feasibility of the project. Solar power is also one of the development opportunities which have been identified by authorities at the national and regional levels.

Numerous positive economic spinoffs from the project are envisaged for all project stages. Job creation will be at its highest during the construction phase of the project (250-300 employees – required for construction of One Phase of 75MW), following by decommissioning (100 people). During preconstruction and operation, although at a reduced scale, jobs created are likely to make a major contribution to the local economy. Permanent, highly skilled and semi-skilled jobs will be created in the operational phase which will contribute to economic stability of the area. Local sourcing of services and materials (where feasible), will contribute to secondary benefits of the project, and could potentially result in the creation of small enterprises and service providers who could in turn generate employment.

Decommissioning will result in some job creation, as well as opportunities through the reuse/ recycling of certain components from the dismantled facility. At the end of decommissioning, there will be job losses and loss of income to the local economy unless the life of the project can be extended such as through retrofitting. Job losses will arise at the end of decommissioning.

Pre-construction/construction

Impact on local economic development without mitigation / enhancement:

Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	3
Result: Low (+42)				
Mitigation / enhancement: » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies and methods where practical				
Impact local economic development with mitigation/enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	3	4	4
Result: Medium (+72)				

Operation

Impact local economic development without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	3
Result: Low (+42)				
Mitigation / enhancement: » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies where practical				
Impact on local economic development with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	4	3	3
Result: Medium (54)				

Decommissioning

Impact on local economic development without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	5	3	4

Result: Medium-high (-63)				
Mitigation / enhancement: » Investigate opportunities for reuse of materials and extension of the life of the operation such as through retrofitting » Procure materials, goods and services from local/regional suppliers where feasible » Implement skills and career development through the decommissioning process » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				
Impact on local economic development with mitigation/enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	5	2	3
Result: Low-medium (-60)				

8.8.3. Creation of employment

The Northern Cape experiences high levels of unemployment, contributed to by long distance to markets, the high aridity levels of the area. There is high dependence on mining operations which will have limited lifespans dependent on availability of mineral resources and international markets.

The greatest number of jobs are anticipated to be created during the construction phase of the project (±250-300 jobs per phase and six phases), followed by decommissioning (100 jobs). Preconstruction will be of limited duration, but the operational phase (7 to 15 jobs) will give rise to long-term (approximately 20 years) highly skilled and semi-skilled jobs.

Decommissioning will result in temporary employment. Jobs will be lost unless the life of the project can be extended through refurbishment and/or retrofitting continued operation.

Pre-construction

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	2	1	5
Result: Low (+48)				
Mitigation / enhancement:				

» Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	2	1	5
Result: Medium (+60)				

Construction

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	3	3	4
Result: Medium (+70)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop skills of employees » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	3	5
Result: Medium-high (+88)				

Operation

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (+96)				
Mitigation / enhancement:				

» Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop skills of employees » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
5	4	4	4	5
Result: High (+117)				

Decommissioning

Impact of job creation without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
5	4	5	5	5
Result: Very high (140)				
Mitigation: » Investigate opportunities for reuse of materials and extension of the life of the operation such as through retrofitting » Procure materials, goods and services from local/regional suppliers where feasible » Implement skills and career development through the decommissioning process » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				
Impact of job creation with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	2	3	4
Result: Low-medium (70)				

8.8.4. Stability of energy supply

Eskom, South Africa's key power producer, has been under pressure in recent years to meet electricity demands which has impacted negatively on stability of power supply. The country has been experiencing power outages, exacerbated by the regular need for key coal-based power stations to undergo maintenance. The proposed project stands to make a positive contribution to South Africa's stability of power supply during its operational phase through diversification from reliance on coal-generated power and distribution to areas of high electricity utilisation. This positive impact will be enhanced through efficient management and operation of the PV facility. A negative aspect of power generated by PV is that it is limited to daylight hours.

Decommissioning of the PV facility after 20 years of operation will cause power generation to cease, which will result in negative impact on stability of power supply. This situation could be delayed should it be found that it is feasible to refurbish/ retrofit infrastructure to allow for either total or partial continued operation. Decommissioning should occur in a phased manner and in close communication with Eskom, so as to avoid and minimize instability of power supply.

Operation

Impact of the project on stability of energy supply without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	5	4	4	4
Result: Medium-high (+88)				
Mitigation / enhancement: » Conduct regular maintenance of the plant to avoid and minimise operational down-time » Maintain close liaison with Eskom regarding any possible scheduled or unscheduled down-time				
Impact on stability of energy supply with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	5	4	5	5
Result: High (+120)				

Decommissioning

Impact on stability of energy supply without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	5	5	5	5
Result: Very high (-140)				
Comment / mitigation: » Investigate the possibility of refurbishment and/or retrofitting for total and/or				

partial continued operation » Carry out careful planning of the phasing of the decommissioning process » Maintain communication with national energy regulator and power producer (Eskom)				
Impact on stability of energy supply with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	5	5	3	5
Result: High (-104)				

8.9. Social Impacts

8.9.1. Expansion of Community Development Projects

During preconstruction, construction, operation and decommissioning, there is potential to increase coordination with local projects and initiatives falling under provincial community development authorities, local authorities and other organisations encouraging community development. This process will ensure that project activities are harmonised with local spatial and development plans (e.g. Integrated Development Plans, Spatial Development Frameworks and Local Economic Development Plans). Building lines of communication will assist with such aspects as disruption of municipal and other services, and the maximisation of opportunities such as building on support programmes such as HIV/Aids prevention. PVAfrica Development (Pty) Ltd plans to ensure that there is liaison, cooperation and assistance provided to organisations such as community trusts functioning in the immediate vicinity of the proposed project.

Pre-construction/construction/operation

Impact on community development projects without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	4	3	3
Result: Low-medium (+54)				
Mitigation / enhancement: » Carry out early identification of existing community initiatives which can be expanded » Conduct consultation with stakeholders regarding community development projects requiring enhancement » Carry out targeted support to existing community development projects in line with identified needs				
Impact on community development projects with mitigation /				

enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (+96)				

Decommissioning

Impact on community development projects without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (-96)				
Mitigation / enhancement: » Carry out early identification of existing community initiatives which can be expanded » Conduct consultation with stakeholders regarding community development projects requiring enhancement » Carry out targeted support to existing community development projects in line with identified needs » Implement skills and career development through the decommissioning process where feasible » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				
Impact on community development projects with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	4	3	3
Result: Low-medium (54)				

8.9.2. Impacts on Public Safety

The proposed development site is situated far from neighbouring towns, with the town of Aggeneys (the closest settlement) being approximately 9 km away. Although there are no communities in close proximity to these servitudes there is one farming family resident on the farm. There are further passers-by in the form of low-volume traffic on the N14. Potential safety hazards during preconstruction, construction and decommissioning include:

» Injury from machinery, equipment and construction vehicles through following unauthorized access to the construction area(s)
» Road accidents involving construction vehicles
» Electrocution from high voltage power lines and substations

The operational project technology is not known to pose any risks to the health of the public, although if not managed could pose a safety hazard should members of the public trespass on to the site. The hazards posed through unauthorized access during the operational phase potentially include electric shocks and/or electrocution through third party tampering with equipment and installations such as live wiring. Since 24 hour security and warning signage will be in place on site, the likelihood of incidents occurring is considered to be very remote.

Pre-construction / construction/ decommissioning

Impact on public safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	3	3	3
Result: Low (48)				
Comment / mitigation : » Institute and maintain 24 hour security and access control to the project site » Set up signage warning of on-site hazards » Clearly demarcate construction areas » Construct and maintain security fencing on the perimeter and around electrical substations » Develop and implement emergency response procedures				
Impact on public safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	3	2	2
Result: Very low (24)				

Operation

Impact on public safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: High (80)				
Comment / mitigation: » Institute and maintain 24 hour security and access control to the site » Set up signage warning of on-site hazards				

» Clearly demarcate operational areas » Construct and maintain security fencing on the perimeter and around electrical substations » Verify the technical competency of staff operating and managing the facility » Implement and carry out regular review of emergency response procedures				
Impact on public safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	1	4	2	2
Result: Low (32)				

8.9.3. Increased noise

The proposed development site is situated in a predominantly natural and remote area with very low ambient noise levels. The neighbouring Black Mountain Mine has limited if any influence on noise levels on the site, and the town of Aggeneys is also situated too far away to have significant influence on ambient noise levels. The relatively close proximity of the development site to the N14 will, however, assist with the attenuation of noise levels.

The primary source of noise during the preconstruction, construction and decommissioning phases will be through the operation of trucks and machinery associated with the construction process. These are the phases where noise impacts are anticipated to be most intense through the operation of trucks for clearing of vegetation (preconstruction), transportation of construction materials (construction) and dismantled materials (decommissioning). There will also be noise impacts generated from the operation of vehicles supplying logistics support, such as supply of water for domestic use. Noise impacts during the operational phase are anticipated to be lower the more limited use of vehicles and equipment for cleaning of panels, vehicles for transport of water and those for supply of services/logistical support. Ambient noise will also be contributed to by the presence of workers during preconstruction, construction, operation and decommissioning.

Pre-construction/ construction /decommissioning

Noise impacts without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	4	4
Result: Medium (80)				
Comment / mitigation : » Implement regular maintenance of vehicles				

» Minimise construction activities between 6pm and 6am in sites close to homestead » Ensure placement of accommodation/ construction camp away from the resident farmer's household » Enforce strict speed limits for vehicles moving on the property » Develop and put into effect a code of conduct for employees				
Noise impacts with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	3	3	3
Result: Medium (54)				

Operation

Noise impacts without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	2	4	4	4
Result: Low (56)				
Comment / mitigation: » Implement regular maintenance of vehicles » Minimise construction activities between 6pm and 6am in sites close to homestead » Enforce strict speed limits for vehicles moving on the property » Develop and put into effect a code of conduct for employees				
Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	2	3	4	3
Result: Low (49)				

8.9.4. Increased risk of crime, disease with influx of workers and opportunity seekers

A major outbreak of HIV/Aids has swept South Africa in recent decades, and communicable diseases also have a high incidence in the country. Desperation for sources of income can also draw people into prostitution. As with other new developments, the proposed project is likely to set up expectations of employment opportunities which could potentially result in in-migration of job-seekers. This could result in an increase in the crime rate and may exacerbate the risk of spread of disease unless measures are put in place to discourage risky behaviour by job-seekers and employees and contractors. It is anticipated that the risk of spread of disease as well as crime will be highest during the preconstruction, construction and decommissioning phases of the project, and that during the operational phase when there is a stable workforce, the risks will be lowest. It is possible that crime could be linked to such activities as tampering with security features and theft of equipment.

Preconstruction/construction/decommissioning

Impact due to influx of workers without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	4	4
Result: Medium-high (88)				
Comment / mitigation: » Enhance and/or support local and provincial authority initiatives on HIV/Aids and communicable disease awareness » Employ local people where possible » Include conditions for contractors to provide HIV/Aids education and introduce rotation to enable contract workers not residing in the area to visit their homes regularly » Provide recreational facilities such as soccer fields for construction workers and facilitate access to nearby towns for shopping, religious gatherings, etc. » Manage expectations of job creation through the information and communication programme » Maintain close liaison with local and provincial law enforcement agencies » Incorporate into the code of conduct for employees including punitive measures for theft and related crimes				
Impact due to influx of workers with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	2
Result: Low (28)				

Operation

Impact due to influx without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	3	3
Result: Medium (60)				
Comment / mitigation: » Enhance and/or support local and provincial authority initiatives on HIV/Aids and communicable disease awareness » Employ local people where possible » Manage expectations of job creation through the information and				

communication programme » Maintain close liaison with local and provincial law enforcement agencies » Incorporate into the code of conduct for employees punitive measures for theft and related crimes				
Impact due to influx of workers with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

8.9.5. Social divisions over limited jobs and perceived preferential access

High unemployment rates within the vicinity of the study area are likely to increase expectations, and perhaps result in unrealistic anticipation, of job creation by the project. The public participation process highlighted the desire amongst community members that job creation should be maximised by the project. The requirement for highly technical and skilled employees during all project phases means that the number of jobs created at community level could be relatively limited. It is possible that divisions within communities could be sown should it be perceived that outsiders are preferentially obtaining jobs, and that employment opportunities are limited for local people. Should there be corruption and nepotism associated with employment, this will exacerbate the problems. The risk of these impacts arising is most likely during the preconstruction, construction and decommissioning project phases when employment levels are at their highest on the project. However, the DoE requirements include use of locally available skills and social beneficiation as part of the development and operation of the project. In addition, the developer should manage expectations from local communities by being transparent.

Preconstruction/ construction/ decommissioning

Social division/ impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	4	5
Result: Medium (99)				
Comment / mitigation: » Employ local people where possible » Establish and maintain transparency in recruitment procedure » Ensure transparency in recruitment procedures » Maintain effective communication with local community structures and stakeholders during all project phases to address potential and real tensions.				

» A communication and information programme should be used to maximise procurement from local service providers » Include management and enhancement measures for local and BBBEE employment in the EMP				
Social division/ impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	3	2	3
Result: Low (40)				

Operation

Social division/ impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	4	4	4
Result: Medium (56)				
Comment / mitigation: » Employ local people where possible » Establish and maintain transparency in recruitment procedures » Ensure transparency in recruitment procedures » Maintain effective communication with local community structures and stakeholders » A communication and information programme should be used to maximise procurement from local service providers » Include management and enhancement measures for local and BBBEE employment in the EMP				
Social division/ impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

8.9.6. Health and Safety Impacts

The development of the PV plant will involve activities that potentially could be unsafe to workers on the project. These activities include clearing of the development site, digging of trenches, laying of cables and backfilling. These activities all require the use of heavy duty vehicles, machinery and equipment. Additionally, there is a risk posed by road accidents during the transportation of components and materials, both on access routes and national/ provincial roads, as well as within the development site. There is furthermore the risk of exposure to diseases including HIV/Aids and communicable diseases such as tuberculosis (TB).

During the operational phase, occupational health and safety impacts could include injury (including electric shocks or electrocution) to workers from routine monitoring and maintenance, as well as when responding to emergencies such as fire, electrical malfunctions or structural failure of equipment such as the collapse of a PV panel during a wind storm. Dangerous conditions could result from corrosion of electrical components, erosion, flooding and third party damage. During decommissioning, there is the risk of injury caused by mishandling or malfunction of electrical components, injury during dismantling of equipment and movement of vehicles or collisions, and events such as suffocation from collapse of trench walls.

Preconstruction/construction/decommissioning

Health and safety impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	3	4	4
Result: Medium (64)				
Comment / mitigation: » Adhere to OHS legal requirements and measures contained in the EMP » Establish and implement OHS procedures for employees on site, including use of Personal Protection Equipment (PPE) » Conduct regular staff training on OHS » Implement an employee code of conduct which incorporates safety issues including prohibition of operating vehicles and machinery after use of substances which could impair reflexes				
Health and safety impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	3	4	3
Result: Low (42)				

Operation

Health and safety impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: Medium (80)				
Comment / mitigation: » Adhere to OHS legal requirements and measures contained in the EMP » Establish and implement OHS procedures for employees on site, including use				

of Personal Protection Equipment (PPE) » Conduct regular staff training on OHS » Implement an employee code of conduct which incorporates safety issues including prohibition of operating vehicles and machinery after use of substances which could impair reflexes				
Health and safety impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	4	4	3
Result: Low (49)				

8.9.7. Impacts from waste (construction, solid, domestic and e-Waste)

Several categories of waste will be generated in each of the project phases (preconstruction; construction; operation and decommissioning). If not appropriately managed, waste generated could result in impacts on air, soil and water quality, as well as visual (aesthetic) quality. Sanitation and wastewater facilities will cater for the anticipated employees during preconstruction; construction; operation and decommissioning. Domestic solid waste generation can be expected to be proportional to the number of workers during each project phase, and thus the highest volumes are likely to be generated during the construction phase. During preconstruction and construction, domestic solid and liquid waste will be the primary source. The volumes of non-domestic and domestic waste will be at their lowest during the operational phase of the project, although on-going PV plant maintenance is likely to result in limited quantities of components requiring replacement. Waste will be disposed of at a suitably registered municipal landfill site.

Decommissioning is anticipated to commence around 20 years after the initial commencement of construction. It is at this stage of the project that the greatest volume of waste is anticipated to be generated. Reuse of materials will be prioritised, and failing this being an option, will be recycled and only as a last resort discarded in licensed landfills. Recyclable materials (glass, metals and certain grades of plastics) will be recycled via existing recycling operations. Non-solid waste will be disposed of at an appropriately registered landfill site. Concrete slabs forming the foundation for the PV modules are planned to be crushed, for use as fill on construction site/road-building projects. Alternatively, crushed concrete will be used for rehabilitation of the disused quarry on the site (such as in the form of gabions). Waste rock (if any), will also be used for the rehabilitation of the disused quarry on the site. e-Waste will be disposed of in a suitably registered landfill site. It is expected that the value received for recyclable waste will be used to subsidise the cost of decommissioning.

Preconstruction/construction

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	5	4	4
Result: Medium-high (96)				
Comment / mitigation: » Implement measures to ensure that disposal at appropriately licenced landfill sites is carried out » Use construction waste rock/soil for rehabilitation of the disused quarry on the Farm Zuurwater » Apply the hierarchy of waste management to project activities » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard » Consider the NEM: Waste Act				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	5	3	3
Result: Low (48)				

Operation

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	4	3	2
Result: Low (35)				
Comment / mitigation: » Implement measures to ensure that disposal of waste, including e-waste, is carried out at appropriately licensed landfill sites » Use construction waste rock/soil for rehabilitation of the disused quarry on the farm Zuurwater » Apply the hierarchy of waste management to operational activities » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard » Implement measures to ensure the efficient maintenance of infrastructure to maximise the lifespan of components » Consider the NEM: Waste Act				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**

1	1	4	3	2
Result: Low (30)				

Decommissioning

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	3	4
Result: Low-medium (70)				
Comment / mitigation: » Apply the hierarchy of waste management to decommissioning activities, thus minimizing waste volumes generated » Clear the development site of all waste generated during decommissioning » Implement measures to ensure disposal to appropriately licensed landfill sites. Dispose e-Waste at a suitably registered landfill site » Use construction waste rock/soil for rehabilitation of disused quarry » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	2	2	3
Result: Very low (25)				

8.9.8. Comparative Assessment of Power Line Alternatives

As power line alternative 2 follows the N14, a higher visual impacts associated with this alternative is expected. Therefore, **Alternative 1** would be the preferred option from a social perspective as this would reduce visual impacts.

8.9.9. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and would therefore not pose additional impacts on the social environment. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is no preference regarding the reservoir location and associated water pipeline route.

8.9.10. Implications for Project Implementation

- The social benefits of the project outweigh the potential negative and localised social impacts / disturbances due to the project.
- Potential negative impacts include the threats to public safety from construction and traffic activity, increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. It is important that potential negative effects are managed as per the mitigations provided and contained in the EMP to prevent them developing into unacceptable cumulative impacts.
- Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements described in the impact assessment are instituted.
- Construction and operational noise, traffic and waste to be well-managed to prevent negative social impacts.
- The DoE requirement for suitable social beneficiation schemes is supported for the development of the project.

8.10. Impact on Traffic

The study area is serviced by a national road (the N14) which is in good condition, and which links the major centres (notably Upington to the east, and Springbok to the west). The N14 further links with traffic travelling to and from Namibia situated to the north of the site. All of the smaller municipalities and communities are further situated either adjacent, or close to the N14. This road is thus of extremely high importance in ensuring economic and social linkages are maintained in this region of the Northern Cape.

The baseline traffic volumes have been found to be very low, and the projected number of project vehicles for all project phases are further regarded by the traffic specialist in the previous report by SRK Consulting as being very low. It was determined that services are at a very good Level of Service "A", even with the project-generated traffic. SANRAL requested a buffer on either side of the N14. A buffer of 60m on the N14 has been applied by the developer. Construction activities will increase traffic on the N14, if that is well managed the impact of the facility on traffic can be manageable.

8.10.1. Traffic Implications of the Proposed Development

The existing traffic flows plus added traffic / road users related to the Zuurwater solar energy facility are expected to generate low traffic flows on the N14. The N14 will still operate at a Level of Service A road, even with this additional traffic. The new, left- and right-turning traffic from the N14 into the formal accesses to the facility is not considered to be of high volumes and no exclusive right-turn lanes or left-turn deceleration lanes will be required to accommodate the facility generated traffic. The access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic.

8.10.2. Location of Access Roads to the Site

From a geometric and road safety perspective, the location of the existing and proposed access road to the facility on the N14 at km92,227 and at km94,072 is considered to be acceptable although there are numerous potential alternative locations should this existing access not be acceptable to the developer, the landowner or SANRAL for any reason.

8.10.3. Road Safety

Road safety conditions along the N14 in the vicinity of the site are considered to be good with an accident rate that is not noticeably higher than the average for the N14. The speed limit on the N14 in the vicinity of the Zuurwater site is 120 km/h and sight distance conditions to and from both directions at the location of the proposed access is considered to be acceptable for this speed limit. There is no evidence of pedestrian or public transport activity nor wild or domestic animal activity within the road reserve in the vicinity of the site. As the volume of traffic that enters and leaves this existing access point is expected to increase, particularly when there will be both construction and operational activities occurring at the same time, advanced warning of this side road activity will be required.

8.10.4. Driver Distraction Due to the PV Panels

Probably one of the biggest potential impacts of this photovoltaic power generation facility is driver distraction, firstly from the novelty impact of the facility as there are not many such facilities currently in South Africa and secondly from potential glare and / or reflection off the panels which may distract drivers as they are travelling past the facility at 120km/h. Setting the arrays back by 60m from the road reserve will reduce the potential impact of the panels. The majority of the PV panels will be located to the north of the N14 and will be north facing away from the N14 and therefore it will not be possible for the panels to reflect onto the N14. On the basis of the above, it will not be possible for any reflection from the panels to occur onto the N14 from the north or south.

It is recommended that temporary high visibility advanced warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 in both directions approaching the position of the two accesses to the facility during construction and that permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 at both accesses once construction is completed and the facility is fully operational. Whilst theoretically there is no potential for reflections from the panels and infrastructure to affect passing motorists on the N14, it is recommended that reflections from the arrays are monitored from the first installation to confirm this. No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed Zuurwater solar energy facility, cumulatively.

8.10.5. Impact Tables Summarising Impacts on Traffic

Pre-construction/construction/decommissioning

Impact on traffic without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	3	4
Result: Low-medium (70)				
Comment / mitigation: » Implement efficient scheduling of goods delivery and water » Implement measures for conduct of employee and contractor drivers » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences » Maintain communication with SANRAL regarding their requirements for measures to be instituted » Implement a 60m buffer on the N14. » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic				
Impact on traffic with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	2
Result: Low (35)				

Operation

Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**

3	2	4	4	3
Result: Low-medium (63)				
Mitigation: Implement efficient scheduling of goods delivery and water » Implement measures for conduct of employee and contractor drivers » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences » Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic				
Impact on traffic with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	3	2
Result: Low (40)				

Pre-construction / construction /decommissioning

Impact on road safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	3	4	4
Result: Medium-High (80)				
Comment / mitigation : » Implement efficient scheduling of goods and water delivery » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic » Implement measures for conduct of employee and contractor drivers » Establish and enforce a strict code of conduct for employees and contractors which includes adherence to traffic rules				
Impact on road safety with mitigation:				

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
2	2	3	2	2
Result: Low (28)				

Operation

Impact on road safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	4	4	4
Result: Medium-high (88)				
Comment / mitigation: » Enforce a strict code of conduct for employees and contractors which includes adherence to traffic rules » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic » Implement efficient scheduling of goods and water delivery » Maintain communication with SANRAL regarding their requirements for measures to be instituted				
Impact on road safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

8.10.6. Implications for Project Implementation

» It is recommended that temporary high visibility advanced warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 in both directions approaching the position of the two accesses to the facility during construction and that permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 at both accesses once construction is completed and the facility is fully operational.

» Whilst theoretically there is no potential for reflections from the panels and infrastructure to affect passing motorists on the N14, it is recommended that reflections from the arrays are monitored from the first installation to confirm this. No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed Zuurwater solar energy facility, cumulatively.

8.11. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers 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 undertakings in the area[21.] Based on information available at the time of undertaking the EIA, the impact of solar facilities on the landscape is therefore likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of solar plant applications. The Northern Cape is earmarked as a potential solar energy hub for South Africa. In the case of the proposed Phase 2 of the Zuurwater Solar Energy Facility, there are other phases to the project and other solar energy facilities proposed in the Khai Ma Local Municipality. Other phases/ projects on Portion 3 of the Farm Zuurwater under the same applicant (PVAfrica Development (Pty) Ltd) and other proposed projects in the area are listed in Table 8.1 and 8.2 and are shown in Figure 8.4.

Table 8.1: Other phases/ projects on Portion 3 of the Farm Zuurwater under the same applicant (PVAfrica Development (Pty) Ltd)

Project	Applicant / Developer	DEA Ref. No	Location	Status
6. Proposed Photovoltaic Plant on the Farm Zuurwater near Aggenys - Unit 4 (75MW)	PVAfrica Development (Pty) Ltd (previously SATO Holdings)	14/12/16/3/2334/4	Section of Farm Zuurwater No. 62	Authorised in August 2012
7. Proposed Photovoltaic Plant on the Farm Zuurwater near Aggenys - Unit 5 (75MW	PVAfrica Development (Pty) Ltd (previously SATO Holdings)	14/12/16/3/2334/5	Section of Farm Zuurwater No. 62	Authorised in August 2012
8. Phase 1 of the Zuurwater PV Facility	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/470	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 6
9. Phase 3 of the Zuurwater PV Facility (60MW)	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/472	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 10
10. Phase 4 of the Zuurwater PV Facility (75MW)	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/473	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 12

[21] Definition as provided by DEA in the EIA Regulations.

The other authorised / proposed projects/ developments in the Khai Ma Local Municipality are listed in Table 2.

Table 8.2: Projects/ Developments Proposed in the Khai Ma Local Municipality

Project	Applicant / Developer	DEA Ref. No	Location	Status
7. Aggeneys Solar Photovoltaic (PV) power plant (84MW)	Orlight SA (Pty) Ltd	12/12/20/2630	Portion 1 of Aroams 57 RD	Environmental Authorisation (EA) issued
8. 10MW Photovoltaic Plant at Black Mountain Mine	Aurora Power Solutions (Pty) Ltd in partnership with Black Mountain Mining	12/12/20/2151	At Black Mountain Mine	Final Basic Assessment Report Submitted to DEA
9. Boesmanland Solar Farm	Boesmanland Solar Farm (Pty) Ltd.	12/12/20/2602	Next to Black Mountain Mine (Portion 6, a portion of Portion 2 of the Farm 62 Zuurwater)	Final EIA submitted to DEA in 2013 Decision – pending
10. Pofadder Wind and Solar Energy Facility	South Africa Mainstream Renewable Power Development (Pty) Ltd	» 14/12/16/3/3/2/348 (Wind) » 14/12/16/3/3/2/347 (Solar)	Near Pofadder	Scoping Phase complete, EIA in process
11. Eskom Aggeneis – Oranjemond 400kV power line	Eskom	12/12/20/2041	From Aggeneis Substation to – Oranjemond Substation	Environmental Authorisation (EA) issued in May 2012.
12. Proposed Gamsberg Zinc Mine and Associated Infrastructure	Black Mountain Mining	» DENC Reference Number: NC/EIA/NAM/KHAI/AGG/2012-NCP/EIA/0000155/2012 » DEA Reference Number: 12/9/11/L955/8 » DMR Reference Number: NCS 30/5/1/2/2/1/518	To the east of the Farm Zuurwater No. 62 on farms Bloemhoek 61 Portion 1, Gams 60 Portion 1, Aroams 57 RE and Gams 60 Portion 4	EIA in process

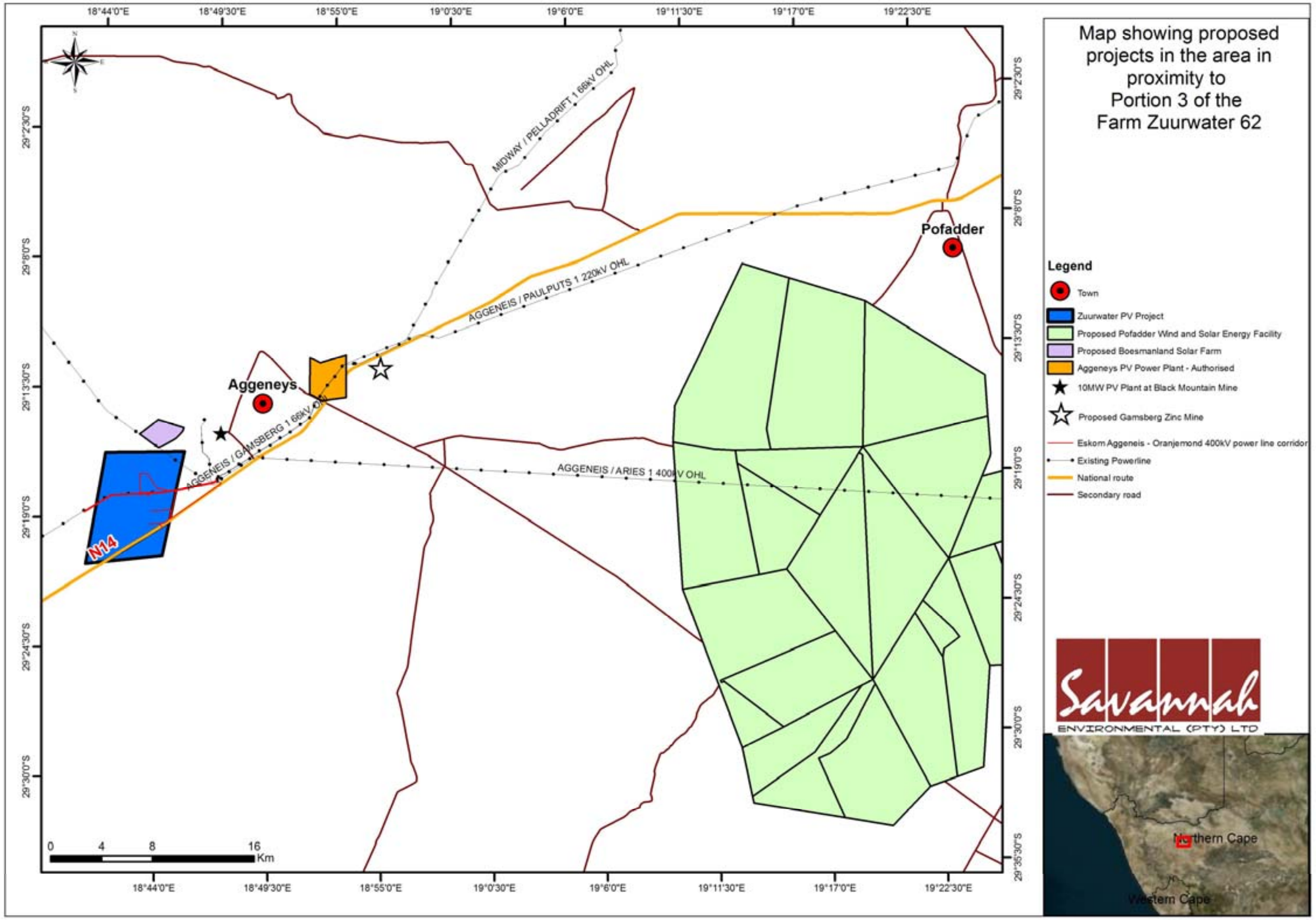

Figure 8. 7: Map showing Phase 1 – Phase 4 and two authorized phases and other proposed projects in the region

None of the above-mentioned solar projects have been awarded preferred bidders status at the time of writing this EIA report. Cumulative impacts discussed below and have been considered within the detailed specialist studies, where applicable (refer to Appendices F - J).

The potential ***cumulative impacts*** as a result of the proposed Phase 2 of the Zuurwater Project and other projects in the area are expected to be associated predominantly with:

» *Visual impact* - The visual impact associated with the proposed Phase 2 of the Zuurwater Project and 5 other Phases of the Zuurwater project will be sequential and additive, due to the visibility of solar panels from 6 or more solar energy facilities on Portion 3 of the Farm Zuurwater No. 62. From a visual perspective, the overlapping viewsheds can be considered favourable, as it represents the consolidation and concentration of potential visual impacts within a clustered region (i.e. the development of a solar energy facility node, rather than dispersing the impact to other areas). A cumulative viewshed in shown in Figure 8.5. The development of numerous similar facilities in the broader area could impact on the visual character and sense of place of the region. The cumulative impact will however to some extent be moderate due to the relatively low incidence of visual receptors in the region.

» *Flora, fauna, and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of avifauna may become cumulative if other renewable energy facilities are developed in the region. Should Phase 2 of the Zuurwater project and 5 other phases of the project and other solar projects in the Namaqualand region be developed, cumulative negative ecological impacts may occur. The significance of this impact is expected to be of a moderate significance and can result in a cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion). However, if negative impacts on ecology are effectively mitigated and managed for each project, through sound environmental management during construction and operation and by formal conservation and active management of the natural areas on site, then the negative impacts on ecosystems on each site can be within acceptable levels, and therefore in keeping with the principles of sustainable development.

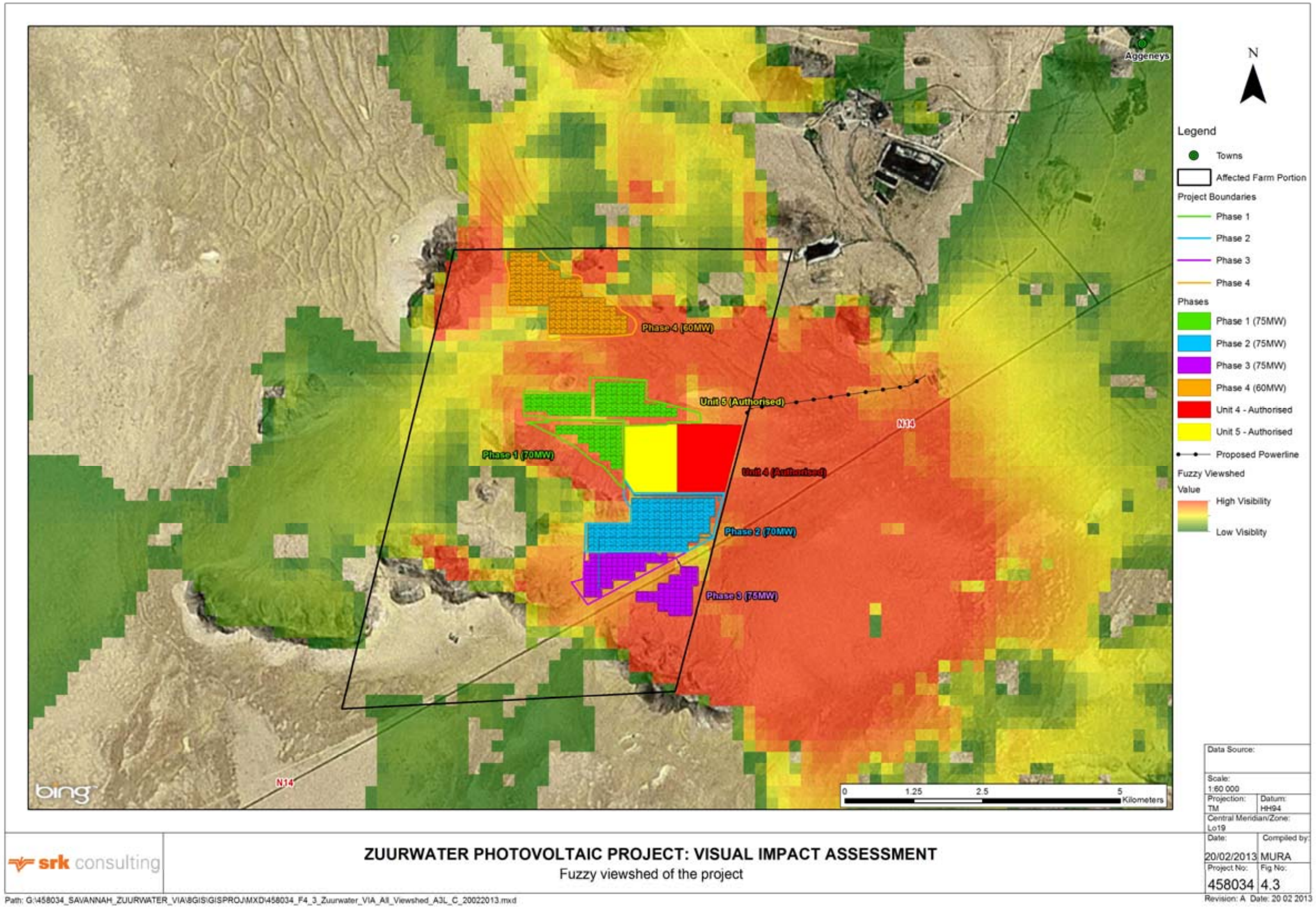

Figure 8. 8: Cumulative Viewshed for the various Phases of the Zuurwater Solar Energy Facility

» *Land-Use and agricultural potential* – The broader farm portion is 4997ha. Development of 6 phases on the broader farm will result in the loss of ~24% of Portion 3 of the farm Zuurwater 62. The remainder of the farm portion can be continued to be utilised for agricultural activities. Due to the limited crop production in the wider study area, the development of multiple solar energy facilities within the Khai Ma Local Municipality will not affect food security in the region. . Due to the vast amounts of land available in the Northern Cape Province, as well as the low agricultural potential and carrying capacity of the land, cumulative impacts on land-use or agricultural potential are of acceptable levels.

» *Cumulative geology, soil and erosion potential* - although the impact of soil removal for the proposed activity has a moderate – low significance, the cumulative impact of soil removal in the area is considered low due to undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate. The cumulative impact of siltation and dust in the area is considered low, with the legal obligation of good soil management for each project.

» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Current mining such as the Black Mountain Mine, presents a noise source, however the potential for cumulative impacts related to noise is low largely due to the low occurrence of sensitive receptors in the area.

» *Infrastructure* - Increased pressure on existing roads and other infrastructure may occur due to various projects being developed. This will require consultation with parties such as Eskom and SANRAL to prevent significant impacts on existing infrastructure in the area/ with the local municipality.

» *Heritage* –Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to ‘sense of place’ will occur from various projects in the region. The potential for the loss of or discovery of heritage artefacts in the Namaqualand region will also increase.

» *Impact on the Social and Economic Environment* - The establishment of a number of solar energy facilities in the area may impact negatively on the social environment as a result of issues associated with, for example, influx of people to the area and increased traffic volumes. Cumulative positive socio-economic impacts from a number of renewable energy facilities in terms of job creation and economic growth and development of infrastructure will occur at a local and district municipality level that is in need of this growth and development. This would be a significant positive impact. The adoption of

management measures will maximise the cumulative impact for local communities. Each project developed will contribute a percentage of annual profits from the solar project to social beneficiation in the local community, as required by the Department of Energy. Over at least 20 years, there will be a cumulative social benefit from multiple phases and likely from other renewable development in the surrounding areas. It is important that the social development efforts are managed effectively and efficiently in co-operation with key stakeholders over time so that they contribute progressively to enhancing the lives of surrounding communities.

8.12. Assessment of the Do Nothing Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Phase 2 of the Zuurwater Solar Energy Facility. Should this alternative be selected, there would be no 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 won't be any transfer of skills to people in terms of the construction and operation of the solar energy facility. 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.

At a broader scale, the benefits of this solar energy facility would not be realised. 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 9^{th} 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 power supply will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province’s grids. The ‘do nothing alternative is, therefore, not a preferred alternative.

8.13. Summary of Impacts

The following table provides a summary of the impact rating of the potential impacts identified and assessed through the EIA. As can be seen from this table, there are positive and negative impacts of high significance expected to be associated with the construction, operation and decommissioning of the proposed facility. With the used of mitigation measures impacts can be mitigated. All identified impacts can therefore be mitigated to acceptable levels.

Table 6. 3: Summary of Impact Ratings For Potential Impacts Associated with Phase 2 of the Zuurwater PV Facility

Impact	**Significance Rating**					
	Preconstruction /Construction		**Operational**		**Decommissioning**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Ecological Impacts						
Ecological impacts on fauna and flora and ecosystems	Medium (63)	Medium (56)	High (110)	Medium (72)	Medium (63)	Medium (56)
Impact of the power line and substation on threatened birds during operations	-	-	High (110)	Medium-High (90)	-	-
Alteration of seasonal recharge patterns of nearby pans and washes	High (110)	Low (63)	High (110)	Low (63)	High (110)	Low (63)
Soils and Agricultural Potential						
Potential soil erosion	Medium-High (96)	Low (42)	Medium (80)	Low (32)	Medium (56)	Low (30)
Contamination of soils	Medium-High (80)	Low (42)	Medium-High (80)	Low (42)	Medium-High (80)	Low (42)
Dust due to loose soils	Medium (72)	Medium (64)	Medium (63	Low (42)	Medium (72)	Medium (64)
Impacts on Land Capability and Agricultural Potential	Medium (80)	Low (49)	Medium (80)	Low (49)	Medium (64)	Low (25)
Impacts on Heritage & Palaeontology						
Destruction of heritage resources/ sites	Low (48)	Low (36)	Low (48)	Low (36)	Low (48)	Low (36)
Destruction of fossils	Low (48)	Low (36)	Low (48)	Low (36)	Low (48)	Low (36)
Visual impacts						
Visual impact of the PV Panels	Medium (60)	Low (40)	Medium-High (88)	Medium (70)	Medium (60)	Low (40)
Visual Impact of the Power	Medium (60)	Low (40)	Medium-High (88)	Medium (70)	Medium (60)	Low (40)

Impact	Significance Rating					
	Preconstruction /Construction		Operational		Decommissioning	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
line						
Economic Impacts						
Disruption of grazing	Medium-High (90)	Low-medium (64)	Medium-high (80)	Medium (63)	Medium-high (80)	Low (42)
Impact on local economic development	Low (+42)	Medium (+72)	Low (+42)	Medium (54)	Medium-high (63)	Low-medium (-60)
Creation of employment	Medium (+70)	Medium-high (+88)	Medium-high (+96)	High (+117)	Very high (140)	Low-medium (70)
Impact of the project on stability of energy supply	-	-	Medium-high (+88)	High (+120)	Very high (-140)	High (-104)
Social						
Impact on community development projects	Low-medium (+54)	Medium-high (+96)	Low-medium (+54)	Medium-high (+96)	Medium-high (96)	Low-medium (54)
Impact on public safety	Low (48)	Very low (24)	High (80)	Low (32)	Low (48)	Very low (24)
Noise	Medium (80)	Medium (54)	Low (56)	Low (49)	Medium-high (80)	Medium (54)
Increased traffic and road safety hazards	Medium-High (80)	Low (28)	Medium-high (88)	Low (32)	Medium-High (80)	Low (28)
Impact due to influx of workers	Medium-high (88)	Low (28)	Medium (60)	Low (32)	Medium-high (88)	Low (28)
Social divisions over limited jobs and perceived preferential access	Medium (99)	Low (40)	Medium (56)	Low (32)	Medium (99)	Low (40)
Health and safety impact	Medium (64)	Low (42)	Low (35)	Low (30)	Medium (64)	Low (42)
Waste (construction, solid, domestic and e-Waste)	Medium-high (96)	Low (48)	Medium-high (80)	Low (48)	Low-medium (70)	Very low (25)
Impact on	Low-	Low (35)	Low-medium	Low (40)	Low-medium	Low (35)

Impact	Significance Rating					
	Preconstruction /Construction		Operational		Decommissioning	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Traffic	medium (70)		(63)		(70)	

CONCLUSIONS AND RECOMMENDATIONS: PHASE 2 OF THE ZUURWATER SOLAR ENERGY FACILITY (DEA REF. NO.: 14/12/16/3/3/2/471) CHAPTER 9

PVAfrica Development (Pty) Ltd is proposing to establish four commercial photovoltaic solar energy facilities on the Farm Zuurwater 62 near Aggeneys, Northern Cape Province. The broader site is located within the Khai Ma Local Municipality (approximately 9 km south-west of Aggeneys. in the Northern Cape Province). ***This Chapter of the EIA report deals only with the conclusions and recommendations of the EIA for the Phase 2 of the larger "Zuurwater PV Facility".*** The purpose of the proposed facility is 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).

The Phase 2 PV arrays are proposed to be located to the south of authorised Unit 4 and Unit 5. Phase 2 is located approximately 12km south-south-west of the town of Aggeneys (straight line distance). The proposed generating capacity for this phase is 75MW, covering an area of 209ha. An on-site substation is also proposed for this phase, as shown in Figure 2.1. A power line is also required. The proposed facility will include the following primary elements (refer to Chapter 2 for more details):

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power line to transmit the power from Phase 2 into the Eskom grid via the Aggeneis MTS Substation. Two alternative power line routes were identified for investigation.
» A new temporary on-site water reservoir and associated water supply pipeline (shared infrastructure between all phases). Three alternative locations and associated pipeline routes were identified for investigation.
» Internal access roads.
» Office, workshop area for maintenance and storage.

» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

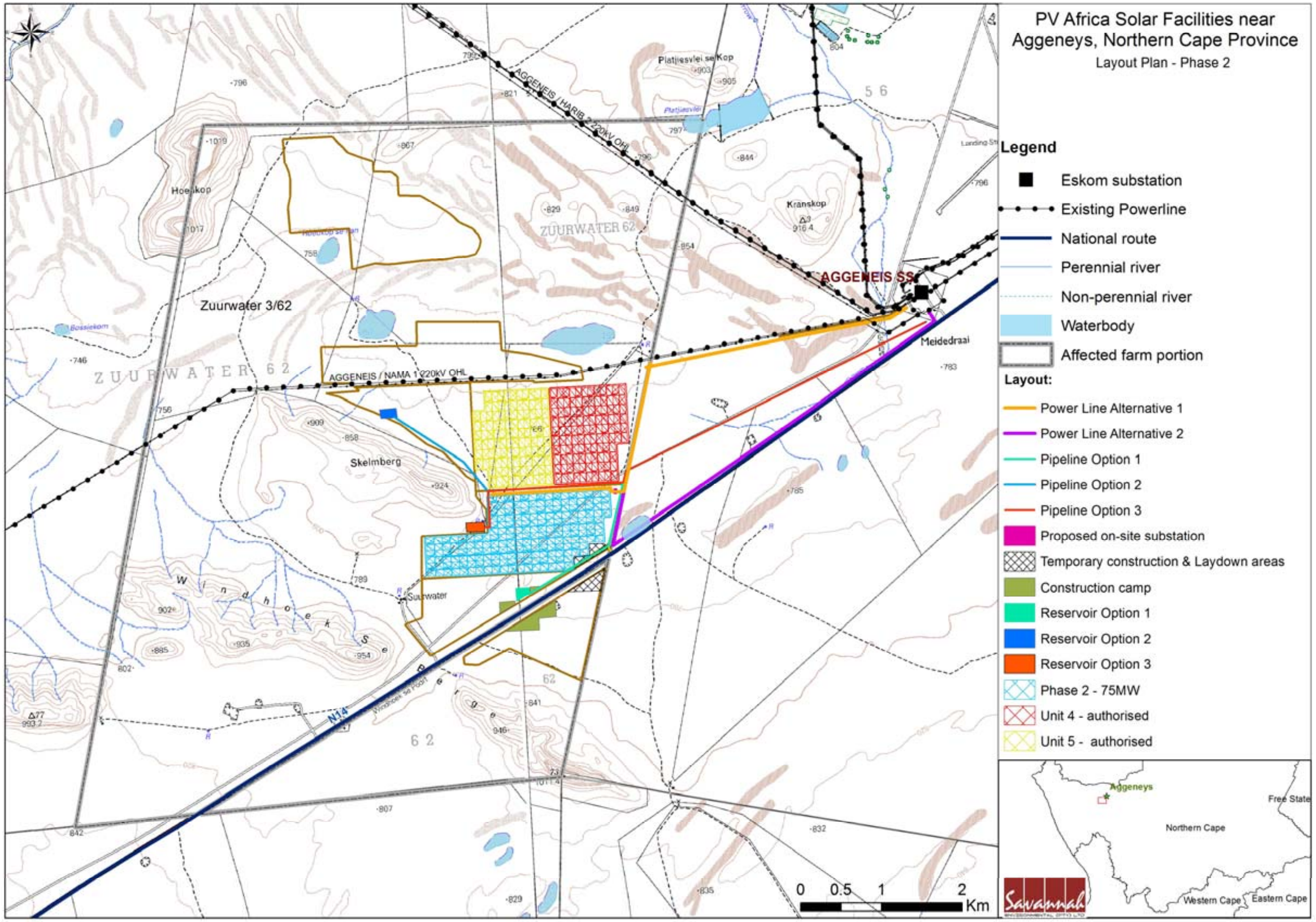

Figure 9.1: Locality / Layout Map for the 75MW PV plant on Portion 3 of the Farm Zuurwater No 62 in the Namakwa District, Northern Cape Province - Phase 2

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 planning 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), PVAfrica Development (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 Phase 2 of the Zuurwater Solar Energy Facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping[22] 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 undertaken to date 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, 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/ entire extent of Portion 3 of the Farm Zuurwater 62), as well as the extent of studies required within the EIA Phase were identified under an EIA report by SRK Consulting (2012), which was accepted by DEA. DEA also accepted the approach / plan of study as proposed by Savannah Environmental to utilise the existing information from the SRK Consulting's Scoping Report and and only conduct an EIA phase study for the project.
» *EIA Phase* – potentially significant biophysical and social impacts[23] and identified feasible alternatives put forward as parts 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 K).

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 for the proposed Phase 2 project are provided in this Chapter.

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[22] The Scoping Phase was undertaken by SRK Consulting (SRK, December 2011) and DEA accepted the approach as proposed by Savannah Environmental to undertake an EIA phase assessment.
[23] Direct, indirect, cumulative that may be either positive or negative.

9.1. Evaluation of Phase 2 of the Zuurwater Solar Energy Facility and Associated Infrastructure

The preceding chapters of this report together with the specialist studies contained within Appendices E -J provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Phase 2 of the Zuurwater Solar Energy Facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the 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 assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws were identified to be associated with the proposed for Phase 2 of the Zuurwater Solar Energy Facility. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Phase 2 of the Zuurwater Solar Energy Facility, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.)
» Social and economic impacts.
» Cumulative impacts.

9.1.1. Impacts on Ecology

The entire extent of Portion 3 of the Farm Zuurwater 62 will not be utilised for Phase 2 of the Zuurwater solar energy facility. The development footprint (panels and associated infrastructure) will cover an extent of ~209ha of the total 4997ha farm portion. This amount to ~4% of the entire farm portion that will be utilised in the long-term and that would suffer long--term loss / disturbance (over 20 years), although a much larger area would be affected by all phases of the Zuurwater Solar Energy Facility. Permanently affected areas include the area for the PV panels and associated infrastructure, as well as the power line and water pipeline route. Areas of ecological sensitivity within the proposed development site were identified through the EIA process. The ecological sensitivity assessment identified those parts of the farm (Portion 3 of the farm Zuurwater 62) that have high conservation value or that may be sensitive to disturbance. The habitats considered most sensitive on the farm (Portion 3 of the farm Zuurwater 62) include: rocky north-facing slopes, south facing slopes and Bushmanland sandy grassland vegetation.

Note that Phase 2 does not occur within any pans/ season washes/ water courses, however any impacts on soils and vegetation will indirectly impact on these pans. Outliers of Important Biodiversity areas that fall within the proposed development footprint were investigated to confirm that no red data species occur within these areas in order to ensure that these parts of the development do not cause unnecessary damage to biodiversity of conservation concern. The majority of the site for development of Phase 2 of the Zuurwater Solar Energy Facility falls within areas of low ecological sensitivity. Some of the proposed development footprint for Phase 2 falls onto areas designated as high sensitivity and ecological support areas. During the field visit it was verified that in these areas, the proposed development can proceed without significantly changing ecosystem processes or causing a significant loss to sensitive biodiversity, provided the recommended mitigation measures as contained in the draft EMP and ecological impact assessment are implemented. The impacts on **ecology** have been rated as **medium significance**, with the implementation of mitigation measures.

The power line may **impact on birds** due to collision or electrocution. Nine bird species of international and/or national conservation concern (Red Data species, IUCN/Birdlife International 2011, Barnes 2000), ranging from Near Threatened to Vulnerable, were considered as possible to occur on site. This impact is rated to be of **medium-high significance** and can be mitigated with the implementation of mitigation measures such as the installation of bird diverters on the power line. It is also recommended that a walk through survey of the power line be undertaken by an avifauna specialist prior to construction of the power line in order to confirm any additional mitigation which may be required to be implemented. For Phase 2 **Power Line Alternative 1 is the ecologically preferred option** as this power line will run adjacent to the PV arrays and an existing Eskom power line, thus keeping the entire footprint more compact, which will limit further habitat and vegetation fragmentation..

The reservoir and associated water pipeline infrastructure is proposed in close proximity to the PV panel areas and the impacts on ecological resources are expected to be similar to those identified for this area. It is recommended that the proposed development avoids the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity. Therefore, **Alternative 1** is recommended as the preferred alternative in this regard.

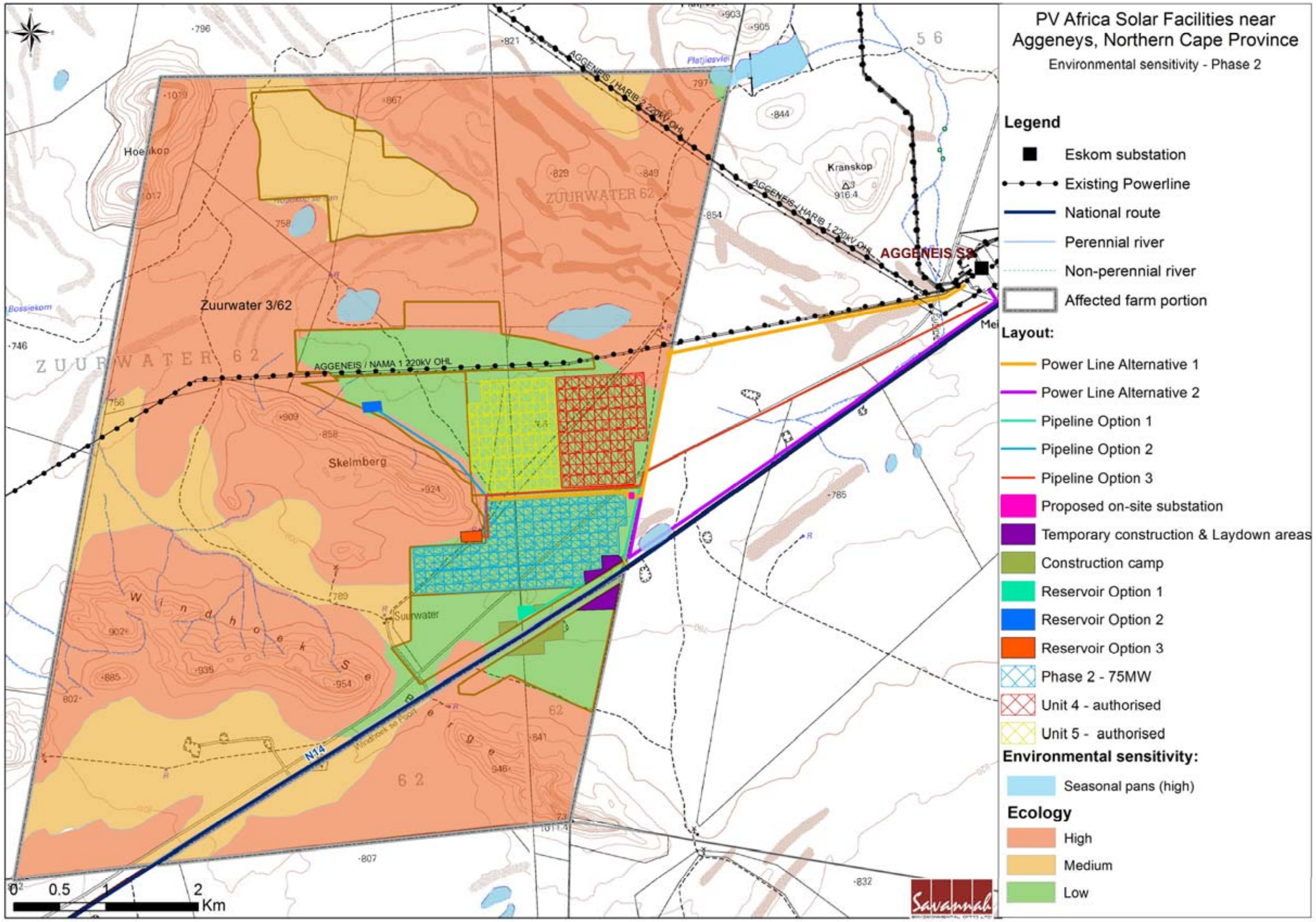

Figure 9.2: Sensitivity map for Phase 2 of the Zuurwater Solar Energy Facility

9.1.2. Impact on Soils, Land Capability and Agricultural Potential

The impacts on **soils** have been rated as **medium significance** with the implementation of mitigation measures. The regic sands and dunes which occur on the site are highly prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. It is therefore important that there should be strict adherence to the Environmental Management Programme and good soil management measures regarding the management of storm water runoff and water erosion control should be implemented during all phases of the project. With the implementation of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

The study area has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The current land use is livestock farming on the farm, predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring.

The impacts on **soils and agricultural potential** have been rated as being of **medium significance**, with the implementation of mitigation measures. No preference is given to the alternative power line routes or reservoir and associated pipeline routes as soils in the area are relatively uniform.

9.1.3. Visual Impacts

The proposed development site is located approximately 9km south-west of the town of Aggeneys in the Northern Cape Province. The site is located in a sparsely populated and remote area. The Black Mountain Mine is located approximately 9km to the north-east of the site. The following potentially sensitive areas exist in the study area:

» The farmers located adjacent to the site (landowners);
» Aggeneys residents; and
» Road users travelling west and east along the N14.

The visual impact of the PV panels and associated infrastructure (including power line) for Phase 2 has been rated as medium significance. During the operational phase the PV panels would be visible from a large distance from the site. The nature of the natural vegetation (i.e. low growing) and the flat topography in the area allows for unobstructed views from various viewpoints in the landscape. It must however be noted that existing infrastructure – such as the Eskom power lines and the Aggenies Substation – do aid in reducing the impact of the PV panels and associated infrastructure in places. Due to the presence of existing power line infrastructure, and the proposal that the power line from the Phase 2 area follow an existing power line to the substation, the change to the overall visual landscape is expected to be minimal. The visual impact of the Phase 2 power line is therefore expected to be low, largely due to the presence of existing power lines in the area. In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and in close proximity to the proposed PV panel areas. Therefore additional visual impacts are not expected. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives.

During the decommissioning or post closure phase of the project, all of the infrastructure will be removed, recycled or re-used off-site. The residual visual impacts of the site are expected to include scarring of the landscape in the areas affected by infrastructure. With the implementation of appropriate management measures such as rehabilitation of disturbed areas and planting of vegetation and visual screening methods at receptors / key viewpoints, this scarring and visual impact could be reduced and removed in the long-term.

The Phase 2 Alternative 2 power line alignment is located in close proximity to the N14, thus being more exposed to views from this road than Alternative 1. Alternative 2 follows the existing Aggeneis-Nama 220kV power line for a portion of the route, thereby consolidating infrastructure of a similar nature to some extent. The Phase 2 **Alternative 1** power line alignment is therefore considered as the **preferred option from a visual perspective**.

9.1.4. Impacts on Heritage Resources

There were no “Heritage Sensitive Areas” identified on the Phase 2 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Phase 1 and will not be impacted by the development footprint of the PV facility. There are no heritage “no go areas” within the site development footprint for Phase 2.

With regard to magnitude and extent of the potential impacts of power lines, it has been noted that their erection generally has a relatively small impact on Stone Age sites. Sampson’s (1985) observations show this from surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon). A more permanent road would tend to be far more destructive (modification of the landscape surface within a continuous strip), albeit relatively limited in spatial extent, i.e. width. On archaeological grounds there is no reason to prefer one alternative route for the power line for Phase 2 over the other.

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure is not expected to pose additional impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary (common to all alternatives) would have localised impacts on the affected properties. This section of the route has however been previously disturbed through construction activities associated with the existing pipeline and it is therefore considered unlikely that heritage resources of significance would be found in this area. There is therefore no preferred alternative in terms of this infrastructure from a heritage perspective.

The impact of the project on **heritage resource** is rated as **low significance**. However, a preconstruction walk-through survey by an archaeologist is to be undertaken for the PV facility and associated infrastructure. Should substantial archaeological or paleontological (fossils) remains be exposed during construction, SAHRA should be alerted as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional archaeologist or palaeontologist. No further specialist palaeontological studies or mitigation were recommended for this development.

9.1.5. Social and Economic Impacts

The proposed project could have negative and positive **social and economic impacts** of **medium significance**. Phase 2 of the Zuurwater Solar Energy Facility will provide opportunities for employment and skills development in the local area. Another potential spin-off from the development is the stimulation of the local economy, including development of industries specifically to provide services and goods for solar power production, and general retail businesses. Potential negative impacts include the threats to public safety from construction and traffic activity, increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. Other impacts on the social environment include impacts associated with noise during construction, as well as impacts on traffic and infrastructure (such as local roads). It is important that potential negative effects are managed as per the recommended mitigation measures to prevent these from developing into unacceptable cumulative impacts. Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements measures (as contained in the socio-economic specialist study and draft EMPr) are utilised.

As power line alternative follows the N14, a higher visual impacts associated with this alternative is expected. Therefore, **Alternative 1** would be the preferred option from a social perspective as this would reduce visual impacts. In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and would therefore not pose additional impacts on the social environment. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is no preference regarding the reservoir location and associated water pipeline route.

9.1.6. Cumulative Impacts

The proposed Phase 2 of the Zuurwater Solar Energy Facility forms part of a larger solar energy facility comprising 6 phases with a total capacity of up to 365MW. In addition, there are other solar energy facilities proposed in the Khai Ma Local Municipality. None of these solar projects have been awarded preferred bidders status at the time of writing this EIA report.

The potential ***cumulative impacts*** as a result of the proposed Phase 2 of the Zuurwater Project and other projects in the area are expected to be associated predominantly with:

» *Visual impact* - The development of numerous similar facilities in the broader area could impact on the visual character and sense of place of the region. The cumulative impact will however to some extent be moderate due to the relatively low incidence of visual receptors in the region.

» *Flora, fauna, and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of avifauna may become cumulative if other renewable energy facilities are developed in the region. Should Phase 2 of the Zuurwater project and 5 other phases of the project and other solar projects in the Namaqualand region be developed, cumulative negative ecological impacts may occur. The significance of this impact is expected to be of a moderate significance and can result in a cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion). However, if negative impacts on ecology are effectively mitigated and managed for each project, through sound environmental management during construction and operation and by formal conservation and active management of the natural areas on site, then the negative impacts on ecosystems on each site can be within acceptable levels, and therefore in keeping with the principles of sustainable development.

» *Land-Use and agricultural potential* – The broader farm portion is 4997ha. Development of 6 phases on the broader farm will result in the loss of ~24% of Portion 3 of the farm Zuurwater 62. The remainder of the farm portion can be continued to be utilised for agricultural activities. Due to the limited crop production in the wider study area, the development of multiple solar energy facilities within the Khai Ma Local Municipality will not affect food security in the region. Due to the vast amounts of land available in the Northern Cape Province, as well as the low agricultural potential and carrying capacity of the land, cumulative impacts on land-use or agricultural potential are of acceptable levels.

» *Cumulative geology, soil and erosion potential* - although the impact of soil removal for the proposed activity has a moderate – low significance, the cumulative impact of soil removal in the area is considered low due to the undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate. The cumulative impact of siltation and dust in the area is considered low, with the legal obligation of good soil management for each project.

» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Current mining such as the Black Mountain Mine, presents a noise source, however the potential for cumulative impacts related to noise is low largely due to the low occurrence of sensitive receptors in the area.

» *Infrastructure* - Increased pressure on existing roads and other infrastructure may occur due to various projects being developed. This will require consultation with parties such as Eskom and SANRAL to prevent significant impacts on existing infrastructure in the area/ with the local municipality.

» *Heritage* –Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to 'sense of place' will occur from various projects in the region. The potential for the loss of or discovery of heritage artefacts in the Namaqualand region will also increase.

» *Impact on the Social and Economic Environment* - The establishment of a number of solar energy facilities in the area may impact negatively on the social environment as a result of issues associated with, for example, influx of people to the area and increased traffic volumes. Cumulative positive socio-economic impacts from a number of renewable energy facilities in terms of job creation and economic growth and development of infrastructure will occur at a local and district municipality level that is in need of this growth and development. This would be a significant positive impact. The adoption of management measures will maximise the cumulative impact for local communities. Each project developed will contribute a percentage of annual profits from the solar project to social beneficiation in the local community, as required by the Department of

Energy. Over at least 20 years, there will be a cumulative social benefit from multiple phases and likely from other renewable development in the surrounding areas. It is important that the social development efforts are managed effectively and efficiently in co-operation with key stakeholders over time so that they contribute progressively to enhancing the lives of surrounding communities.

9.2. Comparison of Alternatives

9.2.1. Power Line Alternatives

In terms of the specialist studies undertaken, the following conclusions were made regarding the preferred power line alternative for Phase 2:

	Alternative 1	**Alternative 2**
Ecology	Preferred	No preferred
Soils and agricultural potential	No preference	No preference
Visual	Preferred	No preferred
Heritage	No preference	No preference
Social	Preferred	No preferred

Based on the above, it is clear that **Alternative 1** is the overall preferred alternative for the power line associated with Phase 2.

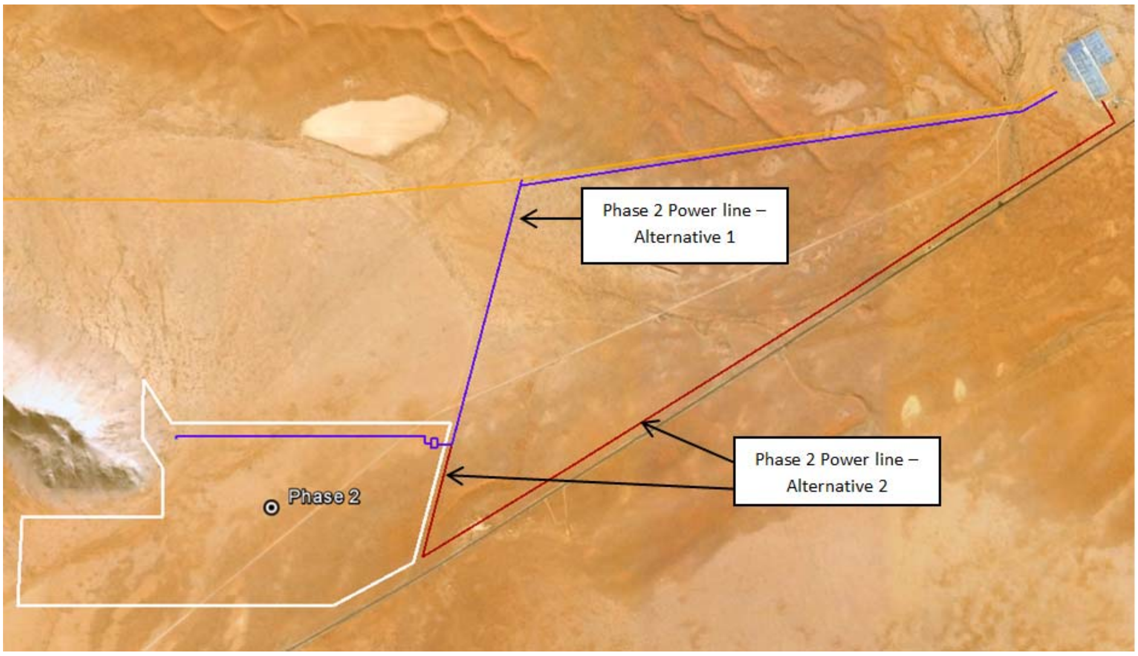

Figure 9.3: Grid Connection Routing Alternatives – Phase 2

9.2.2. Water Reservoir and Associated Pipeline Alternatives

In terms of the specialist studies undertaken, only the ecological assessment recommended a preferred reservoir and water pipeline alternative for implementation. In this regard, **Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option** due to the location of Alternatives 2 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

9.3 Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise from the project proceeding. This could include:

» Loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the PV project (which is limited to the development footprint of 267 hectares). The loss of biodiversity has been minimised by the careful location of the development to avoid key areas supporting biodiversity of particularly high conservation importance.
» Visual impacts associated with the PV panels and power line.
» Change in land-use and loss of agricultural land on the development footprint. The loss of agricultural land has been minimised through the careful placement of the development to avoid key grazing areas located in dune areas on the site.

These costs are expected to occur at a local level.

Benefits of the project include the following:

» Given the very high level of poverty, unemployment and remoteness as well as the limited range of economic opportunity presented in this arid region, the project is poised to bring about important economic benefit at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will transpire during the preconstruction/ construction and operational phases.
» The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix.
» South Africa's per capita greenhouse gas emissions being amongst the highest in the world due to reliance on fossil fuels, the proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW PV project, on a like for like basis.

The benefits of the project are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project.

9.4. 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 a solar energy facility with a generating capacity of 75 MW on a site located on Portion 3 of the Farm Zuurwater 62, has been established by PVAfrica Development (Pty) Ltd. The positive implications of establishing Phase 2 of the Zuurwater Solar Energy Facility on the identified site include the following:

» The potential to harness and utilise solar energy resources within the Northern Cape.
» 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 National electricity grid in the Northern Cape 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.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project 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) for Phase 2 which is 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**.

9.5. 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 Phase 2 of the Zuurwater Solar Energy 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 impacts of Phase 2 of the Zuurwater Solar Energy Facility project can be 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:

» Power Line Alternative 1 must be implemented as the preferred power line alternative.
» Reservoir and pipeline Alternative 1 must be implemented as the preferred alternative.
» The draft Environmental Management Programme (EMP) as contained within Appendix L of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental management standards as detailed for this project. This EMP should be viewed as a dynamic document that should be updated throughout the life cycle of the facility, as appropriate.
» All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices E to J and Appendix P must be implemented.
» An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMPr for the duration of the construction period.
» The regic sands and dunes which occur on the site are highly prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. It is, therefore, important that there should be strict adherence to the EMPr and good soil management

measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project. Therefore, a detailed stormwater management plan must be developed and implemented for the facility following final design.

» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» If any protected plant or tree species will be removed/destroyed by the developer, a collection/destruction permit to be obtained from Northern Cape Department of Environment and Nature Conservation and/or DAFF for the protected species found on site. A walk-through survey of the site development footprint (facility and the power line) will be required prior to construction commencing.
» A walk through survey of the power line to be undertaken by an avifauna specialist prior to construction of the power line in order to highlight spans requiring bird diverters.
» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» Should substantial archaeological or paleontological (fossils) remains be exposed during construction; however, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
» Site rehabilitation of temporary laydown/ construction areas to be undertaken immediately after construction.
» Should the facility be decommissioned, the development footprint must be rehabilitated.
» Alien invasive vegetation to be managed/ removed (as required) during construction, operations, decommissioning and post-closure of the facility.
» The DoE requirement for suitable social beneficiation schemes is supported.
» Following the final design of the facility, a final layout must be submitted to DEA for review and approval prior to commencing with construction.
» Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

ASSESSMENT OF POTENTIAL IMPACTS: PHASE 3 OF THE ZUURWATER SOLAR ENERGY FACILITY (DEA REF. NO.: 14/12/16/3/3/2/472) CHAPTER 10

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 **Phase Three** of the Zuurwater Solar Energy Facility (DEA Ref. No.: 14/12/16/3/3/2/472). This assessment is done for a 60 MW facility and for all the facility's components including:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power lines to transport the power from each Phase into the Eskom grid via the Aggeneis MTS Substation.
» A new on-site water reservoir and associated water supply pipeline (shared infrastructure between all phases)
» Internal access roads.
» Office, workshop area for maintenance and storage.
» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

The Phase 3 PV arrays are proposed to occupy the southern-most position within the larger facility layout (refer to Figure 10.1). Phase 3 is bisected by the N14 and is located approximately 13km south-south-west of the town of Aggeneys (straight line distance). The proposed generating capacity for this Phase is 60MW, covering an area of 192ha. An on-site substation is also proposed for this phase. A new overhead power line (up to a voltage of 275kV) is also required.

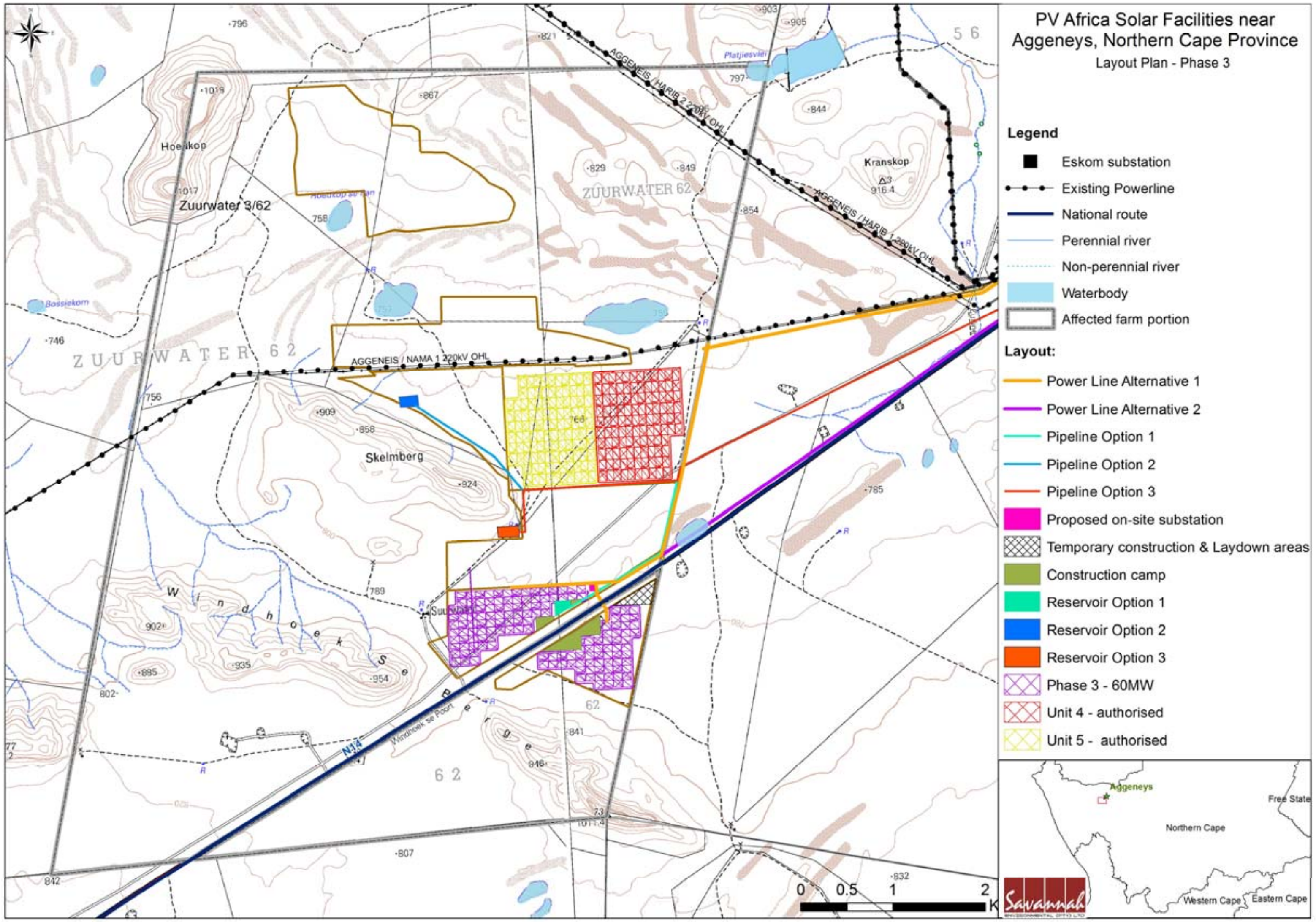

Figure 10.9: Locality / Layout Map for the 60MW PV plant on Portion 3 of the Farm Zuurwater 62 in the Namakwa District, Northern Cape Province - Phase 3

The development of Phase 2 of the Zuurwater project will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access roads, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; construction of power plant, and undertaking site rehabilitation and establishment and implementation of a storm water management plan. Construction is expected to take approximately 15-18 months.
» *Operation* – will include operation of the facility and the generation of electricity. The operational phase is expected to extend in excess of 20 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 and where feasible recycling of the components of the facility; clearance of the site and site rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

6.15. Alternatives

10.1.1. Power Line Alternatives

Two power line options are proposed for Phase 3 (refer to Figure 10.2).

» Alternative 1: This alternative is proposed from the on-site substation to the project boundary and then in a north-west direction, adjacent to the property boundary up to the existing Aggeneis-Nama 220kV power line to the north of the site. The route then follows this power line to the Aggeneis Substation. The length of this power line alternative is ~7.5 km.
» Alternative 2: This alternative is proposed directly adjacent to and to the north of the N14 running north-east towards the Aggeneis Substation. The length of the power line alternative is ~7.1 km.

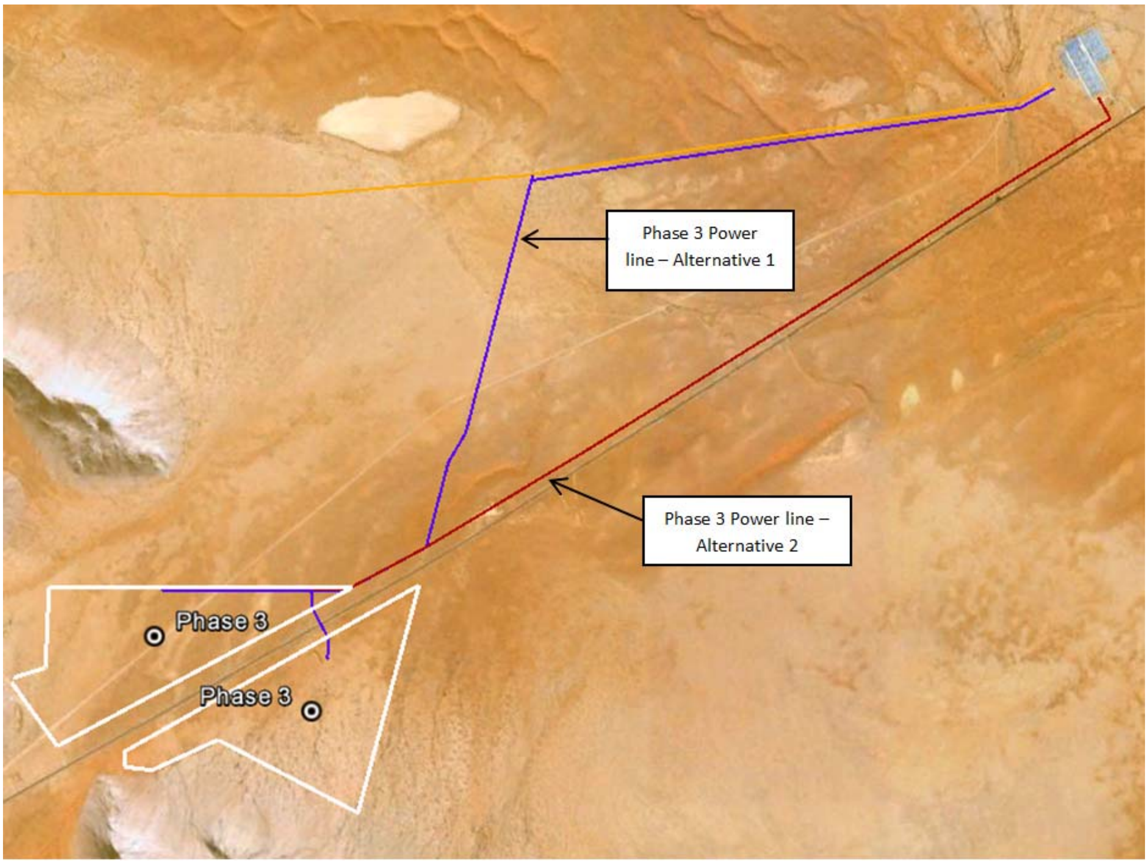

Figure 10.2: Grid Connection Routing Alternatives – Phase 3

10.1.2. Alternatives for on-site water reservoir and associated water supply pipeline

An on-site water reservoir (with a capacity of ~49 995m^3) will be developed to provide water during the operational phase to all phases of the project. This water will be sourced from the nearby Zinc Mine. An existing pipeline between the Aggeneis Substation and the property boundary will be upgraded and utilised for this purpose. A new pipeline section will be constructed within the site boundaries. This infrastructure will be shared between all phases of the project.

Two alternative locations for the reservoir have been identified for investigation (refer to Chapter 2 for more details):

» Alternative 1: The reservoir is proposed to be located within the Phase 3 area adjacent to the N14. The water pipeline is proposed to follow the site boundary in a north-west direction until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 2.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.

» Alternative 2: The reservoir is proposed to be located to the south of the Phase 1 PV Facility. The water pipeline is proposed to be routed in a south-western and then a western direction along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 3.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.

» Alternative 3: The reservoir is proposed to be located to the east of the Phase 2 PV Facility. The water pipeline is proposed to be routed in a northern direction for a short distance, and then along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 2.2km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.

10.2. Methodology for the Assessment of Potentially Significant Impacts

A broader Portion 3 of the Farm Zuurwater 62 was identified by the project developer for the purpose of establishing the proposed Phase 3 of the Zuurwater solar energy facility. The entire Farm Portion will not be utilised for Phase 3 of the solar energy facility, the development footprint (panels and associated infrastructure) will cover an extent of ~192ha of the 4997ha farm portion. This amounts to ~4% of the entire farm portion that will be utilised in the long-term and that would suffer long-term loss / disturbance (over 20 years).

The assessment of potential issues associated with Phase 3 of the solar energy facility and cumulative impacts of the multiple phases of the larger project has involved key input from specialist consultants, the project developer, key stakeholders, and interested and affected parties (I&APs). Cumulative impacts are discussed under Section 10.11.

10.3. 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 undertaken for potential impacts associated with the construction and operation of the Phase 3 of the proposed solar energy facility on the identified site near Aggeneys. Issues were assessed in terms of the criteria detailed in Chapter 4 (Section 4.3.3). 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.

10.4. Potential Impacts on Ecology

Solar energy facilities require relatively large areas of land for placement of infrastructure. Phase 3 of the PV facility requires ~192ha of land for placement of the PV panels. The main expected negative impacts on ecology will be due to loss of vegetation and habitat which may have direct or indirect impacts on individual flora and fauna species. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E - Ecological Impact Report**) for more details). The ecological study undertaken under the previous EIA by SRK Consulting was supplemented by additional site work and a re-assessment report was completed by Savannah Environmental – Refer to Appendix E.

The majority of impacts on ecology will occur during the construction of the proposed PV facility. Impacts on this habitat type could be severely harmful to the survival of threatened species with very limited distribution ranges. Potential impacts for the construction of the solar panels, substation, power line, and the access road were identified as follows:

» Impact on the natural vegetation.
» Impact on the spread of declared weedy and alien invasive plant species.
» Impact on fauna.

Portion 3 of the Farm Zuurwater is situated in an area of vegetation and habitat transitions on the northern edge of the Nama-Karoo and Bushmanland habitat, the western edge of the Kalahari savanna, the southern edge of the Gariep River drainage and the eastern edge of Namaqualand. On the mountains, the Aggeneys Gravel Vygieveld is considered an isolated, rainfall-impoverished and most north-eastern form of true Succulent Karoo vegetation, worthy of special protection due to several rare plant species along with some of its bird inhabitants (e.g. Cinnamon-breasted Warbler). Almost none of this and the more widespread Bushmanland Sandy Grassland vegetation unit are formally conserved. The larger area has at least thirteen plant species of conservation concern, supports four main structural habitats for fauna (with a possibility of about five red data mammals species occurring on the site). The area is further expected to host nine threatened bird species, including the Vulnerable and near-endemic Ludwig's Bustard and Red Lark that are resident and breeding on and around the site. There is a remote possibility that 2 red data reptile species can be present, and a single red data frog may occur on the site.

The habitats considered most sensitive on the broader Farm (Portion 3 of the Farm Zuurwater 62) are the red dunes and areas of deep sand, the mountains and their gravel skirts, and the proximal washes and pans. This leaves the open grassy plains, with shallow soils of mixed gravels and sands, as the least sensitive and most widespread habitat on the farm and surrounding areas. It is proposed that any development should be on the most disturbed areas of the grassy plains, with as little overlap as possible into the drainage lines.

10.4.1. Summary of Ecological Features and Potential Impacts

» *Flora:* The footprint of the 60MW solar energy facility is unlikely to cause widespread loss of threatened flora and/or fauna taxa or change the ecological community structure. The plant species composition on the site will change. However, the area proposed for the Phase 3 development is within the least sensitive area on Portion 3 of the Farm Zuurwater from an ecological perspective, and therefore this project is not considered to have a great influence on any rare plant or animal species. The only protected tree that occurs in the area is *Acacia erioloba* (Camel Thorn), which may be present on the sandy plains. Threatened species and Species of Conservation Concern could occur on the rocky inselbergs and/or quartz plains (however these areas are largely avoided by the development footprint of the PV panels). The effect of shading may alter the vegetation, altering plant community composition, survivorship and/or structure. If shallow excavation is necessary to level the ground first and so alter its soil structure, a slight risk of permanent transformation is expected in the long term but natural adaptation of the vegetation to soil instability (e.g. wind erosion) may mean the effects are temporary or at least capable of rehabilitation.

» *Fauna and Mammals:* From a mammal habitat perspective, it was established that two of the four major habitats are very prominent on the study site, namely terrestrial and rupiculous (rock dwelling) habitat. Of the 56 mammal species expected to occur on the study site, no less than 22 were confirmed during the site visit. Only 3 mammal red data species may occur on the site (Rüppel's horseshoe bat, Geoffroy's horseshoe bat and the Honey badger (however low probability of utilising the site). No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s). The rest of the species richness is made up from common and robust mammals with wide distributional ranges such as aardvarks, springhares, four-striped grass mouse, porcupines, the caracal, the genet, the two mongoose species, the black-backed jackal etc. The development of Phase 3 of the solar energy facility is not considered a significant threat to any bird, reptile or amphibian species, given its limited impact in space (<1,000 ha) and time (<40 years) on the widespread grassy plain habitat.

» *Habitat Loss/ fragmentation:* The PV facility will result in localised habitat fragmentation or connectivity. An increase in weed species on the disturbed areas can be expected. It should further be noted that the greatest potential for impacts to ecology will be during preconstruction/construction, as well as during decommissioning when there is the most activity including levelling and truck movement on the site. The internal access roads within the development site will contribute to habitat loss. During operation, impacts can be expected to be reduced since activities will be restricted primarily to occasional maintenance including panel-cleaning/washing.

- *Birds:* Nine species[24] of international and/or national conservation concern (Red Data species, IUCN/Birdlife International 2011, Barnes 2000), ranging from Near Threatened to Vulnerable, were considered as possible to occur on site, of which two were recorded during the survey (Ludwig's Bustard, Red Lark) and a third reported by the landowner (Kori Bustard). Ludwig's Bustard and Red Lark are both considered Vulnerable by IUCN criteria. The PV array is not considered a direct threat to any bird species, however the new power line is a threat to regular breeding residents (Ludwig's Bustard and Red Lark) and regular visitors to the area (Vulnerable Martial Eagle and Secretarybird, and the Threatened Lanner Falcon). The power line may impact on birds – through either collision or electrocution.
- Herpetofauna (Amphibians and Reptiles): Three Red Data reptiles[25] may occur on the study site. Most of the species of the resident diversity are fairly common and widespread (viz. Karoo tent tortoise, brown house snake, common egg eater, puff adder, horned adder, Cape cobra, Bibron’s tubercled gecko, giant ground gecko, Anchieta’s agama and western rock skink). The high species richness expected on the study site is due to the size of the farm portion (4997 ha), the renowned endemic biodiversity of the Northern Cape and the presence of three of the four habitat types on the site.
- *Pans:* The broader farm portion does form part of the palaeo-drainage system of the Gariep River basin, evident on and around the site as the rather ill-defined Koa River wash(es) and some of their pans. Phase 3 does not occur within any pans/ season washes/ water courses, however any impacts on soils and vegetation will indirectly impact on pans in the broader area. This would cause change of surface and subsurface hydrology, decline of vegetation and fauna populations dependent on the seasonal recharge of the pans.

10.4.2. Ecological Sensitivity Assessment for Phase 3

Additional fieldwork to that completed in the SRK EIA process was conducted by an ecologist to survey and assess the development area for Phase 3 of the PV Facility. This sensitivity assessment is based on a field evaluation of the site and analysis of aerial photography. The ecological sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance.

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[24] Chestnut-banded Plover, Black Harrier, Lanner Falcon, Sclater's Lar, Ludwig's Bustard, Kori Bustard, Martial Eagle, Secretarybird and Red Lark. Two Vulnerable species are expected to be regular breeding residents (Ludwig's Bustard and Red Lark). The Vulnerable Martial Eagle and Secretarybird, and the Threatened Lanner Falcon are expected to be regular visitors to the area, when their prey animals are abundant, but while no sufficiently large trees were seen as likely nest sites for the Eagle or Secretarybird, the large south-facing cliffs, especially on Hoedkop, could well support nesting ledges for the falcon, as they apparently do for Verreaux's Eagle. The remaining four threatened species are expected to be erratic visitors when high rainfall creates productive conditions (plant cover, seeds, insects, small vertebrates).

[25] Namaqua plated lizard, Fisk’s house snake and Namaqua stream frog.

Ecological sensitivity is primarily based on vegetation composition, and has been classified by EcoAgent (2012). Using the information contained in the biodiversity and agricultural report, as well as observations during a field visit, the ecological sensitivity for Phase 3 was reclassified as follows:

Vegetation type / plant community as defined by EcoAgent	**Sensitivity as defined by EcoAgent**	**Re-classified sensitivity**
1. Bushmanland Sandy Grassland (=Vegmap Unit Mucina & Rutherford 2006)	High	High
2.1 Grassland on sandy hummocks	*Low*	*Medium (due to higher grazing potential)*
2.2 Grassland on sandy plains	Low	Low
3 Gravelly calcrete plains(=Vegmap Unit: Aggeneys Gravel Vygieveld, Mucina & Rutherford 2006)	High	High
4. Bushmanland Inselberg Shrubveld (Vegmap Unit Mucina & Rutherford 2006)	High	High
4.1 Shrubveld on mountains, hills slopes and crests	High	High
4.2 South facing slopes	High	High
4.2.1 South-facing scree slopes	High	High
4.2.2 Steep south-facing slopes	High	High
4.3 Rocky north-facing slopes	High	High
5 Azonal vegetation	High	High
5.1 Pans	High	High
5.2 Washes	High	High

The sensitivity of the development footprint for Phase 3 is shown in the table below.

Phase 3 – Infrastructure	**Vegetation**	**Sensitivity**	**Extent**
New PV Array and access roads	Grassland on sandy hummocks	Medium	About 50 % of development on this vegetation
	Grassland on sandy plains	Low	About 45 % of development on this vegetation
	Bushmanland sandy grassland	High	About 5 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.

Substation and Power Line	Grassland on sandy plains	Low	Search and Rescue of species of conservation concern very important prior to commencement of activity.

The ecological sensitivity of Phase 3 of the PV Facility is shown in Figure 10.3. The habitats considered most sensitive on the farm are the Bushmanland sandy grassland vegetation, which only makes up 5% of the development footprint for Phase 3. Outliers of Important Biodiversity areas that fall within the proposed development footprint were investigated to ensure that no red data species occur within these areas and to ensure that these parts of the development do not cause unnecessary damage to biodiversity of conservation concern. Similarly, only 5 % of the proposed development footprint for Phase 3 falls onto areas designated as high sensitivity and ecological support areas. During the last field visit it was verified that in these areas, the proposed development can proceed without significantly changing ecosystem processes or causing a significant loss to sensitive biodiversity, provided the recommended mitigation measures are followed.

As shown in Figure 10.4, the majority of the site for the development of Phase 3 of the PV Facility has been classified as having a low ecological sensitivity: Areas that provide limited ecosystem services and are also of low economic value to the land-owner. Species diversity may be low. Species of conservation concern may be present on such areas, but these are not restricted to these habitats and can be relocated with ease. From an ecological perspective, it should thus be feasible to develop the area as proposed whilst retaining the conservation value and ecological function of the area.

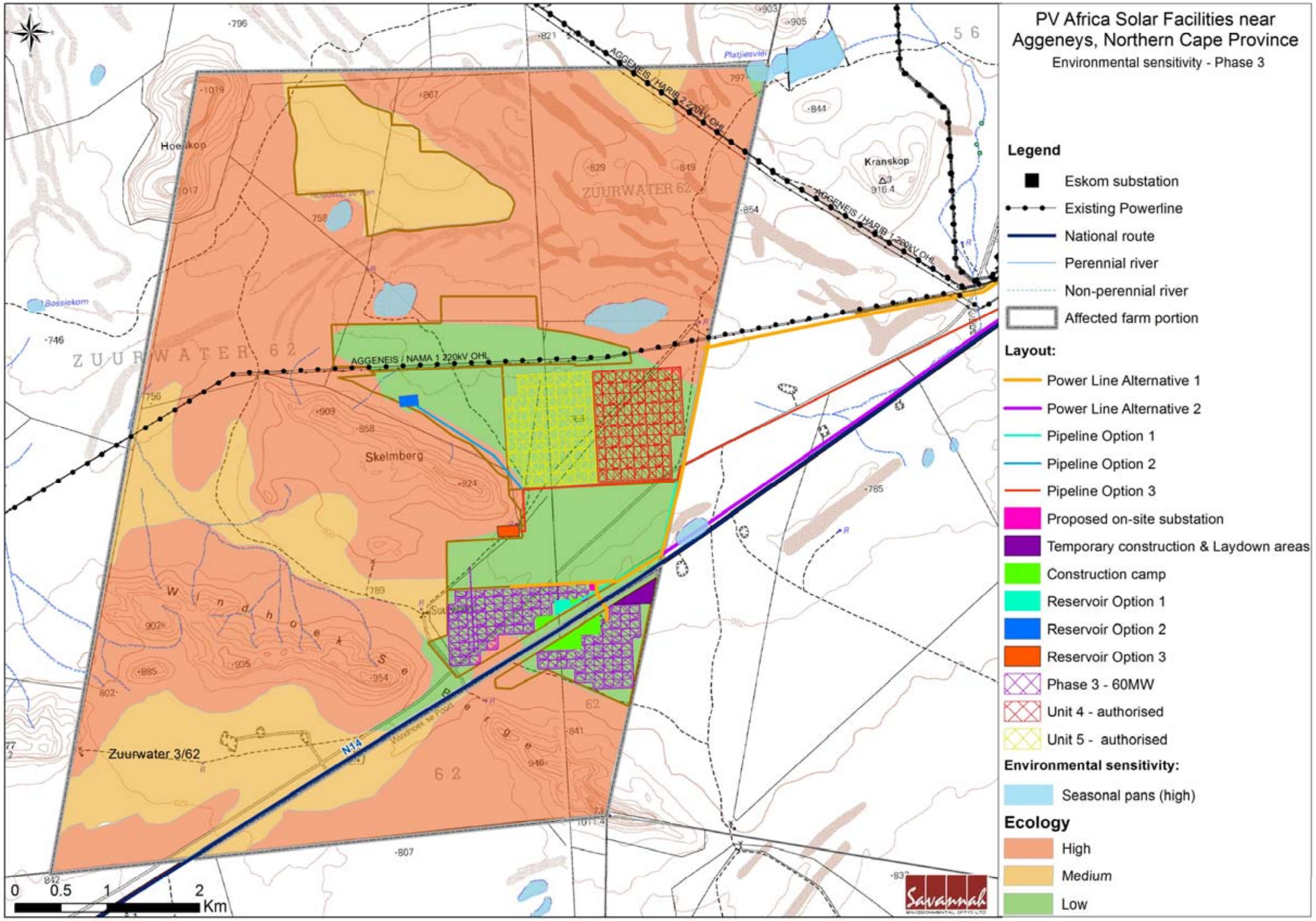

Figure 10.4: Map showing ecological sensitivity assessment ratings for the Phase 3 of the PV Facility

10.4.3. Impact tables summarising the significance of impacts on ecology (with and without mitigation)

Pre-construction/construction/decommissioning:

<table>
<tr><td colspan="5">Impact of PV Facility on ecology without mitigation:
Impact on the functioning of affected Ecological Support Areas (ESA) by the possible change of the desired ecological state or functioning will lead to indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway, e.g. removing a corridor or altering flow of runoff, associated habitat fragmentation. The altered surface may alter runoff and biodiversity migration and composition patterns, but is not expected to significantly alter the functioning of the ESA if mitigation measures are implemented.</td></tr>
<tr><td>Severity</td><td>Spatial extent</td><td>Duration of impact</td><td>Duration of activity</td><td>Frequency of impact</td></tr>
<tr><td>Harmful (4)</td><td>Local (3)</td><td>One month – One year (2)</td><td>Temporary (2)</td><td>Highly likely (5)</td></tr>
<tr><td colspan="5">Result: Medium (63)</td></tr>
<tr><td colspan="5">Mitigation:
» Harvesting of plant material or other damage to fauna and flora must be prevented and avoided, and disciplinary measures to be put in place
» Chemical/petroleum/oil storage area to be bunded (using an impervious surface).
» Introduction of alien plant species must be prevented, and on-going management of alien species control should be carried out
» Disturb the surface as little as possible and only where necessary during construction
» Construct all roads and fences in such a way that they do not significantly alter existing runoff patterns and allow for ample drainage where necessary
» Undertake a rehabilitation plan of all surfaces affected immediately after construction to restore surface characteristics in such a way that it resembles the original and will allow a gradual natural re-vegetation where such has been cleared
» Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated
» Strictly prevent leakage of oil or other chemicals or any other form of pollution, be clear about immediate remedial actions that must be taken should accidental spills occur
» Make use of existing tracks as far as possible, where additional construction activities or maintenance is required, ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery
» Ensure an adequate plant search and rescue program prior to commencement</td></tr>
</table>

of activity, especially geophytes and succulents may need to be relocated

» Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during occasional heavy 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 (storm water and erosion management plan required, together with revegetation of adjacent areas)
» After decommissioning, if the access road or portion thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation
» As soon as the areas affected have been demarcated, carry out a thorough search and rescue operation of all plant species of conservation concern by a horticultural specialist or suitably qualified staff and the ECO before any disturbance or heavy machinery in the area will be allowed.
» Note: many of the species of conservation concern are very small or bulbous species may be dormant, necessitating follow-up work where topsoil will be removed.
» Ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery
» Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during occasional heavy rainfall events, yet preventing erosion of the track and surrounding areas

Impact of PV Facility on ecology with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Project Specific (2)	One month – One year (2)	Temporary (2)	Unlikely (3)
Result: Low (30)				

Operation

Impact of PV Facility on ecology without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: Medium (90)				
Mitigation: » Harvesting of plant material or other damage to fauna and flora must be prevented and avoided, and disciplinary measures to be put in place				

- Chemical/petroleum/oil storage area to be bunded (using an impervious surface).
- Training and awareness programmes for employees on the significance of the ecology to be carried out at regular intervals
- Implement on-going management of alien species control
- Implement measures to ensure no living organisms can come into contact with or entangled by any electrical wiring that might cause short circuits, injury or death.
- Implement storm water management measures.
- Ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery
- Maintain vegetation cover in areas outside the PV arrays.

Impact of PV Facility on ecology with mitigation:

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)

Result: Medium (90)

Impact of water reservoir on ecology without mitigation:

Impacts are expected to be restricted to the actual temporary construction areas only, and with the necessary mitigation measures implemented, surroundings should not be further affected. Rehabilitation of areas that have been disturbed should occur within 1-5 years of construction.

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Activity Specific (1)	Life of Operation (4)	Permanent (5)	Possible (4)

Result: Medium – High (81)

Mitigation:

- No temporary water tanks may be established on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater. Therefore, reservoir alternative 1 should be implemented as the preferred option.
- Keep areas affected to a minimum
- As soon as the areas affected have been demarcated, first carry out a thorough search and rescue operation of all plant species of conservation concern by a horticultural specialist or suitably qualified staff and the ECO before any disturbance or heavy machinery in the area will be allowed.
    - Note: many of the species of conservation concern are very small or bulbous species may be dormant, necessitating follow-up work by the ECO where topsoil will be removed

- o Remove all geophytes and succulents that can be transplanted, keep in a designated on- or off-site nursery and use as far as possible in rehabilitation efforts
- ▪ Prior to the disturbance of any area, the ECO must assess the area for any burrowing mammal, reptile or amphibian and relocate such to a similar habitat out of the footprint area
  - o Ensure that all materials stored on this area are done in such a way that they do not attract and cannot entrap any fauna for the duration of the use of these areas
- ▪ If topsoil needs to be removed, volumes need to be estimated and adequate areas designated for the storage and/or rehabilitation of such topsoil. Such areas will also be subject to a detailed search and rescue operation as above prior to any disturbance taking place.
- ▪ Keep leveling earthworks and soil disturbance to the minimum practically possible, implement a comprehensive topsoil management, soil erosion control and rehabilitation plan once layouts have been finalised
- ▪ Utilise areas as close as possible to existing or future permanent infrastructure, keep buffer zone of the legally required 32 m as a minimum, preferably up to 100 m or more around significant ephemeral drainage lines and/or seasonal pans
- ▪ Remove as little indigenous vegetation as practically possible, rehabilitate and revegetate all areas not used further immediately after construction
  - o Indigenous vegetation that is removed (except species that will be replanted) should be shred and re-applied as mulch or incorporated into re-applied topsoils.
- ▪ Monitor the area regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and revegetation efforts accordingly
- ▪ Strictly prevent leakage of oil or other chemicals and pollutants

» Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Impact of water reservoir on ecology with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Slightly Harmful (3)	Activity Specific (1)	Life of Operation (4)	Permanent (5)	Possible (4)
Result: Medium (72)				

Impact of the power line and substation on threatened birds during operations				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**

Slightly Harmful (4)	Local (3)	Life of Operation (4)	Permanent (5)	Possible (4)
Result: Medium (99)				

Mitigation:

- Limit disturbance to the proposed substation site and power line site and ensure that minimum disturbance takes place in the surrounding area.
- Power line construction should take fauna into account, especially birds and nesting sites.
- A avifauna walk through survey to be conducted prior to construction to determine is power lines need to be fitted with 'flappers' to make the power lines more visible to the birds.
- An avifauna specialist should ground-truth the power line construction areas before development commences in order to ensure no breeding pairs or chicks of conservation significant species are located in the areas and, if there are, how to mitigate the situation before construction begins.
- No power line towers may be placed within 32 m of a pan

Impact of the power line and substation on threatened birds with mitigation:

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Unlikely (2)
Result: Low (63)				

Alteration of seasonal recharge patterns of nearby pans and washes without mitigation:

Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: Medium (90)				

Mitigation:

- Ensure all mitigation recommendations for PV arrays and access roads are implemented
- Ensure that runoff to pans is adequately slowed down to prevent erosion, but not obstructed or deflected to such an extent that runoff patterns into the pans are changed
- Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and re-vegetation efforts accordingly
- Aim to maintain a reasonable cover of indigenous perennial vegetation throughout the operational phase within and on the periphery of the PV array,

preferably low density perennial grasses that can be mowed as need be to reduce fuel loads » Monitor the establishment of alien invasive species around pans and remove as soon as detected, whenever possible before regenerative material can be formed				
Alteration of seasonal recharge patterns of nearby pans and washes with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Insignificant (1)	Project Specific Local (2)	Life of Operation (4)	Permanent (5)	Unlikely (4)
Result: Low (63)				

10.4.4. Impact Summary

Despite the harshness of the environment, a multitude of specially adapted species occur in the many niches provided by the variable landscapes of the area. Most of this biodiversity is concentrated on the mountains and on gravel plains. Vegetation on the less sensitive sandy plains is relatively dynamic and may change dramatically between different seasons, indicating that rehabilitation of disturbed land should be achievable if topsoils are disturbed as little as possible and maintained in a manner that enables the survival of the extensive seed banks within them.

Overall, the impacts can be summarised as follows:

» The proposed Phase 3 of the photovoltaic solar energy facility may have long-term negative impacts on the ecology of the land portion / development footprint and landscape features within it if mitigation measures are not strictly adhered to or implemented.

» Potential negative impacts on the ecological environment would be loss of biodiversity and associated soil degradation as a result of construction and operation of the facility, possible introduction of alien invasive plants and a long-term loss of vegetation.

» A loss of habitats for flora and fauna will occur with the alteration of large areas occupied by the proposed development. The placement of different components of the proposed development has been optimised according to ecological recommendations. This, coupled with the implementation of mitigating measures by the developer, contractors, and operational staff will enable the retention of basic functionality of the ecosystems affected and hence greatly reduce the negative impact of the development.

- The impact on fauna is expected to be negligent. Animals that may be present within the development footprint are mobile and will move away during construction, possibly resettling after construction. No restricted or specific habitat of vertebrates will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas.
- Vegetation cover is expected to change due to the changed environment within and around the proposed development. Rehabilitation and continued monitoring must be carried out until the decommissioning phase to ensure that a stable and functional vegetation cover is established and maintained.
- Phase 3 does not occur within any pans/ season washes/ water courses, however any impacts on soils and vegetation will indirectly impact on these pans.

From an ecological perspective, it should therefore be feasible to develop the Phase 3 area as proposed while retaining the conservation value and ecological function of the area.

10.4.5. Comparative Assessment of Power Line Alternatives

For Phase 3, **Power Line Alternative 2 is the ecologically preferred option** as this power line will run adjacent to the PV arrays and an existing Eskom power line, thus keeping the entire footprint more compact, which will limit further habitat and vegetation fragmentation.

10.4.6. Comparative Assessment of Water Reservoir and associated pipeline alternatives

For Phase 3, **Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option** due to the location of Alternatives 1 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

10.4.7. Implications for Project Implementation

- No temporary infrastructure (such as reservoir Alternatives 1 and 3) may be established on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater.
- If any protected plant or tree species will be removed/ destroyed by the developer, a collection/destruction permit is to be obtained from Northern Cape Department of Environment and Nature Conservation for the protected species found on site.
- Mitigation measures as contained in the EMP must be employed during construction and operations to manage impacts on ecology.

- Site rehabilitation of temporary laydown/ construction areas to be undertaken immediately after construction.
- Should the facility be decommissioned, the development footprint must be rehabilitated.
- Alien invasive vegetation to be managed/ removed (as required) during construction, operations, decommissioning and post-closure of the facility.
- A walk through survey to be undertaken by an ecologist prior to construction of the facility and the power line.
- A walk through survey of the power line to be undertaken by an avifauna specialist prior to construction of the power line.
- An Environmental Management Programme (EMPr) must be implemented during the development of the solar energy facility.

10.5. Potential Impacts on Soils and Agricultural Potential

10.5.1. Impacts on Soils

The regic sands which occur on the site are very prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. The extremely flat nature of the development site means that areas can be prone to widespread surface wash during occasional intense rainfall events. Increased erosion potential will result from scouring effect on drainage lines due to run-off from hard surface areas, as well as increased erosion from areas of exposed soils. Failure to avoid and minimise civil works in wash areas could result in erosion and sedimentation. Extensive removal of vegetation from the development site could also leave the area prone to both water- and wind erosion. Furthermore, unless stocking rates are well managed, temporary removal of a portion of the farm from available grazing (the proposed development site) could increase pressures on the remainder of the farm. The risk of erosion at a larger scale is minimised by the high infiltration rates of the soils, combined with the fact that surface drainage is associated with an endorheic pan (closed system with no outflow to neighbouring catchments). Dust, due to loose soil is also a potential impact, mainly during the construction phase.

Activities that may have an impact on soils include:

- Solar facility footprint (i.e. an array of PV panels, mounting structures, underground cabling between project components and fencing)
- Construction and positioning of internal access roads
- Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)
- Construction and operation of the on-site substation
- Construction and positioning of the on-site workshop area for maintenance, storage, and offices and temporary construction/ laydown areas.

The potential impacts on soil include:

» Soil loss/ erosion
» Soil contamination
» Loss of agricultural land

10.5.2. Impact tables summarising the significance of impacts on soils (with and without mitigation)

Pre-construction/construction

Potential soil erosion without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Permanent (5)	(Daily)4	(Likely)4
Result: Medium-High (96)				
Mitigation: » Avoid disturbance to pans/ seasonal washes. » Minimise the removal of vegetation and the disturbance of topography » Design and construct/install measures which will prevent erosion from panel-washing during operation, to ensure that this is adequately dissipated to sheet flow » Ensure adequate dissipation of concentrated flow to sheet flow from hard surfaces (including panels) to avoid and minimize erosion. This can be achieved by strategically placing stone downstream of hardened surface areas » Place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where appropriate. » Avoid construction during heavy rainfall events where possible. » Implement stormwater management and other erosion (including wind) prevention measures » Construction vehicles are to remain within the development area and avoid unnecessary disturbance.				
Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Project Specific (2)	Between one-ten years (3)	Temporary (3)	Unlikely (3)
Result: Low (42)				

Operation

Potential soil erosion without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	(Project	Life of	Life of	Possible (4)

	Specific) 2	operation (4)	operation (4)	
Result: High (99)				

Mitigation:

- » Minimise the removal of vegetation and disturbance of topography
- » Place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where appropriate
- » Ensure timeous repair of erosion
- » Maintain measures which will prevent erosion from panel-washing during operation, to ensure that this is adequately dissipated to sheet flow
- » Maintain measures which will prevent erosion from water/waste treatment works to ensure that this is adequately dissipated to sheet flow
- » Ensure adequate dissipation of concentrated flow to sheet flow from hard surfaces (including panels) to avoid and minimize erosion. This can be achieved by strategically placing stone downstream of hardened surface areas
- » Ensure timeous repair of erosion, and place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where required

Potential soil erosion with mitigation:

Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Project Specific (2)	Life of operation (4)	Life of operation (4)	Unlikely (3)
Result: Medium (63)				

Decommissioning

Potential soil erosion without mitigation:

Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One Month – One Year (2)	Temporary (2)	Definite (5)
Result: Medium (56)				

Comment / mitigation:

- » Removal of PV panels and associated infrastructure
- » Soils surface to be graded to be free-draining
- » Rehabilitate disturbed areas to original agricultural potential and re-vegetate using appropriately chosen indigenous grasses
- » Ensure timeous repair of erosion, and place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where required
- » Continue monitoring until it can be demonstrated that vegetation is self-sustaining and no erosion channels exist (approximately 2 years following completion of decommissioning).

Potential soil erosion with mitigation:

Severity	**Spatial**	**Duration of**	**Duration of**	**Frequency of**

	extent	impact	activity	impact
Potentially Harmful (2)	Activity Specific (1)	One Month – One Year (2)	Temporary (2)	Likely (4)
Result: Low (30)				

Pre-construction/construction/operation/decommissioning

Soil Contamination: Impact Without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium- High (80)				
Comment / mitigation: » Conduct regular maintenance of vehicles within a dedicated area to avoid and minimise leaks. » Ensure legislative requirements are met for sanitation. » Chemical/petroleum/oil storage area to be bunded (using an impervious surface). » Carry out regular maintenance of any on-site chemical/petroleum/oil storage tank » Implement disposal of e-Waste or hazardous waste at an appropriately licensed landfill site » Carry out rehabilitation following leaks and spills » Conduct removal of contaminated soils to suitable licenced landfill sites » During maintenance activities of the substation, used oils and old transformers must be disposed of correctly. Used transformers are classified as hazardous waste and should be disposed of at a hazardous landfill site.				
Soil Contamination: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	Life of Operation (4)	Infrequent (3)	Unlikely (3)
Result: Low (42)				

Pre-construction/construction/decommissioning

Dust due to loose soils: Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One to ten years (3)	Regularly (4)	Likely (4)
Result: Medium (72)				
Comment / mitigation:				

» Keep the amount of land that needs to be cleared (or development footprint) to a minimum at any given time thereby reducing the amount of erodible surface area;
» Remain on designated roads/tracks
» Rehabilitate after construction and decommissioning. Where possible, re-vegetation of the land should be undertaken with indigenous vegetation immediately after construction is completed in areas that will not be used during the operational phase
» Soil stockpiles should be stored in sheltered areas at the site on the leeward side of hills and inselbergs and covered where possible
» Limit speed at the site to < 40 km/hr and enforce code of conduct for operation of vehicles
» Should the prevailing wind speed increase to levels above 5.4 m/s (~20 km/hr), any land clearing activity should be stopped until wind speeds decrease to below the afore mentioned threshold level
» Utilise dust suppression measures, particularly on access roads

Dust due to loose soils: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (3)	One to ten years (3)	Regularly (4)	Seldom (4)
Result: Medium (64)				

Operation

Dust due to loose soils: Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (3)	Life of Operation (4)	Life of Operation (4)	Infrequent (3)
Result: Medium (63)				

Comment / mitigation:

» Vehicles to utilise designated roads/tracks
» Rehabilitate after construction and decommissioning. Where possible, re-vegetation of the land should be undertaken with indigenous vegetation immediately after construction is completed in areas that will not be used during the operational phase;
» Soil stockpiles should be stored in sheltered areas at the site on the leeward side of hills and inselbergs and covered where possible;
» Limit speed at the site to < 40 km/hr and enforce code of conduct for operation of vehicles
» Should the prevailing wind speed increase to levels above 5.4 m/s (~20 km/hr), any land clearing activity should be stopped until wind speeds decrease to below the afore mentioned threshold level

» Utilise dust suppression measures, particularly on access roads				
Dust due to loose soils: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Local (2)	Life of Operation (4)	Life of Operation (4)	Very Seldom (2)
Result: Low (42)				

10.5.3. Impacts on Land Capability and Agricultural Potential

Agricultural potential is primarily determined by the suitability of the soil profile to support crop production. The soil needs to be adequately thick to support root development and the drainage characteristics need to be good to prevent chemical crusting on the surface. In addition to the soil characteristics, climatic factors are also important because the annual rainfall needs to be adequate to sustain a viable crop production. A major limiting factor in terms of agricultural potential on the site is the availability of water for irrigation as the site is ~40km from the Orange River. The agricultural potential of the site is low and limited to extensive grazing due to the low rainfall in the area. Portion 3 of the Farm Zuurwater has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The current land use is livestock farming on Portion 3 of the Farm Zuurwater, predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring. The proposed site supports natural vegetation interspersed with current and past grazing lands.

No areas with arable potential occur and this is due to a lack of rainfall or irrigation potential. The carrying capacity is typically 4 large stock units (LSU)/100 ha. No grazing or agriculture will take place at the footprint of the solar panels and associated infrastructure (i.e. ~192ha of the 4997ha farm portion), which was sited considering the current agricultural activities. However, the remainder of the site will continue the current land use – i.e. grazing of livestock. At the end of the project life, it is anticipated that removal of the solar panels would enable the majority of the land to be rehabilitated and used for a suitable land-use or activity. Therefore, the impact of the PV Facility on land capability and agricultural potential is not significant and will not impact on food security of the country.

10.5.4. Impact tables summarising the significance of impacts on agricultural potential (with and without mitigation)

Preconstruction/Construction/Operation

Impact on agricultural potential without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Project Specific (2)	Life of operation (4)	(Life of Operation) 4	Likely (4)
Result: Medium (80)				
Comment / mitigation: » Avoid unnecessary removal of vegetation cover and soil » Rehabilitate disturbed areas to original agricultural potential and re-vegetate using appropriately chosen indigenous grasses » Allow access of livestock and wildlife to grazing on the broader farm portion (outside of the development footprint) » Maintain on-going interaction with the farmer regarding appropriate stocking rates on the development area, and the farm as a whole				
Impact on agricultural potential with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	Life of operation (4)	Life of operation (4)	Unlikely (3)
Result: Low (49)				

Decommissioning

Impact on agricultural potential without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One Month to One Year (2)	Life of operation (4)	Likely (4)
Result: Medium (64)				
Comment / mitigation: » Remove all PV panels and associated infrastructure » Rehabilitate disturbed areas to original agricultural potential and revegetate using appropriately chosen indigenous grasses.				
Impact on agricultural potential with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	One Month to One Year (2)	Temporary (2)	Unlikely (3)
Result: Low (25)				

10.5.5. Comparative Assessment of Power Line Alternatives

No preference made as the soils associated with both power line alternatives are fairly uniform.

10.5.6. Comparative Assessment of Water Reservoir and associated pipeline alternatives

No preference made as the soils associated with both alternatives are fairly uniform.

10.5.7. Implications for Project Implementation

» The regic sands and dunes which occur on the site are very prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines.
» It is therefore important that there should be strict adherence to the Environmental Management Plan and good soil management measures regarding the management of storm water runoff and water erosion control should be implemented during all phases of the project.
» With the use of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

10.6. Assessment of Potential Impacts on Heritage & Palaeontology

10.6.1. Archaeology

Disturbance of the soil on the proposed development site could potentially have a destructive impact on heritage resources where these are present. The key risks to heritage resources are during the preconstruction and construction phases when site-clearing and preparation are undertaken. Disturbance of surfaces includes any construction including any *clearance* of, or *excavation* into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible).

The heritage study and palaeontology study did not reveal any significant heritage resources on the site. Very sparse heritage traces were found in the development footprint areas and broader farm portion. On the plains extremely minimal traces were found. A single quartz flake was noted in an erosion feature at 29.32997o S 18.748650 E; and, intriguingly, a single quartz biface (ESA) was found in a deflation area at 29.33123° S 18.74606° E. No other artefacts or notable features were found in association with these. Such completely isolated single-artefact finds could not be considered as constituting “sites” in a conventional archaeological or heritage sense. These observations noted fall under Type 1 for Classes 1-7, again reflecting low heritage significance, low potential and absence of contextual and key types of evidence.

In all instances the impact of the PV Facility, if any, would be local. Impacts on heritage and archaeological resources may be mitigated and hence classed as ‘short term’ but the original in situ context is usually altered in a ‘permanent’ way. If the archaeological or heritage significance of the resources in question are considered to be low – which is the case here – then the significance of the permanent loss is low. The probability of impacts on heritage including archaeological resources is Improbable. Subject to pre-construction ground-truthing, no ‘Phase 2’ mitigation work is regarded as necessary in terms of present development layout.

However, in the event that any heritage feature (which may be sub-surface, such as an unmarked grave) is encountered during the development or operational life of the facility, work is to be halted immediately and contact made with SAHRA (Ms C. Scheermeyer at 021-4624502) and/or the Northern Cape Heritage Authority Ngwao Bošwa jwa Kapa Bokone (Mr A. Timothy) who would arrange for the evaluation of the find for possible mitigation.

From an archaeological perspective the observed heritage resources are of very low significance (low occurrence). Criteria used here for impact significance assessment rate the impacts as Low (even taking into consideration the fact that for heritage traces, unlike biological processes, impacts tend to be irreversible, of permanent duration and high magnitude).

10.6.2. Impact tables summarising the significance of impacts on heritage sites, or objects (with and without mitigation).

Pre-construction/construction/operation/decommissioning
Pre-construction/construction/operation/decommissioning

Destruction of heritage resources/ sites – PV facility: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project Specific (2)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (48)				
Mitigation: » In the event that heritage resources are found, the South African Heritage				

Resources Agency and Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority) should be informed and necessary permits obtained » Although unlikely, where necessary, arrangements for in situ preservation should be made with the heritage authorities				
Destruction of heritage resources/sites – PV facility: impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Activity Specific (1)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (36)				

Destruction of heritage resources/ sites – power line: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (1)	Permanent (5)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (16)				
Mitigation: » Mitigation measures are not considered necessary.				
Destruction of heritage resources/sites – power line: impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (1)	Permanent (5)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (16)				

10.6.3. Impacts on Palaeontology

The Mid Proterozoic basement rocks of the Namaqua-Natal Province are entirely unfossiliferous (Almond & Pether 2008). The fossil record of the Kalahari Group as a whole is generally sparse and low in diversity; no fossils are recorded here in the recent Pofadder geology sheet explanation by Agenbacht (2007). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying Dwyka Group may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (e.g. Hodotermes, the harvester termite), ostrich egg shells (Struthio) and shells of land snails (e.g. Trigonephrus) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (e.g. Corbula, Unio) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels. The younger fluvial and alluvial sands and gravels within the proposed development area are unlikely to contain any substantial fossil or subfossil remains.

The overall palaeontological sensitivity of the Precambrian basement rocks, as well as of the Kalahari Group and younger sediments mapped within the study region, ranges from zero to low (Almond & Pether 2008). The proposed development has a small footprint and deep excavations are not envisaged for photovoltaic installations. The paleontological sensitivity is also relatively low for sediments such as the Precambrian basement rocks, Kalahari group rocks and younger sediments, meaning that the proposed developments will have minimal impact (Almond & Pether, 2008). For these reasons, no further palaeontological specialist palaeontological studies or mitigation are recommended for this development.

However, should substantial fossil remains be exposed during construction; however, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.

10.6.4. Impact tables summarising the significance of impacts on Palaeontology sites, or objects (with and without mitigation).

Pre-construction/construction/operation/decommissioning

Destruction of fossils: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**

Small (2)	Project Specific (2)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (48)				
Mitigation: » In the event that fossils are found, the South African Heritage Resources Agency and Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority) should be informed and necessary permits obtained » Although unlikely, where necessary, arrangements for in situ preservation should be made with the heritage authorities. » Should human remains be uncovered during construction/ excavations, this must be reported to the nearest police station.				
Destruction of fossils with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Activity Specific (1)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (36)				

10.6.5. Comparative Assessment of Power Line Alternatives

With regard to magnitude and extent of the potential impacts of powerlines, it has been noted that their erection generally has a relatively small impact on Stone Age sites. Sampson's (1985) observations show this from surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon). A more permanent road would tend to be far more destructive (modification of the landscape surface within a continuous strip), albeit relatively limited in spatial extent, i.e. width. On archaeological grounds there is no reason to prefer one alternative route for the power line for Phase 3 over the other.

10.6.6. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure is not expected to pose additional impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary (common to all alternatives) would have localised impacts on the affected properties. This section of the route has however been previously disturbed through construction activities associated with the existing pipeline and it is therefore considered unlikely that heritage resources of significance would be found in this area. There is therefore no preferred alternative in terms of this infrastructure from a heritage perspective.

10.6.7. Implications for Project Implementation

» No "Heritage Sensitive Areas" were identified on the Phase 3 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Phase 3 and will not be impacted by the development footprint of the PV facility.
» It was concluded that there are no heritage "No Go Areas" within the site and that the development could go ahead as planned.
» A preconstruction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» Should substantial archaeological or paleontological (fossils) remains be exposed during construction, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
» No further specialist palaeontological studies or mitigation are recommended for this development.

10.7. Assessment of Potential Visual Impacts

Potential visual impacts of Phase 3 of the PV Facility are discussed in this Section, with cumulative visual impacts of multiple phases of this project and approved projects in the area being dealt with separately under Section 10.10.

10.7.1. Visual Character and Quality of the Study Area

The Zuurwater site is located approximately 20km south-west from the town of Aggeneys in the Northern Cape Province of South Africa. The site is located in a sparsely populated and remote area. The Black Mountain Mine is located approximately 9km to the north-north-east of the site. The site is located adjacent to the N14 highway, which runs west to east between the town of Springbok and Pofadder. The existing Eskom Aggenies Substation is located approximately 5km to the east of the site. The area is very flat, with large open plains. The skyline is broken by small rocky outcrops called inselbergs. The visual character of the area is characterised by a changing landscape character associated with the interface between natural areas and modified rural / pastoral or agricultural zones. The skyline is broken by the small inselbergs to the west of the site, which are the only major natural features in the landscape. The landscape is disturbed to the east of the site due to the presence of a large Eskom substation and the mining activities at Black Mountain; however these features are relatively far from the site. Due to this the visual quality rating for the area could be described as medium, due to the lack of natural features in the landscape and some disturbances to the landscape in the east.

10.7.2. Sense of Place

An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places. Lynch defines 'sense of place' as "the extent to which a person can recognise or recall a place as being distinct from other places – as having a vivid or unique, or at least a particular, character of its own" (Lynch, 1992:131). The area around the proposed Zuurwater site is barren and sparse in terms of natural features. In terms of being distinct from other areas, this site is situated along the main road between Springbok and Pofadder; the landscape between these two towns is flat and barren, with some small hills breaking the skyline. Thus this site is not different from the surrounding landscape in its current form. Altering the site through developing the PV arrays may change the sense of place for the site. This change could impact on the sense of place, as the sense of place of the site could allow for the site to be unique in the area. Currently, the sense of place for the site is low.

10.7.3. Visual Receptors

The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon. Sensitivity is also dependent on the viewer's perception of the area and their ability to adapt to changes in the environment. This can also include how frequently they are exposed to the view, i.e. static views from houses would have a higher sensitivity than transient views experienced by motorists. The following potentially sensitive areas exist in the study area:

- The farmers located adjacent to the site (landowners);
- Aggeneys residents; and
- Road users travelling west and east along the N14.

Based on the analysis undertaken, the following individuals could potentially be more sensitive to the development:

- Local residents; and
- Road users travelling along the N14.

It must be noted that whilst on site, traffic flow along the N14 was considered. Whilst a traffic count was not undertaken, it was noted that there were very few motorists travelling between Aggeneys and Springbok. However, it was not known if traffic volumes increase during holiday seasons. The viewer sensitivity are ranked from High (5) to Low (1) based on the probable perceptions of the viewers and their willingness to change.

10.7.4. Visual Exposure / Viewshed

Visual exposure is determined by the zone of visual influence or “the viewshed”. A viewshed is a subset of a landscape unit (envelope) and is the topographically defined area that includes all the major observation sites from which the proposed development will be visible. The boundary of the viewshed demarcates the zone of visual influence. It must be noted for the study of the visual impact of the proposed activities at the Zuurwater Site, each of the activities were investigated separately. Each of the activities was modelled on a hypothetically flat surface. Areas on this surface, where the given activity may be visible, are highlighted. The viewshed is shown in Figure 10.4.

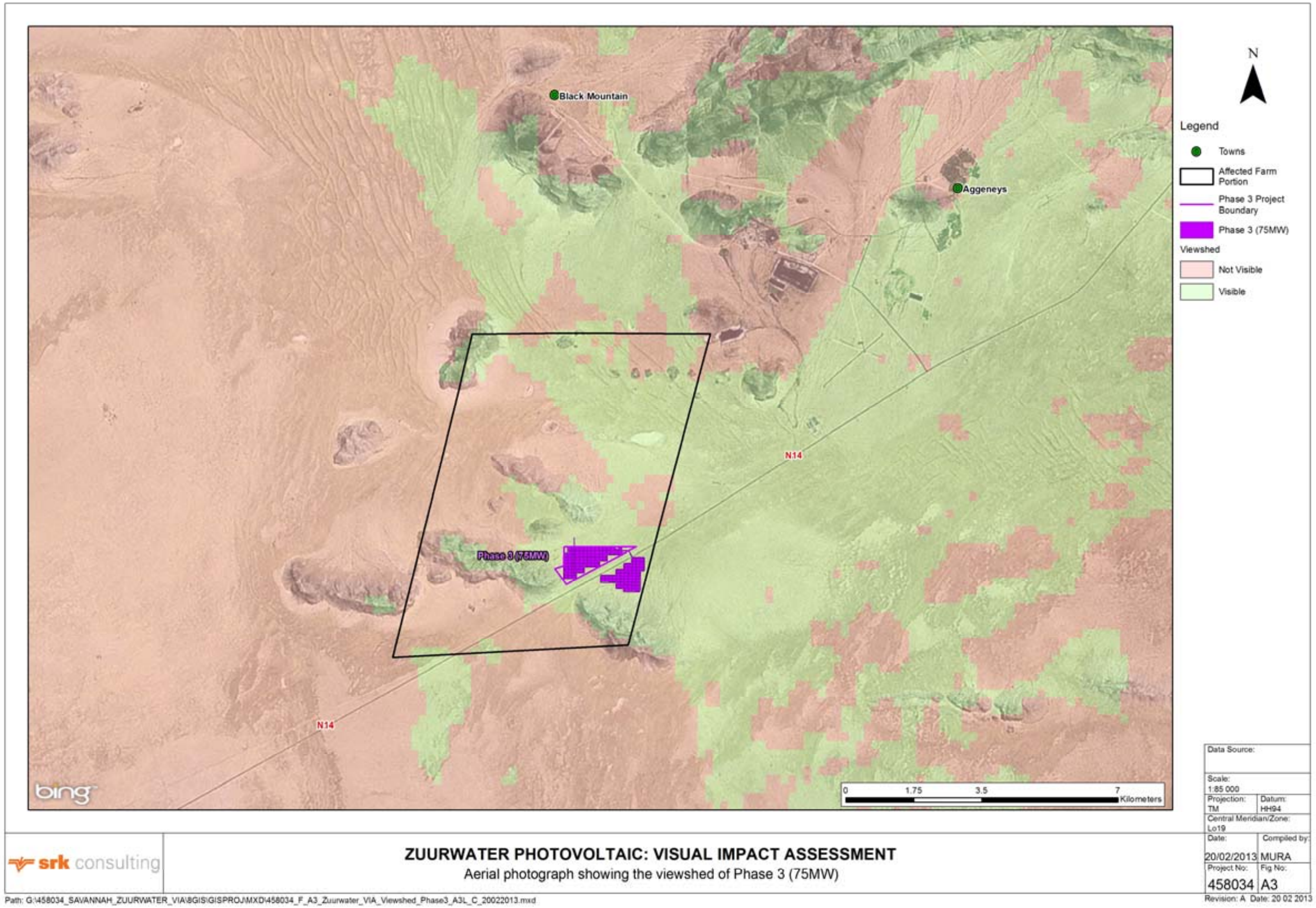

Figure 10.4: Viewshed for Phase 3 of the PV Facility on Portion 3 of the Farm Zuurwater

Phase 3 is positioned approximately 100m from the N14 and 13 km from the town of Aggeneys. This places the N14 viewers into the adjacent category of the visibility and distance rating, however these users can be considered to be transient, whilst the majority of potential viewers (Aggeneys residents) lie with the background category. Thus, the rating is calculated as Background (1). There are not a lot of natural or other types of features in the landscape to aid in shielding views of the overall Zuurwater site. Phase 3 is located in the open, the inselberg to the west and south west of the site may provide some VAC, however due to the spatial extent of the site in relation to this outcrop the VAC is calculated as LOW (5)

During the pre-construction and construction phases of the development of the Zuurwater site, there is potential for a visual impact. This impact could stem from the clearing of sections of the landscape, as well as setting aside areas for the assembling of the infrastructure on the site. It is expected that these visual impacts will be localised to the N14 in the beginning, expanding to a larger area of influence as the size of the excavations increase. During the operational phase, as indicated in the viewshed, the PV panels would be visible from a large distance from the site. The nature of the natural vegetation (i.e. low growing) and the flat topography in the area allows for unobstructed views from various viewpoints in the landscape. It must however be noted that existing infrastructure – Eskom powerlines and substation – do aid in reducing the impact of the PV panels in places.

During the decommissioning or post closure phase of the project, all of the infrastructure will be removed, recycled or re-used in other projects off-site. The visual impacts of the site are expected to be scarring of the landscape where the existing farm roads were used, as well as where the PV panels were placed. With correct management measures, this scarring and visual impact could be reduced.

10.7.5. <u>Impact tables summarising the significance of visual impacts of the PV facility (with and without mitigation)</u>

Preconstruction/construction/decommissioning

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	One to ten years (3)	Temporary (2)	Possible (4)
Result: Medium (60)				
Mitigation: » Minimise the size of the laydown area and work areas » Implement strict procedures for location and management of the				

construction site, laydown and work areas » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Minimise reflective surfaces » Appropriate choice of colour for buildings » Ensure the site is kept neat and tidy (free of litter and refuse) at all times » Any disturbance to the sparse vegetation on site should be kept to a minimum				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Project specific (2)	One to ten years (3)	Temporary (2)	Seldom (3)
Result: Low (40)				

Operation

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium-High (88)				
Mitigation: » Put in place measures for the efficient management of the facility » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Ensure that the PV panels do not cause disruption of passing traffic on the N14. » Ensure fence boundaries and on-site buildings are maintained, in order to keep the site looking neat » Keep the site free of debris and litter, and alien invasive species				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Unlikely (3)

Result: Medium (70)

10.7.6. Visual Impact of the Power line

It is proposed that the PV panels will be connected to the existing Eskom grid and so will entail the connection via an overhead power line to the existing substation. During the pre-construction and construction phases of the proposed new power line, there is a potential for a visual impact. This impact could stem from the clearing of sections of the landscape, as well as setting aside areas for the assembling of the infrastructure on the site. It should however be noted that the overall development footprint for the construction of the power line will be significantly smaller than that of the PV panels.

It is expected that these visual impacts will be localised to the N14 near the existing substation site, however due to the slight undulations in the topography as well as the distance of viewers from the majority of the proposed alignment, much of the preconstruction and construction activities should be shielded from view. During the operational phase, as was shown in the viewshed, the proposed power line is predicted to be visible over a large area. However, due to the presence of existing power line infrastructure, and the proposal that the power line from the Phase 2 area follow an existing power line to the substation for a portion of the length, the change to the overall visual landscape is expected to be minimal. The visual impact of the Phase 2 power line is therefore expected to be low, largely due to the presence of existing power lines in the area.

During the decommissioning or post closure phase of the project, all of the infrastructure used could be removed, recycled or re-used in other projects off-site or integrated into the existing electrical reticulation system. If the infrastructure is removed, the overall visual impact could be seen to be minimal due to the overall footprint disturbed being limited to the servitude of the power line alignment.

10.7.7. Impact tables summarising the significance of visual impacts of the power Line (with and without mitigation)

Preconstruction/construction/decommissioning

Visual impact without mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Local (3)	One to ten years (3)	Temporary (2)	Possible (4)
Result: Medium (60)				
Mitigation:				

» Minimise the size of the laydown area and work areas » Implement strict procedures for location and management of the construction site, laydown and work areas » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Minimise reflective surfaces » Appropriate choice of colour for buildings » Ensure the site is kept neat and tidy (free of litter and refuse) at all times » Any disturbance to the sparse vegetation on site should be kept to a minimum				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Project specific (2)	One to ten years (3)	Temporary (2)	Seldom (3)
Result: Low (40)				

Operation

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium-High (88)				
Mitigation: » Put in place measures for the efficient management of the facility » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Ensure fence boundaries and on-site buildings are maintained, in order to keep the site looking neat » Keep the site free of debris and litter, and alien invasive species				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Unlikely (3)

Result: Medium (70)

10.7.8. Comparative Assessment of Power Line Alternatives

The Phase 3 Alternative 2 power line alignment is located in close proximity to the N14, thus being more exposed to views from this road than Alternative 1. Alternative 2 follows the existing Aggeneis-Nama 220kV power line for a portion of the route, thereby consolidating infrastructure of a similar nature to some extent. The Phase 3 **Alternative 1** power line alignment is therefore considered as the **preferred option from a visual perspective**.

10.7.9. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure would not pose additional visual impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is therefore no preferred alternative in terms of these alternatives from a visual perspective.

10.7.10. Mitigation of Visual Impacts

The role of mitigation is critical in finding a design / rehabilitation solution that will be visually acceptable. Potential mitigation measures have been taken into consideration during the design phase, as discussed above and is also provided by natural features in the area. Only effective, economically feasible, appropriate and visually acceptable mitigation measures should be considered and these should form part of an EMPr to be implemented should the project be approved. Sound planning and design techniques are essential to implement creative alternatives to meet the project’s objectives. These techniques must be viewed as principles or objectives and not rigid standards with limited flexibility:

» During the pre-construction and construction phases of the project, assembly areas and work camps must be kept free of litter. These sites would be visible from the N14 and therefore in order to reduce the visual impact of these sites should be kept presentable and neat;
» Along the N14 are a series of man-made soil berms, these berms act as a visual barrier between sections of the N14 and the PV facility. If practical, these berms could be extended to run along the N14 boundary fence-line to act as a visual barrier between the motorists using the N14 and the PV Facility.

» Buildings on the site should be painted a colour which is consistent with the surrounding landscape. Colours which have a high contrast to the area around the site should be avoided. In order to avoid potential glare, which may cause a distraction to road users of the N14, all surfaces, if possible, should have a matte finish;
» Due to the relatively undisturbed and landscape lacking in vegetative cover, it is recommended that the sites, the sites should be kept neat (no stockpiles of soil or refuse) and litter free, as well as alien vegetation control measures put in place;
» With regards to lighting, the following should be considered:
  - o Lighting on the fence line and security lighting should be faced inwards, except for nocturnal safety lighting; and
  - o Lighting internally, if practical, should be low foot-level lighting, fitted with low intensity bulbs should be used.
» These lighting recommendations should be considered only if they do not pose a threat to site safety.
» In terms of post-closure rehabilitation it is important to restore the environment to a condition whereby the natural functioning of the ecosystem can take place;
» During construction activities, dust control measures should be implemented, i.e. have a water tanker available, and reduce onsite driving speeds;
» External signage should be kept to a minimum and where possible attached to existing buildings to avoid free-standing signs in the landscape.

10.7.11. Implications for Project Implementation

» Visual impacts associated with the PV facility and associated infrastructure (including the power line) are expected to be of low significance largely due to the absence of many visual sensitive receptors from the area as well as the presence of existing power line and the proposal that the preferred power line route to the substation be constructed in parallel to this existing power line for a portion of the route.
» Visual Impacts are difficult to mitigate, however, possible mitigation measures are recommended in Section 10.6.9 above and are included in the EMP.
» In addition, to limit scarring of the landscape, rehabilitate disturbed construction areas and re-vegetate using appropriate indigenous grasses
» Ensure that the PV panels do not cause disruption of passing traffic on the N14.

10.8. Economic impacts

Potential economic (and social) impacts include:

» Disruption of grazing

» Disruption of N14 and other infrastructure
» Economic development
» Creation of employment
» Stability of energy supply
» Expansion of community development projects
» Impacts on public safety
» Noise during construction
» Increased traffic and road safety hazards
» Increased risk of crime, disease with influx of workers and opportunity seekers
» Social divisions over limited jobs and perceived preferential access
» Occupational health and safety
» Impacts from waste (construction, solid, domestic and e-Waste)
» Visual impact

These impacts associated with Phase 3 are discussed below. Cumulative impacts of multiple phases of this project and approved projects in the area are dealt with separately under Section 10.10.

During construction approximately 250-300 jobs will be created over a 15 - 18 month period for this phase of the PV Project. During the operation phase approximately 7-15 full-time employees will be employed during. PVAfrica Development (Pty) Ltd is committing 1.5% and 0.6% of its annual project revenues over 20 years to socio-economic development and enterprise development in local communities respectively. During construction, temporary camps will house construction staff. There are no communities in the immediate vicinity of the site and within the servitude (27.5 m on either side) of the power line.

10.8.1. Disruption of Grazing Activities

The farm as a whole has a relatively low grazing / agricultural potential in the national context, given the low rainfall and high evaporation rates experienced in the area. In this region of the country, commercial livestock ranches are generally large, often comprising tens of thousands of hectares. Net returns are negative for a given year depending on variables including feed costs, weather variables and livestock prices. Return on investments has been low for smaller land owners, and negative net returns can occur based on smaller farming units for three out of twenty years on average. The agricultural specialist report provides information on the extent to which the proposed project will decrease the stocking rate of the Portion 3 of the Farm Zuurwater. During construction, the preparation of the site and the presence of construction equipment will result in disruption of grazing. During the operational phase – the area occupied by the PV panels cannot be used for agriculture. Decommissioning is likely to result again in a temporary more intense disruption of grazing, owing to the presence of vehicles and equipment for the removal of infrastructure.

Pre-construction/construction

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	4	5
Result: Medium-High (90)				
Mitigation: » Implement stormwater management and other erosion prevention measures » Construction vehicles are to remain within the proposed development area » Avoid and minimise the removal of natural vegetation/ grazing				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	3	5
Result: Low-medium (64)				

Operation

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: Medium-high (80)				
Mitigation: » Rehabilitate disturbed land within the development area to original agricultural potential and consider allowing grazing (with conservative stocking rates) between the panels if and where possible. » Prevent disruption of natural vegetation/ grazing both within and around the development area » Maintain stormwater management and other erosion prevention measures » Operational vehicles are to remain within the proposed development area » Implement measures to prevent livestock coming into contact with or entangled by any electrical wiring that might cause short circuits, injury or death.				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	4	4	3
Result: Medium (63)				

Decommissioning

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	3	5
Result: Medium-high (80)				
Mitigation: » Maintain and enhance stormwater management and other erosion (including wind) prevention measures » Implement measures to rehabilitate compaction of soil resulting from the concrete footings, other PV infrastructure and vehicle access. » Undertake rehabilitation to original agricultural potential » Reinstitute conservative stocking rate within development footprint following rehabilitation				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	4
Result: Low (42)				

10.8.2. <u>Economic development</u>

The Northern Cape is a region of marked economic underdevelopment and unemployment, and given the arid and remote nature of the environment, opportunities are limited. Mining, a key contributor to the regional economy, has a limited lifespan entirely dependent on life of mine. This project represents the chance of harnessing the underutilized high solar irradiation levels of this region of the Northern Cape, and the diversification of the local economy. The location within the immediate study area of the Eskom power lines forming part of the national grid feeding Namibia and Springbok also enhances the economic feasibility of the project. Solar power is also one of the development opportunities which have been identified by authorities at the national and regional levels.

Numerous positive economic spinoffs from the project are envisaged for all project stages. Job creation will be at its highest during the construction phase of the project (250-300 employees – required for construction of One Phase of 60MW - 75MW), following by decommissioning (100 people). During preconstruction and operation, although at a reduced scale, jobs created are likely to make a major contribution to the local economy. Permanent, highly skilled and semi-skilled jobs will be created in the operational phase which will contribute to economic stability of the area. Local sourcing of services and materials (where feasible), will contribute to secondary benefits of the project, and could potentially result in the creation of small enterprises and service providers who could in turn generate employment.

Decommissioning will result in some job creation, as well as opportunities through the reuse/ recycling of certain components from the dismantled facility. At the end of decommissioning, there will be job losses and loss of income to the local economy unless the life of the project can be extended such as through retrofitting. Job losses will arise at the end of decommissioning.

Pre-construction/construction

Impact on local economic development without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	3
Result: Low (+42)				
Mitigation / enhancement: » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies and methods where practical				
Impact local economic development with mitigation/enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	3	4	4
Result: Medium (+72)				

Operation

Impact local economic development without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	3
Result: Low (+42)				
Mitigation / enhancement: » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies where practical				

Impact on local economic development with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	4	3	3
Result: Medium (54)				

Decommissioning

Impact on local economic development without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	5	3	4
Result: Medium-high (-63)				
Mitigation / enhancement: » Investigate opportunities for reuse of materials and extension of the life of the operation such as through retrofitting » Procure materials, goods and services from local/regional suppliers where feasible » Implement skills and career development through the decommissioning process » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				
Impact on local economic development with mitigation/enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	5	2	3
Result: Low-medium (-60)				

10.8.3. Creation of employment

The Northern Cape experiences high levels of unemployment, contributed to by long distance to markets, the high aridity levels of the area. There is high dependence on mining operations which will have limited lifespans dependent on availability of mineral resources and international markets.

The greatest number of jobs are anticipated to be created during the construction phase of the project (±250-300 jobs per phase and six phases), followed by decommissioning (100 jobs). Preconstruction will be of limited duration, but the operational phase (7 to 15 jobs) will give rise to long-term (approximately 20 years) highly skilled and semi-skilled jobs.

Decommissioning will result in temporary employment. Jobs will be lost unless the life of the project can be extended through refurbishment and/or retrofitting continued operation.

Pre-construction

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	2	1	5
Result: Low (+48)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	2	1	5
Result: Medium (+60)				

Construction

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	3	3	4
Result: Medium (+70)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop skills of employees » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial**	**Duration of**	**Duration of**	**Frequency of**

	extent	impact	activity	impact
4	4	3	3	5
Result: Medium-high (+88)				

Operation

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (+96)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop skills of employees » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
5	4	4	4	5
Result: High (+117)				

Decommissioning

Impact of job creation without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
5	4	5	5	5
Result: Very high (140)				
Mitigation: » Investigate opportunities for reuse of materials and extension of the life of the operation such as through retrofitting » Procure materials, goods and services from local/regional suppliers where feasible » Implement skills and career development through the decommissioning process » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative				

employment				
Impact of job creation with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	2	3	4
Result: Low-medium (70)				

10.8.4. Stability of energy supply

Eskom, South Africa's key power producer, has been under pressure in recent years to meet electricity demands which has impacted negatively on stability of power supply. The country has been experiencing power outages, exacerbated by the regular need for key coal-based power stations to undergo maintenance. The proposed project stands to make a positive contribution to South Africa's stability of power supply during its operational phase through diversification from reliance on coal-generated power and distribution to areas of high electricity utilisation. This positive impact will be enhanced through efficient management and operation of the PV facility. A negative aspect of power generated by PV is that it is limited to daylight hours.

Decommissioning of the PV facility after 20 years of operation will cause power generation to cease, which will result in negative impact on stability of power supply. This situation could be delayed should it be found that it is feasible to refurbish/ retrofit infrastructure to allow for either total or partial continued operation. Decommissioning should occur in a phased manner and in close communication with Eskom, so as to avoid and minimize instability of power supply.

Operation

Impact of the project on stability of energy supply without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	5	4	4	4
Result: Medium-high (+88)				
Mitigation / enhancement: » Conduct regular maintenance of the plant to avoid and minimise operational down-time » Maintain close liaison with Eskom regarding any possible scheduled or unscheduled down-time				
Impact on stability of energy supply with mitigation / enhancement:				
Severity	**Spatial**	**Duration of**	**Duration of**	**Frequency of**

	extent	impact	activity	impact
3	5	4	5	5
Result: High (+120)				

Decommissioning

Impact on stability of energy supply without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	5	5	5	5
Result: Very high (-140)				
Comment / mitigation: » Investigate the possibility of refurbishment and/or retrofitting for total and/or partial continued operation » Carry out careful planning of the phasing of the decommissioning process » Maintain communication with national energy regulator and power producer (Eskom)				
Impact on stability of energy supply with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	5	5	3	5
Result: High (-104)				

10.9. Social Impacts

10.9.1. Expansion of Community Development Projects

During preconstruction, construction, operation and decommissioning, there is potential to increase coordination with local projects and initiatives falling under provincial community development authorities, local authorities and other organisations encouraging community development. This process will ensure that project activities are harmonised with local spatial and development plans (e.g. Integrated Development Plans, Spatial Development Frameworks and Local Economic Development Plans). Building lines of communication will assist with such aspects as disruption of municipal and other services, and the maximisation of opportunities such as building on support programmes such as HIV/Aids prevention. PVAfrica Development (Pty) Ltd plans to ensure that there is liaison, cooperation and assistance provided to organisations such as community trusts functioning in the immediate vicinity of the proposed project.

Pre-construction/construction/operation

Impact on community development projects without mitigation / enhancement:

Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	4	3	3
Result: Low-medium (+54)				
Mitigation / enhancement: » Carry out early identification of existing community initiatives which can be expanded » Conduct consultation with stakeholders regarding community development projects requiring enhancement » Carry out targeted support to existing community development projects in line with identified needs				
Impact on community development projects with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (+96)				

Decommissioning

Impact on community development projects without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (-96)				
Mitigation / enhancement: » Carry out early identification of existing community initiatives which can be expanded » Conduct consultation with stakeholders regarding community development projects requiring enhancement » Carry out targeted support to existing community development projects in line with identified needs » Implement skills and career development through the decommissioning process where feasible » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				
Impact on community development projects with mitigation / enhancement:				
Severity	**Spatial**	**Duration of**	**Duration of**	**Frequency of**

	extent	impact	activity	impact
2	3	4	3	3
Result: Low-medium (54)				

10.9.2. Impacts on Public Safety

The proposed development site is situated far from neighbouring towns, with the town of Aggeneys (the closest settlement) being approximately 9km away. Although there are no communities in close proximity to these servitudes there is one farming family resident on the farm. There are further passers-by in the form of low-volume traffic on the N14. Potential safety hazards during preconstruction, construction and decommissioning include:

» Injury from machinery, equipment and construction vehicles through following unauthorized access to the construction area(s)
» Road accidents involving construction vehicles
» Electrocution from high voltage power lines and substations

The operational project technology is not known to pose any risks to the health of the public, although if not managed could pose a safety hazard should members of the public trespass on to the site. The hazards posed through unauthorized access during the operational phase potentially include electric shocks and/or electrocution through third party tampering with equipment and installations such as live wiring. Since 24 hour security and warning signage will be in place on site, the likelihood of incidents occurring is considered to be very remote.

Pre-construction / construction/ decommissioning

Impact on public safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	3	3	3
Result: Low (48)				
Comment / mitigation : » Institute and maintain 24 hour security and access control to the project site » Set up signage warning of on-site hazards » Clearly demarcate construction areas » Construct and maintain security fencing on the perimeter and around electrical substations » Develop and implement emergency response procedures				
Impact on public safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	3	2	2

Result: Very low (24)

Operation

Impact on public safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: High (80)				
Comment / mitigation: » Institute and maintain 24 hour security and access control to the site » Set up signage warning of on-site hazards » Clearly demarcate operational areas » Construct and maintain security fencing on the perimeter and around electrical substations » Verify the technical competency of staff operating and managing the facility » Implement and carry out regular review of emergency response procedures				
Impact on public safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	1	4	2	2
Result: Low (32)				

10.9.3. Increased noise

The proposed development site is situated in a predominantly natural and remote area with very low ambient noise levels. The neighbouring Black Mountain Mine has limited if any influence on noise levels on the site, and the town of Aggeneys is also situated too far away to have significant influence on ambient noise levels. The relatively close proximity of the development site to the N14 will, however, assist with the attenuation of noise levels.

The primary source of noise during the preconstruction, construction and decommissioning phases will be through the operation of trucks and machinery associated with the construction process. These are the phases where noise impacts are anticipated to be most intense through the operation of trucks for clearing of vegetation (preconstruction), transportation of construction materials (construction) and dismantled materials (decommissioning). There will also be noise impacts generated from the operation of vehicles supplying logistics support, such as supply of water for domestic use. Noise impacts during the operational phase are anticipated to be lower the more limited use of vehicles and equipment for cleaning of panels, vehicles for transport of water and those for supply of services/logistical support. Ambient noise will also be contributed to by the presence of workers during preconstruction, construction, operation and decommissioning.

Pre-construction/ construction /decommissioning

Noise impacts without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	4	4
Result: Medium (80)				
Comment / mitigation : » Implement regular maintenance of vehicles » Minimise construction activities between 6pm and 6am in sites close to homestead » Ensure placement of accommodation/ construction camp away from the resident farmer's household » Enforce strict speed limits for vehicles moving on the property » Develop and put into effect a code of conduct for employees				
Noise impacts with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	3	3	3
Result: Medium (54)				

Operation

Noise impacts without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	2	4	4	4
Result: Low (56)				
Comment / mitigation: » Implement regular maintenance of vehicles » Minimise construction activities between 6pm and 6am in sites close to homestead » Enforce strict speed limits for vehicles moving on the property » Develop and put into effect a code of conduct for employees				
Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	2	3	4	3
Result: Low (49)				

10.9.4. Increased risk of crime, disease with influx of workers and opportunity seekers

A major outbreak of HIV/Aids has swept South Africa in recent decades, and communicable diseases also have a high incidence in the country. Desperation for sources of income can also draw people into prostitution. As with other new developments, the proposed project is likely to set up expectations of employment opportunities which could potentially result in in-migration of job-seekers. This could result in an increase in the crime rate and may exacerbate the risk of spread of disease unless measures are put in place to discourage risky behaviour by job-seekers and employees and contractors. It is anticipated that the risk of spread of disease as well as crime will be highest during the preconstruction, construction and decommissioning phases of the project, and that during the operational phase when there is a stable workforce, the risks will be lowest. It is possible that crime could be linked to such activities as tampering with security features and theft of equipment.

Preconstruction/construction/decommissioning

Impact due to influx of workers without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	4	4
Result: Medium-high (88)				
Comment / mitigation: » Enhance and/or support local and provincial authority initiatives on HIV/Aids and communicable disease awareness » Employ local people where possible » Include conditions for contractors to provide HIV/Aids education and introduce rotation to enable contract workers not residing in the area to visit their homes regularly » Provide recreational facilities such as soccer fields for construction workers and facilitate access to nearby towns for shopping, religious gatherings, etc. » Manage expectations of job creation through the information and communication programme » Maintain close liaison with local and provincial law enforcement agencies » Incorporate into the code of conduct for employees including punitive measures for theft and related crimes				
Impact due to influx of workers with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	2
Result: Low (28)				

Operation

Impact due to influx without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	3	3
Result: Medium (60)				
Comment / mitigation: » Enhance and/or support local and provincial authority initiatives on HIV/Aids and communicable disease awareness » Employ local people where possible » Manage expectations of job creation through the information and communication programme » Maintain close liaison with local and provincial law enforcement agencies » Incorporate into the code of conduct for employees punitive measures for theft and related crimes				
Impact due to influx of workers with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

10.9.5. Social divisions over limited jobs and perceived preferential access

High unemployment rates within the vicinity of the study area are likely to increase expectations, and perhaps result in unrealistic anticipation, of job creation by the project. The public participation process highlighted the desire amongst community members that job creation should be maximised by the project. The requirement for highly technical and skilled employees during all project phases means that the number of jobs created at community level could be relatively limited. It is possible that divisions within communities could be sown should it be perceived that outsiders are preferentially obtaining jobs, and that employment opportunities are limited for local people. Should there be corruption and nepotism associated with employment, this will exacerbate the problems. The risk of these impacts arising is most likely during the preconstruction, construction and decommissioning project phases when employment levels are at their highest on the project. However, the DoE requirements include use of locally available skills and social beneficiation as part of the development and operation of the project. In addition, the developer should manage expectations from local communities by being transparent.

Preconstruction/ construction/ decommissioning

Social division / impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	4	5
Result: Medium (99)				
Comment / mitigation: » Employ local people where possible » Establish and maintain transparency in recruitment procedure » Ensure transparency in recruitment procedures » Maintain effective communication with local community structures and stakeholders during all project phases to address potential and real tensions. » A communication and information programme should be used to maximise procurement from local service providers » Include management and enhancement measures for local and BBBEE employment in the EMP				
Social division / impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	3	2	3
Result: Low (40)				

Operation

Social division / impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	4	4	4
Result: Medium (56)				
Comment / mitigation: » Employ local people where possible » Establish and maintain transparency in recruitment procedures » Ensure transparency in recruitment procedures » Maintain effective communication with local community structures and stakeholders » A communication and information programme should be used to maximise procurement from local service providers » Include management and enhancement measures for local and BBBEE employment in the EMP				
Social division / impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2

Result: Low (32)

10.9.6. Health and Safety Impacts

The development of the PV plant will involve activities that potentially could be unsafe to workers on the project. These activities include clearing of the development site, digging of trenches, laying of cables and backfilling. These activities all require the use of heavy duty vehicles, machinery and equipment. Additionally, there is a risk posed by road accidents during the transportation of components and materials, both on access routes and national/ provincial roads, as well as within the development site. There is furthermore the risk of exposure to diseases including HIV/Aids and communicable diseases such as tuberculosis (TB).

During the operational phase, occupational health and safety impacts could include injury (including electric shocks or electrocution) to workers from routine monitoring and maintenance, as well as when responding to emergencies such as fire, electrical malfunctions or structural failure of equipment such as the collapse of a PV panel during a wind storm. Dangerous conditions could result from corrosion of electrical components, erosion, flooding and third party damage. During decommissioning, there is the risk of injury caused by mishandling or malfunction of electrical components, injury during dismantling of equipment and movement of vehicles or collisions, and events such as suffocation from collapse of trench walls.

Preconstruction/construction/decommissioning

Health and safety impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	3	4	4
Result: Medium (64)				
Comment / mitigation: » Adhere to OHS legal requirements and measures contained in the EMP » Establish and implement OHS procedures for employees on site, including use of Personal Protection Equipment (PPE) » Conduct regular staff training on OHS » Implement an employee code of conduct which incorporates safety issues including prohibition of operating vehicles and machinery after use of substances which could impair reflexes				
Health and safety impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	3	4	3

Result: Low (42)

Operation

Health and safety impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: Medium (80)				
Comment / mitigation: » Adhere to OHS legal requirements and measures contained in the EMP » Establish and implement OHS procedures for employees on site, including use of Personal Protection Equipment (PPE) » Conduct regular staff training on OHS » Implement an employee code of conduct which incorporates safety issues including prohibition of operating vehicles and machinery after use of substances which could impair reflexes				
Health and safety impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	4	4	3
Result: Low (49)				

10.9.7. Impacts from waste (construction, solid, domestic and e-Waste)

Several categories of waste will be generated in each of the project phases (preconstruction; construction; operation and decommissioning). If not appropriately managed, waste generated could result in impacts on air, soil and water quality, as well as visual (aesthetic) quality. Sanitation and wastewater facilities will cater for the anticipated employees during preconstruction; construction; operation and decommissioning. Domestic solid waste generation can be expected to be proportional to the number of workers during each project phase, and thus the highest volumes are likely to be generated during the construction phase. During preconstruction and construction, domestic solid and liquid waste will be the primary source. The volumes of non-domestic and domestic waste will be at their lowest during the operational phase of the project, although on-going PV plant maintenance is likely to result in limited quantities of components requiring replacement. Waste will be disposed of at a suitably registered municipal landfill site.

Decommissioning is anticipated to commence around 20 years after the initial commencement of construction. It is at this stage of the project that the greatest volume of waste is anticipated to be generated. Reuse of materials will be prioritised, and failing this being an option, will be recycled and only as a last resort discarded in licensed landfills. Recyclable materials (glass, metals and certain grades of plastics) will be recycled via existing recycling operations. Non-solid waste will be disposed of at an appropriately registered landfill site. Concrete slabs forming the foundation for the PV modules are planned to be crushed, for use as fill on construction site/road-building projects. Alternatively, crushed concrete will be used for rehabilitation of the disused quarry on the site (such as in the form of gabions). Waste rock (if any), will also be used for the rehabilitation of the disused quarry on the site. e-Waste will be disposed of in a suitably registered landfill site. It is expected that the value received for recyclable waste will be used to subsidise the cost of decommissioning.

Preconstruction/construction

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	5	4	4
Result: Medium-high (96)				
Comment / mitigation: » Implement measures to ensure that disposal at appropriately licenced landfill sites is carried out » Use construction waste rock/soil for rehabilitation of the disused quarry on the Farm Zuurwater » Apply the hierarchy of waste management to project activities » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard » Consider the NEM: Waste Act				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	5	3	3
Result: Low (48)				

Operation

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	4	3	2
Result: Low (35)				
Comment / mitigation: » Implement measures to ensure that disposal of waste, including e-waste, is carried out at appropriately licensed landfill sites				

» Use construction waste rock/soil for rehabilitation of the disused quarry on the farm Zuurwater » Apply the hierarchy of waste management to operational activities » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard » Implement measures to ensure the efficient maintenance of infrastructure to maximise the lifespan of components » Consider the NEM: Waste Act				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	1	4	3	2
Result: Low (30)				

Decommissioning

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	3	4
Result: Low-medium (70)				
Comment / mitigation: » Apply the hierarchy of waste management to decommissioning activities, thus minimizing waste volumes generated » Clear the development site of all waste generated during decommissioning » Implement measures to ensure disposal to appropriately licensed landfill sites. Dispose e-Waste at a suitably registered landfill site » Use construction waste rock/soil for rehabilitation of disused quarry » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	2	2	3
Result: Very low (25)				

10.9.8. Comparative Assessment of Power Line Alternatives

As power line alternative 2 follows the N14, a higher visual impacts associated with this alternative is expected. Therefore, **Alternative 1** would be the preferred option from a social perspective as this would reduce visual impacts.

10.9.9. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and would therefore not pose additional impacts on the social environment. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is no preference regarding the reservoir location and associated water pipeline route.

10.9.10. Implications for Project Implementation

» The social benefits of the project outweigh the potential negative and localised social impacts / disturbances due to the project.
» Potential negative impacts include the threats to public safety from construction and traffic activity, increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. It is important that potential negative effects are managed as per the mitigations provided and contained in the EMP to prevent them developing into unacceptable cumulative impacts.
» Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements described in the impact assessment are instituted.
» Construction and operational noise, traffic and waste to be well-managed to prevent negative social impacts.
» The DoE requirement for suitable social beneficiation schemes is supported for the development of the project.

10.10. Impact on Traffic

The study area is serviced by a national road (the N14) which is in good condition, and which links the major centres (notably Upington to the east, and Springbok to the west). The N14 further links with traffic travelling to and from Namibia situated to the north of the site. All of the smaller municipalities and communities are further situated either adjacent, or close to the N14. This road is thus of extremely high importance in ensuring economic and social linkages are maintained in this region of the Northern Cape.

The baseline traffic volumes have been found to be very low, and the projected number of project vehicles for all project phases are further regarded by the traffic specialist in the previous report by SRK Consulting as being very low. It was determined that services are at a very good Level of Service “A”, even with the project-generated traffic. SANRAL requested a buffer on either side of the N14. A buffer of 60m on the N14 has been applied by the developer. Construction activities will increase traffic on the N14, if that is well managed the impact of the facility on traffic can be manageable.

10.10.1. Traffic Implications of the Proposed Development

The existing traffic flows plus added traffic / road users related to the Zuurwater solar energy facility are expected to generate low traffic flows on the N14. The N14 will still operate at a Level of Service A road, even with this additional traffic. The new, left- and right-turning traffic from the N14 into the formal accesses to the facility is not considered to be of high volumes and no exclusive right-turn lanes or left-turn deceleration lanes will be required to accommodate the facility generated traffic. The access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic.

10.10.2. Location of Access Roads to the Site

From a geometric and road safety perspective, the location of the existing and proposed access road to the facility on the N14 at km92,227 and at km94,072 is considered to be acceptable although there are numerous potential alternative locations should this existing access not be acceptable to the developer, the landowner or SANRAL for any reason.

10.10.3. Road Safety

Road safety conditions along the N14 in the vicinity of the site are considered to be good with an accident rate that is not noticeably higher than the average for the N14. The speed limit on the N14 in the vicinity of the Zuurwater site is 120 km/h and sight distance conditions to and from both directions at the location of the proposed access is considered to be acceptable for this speed limit. There is no evidence of pedestrian or public transport activity nor wild or domestic animal activity within the road reserve in the vicinity of the site. As the volume of traffic that enters and leaves this existing access point is expected to increase, particularly when there will be both construction and operational activities occurring at the same time, advanced warning of this side road activity will be required.

10.10.4. Driver Distraction Due to the PV Panels

Probably one of the biggest potential impacts of this photovoltaic power generation facility is driver distraction, firstly from the novelty impact of the facility as there are not many such facilities currently in South Africa and secondly from potential glare and / or reflection off the panels which may distract drivers as they are travelling past the facility at 120km/h. Setting the arrays back by 60m from the road reserve will reduce the potential impact of the panels. The majority of the PV panels will be located to the north of the N14 and will be north facing away from the N14 and therefore it will not be possible for the panels to reflect onto the N14. On the basis of the above, it will not be possible for any reflection from the panels to occur onto the N14 from the north or south.

It is recommended that temporary high visibility advanced warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 in both directions approaching the position of the two accesses to the facility during construction and that permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 at both accesses once construction is completed and the facility is fully operational. Whilst theoretically there is no potential for reflections from the panels and infrastructure to affect passing motorists on the N14, it is recommended that reflections from the arrays are monitored from the first installation to confirm this. No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed Zuurwater solar energy facility, cumulatively.

10.10.5. Impact Tables Summarising Impacts on Traffic

Pre-construction/construction/decommissioning

Impact on traffic without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	3	4
Result: Low-medium (70)				
Comment / mitigation: » Implement efficient scheduling of goods delivery and water » Implement measures for conduct of employee and contractor drivers » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences » Maintain communication with SANRAL regarding their requirements for measures to be instituted » Implement a 60m buffer on the N14. » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic				

Impact on traffic with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	2
Result: Low (35)				

Operation

Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	4	4	3
Result: Low-medium (63)				
Mitigation: Implement efficient scheduling of goods delivery and water » Implement measures for conduct of employee and contractor drivers » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences » Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic				
Impact on traffic with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	3	2
Result: Low (40)				

Pre-construction / construction /decommissioning

Impact on road safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	3	4	4
Result: Medium-High (80)				
Comment / mitigation : » Implement efficient scheduling of goods and water delivery » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project				

commencement » Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic » Implement measures for conduct of employee and contractor drivers » Establish and enforce a strict code of conduct for employees and contractors which includes adherence to traffic rules				
Impact on road safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	2
Result: Low (28)				

Operation

Impact on road safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	4	4	4
Result: Medium-high (88)				
Comment / mitigation: » Enforce a strict code of conduct for employees and contractors which includes adherence to traffic rules » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic » Implement efficient scheduling of goods and water delivery » Maintain communication with SANRAL regarding their requirements for measures to be instituted				
Impact on road safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

10.10.6. Implications for Project Implementation

- It is recommended that temporary high visibility advanced warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 in both directions approaching the position of the two accesses to the facility during construction and that permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 at both accesses once construction is completed and the facility is fully operational.
- Whilst theoretically there is no potential for reflections from the panels and infrastructure to affect passing motorists on the N14, it is recommended that reflections from the arrays are monitored from the first installation to confirm this. No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed Zuurwater solar energy facility, cumulatively.

10.11. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers 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 undertakings in the area[26]. Based on information available at the time of undertaking the EIA, the impact of solar facilities on the landscape is therefore likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of solar plant applications. The Northern Cape is earmarked as a potential solar energy hub for South Africa. In the case of the proposed Phase 3 of the Zuurwater Solar Energy Facility, there are other phases to the project and other solar energy facilities proposed in the Khai Ma Local Municipality. Other phases/ projects on Portion 3 of the Farm Zuurwater under the same applicant (PVAfrica Development (Pty) Ltd) are shown in Table 1 and are shown in Figure 10.5.

Table 10.1: Other phases/ projects on Portion 3 of the Farm Zuurwater under the same applicant (PVAfrica Development (Pty) Ltd)

Project	Applicant / Developer	DEA Ref. No	Location	Status
11. Proposed Photovoltaic Plant on the Farm Zuurwater near Aggenys - Unit 4 (75MW)	PVAfrica Development (Pty) Ltd (previously SATO Holdings)	14/12/16/3/2334/4	Section of Farm Zuurwater No. 62	Authorised in August 2012
12. Proposed Photovoltaic Plant on the	PVAfrica Development (Pty) Ltd	14/12/16/3/2334/5	Section of Farm Zuurwater No. 62	Authorised in August 2012

[26] Definition as provided by DEA in the EIA Regulations.

Farm Zuurwater near Aggenys - Unit 5 (75MW	(previously SATO Holdings)			
13. Phase 1 of the Zuurwater PV Facility (75MW)	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/470	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 6
14. Phase 2 of the Zuurwater PV Facility	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/471	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 8
15. Phase 4 of the Zuurwater PV Facility (75MW)	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/473	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 12

The other authorised / proposed projects/ developments in the Khai Ma Local Municipality are listed in Table 2.

Table 10.2: Projects/ Developments Proposed in the Khai Ma Local Municipality

Project	**Applicant / Developer**	**DEA Ref. No**	**Location**	**Status**
13. Aggeneys Solar Photovoltaic (PV) power plant (84MW)	Orlight SA (Pty) Ltd	12/12/20/2630	Portion 1 of Aroams 57 RD	Environmental Authorisation (EA) issued
14. 10MW Photovoltaic Plant at Black Mountain Mine	Aurora Power Solutions (Pty) Ltd in partnership with Black Mountain Mining	12/12/20/2151	At Black Mountain Mine	Final Basic Assessment Report Submitted to DEA
15. Boesmanland Solar Farm	Boesmanland Solar Farm (Pty) Ltd.	12/12/20/2602	Next to Black Mountain Mine (Portion 6, a portion of Portion 2 of the Farm 62 Zuurwater)	Final EIA submitted to DEA in 2013 Decision – pending
16. Pofadder Wind and Solar Energy Facility	South Africa Mainstream Renewable Power Development (Pty) Ltd	» 14/12/16/3/3/2/348 (Wind) » 14/12/16/3/3/2/347 (Solar)	Near Pofadder	Scoping Phase complete, EIA in process
17. Eskom Aggeneis – Oranjemond 400kV power line	Eskom	12/12/20/2041	From Aggeneis Substation to – Oranjemond Substation	Environmental Authorisation (EA) issued in May 2012.

18. Proposed Gamsberg Zinc Mine and Associated Infrastructure	Black Mountain Mining	» DENC Reference Number: NC/EIA/NAM/KHAI/AGG/2012-NCP/EIA/0000155/2012 » DEA Reference Number: 12/9/11/L955/8 » DMR Reference Number: NCS 30/5/1/2/2/1/518	To the east of the Farm Zuurwater No. 62 on farms Bloemhoek 61 Portion 1, Gams 60 Portion 1, Aroams 57 RE and Gams 60 Portion 4	EIA in process

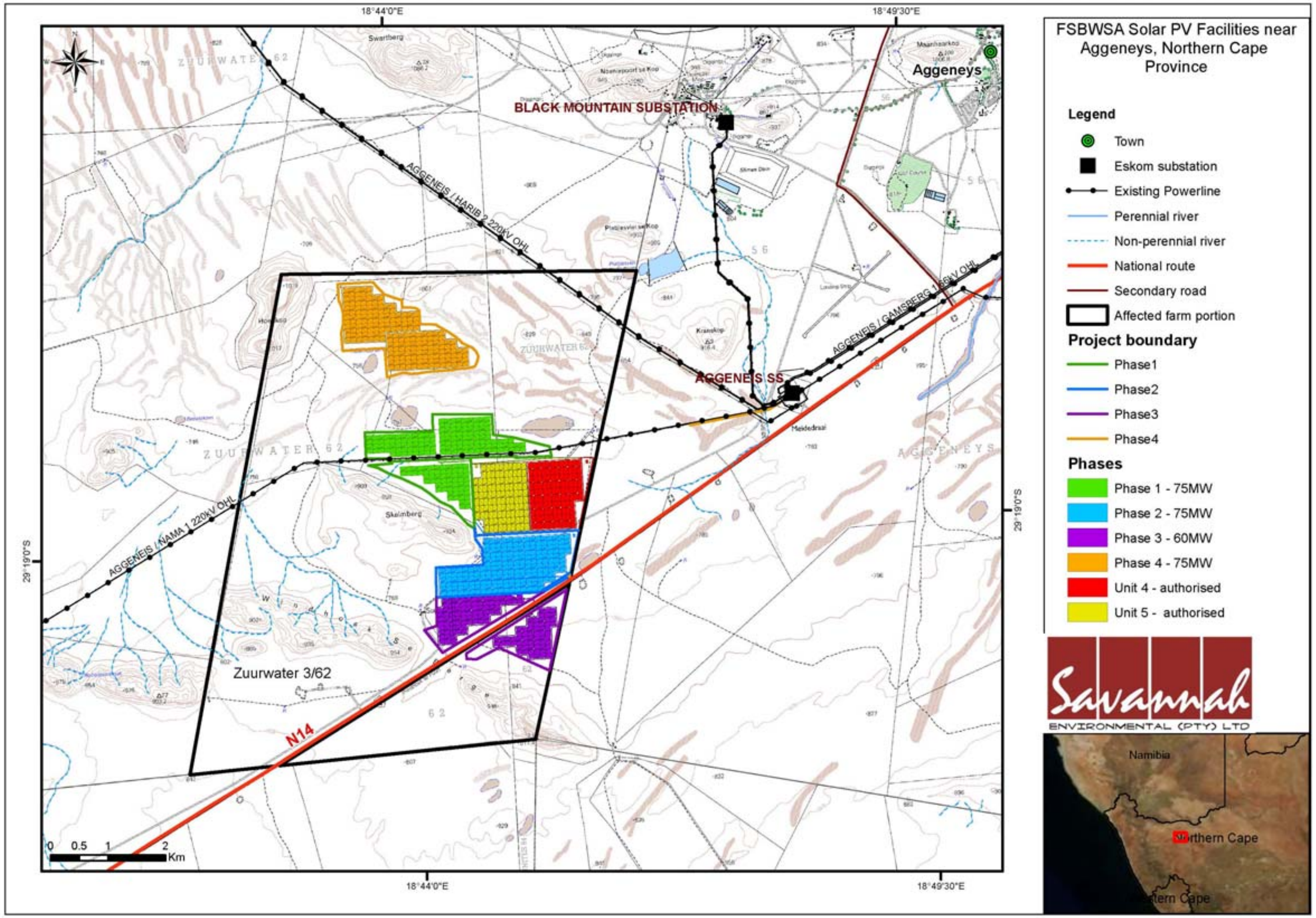

Figure 10.10: Map showing Phase 1 – Phase 4 and two authorized phases of the proposed solar projects on Portion 3 of the Farm Zuurwater No. 62

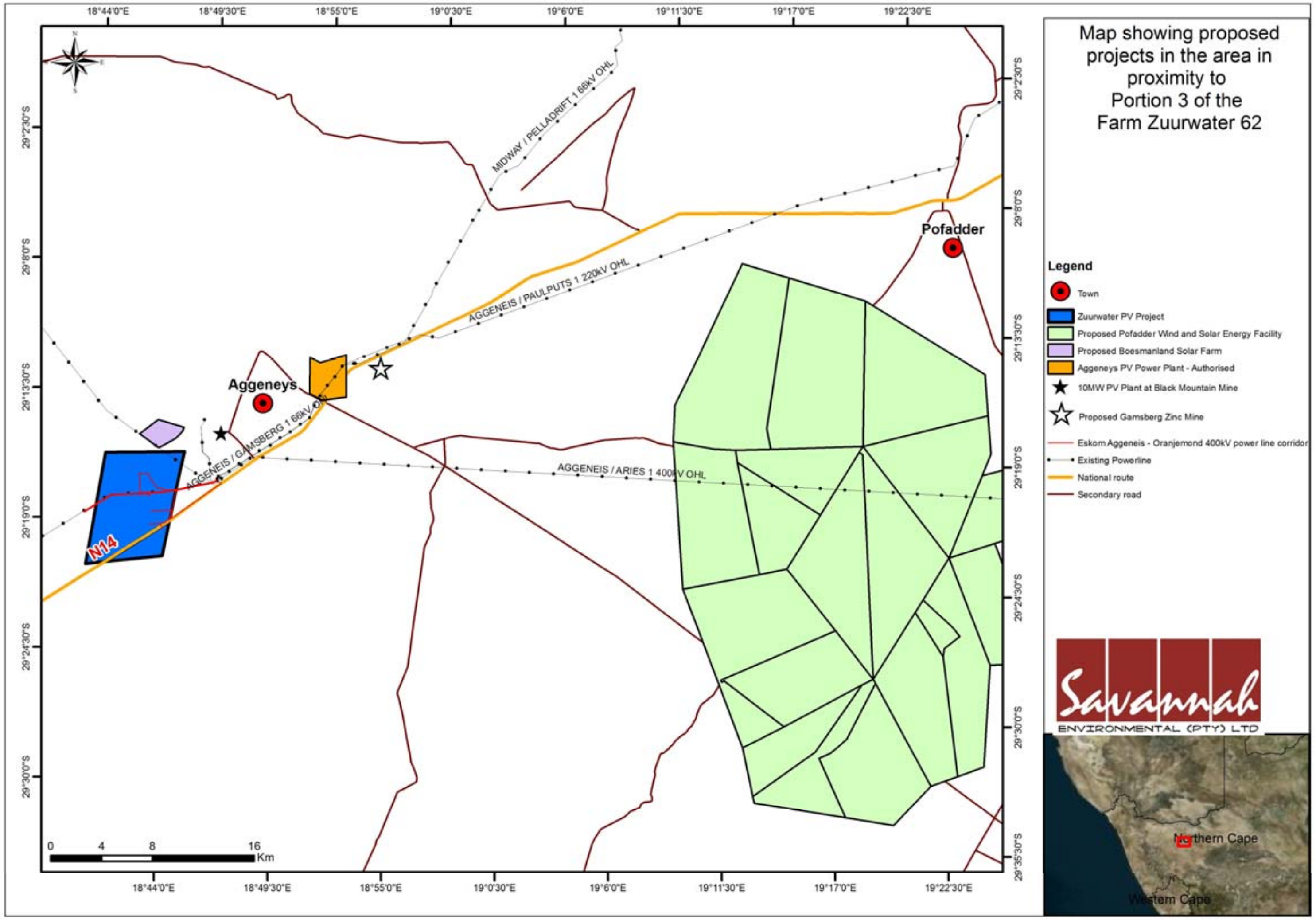

Figure 10.5: Map showing other proposed and authorised project within the vicinity of the Zuurwater Project

None of the above-mentioned solar projects have been awarded preferred bidders status at the time of writing this EIA report. Cumulative impacts discussed below and have been considered within the detailed specialist studies, where applicable (refer to Appendices F - J).

The potential ***cumulative impacts*** as a result of the proposed Phase 3 of the Zuurwater Project and other projects in the area are expected to be associated predominantly with:

» *Visual impact* - The visual impact associated with the proposed Phase 3 of the Zuurwater Project and 5 other Phases of the Zuurwater project will be sequential and additive, due to the visibility of solar panels from 6 or more solar energy facilities on Portion 3 of the Farm Zuurwater No. 62. From a visual perspective, the overlapping viewsheds can be considered favourable, as it represents the consolidation and concentration of potential visual impacts within a clustered region (i.e. the development of a solar energy facility node, rather than dispersing the impact to other areas). A cumulative viewshed in shown in Figure 10.6. The development of numerous similar facilities in the broader area could impact on the visual character and sense of place of the region. The cumulative impact will however to some extent be moderate due to the relatively low incidence of visual receptors in the region.

» *Flora, fauna, and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of avifauna may become cumulative if other renewable energy facilities are developed in the region. Should Phase 3 of the Zuurwater project and 5 other phases of the project and other solar projects in the Namaqualand region be developed, cumulative negative ecological impacts may occur. The significance of this impact is expected to be of a moderate significance and can result in a cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion). However, if negative impacts on ecology are effectively mitigated and managed for each project, through sound environmental management during construction and operation and by formal conservation and active management of the natural areas on site, then the negative impacts on ecosystems on each site can be within acceptable levels, and therefore in keeping with the principles of sustainable development.

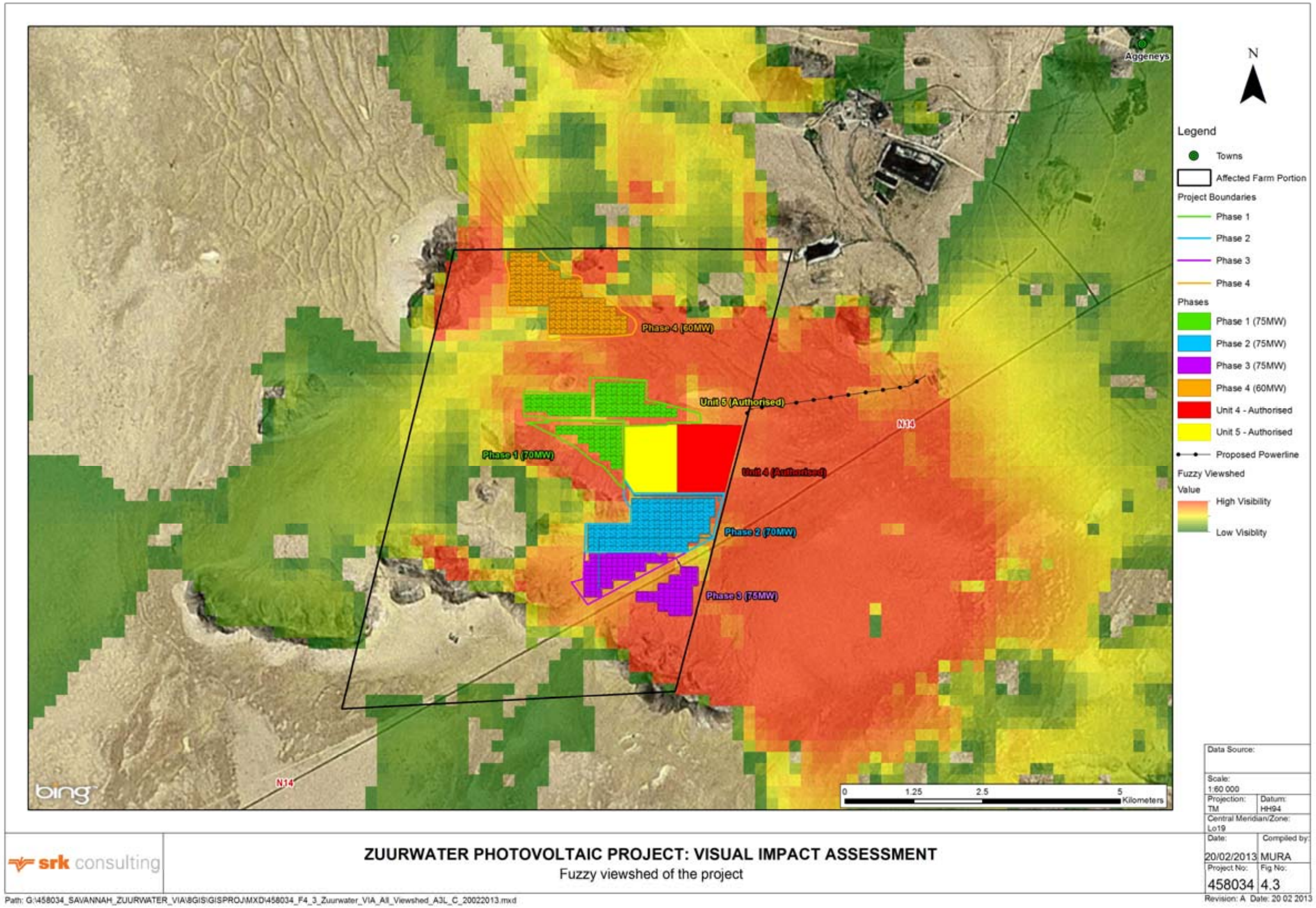

Figure 10.6: Cumulative Viewshed for the various Phases of the Zuurwater Solar Energy Facility

» *Land-Use and agricultural potential* – The broader farm portion is 4997ha. Development of 6 phases on the broader farm will result in the loss of ~24% of Portion 3 of the farm Zuurwater 62. The remainder of the farm portion can be continued to be utilised for agricultural activities. Due to the limited crop production in the wider study area, the development of multiple solar energy facilities within the Khai Ma Local Municipality will not affect food security in the region. . Due to the vast amounts of land available in the Northern Cape Province, as well as the low agricultural potential and carrying capacity of the land, cumulative impacts on land-use or agricultural potential are of acceptable levels.

» *Cumulative geology, soil and erosion potential* - although the impact of soil removal for the proposed activity has a moderate – low significance, the cumulative impact of soil removal in the area is considered low due to undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate. The cumulative impact of siltation and dust in the area is considered low, with the legal obligation of good soil management for each project.

» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Current mining such as the Black Mountain Mine, presents a noise source, however the potential for cumulative impacts related to noise is low largely due to the low occurrence of sensitive receptors in the area.

» *Infrastructure* - Increased pressure on existing roads and other infrastructure may occur due to various projects being developed. This will require consultation with parties such as Eskom and SANRAL to prevent significant impacts on existing infrastructure in the area/ with the local municipality.

» *Heritage* –Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to ‘sense of place’ will occur from various projects in the region. The potential for the loss of or discovery of heritage artefacts in the Namaqualand region will also increase.

» *Impact on the Social and Economic Environment* - The establishment of a number of solar energy facilities in the area may impact negatively on the social environment as a result of issues associated with, for example, influx of people to the area and increased traffic volumes. Cumulative positive socio-economic impacts from a number of renewable energy facilities in terms of job creation and economic growth and development of infrastructure will occur at a local and district municipality level that is in need of this growth and development. This would be a significant positive impact. The adoption of

management measures will maximise the cumulative impact for local communities. Each project developed will contribute a percentage of annual profits from the solar project to social beneficiation in the local community, as required by the Department of Energy. Over at least 20 years, there will be a cumulative social benefit from multiple phases and likely from other renewable development in the surrounding areas. It is important that the social development efforts are managed effectively and efficiently in co-operation with key stakeholders over time so that they contribute progressively to enhancing the lives of surrounding communities.

10.12. Assessment of the Do Nothing Alternative

The ‘do-nothing’ alternative is the option of not constructing the proposed Phase 3 of the Zuurwater Solar Energy Facility. Should this alternative be selected, there would be no 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 won’t be any transfer of skills to people in terms of the construction and operation of the solar energy facility. 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 60 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.

At a broader scale, the benefits of this solar energy facility would not be realised. 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 power supply will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province’s grids. The ‘do nothing alternative is, therefore, not a preferred alternative.

10.13. Summary of Impacts

The following table provides a summary of the impact rating of the potential impacts identified and assessed through the EIA. As can be seen from this table, there are positive and negative impacts of high significance expected to be associated with the construction, operation and decommissioning of the proposed facility. With the used of mitigation measures impacts can be mitigated. All identified impacts can therefore be mitigated to acceptable levels.

Table 10. 4: Summary of Impact Ratings For Potential Impacts Associated with Phase 3 of the Zuurwater PV Facility

Impact	Significance Rating					
	Preconstruction /Construction		Operational		Decommissioning	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Ecological Impacts						
Ecological impacts on fauna and flora and ecosystems	Medium (63)	Low (30)	Medium (90)	Medium (90)	Medium (63)	Medium (56)
Impact of water reservoir on ecology	Medium – High (81)	Medium (72)	Medium – High (81)	Medium (72)	Medium – High (81)	Medium (72)
Impact of the power line and substation on threatened birds during operations	-	-	High (110)	Medium-High (90)	-	-
Alteration of seasonal recharge patterns of nearby pans and washes	High (110)	Low (63)	High (110)	Low (63)	High (110)	Low (63)
Soils and Agricultural Potential						
Potential soil erosion	Medium-High (96)	Low (42)	Medium (80)	Low (32)	Medium (56)	Low (30)
Contamination of soils	Medium-High (80)	Low (42)	Medium-High (80)	Low (42)	Medium-High (80)	Low (42)
Dust due to loose soils	Medium (72)	Medium (64)	Medium (63	Low (42)	Medium (72)	Medium (64)
Impacts on Land Capability and Agricultural Potential	Medium (80)	Low (49)	Medium (80)	Low (49)	Medium (64)	Low (25)
Impacts on Heritage & Palaeontology						
Destruction of heritage resources/ sites	Low (48)	Low (36)	Low (48)	Low (36)	Low (48)	Low (36)
Destruction of fossils	Low (48)	Low (36)	Low (48)	Low (36)	Low (48)	Low (36)
Visual impacts						
Visual impact of the PV	Medium (60)	Low (40)	Medium-High (88)	Medium (70)	Medium (60)	Low (40)

Impact	**Significance Rating**					
	Preconstruction /Construction		**Operational**		**Decommissioning**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Panels						
Visual Impact of the Power line	Medium (60)	Low (40)	Medium-High (88)	Medium (70)	Medium (60)	Low (40)
Economic Impacts						
Disruption of grazing	Medium-High (90)	Low-medium (64)	Medium-high (80)	Medium (63)	Medium-high (80)	Low (42)
Impact on local economic development	Low (+42)	Medium (+72)	Low (+42)	Medium (54)	Medium-high (63)	Low-medium (-60)
Creation of employment	Medium (+70)	Medium-high (+88)	Medium-high (+96)	High (+117)	Very high (140)	Low-medium (70)
Impact of the project on stability of energy supply	-	-	Medium-high (+88)	High (+120)	Very high (-140)	High (-104)
Social						
Impact on community development projects	Low-medium (+54)	Medium-high (+96)	Low-medium (+54)	Medium-high (+96)	Medium-high (96)	Low-medium (54)
Impact on public safety	Low (48)	Very low (24)	High (80)	Low (32)	Low (48)	Very low (24)
Noise	Medium (80)	Medium (54)	Low (56)	Low (49)	Medium-high (80)	Medium (54)
Increased traffic and road safety hazards	Medium-High (80)	Low (28)	Medium-high (88)	Low (32)	Medium-High (80)	Low (28)
Impact due to influx of workers	Medium-high (88)	Low (28)	Medium (60)	Low (32)	Medium-high (88)	Low (28)
Social divisions over limited jobs and perceived preferential access	Medium (99)	Low (40)	Medium (56)	Low (32)	Medium (99)	Low (40)
Health and safety impact	Medium (64)	Low (42)	Low (35)	Low (30)	Medium (64)	Low (42)
Waste (construction,	Medium-high (96)	Low (48)	Medium-high (80)	Low (48)	Low-medium	Very low (25)

Impact	Significance Rating					
	Preconstruction /Construction		Operational		Decommissioning	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
solid, domestic and e-Waste)					(70)	
Impact on Traffic	Low-medium (70)	Low (35)	Low-medium (63)	Low (40)	Low-medium (70)	Low (35)

CONCLUSIONS AND RECOMMENDATIONS: PHASE 3 OF THE ZUURWATER SOLAR ENERGY FACILITY

(DEA REF. NO.: 14/12/16/3/3/2/472) CHAPTER 11

PVAfrica Development (Pty) Ltd is proposing to establish four commercial photovoltaic solar energy facilities on the Farm Zuurwater 62 near Aggenys, Northern Cape Province. The broader site is located within the Khai Ma Local Municipality (approximately 9 km south-west of Aggeneys. in the Northern Cape Province). ***This Chapter of the EIA report deals only with the conclusions and recommendations of the EIA for the Phase 3 of the larger "Zuurwater PV Facility".*** The purpose of the proposed facility is 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).

This assessment was done for a 60 MW facility and for all the facility's components including:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power line to transmit the power from Phase 3 into the Eskom grid via the Aggeneis MTS Substation. Two alternative power line routes were identified for investigation.
» A new temporary on-site water reservoir and associated water supply pipeline (shared infrastructure between all phases). Three alternative locations and associated pipeline routes were identified for investigation.
» Internal access roads.
» Office, workshop area for maintenance and storage.
» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

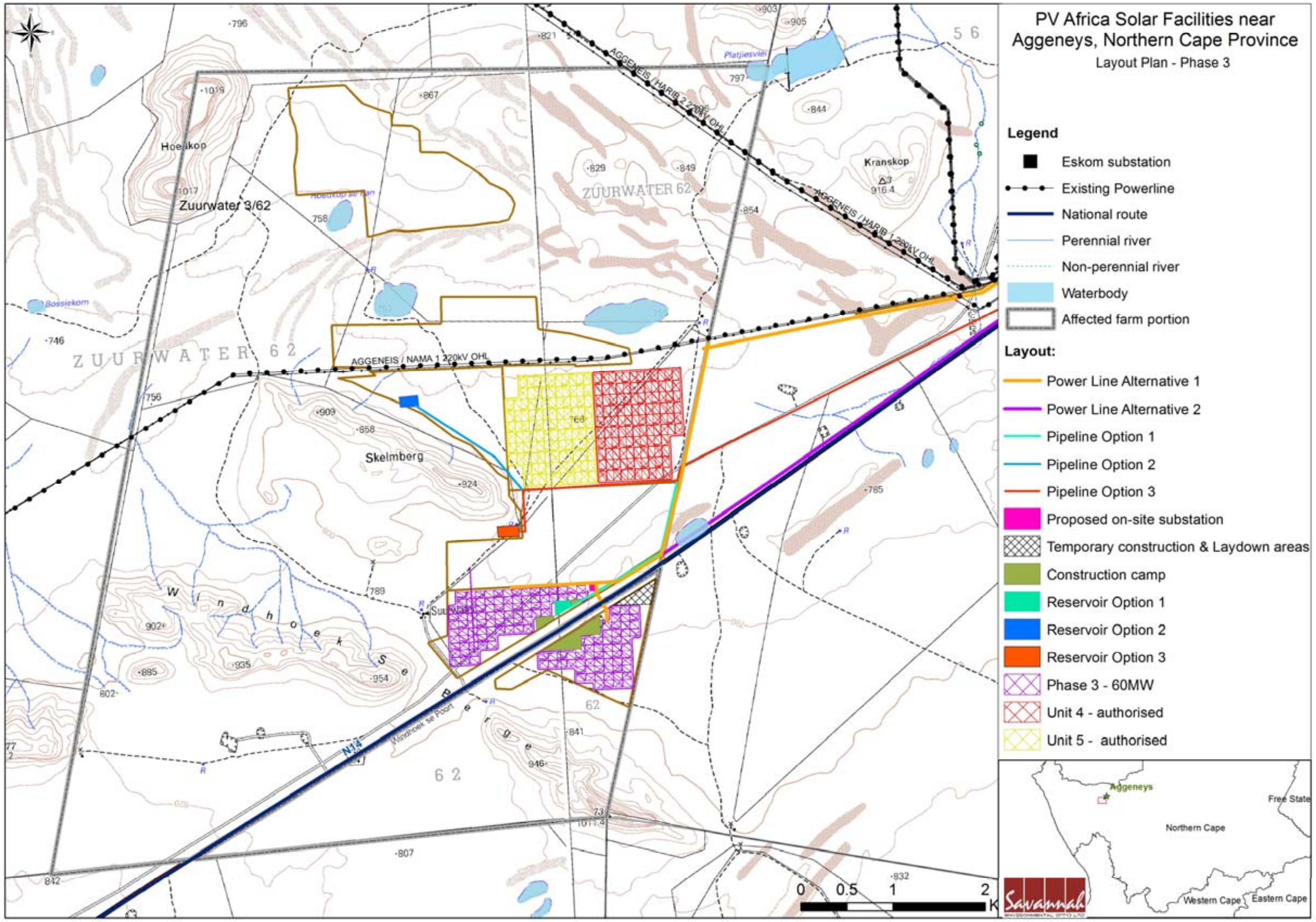

Figure 11.1: Locality map illustrating the location of the development site for Phase 3 (and other phases) of the Zuurwater PV Facility and layout of the proposed facility

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 planning 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), PVAfrica Development (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 Phase 3 of the Zuurwater Solar Energy Facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping[27] 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 undertaken to date 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, 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/ entire extent of Portion 3 of the Farm Zuurwater 62), as well as the extent of studies required within the EIA Phase were identified under an EIA report by SRK Consulting (2012), which was accepted by DEA. DEA also accepted the approach / plan of study as proposed by Savannah Environmental to utilise the existing information from the SRK Consulting's Scoping Report and only conduct an EIA phase study for the project.
» *EIA Phase* – potentially significant biophysical and social impacts[28] and identified feasible alternatives put forward as parts 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 for the proposed Phase31 project are provided in this Chapter.

[27] The Scoping Phase was undertaken by SRK Consulting (SRK, December 2011) and DEA accepted the approach as proposed by Savannah Environmental to undertake an EIA phase assessment.
[28] Direct, indirect, cumulative that may be either positive or negative.

13.1 Evaluation of Phase 3 of the Zuurwater Solar Energy Facility and Associated Infrastructure

The preceding chapters of this report together with the specialist studies contained within Appendices E -J and Appendix P provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Phase 3 of the Zuurwater Solar Energy Facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the 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 assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws associated with the site proposed for Phase 3 of the Zuurwater Solar Energy Facility. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Phase 3 of the Zuurwater Solar Energy Facility, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Social and economic impacts.
» Cumulative impacts.

11.1.1. Impacts on Ecology

The entire extent of Portion 3 of Farm Zuurwater will not be utilised for Phase 3 of the Zuurwater solar energy facility. The developmental footprint (panels and associated infrastructure) will cover an extent of ~192ha of the total 4997ha farm portion. This amount to ~4% of the entire farm portion that will be utilised in the long-term and that would suffer long-term loss / disturbance (over 20 years), although a much larger area would be affected by all phases of the Zuurwater Solar Energy Facility. Permanently affected areas include the area for the PV panels and associated infrastructure, as well as the power line and water pipeline route. Areas of ecological sensitivity within the proposed development site for Phase 3 were identified through the EIA process. The ecological sensitivity map of Phase 3 of the PV Facility is shown in Figure 11.2. The ecological sensitivity assessment identified those parts of the study area that have high conservation value or that may be sensitive to disturbance. The habitats considered most sensitive on the farm are the Bushmanland sandy grassland vegetation, which only makes up 5% of the development footprint for Phase 3.

Note that Phase 3 does not occur within any pans/ season washes/ water courses, however any impacts on soils and vegetation will indirectly impact on these pans. Outliers of Important Biodiversity areas that fall within the proposed development footprint were investigated to confirm that no red data species occur within these areas in order to ensure that these parts of the development do not cause unnecessary damage to biodiversity of conservation concern. Majority of the site for the development of Phase 3 of the PV Facility has been classified as having a low ecological sensitivity: Areas that provide limited ecosystem services and are also of low economic value to the land-owner. Species diversity may be low. Species of conservation concern may be present on such areas, but these are not restricted to these habitats and can be relocated with ease. From an ecological perspective, it should thus be feasible to develop the area as proposed whilst retaining the conservation value and ecological function of the area. Therefore the proposed development can proceed without significantly changing ecosystem processes or causing a significant loss to sensitive biodiversity, provided the recommended mitigation measures as contained in the draft EMPr and ecological impact assessment are implemented. The impacts on **ecology** have been rated as **medium significance**, with the use of mitigation measures.

The power line may **impact on birds** due to collision or electrocution. Nine bird species of international and/or national conservation concern (Red Data species, IUCN/Birdlife International 2011, Barnes 2000), ranging from Near Threatened to Vulnerable, were considered as possible to occur on site. This impact is rated to be of **medium-high significance** and can be mitigated with the implementation of mitigation measures such as the installation of bird diverters on the power line. It is also recommended that a walk through survey of the power line be undertaken by an avifauna specialist prior to construction of the power line in order to confirm any additional mitigation which may be required to be implemented. For Phase 3, **Power Line Alternative 2 is the ecologically preferred option** as this power line will run adjacent to the PV arrays and an existing Eskom power line, thus keeping the entire footprint more compact, which will limit further habitat and vegetation fragmentation.

The reservoir and associated water pipeline infrastructure is proposed in close proximity to the PV panel areas and the impacts on ecological resources are expected to be similar to those identified for this area. It is recommended that the proposed development avoids the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity. Therefore, **Alternative 1** is recommended as the preferred alternative in this regard.

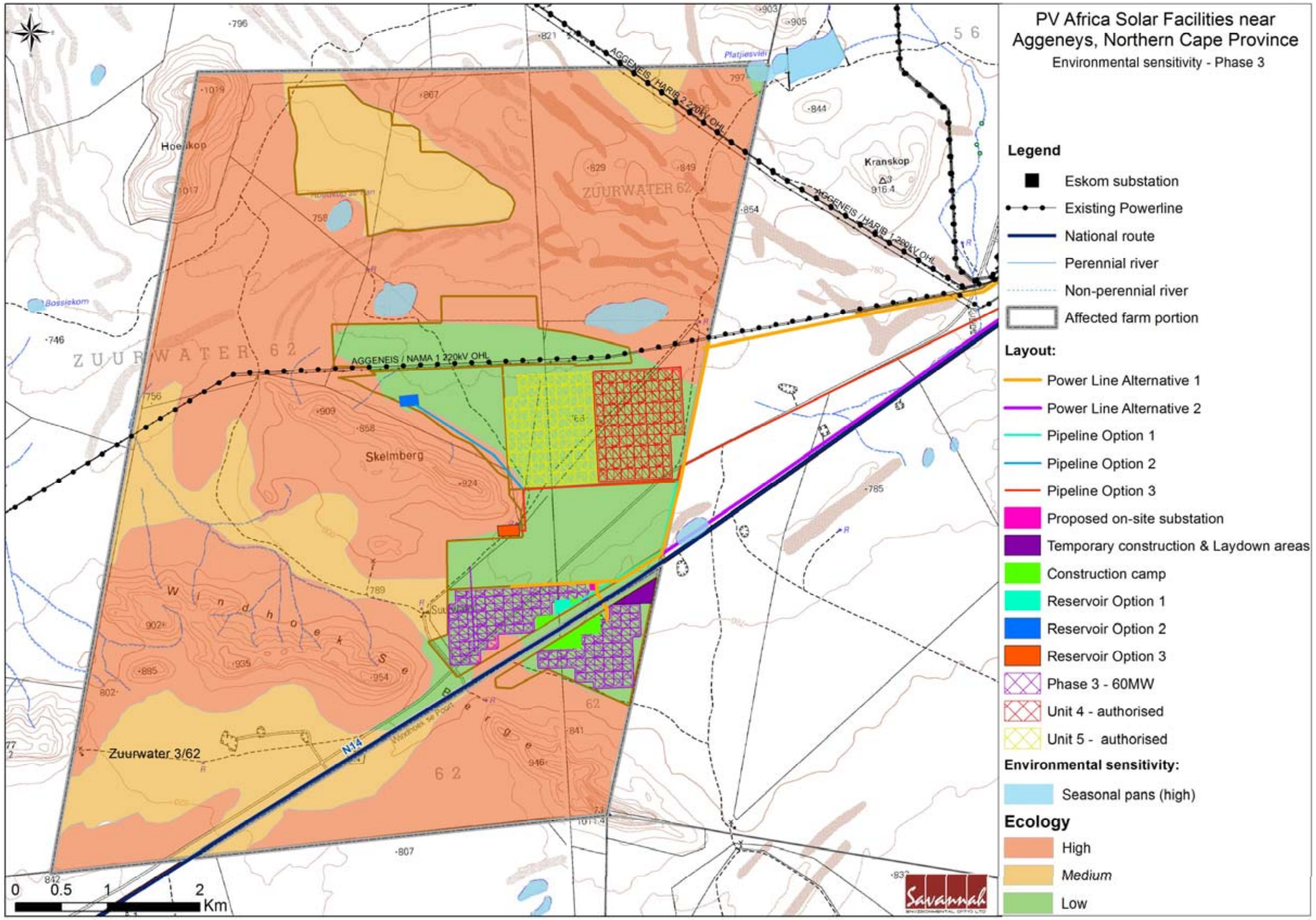

Figure 11.2: Environmental Sensitivity map for Phase 3 of the Zuurwater Solar Energy Facility

11.1.2. Impact on Soils, Land Capability and Agricultural Potential

The impacts on **soils** have been rated as **medium significance**, with the use of mitigation measures. The regic sands and dunes which occur on the site are highly prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. It is therefore important that there should be strict adherence to the Environmental Management Programme and good soil management measures regarding the management of storm water runoff and water erosion control should be implemented during all phases of the project. With the implementation of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

The study area has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The current land use is livestock farming on the farm, predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring.

The impacts on **soils and agricultural potential** have been rated as being of **medium significance**, with the implementation of mitigation measures. No preference is given to the alternative power line routes or reservoir and associated pipeline routes as soils in the area are relatively uniform.

11.1.3. Visual Impacts

The proposed development site is located approximately 9km south-west of the town of Aggeneys in the Northern Cape Province. Phase 3 is positioned approximately 100m on either side of the N14 between Aggeneys and Springbok, and is located to the south of the development site. The site is located in a sparsely populated and remote area. The Black Mountain Mine is located approximately 9km to the north-east of the site. The following potentially sensitive areas exist in the study area:

» The farmers located adjacent to the site (landowners);
» Aggeneys residents; and
» Road users travelling west and east along the N14.

The visual impact of the PV panels and associated infrastructure (including power line) for Phase 3 has been rated as **medium significance**. During the operational phase the PV panels would be visible from a large distance from the site. The nature of the natural vegetation (i.e. low growing) and the flat topography in the area allows for unobstructed views from various viewpoints in the landscape. It must however be noted that existing infrastructure – such as the Eskom power lines and the Aggenies Substation – do aid in reducing the impact of the PV panels and associated infrastructure in places. Due to the presence of existing power line infrastructure, and the proposal that the power line from the Phase 3 area follow an existing power line to the substation, the change to the overall visual landscape is expected to be minimal. The visual impact of the Phase 3 power line is therefore expected to be low, largely due to the presence of existing power lines in the area. In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and in close proximity to the proposed PV panel areas. Therefore additional visual impacts are not expected. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives.

During the decommissioning or post closure phase of the project, all of the infrastructure will be removed, recycled or re-used off-site. The residual visual impacts of the site are expected to include scarring of the landscape in the areas affected by infrastructure. With the implementation of appropriate management measures such as rehabilitation of disturbed areas and planting of vegetation and visual screening methods at receptors / key viewpoints, this scarring and visual impact could be reduced and removed in the long-term.

The Phase 3 Alternative 2 power line alignment is located in close proximity to the N14, thus being more exposed to views from this road than Alternative 1. Alternative 2 follows the existing Aggeneis-Nama 220kV power line for a portion of the route, thereby consolidating infrastructure of a similar nature to some extent. The Phase 3 **Alternative 1** power line alignment is therefore considered as the **preferred option from a visual perspective**.

11.1.4. Impacts Heritage on Heritage Resources

There were no “Heritage Sensitive Areas” identified on the Phase 3 development site. Two heritage artefacts of low heritage significance occur outside the development footprint for Phase 3 and will not be impacted by the development footprint of the PV facility. There are no heritage “no go areas” within the site development footprint for Phase 3.

With regard to magnitude and extent of the potential impacts of power lines, it has been noted that their erection generally has a relatively small impact on Stone Age sites. Sampson’s (1985) observations show this from surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon). A more permanent road would tend to be far more destructive (modification of the landscape surface within a continuous strip), albeit relatively limited in spatial extent, i.e. width. On archaeological grounds there is no reason to prefer one alternative route for the power line for Phase 3 over the other.

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure is not expected to pose additional impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary (common to all alternatives) would have localised impacts on the affected properties. This section of the route has however been previously disturbed through construction activities associated with the existing pipeline and it is therefore considered unlikely that heritage resources of significance would be found in this area. There is therefore no preferred alternative in terms of this infrastructure from a heritage perspective.

The impact of the project on **heritage resource** is rated as **low significance**. However, a pre-construction walk-through survey by an archaeologist is to be undertaken for the PV facility and associated infrastructure. Should substantial archaeological or paleontological (fossils) remains be exposed during construction, SAHRA should be alerted as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional archaeologist or palaeontologist. No further specialist palaeontological studies or mitigation were recommended for this development.

11.1.5. Social and Economic Impacts

The proposed project could have negative and positive **social and economic impacts** of **medium significance**. Phase 3 of the Zuurwater Solar Energy Facility will provide opportunities for employment and skills development in the local area. Another potential spin-off from the development is the stimulation of the local economy, including development of industries specifically to provide services and goods for solar power production, and general retail businesses. Potential negative impacts include the threats to public safety from construction and traffic activity, increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. Other impacts on the social environment include impacts associated with noise during construction, as well as impacts on traffic and infrastructure (such as local roads). It is important that potential negative effects are managed as per the recommended mitigation measures to prevent these from developing into unacceptable cumulative impacts. Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements measures (as contained in the socio-economic specialist study and draft EMPr) are utilised.

As power line alternative follows the N14, a higher visual impacts associated with this alternative is expected. Therefore, **Alternative 1** would be the preferred option from a social perspective as this would reduce visual impacts. In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and would therefore not pose additional impacts on the social environment. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is no preference regarding the reservoir location and associated water pipeline route.

11.1.6. Cumulative Impacts

The proposed Phase 3 of the Zuurwater Solar Energy Facility forms part of a larger solar energy facility comprising 6 phases with a total capacity of up to 365MW. In addition, there are other solar energy facilities proposed in the Khai Ma Local Municipality. None of these solar projects have been awarded preferred bidders status at the time of writing this EIA report.

The potential ***cumulative impacts*** as a result of the proposed Phase 3 of the Zuurwater Project and other projects in the area are expected to be associated predominantly with:

» *Visual impact* - The development of numerous similar facilities in the broader area could impact on the visual character and sense of place of the region. The cumulative impact will however to some extent be moderate due to the relatively low incidence of visual receptors in the region.

» *Flora, fauna, and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of avifauna may become cumulative if other renewable energy facilities are developed in the region. Should Phase 3 of the Zuurwater project and 5 other phases of the project and other solar projects in the Namaqualand region be developed, cumulative negative ecological impacts may occur. The significance of this impact is expected to be of a moderate significance and can result in a cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion). However, if negative impacts on ecology are effectively mitigated and managed for each project, through sound environmental management during construction and operation and by formal conservation and active management of the natural areas on site, then the negative impacts on ecosystems on each site can be within acceptable levels, and therefore in keeping with the principles of sustainable development.

» *Land-Use and agricultural potential* – The broader farm portion is 4997ha. Development of 6 phases on the broader farm will result in the loss of ~24% of Portion 3 of the farm Zuurwater 62. The remainder of the farm portion can be continued to be utilised for agricultural activities. Due to the limited crop production in the wider study area, the development of multiple solar energy facilities within the Khai Ma Local Municipality will not affect food security in the region. Due to the vast amounts of land available in the Northern Cape Province, as well as the low agricultural potential and carrying capacity of the land, cumulative impacts on land-use or agricultural potential are of acceptable levels.

» *Cumulative geology, soil and erosion potential* - although the impact of soil removal for the proposed activity has a moderate – low significance, the cumulative impact of soil removal in the area is considered low due to the undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate. The cumulative impact of siltation and dust in the area is considered low, with the legal obligation of good soil management for each project.

» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Current mining such as the Black Mountain Mine, presents a noise source, however the potential for cumulative impacts related to noise is low largely due to the low occurrence of sensitive receptors in the area.

» *Infrastructure* - Increased pressure on existing roads and other infrastructure may occur due to various projects being developed. This will require consultation with parties such as Eskom and SANRAL to prevent significant impacts on existing infrastructure in the area/ with the local municipality.

» *Heritage* –Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to ‘sense of place’ will occur from various projects in the region. The potential for the loss of or discovery of heritage artefacts in the Namaqualand region will also increase.

» *Impact on the Social and Economic Environment* - The establishment of a number of solar energy facilities in the area may impact negatively on the social environment as a result of issues associated with, for example, influx of people to the area and increased traffic volumes. Cumulative positive socio-economic impacts from a number of renewable energy facilities in terms of job creation and economic growth and development of infrastructure will occur at a local and district municipality level that is in need of this growth and development. This would be a significant positive impact. The adoption of management measures

will maximise the cumulative impact for local communities. Each project developed will contribute a percentage of annual profits from the solar project to social beneficiation in the local community, as required by the Department of Energy. Over at least 20 years, there will be a cumulative social benefit from multiple phases and likely from other renewable development in the surrounding areas. It is important that the social development efforts are managed effectively and efficiently in co-operation with key stakeholders over time so that they contribute progressively to enhancing the lives of surrounding communities.

11.2. Comparison of Alternatives

11.2.1. Power Line Alternatives

In terms of the specialist studies undertaken, the following conclusions were made regarding the preferred power line alternative for Phase 3:

	Alternative 1	**Alternative 2**
Ecology	Preferred	No preferred
Soils and agricultural potential	No preference	No preference
Visual	Preferred	No preferred
Heritage	No preference	No preference
Social	Preferred	No preferred

Based on the above, it is clear that **Alternative 1** is the overall preferred alternative for the power line associated with Phase 3.

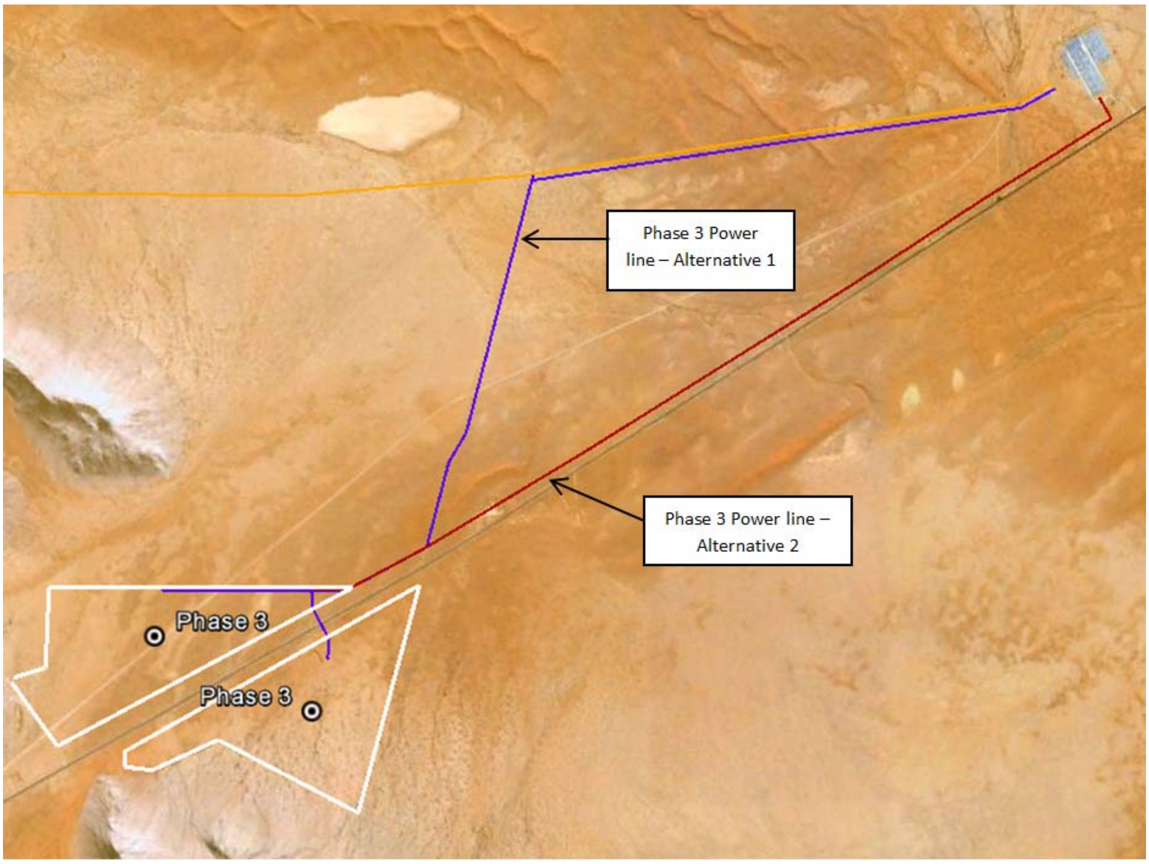

Figure 11.3: Grid Connection Routing Alternatives – Phase 3

11.2.2. Water Reservoir and Associated Pipeline Alternatives

In terms of the specialist studies undertaken, only the ecological assessment recommended a preferred reservoir and water pipeline alternative for implementation. In this regard, **Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option** due to the location of Alternatives 2 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

13.2 Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise from the project proceeding. This could include:

» Loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the PV project (which is limited to the development footprint of 267 hectares). The loss of biodiversity has been minimised by the careful location of the development to avoid key areas supporting biodiversity of particularly high conservation importance.
» Visual impacts associated with the PV panels and power line.

» Change in land-use and loss of agricultural land on the development footprint. The loss of agricultural land has been minimised through the careful placement of the development to avoid key grazing areas located in dune areas on the site.

These costs are expected to occur at a local level.

Benefits of the project include the following:

» Given the very high level of poverty, unemployment and remoteness as well as the limited range of economic opportunity presented in this arid region, the project is poised to bring about important economic benefit at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will transpire during the preconstruction/ construction and operational phases.
» The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix.
» South Africa's per capita greenhouse gas emissions being amongst the highest in the world due to reliance on fossil fuels, the proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW PV project, on a like for like basis.

The benefits of the project are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project.

13.3 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 a solar energy facility with a generating capacity of 60MW on a site located on portion 3 of the Farm Zuurwater 62, has been established by PVAfrica Development (Pty) Ltd. The positive implications of establishing Phase 3 of the Zuurwater Solar Energy Facility on the identified site include the following:

» The potential to harness and utilise solar energy resources within the Northern Cape.
» 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 National electricity grid in the Northern Cape 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.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project 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) for Phase 3 which is 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**.

13.4 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 Phase 3 of the Zuurwater Solar Energy 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 impacts of Phase 3 of the Zuurwater Solar Energy Facility project can be 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:

» Power Line Alternative 1 must be implemented as the preferred power line alternative.
» Reservoir and pipeline Alternative 1 must be implemented as the preferred alternative.
» 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 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 key in achieving the appropriate environmental management standards as detailed for this project. This EMPr should be viewed as a dynamic document that should be updated throughout the life cycle of the facility, as appropriate.
» All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices E to J and Appendix P must be implemented.
» An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMPr for the duration of the construction period.
» The regic sands and dunes which occur on the site are highly prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. It is, therefore, important that there should be strict adherence to the EMPr and good soil management measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project. Therefore, a detailed stormwater management plan must be developed and implemented for the facility following final design.
» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» If any protected plant or tree species will be removed/destroyed by the developer, a collection/destruction permit to be obtained from Northern Cape Department of Environment and Nature Conservation and/or DAFF for the protected species found on site. A walk-through survey of the site development footprint (facility and the power line) will be required prior to construction commencing.
» A walk through survey of the power line to be undertaken by an avifauna specialist prior to construction of the power line in order to highlight spans requiring bird diverters.
» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.

» Should substantial archaeological or paleontological (fossils) remains be exposed during construction; however, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
» Site rehabilitation of temporary laydown/ construction areas to be undertaken immediately after construction.
» Should the facility be decommissioned, the development footprint must be rehabilitated.
» Alien invasive vegetation to be managed/ removed (as required) during construction, operations, decommissioning and post-closure of the facility.
» The DoE requirement for suitable social beneficiation schemes is supported.
» Following the final design of the facility, a final layout must be submitted to DEA for review and approval prior to commencing with construction.
» Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

ASSESSMENT OF POTENTIAL IMPACTS: PHASE 4 OF THE SOLAR ENERGY FACILITY (DEA REF. NO.: 14/12/16/3/3/2/473) CHAPTER 12

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 **Phase 4** of the Zuurwater Solar Energy Facility (DEA Ref. No.: 14/12/16/3/3/2/473). This assessment is done for a 75 MW facility and for all the facility's components including:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power lines to transport the power from each Phase into the Eskom grid via the Aggeneis MTS Substation.
» A new on-site water reservoir and associated water supply pipeline (shared infrastructure between all phases)
» Internal access roads.
» Office, workshop area for maintenance and storage.
» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

The Phase 4 array is proposed to be located to the north of the Phase 1 PV array (phase 4 is indicated in orange in Figure 12.1). Phase 4 is located approximately 11km south-west of the town of Aggeneys (straight line distance). The proposed generating capacity for this phase is 75MW, covering an area of 222ha. An on-site substation is also proposed for this phase. A new overhead power line (up to a voltage of 275kV) is also required.

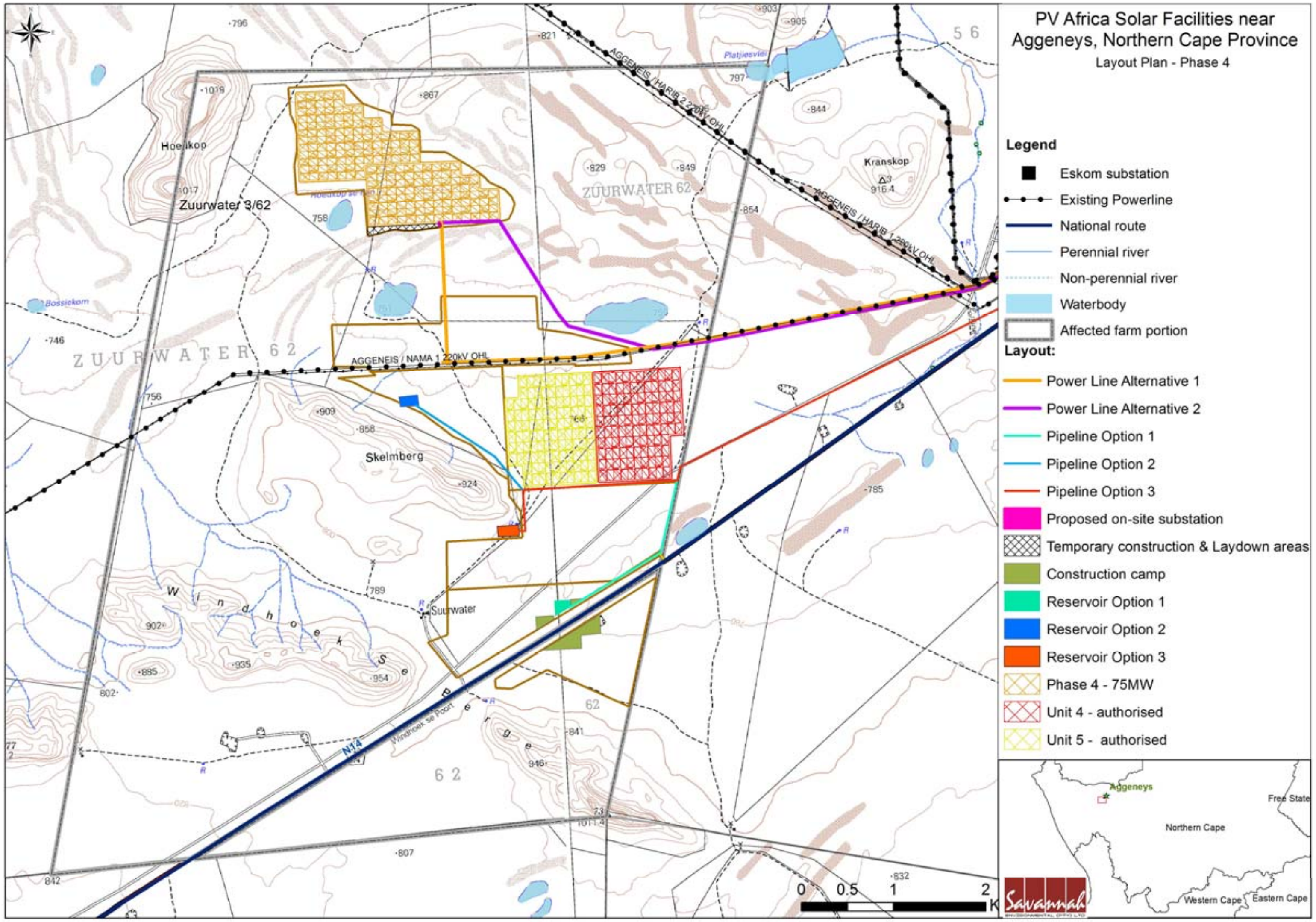

Figure 12.11: Locality / Layout Map for the 75MW PV plant on Portion 3 of the Farm Zuurwater No 62 in the Namakwa District, Northern Cape Province - Phase 4

The development of Phase 4 of the Zuurwater project will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access roads, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; construction of power plant, and undertaking site rehabilitation and establishment and implementation of a storm water management plan. Construction is expected to take approximately 15-18 months.
» *Operation* – will include operation of the facility and the generation of electricity. The operational phase is expected to extend in excess of 20 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 and where feasible recycling of the components of the facility; clearance of the site and site rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

6.16. Methodology for the Assessment of Potentially Significant Impacts

A broader Portion 3 of the Farm Zuurwater 62 was identified by the project developer for the purpose of establishing the proposed Phase 4 of the Zuurwater solar energy facility. The entire Farm Portion will not be utilised for Phase 4 of the solar energy facility, the development footprint (panels and associated infrastructure) will cover an extent of ~222ha of the 4997ha farm portion. This amount to ~4.5% of the entire farm portion that will be utilised in the long-term and that would suffer long-term loss / disturbance (over 20 years).

The assessment of potential issues associated with Phase 4 of the solar energy facility and cumulative impacts of the multiple phases of the larger project has involved key input from specialist consultants, the project developer, key stakeholders, and interested and affected parties (I&APs). Cumulative impacts are discussed under Section 12.11.

6.17. 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 undertaken for potential impacts associated with the construction and operation of the Phase 4 of the proposed Solar Energy Facility on the identified site near Aggeneys. Issues were assessed in terms of the criteria detailed in Chapter 4 (Section 4.3.3). 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.

6.18. Alternatives

12.3.1. Power Line Alternatives

Two power line options are proposed for Phase 4 (refer to Figure 12.2).

» Alternative 1: This alternative is proposed in a southern direction up to the existing Aggeneis-Nama 220kV power line to the south of the site. The route then follows this power line to the Aggeneis Substation. The length of the power line alternative is ~7.7km.
» Alternative 2: This alternative is proposed in a south-eastern direction up to the existing Aggeneis-Nama 220kV power line to the south of the site. The route then follows this power line to the Aggeneis Substation. The length of the power line alternative is ~6.2 km.

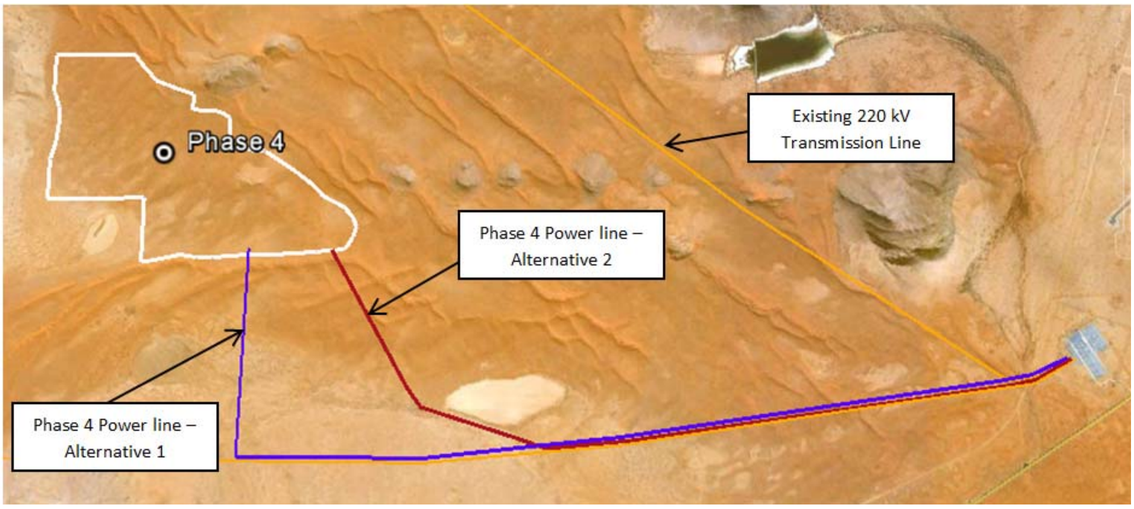

Figure 12.2: Grid Connection Routing Alternatives – Phase 4

12.3.2. Alternatives for on-site water reservoir and associated water supply pipeline

An on-site water reservoir (with a capacity of ~49 995m^3) will be developed to provide water during the operational phase to all phases of the project. This water will be sourced from the nearby Zinc Mine. An existing pipeline between the Aggeneis Substation and the property boundary will be upgraded and utilised for this purpose. A new pipeline section will be constructed within the site boundaries. This infrastructure will be shared between all phases of the project.

Two alternative locations for the reservoir have been identified for investigation (refer to Chapter 2 for more details):

» Alternative 1: The reservoir is proposed to be located within the Phase 3 area adjacent to the N14. The water pipeline is proposed to follow the site boundary in a north-west direction until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 2.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.
» Alternative 2: The reservoir is proposed to be located to the south of the Phase 1 PV Facility. The water pipeline is proposed to be routed in a south-western and then a western direction along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 3.5km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.
» Alternative 3: The reservoir is proposed to be located to the east of the Phase 2 PV Facility. The water pipeline is proposed to be routed in a northern direction for a short distance, and then along the northern border of the Phase 2 area until it joins with the existing water pipeline just north of the Phase 2 area, a distance of approximately 2.2km. The existing pipeline to Aggeneis Substation will be upgraded from this point, a distance of approximately 4km.

12.4. Potential Impacts on Ecology

Solar energy facilities require relatively large areas of land for placement of infrastructure. Phase 4 of the PV facility requires ~222ha. The main expected negative impacts on ecology will be due to loss of vegetation and habitat which may have direct or indirect impacts on individual flora and fauna species. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E - Ecological Impact Report** for more details). The ecological study undertaken under the previous EIA by SRK Consulting was supplemented by additional site work and a re-assessment report was completed by Savannah Environmental – See Appendix E.

The majority of impacts on ecology will occur during the construction of the proposed PV facility. Impacts on this habitat type could be severely harmful to the survival of threatened species with very limited distribution ranges. Potential impacts for the construction of the solar panels, substation, power line, and the access road were identified as follows:

» Impact on the natural vegetation.
» Impact on the spread of declared weedy and alien invasive plant species.
» Impact on fauna.

Portion 3 of the Farm Zuurwater is situated in an area of vegetation and habitat transitions on the northern edge of the Nama-Karoo and Bushmanland habitat, the western edge of the Kalahari savanna, the southern edge of the Gariep River drainage and the eastern edge of Namaqualand. On the mountains, the Aggeneys Gravel Vygieveld is considered an isolated, rainfall-impoverished and most north-eastern form of true Succulent Karoo vegetation, worthy of special protection due to several rare plant species along with some of its bird inhabitants (e.g. Cinnamon-breasted Warbler). Almost none of this and the more widespread Bushmanland Sandy Grassland vegetation unit are formally conserved. The larger area has at least thirteen plant species of conservation concern, supports four main structural habitats for fauna (with a possibility of about five red data mammals species occurring on the site). The area is further expected to host nine threatened bird species, including the Vulnerable and near-endemic Ludwig's Bustard and Red Lark that are resident and breeding on and around the site. There is a remote possibility that 2 red data reptile species can be present, and a single red data frog may occur on the site.

The habitats considered most sensitive on the farm are the red dunes and areas of deep sand, the mountains and their gravel skirts, and the proximal washes and pans. This leaves the open grassy plains, with shallow soils of mixed gravels and sands, as the least sensitive and most widespread habitat on the farm and surrounding areas. It is proposed that any development should be on the most disturbed areas of the grassy plains, with as little overlap as possible into the drainage lines.

12.4.1. Summary of Ecological Features and Potential Impacts

» *Flora:* The footprint of the 75MW solar energy facility is unlikely to cause widespread loss of threatened flora and/or fauna taxa or change the ecological community structure. The plant species composition on the site will change. However, the area proposed for the Phase 4 development is within the least sensitive area on Portion 3 of the Farm Zuurwater from an ecological perspective, and therefore the project is not considered to have a great influence on any rare plant or animal species. The only protected tree that occurs in the area is *Acacia erioloba* (Camel Thorn), which may be present on the sandy plains. Threatened species and Species of Conservation Concern could occur on the rocky inselbergs and/or quartz plains (however these areas are largely avoided by the development footprint of the PV panels). The effect of shading may alter the vegetation, altering plant community composition, survivorship and/or structure. If shallow excavation is necessary to level the ground first and so alter its soil structure, a slight risk of permanent transformation is expected in the long term but natural adaptation of the vegetation to soil instability (e.g. wind erosion) may mean the effects are temporary or at least capable of rehabilitation.

- *Fauna and Mammals*: From a mammal habitat perspective, it was established that two of the four major habitats are very prominent on the study site, namely terrestrial and rupiculous (rock dwelling) habitat. Of the 56 mammal species expected to occur on the study site, no less than 22 were confirmed during the site visit. Only 3 mammal red data species may occur on the site (Rüppel's horseshoe bat, Geoffroy's horseshoe bat and the Honey badger (however low probability of utilising the site). No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s). The rest of the species richness is made up from common and robust mammals with wide distributional ranges such as aardvarks, springhares, four-striped grass mouse, porcupines, the caracal, the genet, the two mongoose species, the black-backed jackal etc. The development of Phase 4 of the solar energy facility is not considered a significant threat to any bird, reptile or amphibian species, given its limited impact in space (<1,000 ha) and time (<40 years) on the widespread grassy plain habitat.
- *Habitat Loss/ fragmentation*: The PV facility will result in localised habitat fragmentation or connectivity. An increase in weed species on the disturbed areas can be expected. It should further be noted that the greatest potential for impacts to ecology will be during preconstruction/construction, as well as during decommissioning when there is the most activity including levelling and truck movement on the site. The internal access roads within the development site will contribute to habitat loss. During operation, impacts can be expected to be reduced since activities will be restricted primarily to occasional maintenance including panel-cleaning/washing.
- *Birds*: Nine species[29] of international and/or national conservation concern (Red Data species, IUCN/Birdlife International 2011, Barnes 2000), ranging from Near Threatened to Vulnerable, were considered as possible to occur on site, of which two were recorded during the survey (Ludwig's Bustard, Red Lark) and a third reported by the landowner (Kori Bustard). Ludwig's Bustard and Red Lark are both considered Vulnerable by IUCN criteria. The PV array is not considered a direct threat to any bird species, however the new power line is a threat to regular breeding residents (Ludwig's Bustard and Red Lark) and regular visitors to the area (Vulnerable Martial Eagle and Secretarybird, and the Threatened Lanner Falcon). The power line may impact on birds through either collision or electrocution.

[29] Chestnut-banded Plover, Black Harrier, Lanner Falcon, Sclater's Lar, Ludwig's Bustard, Kori Bustard, Martial Eagle, Secretarybird and Red Lark. Two Vulnerable species are expected to be regular breeding residents (Ludwig's Bustard and Red Lark). The Vulnerable Martial Eagle and Secretarybird, and the Threatened Lanner Falcon are expected to be regular visitors to the area, when their prey animals are abundant, but while no sufficiently large trees were seen as likely nest sites for the Eagle or Secretarybird, the large south-facing cliffs, especially on Hoedkop, could well support nesting ledges for the falcon, as they apparently do for Verreaux's Eagle. The remaining four threatened species are expected to be erratic visitors when high rainfall creates productive conditions (plant cover, seeds, insects, small vertebrates).

- *Herpetofauna (Amphibians and Reptiles)*: Three Red Data reptiles[30] may occur on the study site. Most of the species of the resident diversity are fairly common and widespread (viz. Karoo tent tortoise, brown house snake, common egg eater, puff adder, horned adder, Cape cobra, Bibron's tubercled gecko, giant ground gecko, Anchieta's agama and western rock skink). The high species richness expected on the study site (Portion 3 of the Farm Zuurwater 62) is due to the size of the farm portion (4997 ha) and the renowned endemic biodiversity of the Northern Cape and the presence of three of the four habitat types on the site.
- *Pans*: The broader farm portion does form part of the palaeo-drainage system of the Gariep River basin, evident on and around the site as the rather ill-defined washes and some of their pans. Phase 4 does not occur within any pans/ season washes/ watercourses, however any impacts on soils and vegetation will indirectly impact on these areas. This would cause change of surface and subsurface hydrology, decline of vegetation and fauna populations dependent on the seasonal recharge of the pans.

12.4.2. Ecological Sensitivity Assessment for Phase 4

Additional fieldwork to that completed in the SRK EIA process was conducted by an ecologist to survey and assesses the development area for Phase 4 of the PV Facility. This sensitivity assessment is based on a field evaluation of the site and analysis of aerial photography. The ecological sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance.

Ecological sensitivity is primarily based on vegetation composition, and has been classified by EcoAgent (2012). Using the information contained in the biodiversity and agricultural report, as well as observations during a field visit, the ecological sensitivity for Phase 4 was classified as follows:

Vegetation type / plant community as defined by EcoAgent	**Sensitivity as defined by EcoAgent**	**Re-classified sensitivity**
1. Bushmanland Sandy Grassland (=Vegmap Unit Mucina & Rutherford 2006)	High	High
2.1 Grassland on sandy hummocks	*Low*	*Medium (due to higher grazing potential)*
2.2 Grassland on sandy plains	Low	Low
3 Gravelly calcrete plains(=Vegmap Unit: Aggeneys Gravel Vygieveld, Mucina & Rutherford 2006)	High	High

[30] Namaqua plated lizard, Fisk's house snake and Namaqua stream frog.

Vegetation type / plant community as defined by EcoAgent	Sensitivity as defined by EcoAgent	Re-classified sensitivity
4. Bushmanland Inselberg Shrubveld (Vegmap Unit Mucina & Rutherford 2006)	High	High
4.1 Shrubveld on mountains, hills slopes and crests	High	High
4.2 South facing slopes	High	High
4.2.1 South-facing scree slopes	High	High
4.2.2 Steep south-facing slopes	High	High
4.3 Rocky north-facing slopes	High	High
5 Azonal vegetation	High	High
5.1 Pans	High	High
5.2 Washes	High	High

The sensitivity of the development footprint for Phase 4 is shown in the table below.

Phase 4:	Vegetation	Sensitivity	Extent
New PV Array and access roads	Grassland on sandy hummocks	Medium	About 90 % of development on this vegetation
	Bushmanland sandy grassland	High	About 5 % of development on this vegetation
	Bushmanland sandy grassland	High	About 5 % of development on this vegetation. Search and Rescue of species of conservation concern very important prior to commencement of activity.
Substation and Power Line	Vegetation	Sensitivity	Actions
	Bushmanland sandy grassland	High	Search and Rescue of species of conservation concern very important prior to commencement of activity.
	Washes	High	Search and Rescue of species of conservation concern very important prior to commencement of activity. Ensure access road does not influence natural drainage patterns to and from nearby pans.
	Grassland on sandy plains	Low	Search and Rescue of species of conservation concern very important prior to commencement of activity.

The ecological sensitivity of Phase 4 of the PV Facility is shown in Figure 12.3. The habitats considered most sensitive on the farm are the Rocky north-facing slopes, south facing slopes, inselbergs, pans and Bushmanland sandy grassland. Outliers of Important Biodiversity areas that fall within the proposed development footprint were investigated to ensure that no red data species occur within these areas and to ensure that these parts of the development do not cause unnecessary damage to biodiversity of conservation concern. Phase 4 falls within grasslands on sandy hummocks and has been rated as having medium ecological sensitivity. During the last field visit it was verified that in these areas, the proposed development can proceed without significantly changing ecosystem processes or causing a significant loss to sensitive biodiversity, provided the recommended mitigation measures are followed.

As shown in Figure 12.3 majority of the site for the development of Phase 4 of the PV Facility has been classified as having a medium ecological sensitivity: Areas that provide limited ecosystem services and are also of low economic value to the land-owner. Species diversity may be low. Species of conservation concern may be present on such areas, but these are not restricted to these habitats and can be relocated with ease.

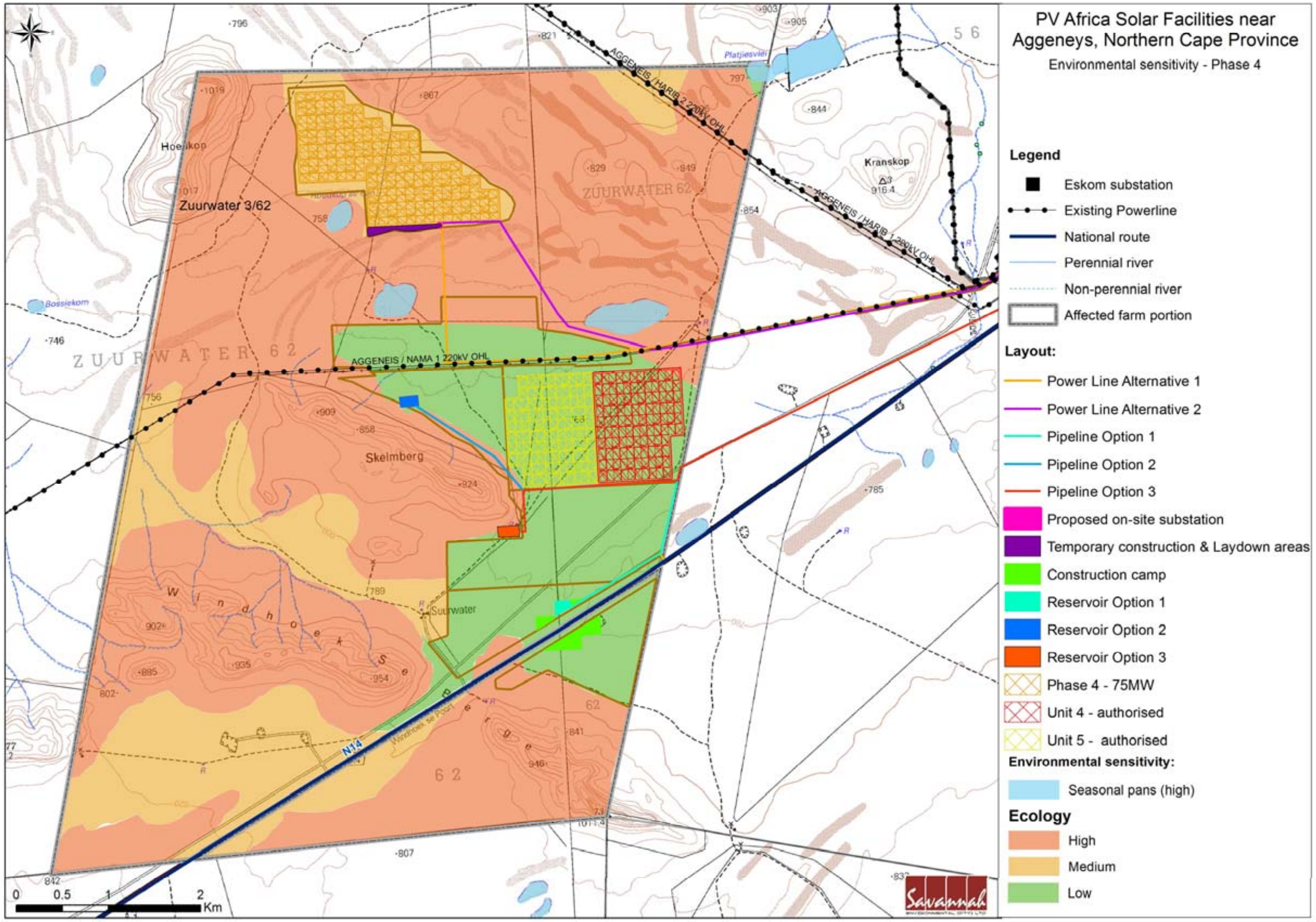

Figure 12.3: Map showing ecological sensitivity assessment ratings for the Phase 4 of the PV Facility

12.4.3. Impact tables summarising the significance of impacts on ecology (with and without mitigation)

Pre-construction/construction/decommissioning:

Impact of PV Facility on ecology without mitigation: Impact on the functioning of affected Ecological Support Areas (ESA) by the possible change of the desired ecological state or functioning will lead to indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway, e.g. removing a corridor or altering flow of runoff, associated habitat fragmentation. The altered surface may alter runoff and biodiversity migration and composition patterns, but is not expected to significantly alter the functioning of the ESA if mitigation measures are implemented.				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	One month – One year (2)	Temporary (2)	Highly likely (5)
Result: Medium (63)				
Mitigation: » Harvesting of plant material or other damage to fauna and flora must be prevented and avoided, and disciplinary measures to be put in place » Chemical/petroleum/oil storage area to be bunded (using an impervious surface). » Introduction of alien plant species must be prevented, and on-going management of alien species control should be carried out » Disturb the surface as little as possible and only where necessary during construction » Construct all roads and fences in such a way that they do not significantly alter existing runoff patterns and allow for ample drainage where necessary » Undertake a rehabilitation plan of all surfaces affected immediately after construction to restore surface characteristics in such a way that it resembles the original and will allow a gradual natural re-vegetation where such has been cleared » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated » Strictly prevent leakage of oil or other chemicals or any other form of pollution, be clear about immediate remedial actions that must be taken should accidental spills occur » Make use of existing tracks as far as possible, where additional construction activities or maintenance is required, ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery » Ensure an adequate plant search and rescue program prior to commencement				

of activity, especially geophytes and succulents may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during occasional heavy 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 (storm water and erosion management plan required, together with revegetation of adjacent areas) » After decommissioning, if the access road or portion thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation » As soon as the areas affected have been demarcated, carry out a thorough search and rescue operation of all plant species of conservation concern by a horticultural specialist or suitably qualified staff and the ECO before any disturbance or heavy machinery in the area will be allowed. » Note: many of the species of conservation concern are very small or bulbous species may be dormant, follow-up where topsoil will be removed » Ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during occasional heavy rainfall events, yet preventing erosion of the track and surrounding areas				
Impact of PV Facility on ecology with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Project Specific (2)	One month – One year (2)	Temporary (2)	Unlikely (3)
Result: Low (30)				

Operation

Impact of PV Facility on ecology without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: Medium (90)				
Mitigation: » Harvesting of plant material or other damage to fauna and flora must be prevented and avoided, and disciplinary measures to be put in place » Chemical/petroleum/oil storage area to be bunded (using an impervious surface). » Training and awareness programmes for employees on the significance of the				

ecology to be carried out at regular intervals » Implement on-going management of alien species control » Implement measures to ensure no living organisms can come into contact with or entangled by any electrical wiring that might cause short circuits, injury or death. » Implement storm water management measures. » Ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery » Maintain vegetation cover in areas outside the PV arrays.				
Impact of PV Facility on ecology with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: Medium (90)				

Impact of water reservoir on ecology without mitigation: Impacts are expected to be restricted to the actual temporary construction areas only, and with the necessary mitigation measures implemented, surroundings should not be further affected. Rehabilitation of areas that have been disturbed should occur within 1-5 years of construction.				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Harmful (4)	Activity Specific (1)	Life of Operation (4)	Permanent (5)	Possible (4)
Result: Medium – High (81)				
Mitigation: ▪ No temporary water tanks may be established on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater. Therefore, reservoir alternative 1 should be implemented as the preferred option. ▪ Keep areas affected to a minimum ▪ As soon as the areas affected have been demarcated, first carry out a thorough search and rescue operation of all plant species of conservation concern by a horticultural specialist or suitably qualified staff and the ECO before any disturbance or heavy machinery in the area will be allowed. o Note: many of the species of conservation concern are very small or bulbous species may be dormant, necessitating follow-up work by the ECO where topsoil will be removed o Remove all geophytes and succulents that can be transplanted, keep in a designated on- or off-site nursery and use as far as possible in rehabilitation efforts ▪ Prior to the disturbance of any area, the ECO must assess the area for any				

burrowing mammal, reptile or amphibian and relocate such to a similar habitat out of the footprint area

    - Ensure that all materials stored on this area are done in such a way that they do not attract and cannot entrap any fauna for the duration of the use of these areas

- If topsoil needs to be removed, volumes need to be estimated and adequate areas designated for the storage and/or rehabilitation of such topsoil. Such areas will also be subject to a detailed search and rescue operation as above prior to any disturbance taking place.
- Keep leveling earthworks and soil disturbance to the minimum practically possible, implement a comprehensive topsoil management, soil erosion control and rehabilitation plan once layouts have been finalised
- Utilise areas as close as possible to existing or future permanent infrastructure, keep buffer zone of the legally required 32 m as a minimum, preferably up to 100 m or more around significant ephemeral drainage lines and/or seasonal pans
- Remove as little indigenous vegetation as practically possible, rehabilitate and revegetate all areas not used further immediately after construction
    - Indigenous vegetation that is removed (except species that will be replanted) should be shred and re-applied as mulch or incorporated into re-applied topsoils.
- Monitor the area regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and revegetation efforts accordingly
- Strictly prevent leakage of oil or other chemicals and pollutants

» Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Impact of water reservoir on ecology with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Slightly Harmful (3)	Activity Specific (1)	Life of Operation (4)	Permanent (5)	Possible (4)
Result: Medium (72)				

Impact of the power line and substation on threatened birds during operations with mitigation				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Slightly Harmful (4)	Local (3)	Life of Operation (4)	Permanent (5)	Possible (4)
Result: Medium (99)				
Mitigation:				

- » Limit disturbance to the proposed substation site and power line site and ensure that minimum disturbance takes place in the surrounding area.
- » Power line construction should take fauna into account, especially birds and nesting sites.
- » A avifauna walk through survey to be conducted prior to construction to determine is power lines need to be fitted with 'flappers' to make the power lines more visible to the birds.
- » An avifauna specialist should ground-truth the power line construction areas before development commences in order to ensure no breeding pairs or chicks of conservation significant species are located in the areas and, if there are, how to mitigate the situation before construction begins.
- » No power line towers may be placed within 32 m of a pan

Impact of the power line and substation on threatened birds with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Unlikely (2)
Result: Low (63)				

Alteration of seasonal recharge patterns of nearby pans and washes without mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Potentially Harmful (2)	Local (3)	Life of Operation (4)	Permanent (5)	Highly likely (5)
Result: Medium (90)				

Mitigation:

- » Ensure all mitigation recommendations for PV arrays and access roads are implemented
- » Ensure that runoff to pans is adequately slowed down to prevent erosion, but not obstructed or deflected to such an extent that runoff patterns into the pans are changed
- » Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and re-vegetation efforts accordingly
- » Aim to maintain a reasonable cover of indigenous perennial vegetation throughout the operational phase within and on the periphery of the PV array, preferably low density perennial grasses that can be mowed as need be to reduce fuel loads
- » Monitor the establishment of alien invasive species around pans and remove as soon as detected, whenever possible before regenerative material can be

formed				
Alteration of seasonal recharge patterns of nearby pans and washes with mitigation:				
Severity	Spatial extent	Duration of impact	Duration of activity	Frequency of impact
Insignificant (1)	Project Specific Local (2)	Life of Operation (4)	Permanent (5)	Unlikely (4)
Result: Low (63)				

12.4.4. Impact Summary

Despite the harshness of the environment, a multitude of specially adapted species occur in the many niches provided by the variable landscapes of the area. Most of this biodiversity is concentrated on the mountains and on gravel plains. Vegetation on the less sensitive sandy plains is relatively dynamic and may change dramatically between different seasons, indicating that rehabilitation of disturbed land should be achievable if topsoils are disturbed as little as possible and maintained in a manner that enables the survival of the extensive seed banks within them.

Overall, the impacts can be summarised as follows:

» The proposed Phase 4 of the photovoltaic solar energy facility may have long-term negative impacts on the ecology of the land portion / development footprint and landscape features within it if mitigation measures are not strictly adhered to or implemented
» Potential negative impacts on the ecological environment would be loss of biodiversity and associated soil degradation as a result of construction and operation of the facility, possible introduction of alien invasive plants and a long-term loss of vegetation.
» A loss of habitats for flora and fauna will occur with the alteration of large areas occupied by the proposed development. The placement of different components of the proposed development has been optimised according to ecological recommendations. This, coupled with the implementation of mitigating measures by the developer, contractors, and operational staff will enable the retention of basic functionality of the ecosystems affected and hence greatly reduce the negative impact of the development.
» The impact on fauna is expected to be negligent. Animals that may be present within the development footprint are mobile and will move away during construction, possibly resettling after construction. No restricted or specific habitat of vertebrates will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas.

- Vegetation cover is expected to change due to the changed environment within and around the proposed development. Rehabilitation and continued monitoring must be carried out until the decommissioning phase to ensure that a stable and functional vegetation cover is established and maintained.
- Phase 4 does not occur within any pans/ season washes/ water courses, however any impacts on soils and vegetation will indirectly impact on these pans.

From an ecological perspective, it should therefore be feasible to develop the Phase 4 area as proposed whilst retaining the conservation value and ecological function of the area.

12.4.5. Comparative Assessment of Power Line Alternatives

The Phase 4 Power Line **Alternative 2** is the ecologically preferred power line option as the power line will run adjacent to the PV arrays and the existing Eskom power line, thus keeping the entire footprint more compact, which will limit further habitat and vegetation fragmentation.

12.4.6. Comparative Assessment of Water Reservoir and associated pipeline alternatives

For Phase 4, **Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option** due to the location of Alternatives 1 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

12.4.7. Implications for Project Implementation

- No temporary infrastructure (such as reservoir Alternatives 1 and 3) may be established on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater.
- If any protected plant or tree species will be removed/ destroyed by the developer, a collection/destruction permit is to be obtained from Northern Cape Department of Environment and Nature Conservation for the protected species found on site.
- An Environmental Management Programme (EMPr) must be implemented during the development of the solar energy facility.
- Mitigation measures as contained in the EMPr must be employed during construction and operations to manage impacts on ecology.
- Site rehabilitation of temporary laydown/ construction areas to be undertaken immediately after construction.
- Should the facility be decommissioned, the development footprint must be rehabilitated.

- Alien invasive vegetation to be managed/ removed (as required) during construction, operations, decommissioning and post-closure of the facility.
- A walk through survey to be undertaken by an ecologist prior to construction of the facility and the power line.
- A walk through survey of the power line to be undertaken by an avifauna specialist prior to construction of the power line.

12.5. Potential Impacts on Soils and Agricultural Potential

12.5.1. Impacts on Soils

The regic sands which occur on the site are very prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. The extremely flat nature of the development site means that areas can be prone to widespread surface wash during occasional intense rainfall events. Increased erosion potential will result from scouring effect on drainage lines due to run-off from hard surface areas, as well as increased erosion from areas of exposed soils. Failure to avoid and minimise civil works in wash areas could result in erosion and sedimentation. Extensive removal of vegetation from the development site could also leave the area prone to both water- and wind erosion. Furthermore, unless stocking rates are well managed, temporary removal of a portion of the farm from available grazing (the proposed development site) could increase pressures on the remainder of the farm. The risk of erosion at a larger scale is minimised by the high infiltration rates of the soils, combined with the fact that surface drainage is associated with an endorheic pan (closed system with no outflow to neighbouring catchments). Dust, due to loose soil is also a potential impact, mainly during the construction phase.

Activities that may have an impact on soils include:

- Solar facility footprint (i.e. an array of PV panels, mounting structures, underground cabling between project components and fencing)
- Construction and positioning of internal access roads
- Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)
- Construction and operation of the on-site substation
- Construction and positioning of the on-site workshop area for maintenance, storage, and offices and temporary construction/ laydown areas.

The potential impacts on soil include:

- Soil loss/ erosion
- Soil contamination
- Loss of agricultural land

12.5.2. Impact tables summarising the significance of impacts on soils (with and without mitigation)

Pre-construction/construction

Potential soil erosion without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Permanent (5)	(Daily)4	(Likely)4
Result: Medium-High (96)				
Mitigation: » Avoid disturbance to pans/ seasonal washes. » Minimise the removal of vegetation and the disturbance of topography » Design and construct/install measures which will prevent erosion from panel-washing during operation, to ensure that this is adequately dissipated to sheet flow » Ensure adequate dissipation of concentrated flow to sheet flow from hard surfaces (including panels) to avoid and minimize erosion. This can be achieved by strategically placing stone downstream of hardened surface areas » Place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where appropriate. » Avoid construction during heavy rainfall events where possible. » Implement stormwater management and other erosion (including wind) prevention measures » Construction vehicles are to remain within the development area and avoid unnecessary disturbance.				
Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Project Specific (2)	Between one-ten years (3)	Temporary (3)	Unlikely (3)
Result: Low (42)				

Operation

Potential soil erosion without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	(Project Specific) 2	Life of operation (4)	Life of operation (4)	Possible (4)
Result: High (99)				
Mitigation: » Minimise the removal of vegetation and disturbance of topography » Place hessian/geofabric (or similar) attached to rows of stakes to decrease flow				

velocities where appropriate » Ensure timeous repair of erosion » Maintain measures which will prevent erosion from panel-washing during operation, to ensure that this is adequately dissipated to sheet flow » Maintain measures which will prevent erosion from water/waste treatment works to ensure that this is adequately dissipated to sheet flow » Ensure adequate dissipation of concentrated flow to sheet flow from hard surfaces (including panels) to avoid and minimize erosion. This can be achieved by strategically placing stone downstream of hardened surface areas » Ensure timeous repair of erosion, and place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where required				
Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Project Specific (2)	Life of operation (4)	Life of operation (4)	Unlikely (3)
Result: Medium (63)				

Dust due to loose soils: Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (3)	Life of Operation (4)	Life of Operation (4)	Infrequent (3)
Result: Medium (63)				
Comment / mitigation: » Vehicles to utilise designated roads/tracks » Rehabilitate after construction and decommissioning. Where possible, re-vegetation of the land should be undertaken with indigenous vegetation immediately after construction is completed in areas that will not be used during the operational phase; » Soil stockpiles should be stored in sheltered areas at the site on the leeward side of hills and inselbergs and covered where possible; » Limit speed at the site to < 40 km/hr and enforce code of conduct for operation of vehicles » Should the prevailing wind speed increase to levels above 5.4 m/s (~20 km/hr), any land clearing activity should be stopped until wind speeds decrease to below the afore mentioned threshold level » Utilise dust suppression measures, particularly on access roads				
Dust due to loose soils: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant	Local (2)	Life of	Life of	Very Seldom

(1)		Operation (4)	Operation (4)	(2)
Result: Low (42)				

Decommissioning

Potential soil erosion without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One Month – One Year (2)	Temporary (2)	Definite (5)
Result: Medium (56)				
Comment / mitigation: » Removal of PV panels and associated infrastructure » Soils surface to be graded to be free-draining » Rehabilitate disturbed areas to original agricultural potential and re-vegetate using appropriately chosen indigenous grasses » Ensure timeous repair of erosion, and place hessian/geofabric (or similar) attached to rows of stakes to decrease flow velocities where required » Continue monitoring until it can be demonstrated that vegetation is self-sustaining and no erosion channels exist (approximately 2 years following completion of decommissioning)				
Potential soil erosion with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Potentially Harmful (2)	Activity Specific (1)	One Month – One Year (2)	Temporary (2)	Likely (4)
Result: Low (30)				

Pre-construction/construction/operation/decommissioning

Soil Contamination: Impact Without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium- High (80)				
Comment / mitigation: » Conduct regular maintenance within dedicated area for vehicles to avoid and minimise leaks. » Ensure legislative requirements are met for sanitation. » Chemical/petroleum/oil storage area to be bunded (using an impervious surface). » Carry out regular maintenance of any on-site chemical/petroleum/oil storage tank				

» Implement disposal of e-Waste or hazardous waste at an appropriately licensed landfill site » Carry out rehabilitation following leaks and spills » Conduct removal of contaminated soils to suitable licenced landfill sites » During maintenance activities of the substation, used oils and old transformers must be disposed of correctly. Used transformers are classified as hazardous waste and should be disposed of at a hazardous landfill site.				
Soil Contamination: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	Life of Operation (4)	Infrequent (3)	Unlikely (3)
Result: Low (42)				

Pre-construction/construction/decommissioning

Dust due to loose soils: Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One to ten years (3)	Regularly (4)	Likely (4)
Result: Medium (72)				
Comment / mitigation: » Keep the amount of land that needs to be cleared (or development footprint) to a minimum at any given time thereby reducing the amount of erodible surface area; » Remain on designated roads/tracks » Rehabilitate after construction and decommissioning. Where possible, re-vegetation of the land should be undertaken with indigenous vegetation immediately after construction is completed in areas that will not be used during the operational phase » Soil stockpiles should be stored in sheltered areas at the site on the leeward side of hills and inselbergs and covered where possible » Limit speed at the site to < 40 km/hr and enforce code of conduct for operation of vehicles » Should the prevailing wind speed increase to levels above 5.4 m/s (~20 km/hr), any land clearing activity should be stopped until wind speeds decrease to below the afore mentioned threshold level » Utilise dust suppression measures, particularly on access roads				
Dust due to loose soils: Impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Local (3)	One to ten	Regularly (4)	Seldom (4)

		years (3)		
Result: Medium (64)				

12.5.3. Impacts on Land Capability and Agricultural Potential

Agricultural potential is primarily determined by the suitability of the soil profile to support crop production. The soil needs to be adequately thick to support root development and the drainage characteristics need to be good to prevent chemical crusting on the surface. In addition to the soil characteristics, climatic factors are also important because the annual rainfall needs to be adequate to sustain a viable crop production. A major limiting factor in terms of agricultural potential on the site is the availability of water for irrigation as the site is ~40km from the Orange River. The agricultural potential of the site is low and limited to extensive grazing due to the low rainfall in the area. Portion 3 of the Farm Zuurwater has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The current land use is livestock farming on Portion 3 of the Farm Zuurwater, predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring. The proposed site supports natural vegetation interspersed with current and past grazing lands.

No areas with arable potential occur and this is due to a lack of rainfall or irrigation potential. The carrying capacity is typically 4 large stock units (LSU)/100 ha. No grazing or agriculture will take place at the footprint of the solar panels and associated infrastructure (i.e. ~222ha of the 4997ha farm portion), which was sited considering the current agricultural activities. However, the remainder of the site will continue the current land use – i.e. grazing of livestock. At the end of the project life, it is anticipated that removal of the solar panels would enable the majority of the land to be rehabilitated and used for a suitable land-use or activity. Therefore, the impact of the PV Facility on land capability and agricultural potential is not significant and will not impact on food security of the country.

12.5.4. Impact tables summarising the significance of impacts on agricultural potential (with and without mitigation)

Preconstruction/Construction/Operation

Impact on agricultural potential without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Project Specific (2)	Life of operation (4)	(Life of Operation) 4	Likely (4)
Result: Medium (80)				
Comment / mitigation:				

» Avoid unnecessary removal of vegetation cover and soil » Rehabilitate disturbed areas to original agricultural potential and re-vegetate using appropriately chosen indigenous grasses » Allow access of livestock and wildlife to grazing on the broader farm portion (outside of the development footprint) » Maintain on-going interaction with the farmer regarding appropriate stocking rates on the development area, and the farm as a whole				
Impact on agricultural potential with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	Life of operation (4)	Life of operation (4)	Unlikely (3)
Result: Low (49)				

Decommissioning

Impact on agricultural potential without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Significant (3)	Local (3)	One Month to One Year (2)	Life of operation (4)	Likely (4)
Result: Medium (64)				
Comment / mitigation: » Remove all PV panels and associated infrastructure » Rehabilitate disturbed areas to original agricultural potential and revegetate using appropriately chosen indigenous grasses.				
Impact on agricultural potential with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Activity Specific (1)	One Month to One Year (2)	Temporary (2)	Unlikely (3)
Result: Low (25)				

12.5.5. Comparative Assessment of Power Line Alternatives

No preference made as the soils associated with both power line alternatives are fairly uniform.

12.5.6. Comparative Assessment of Water Reservoir and associated pipeline alternatives

No preference made as the soils associated with both alternatives are fairly uniform.

12.5.7. Implications for Project Implementation

- The regic sands and dunes which occur on the site are very prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines.
- It is therefore important that there should be strict adherence to the Environmental Management Programme and good soil management measures regarding the management of storm water runoff and water erosion control should be implemented during all phases of the project.
- With the use of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

12.6. Assessment of Potential Impacts on Heritage & Palaeontology

12.6.1. Archaeology

Disturbance of the soil on the proposed development site could potentially have a destructive impact on heritage resources where these are present. The key risks to heritage resources are during the preconstruction and construction phases when site-clearing and preparation are undertaken. Disturbance of surfaces includes any construction including any *clearance* of, or *excavation* into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible).

The heritage study and palaeontology study did not reveal any significant heritage resources on the site. Very sparse heritage traces were found in the development footprint areas and broader farm portion.

On the plains extremely minimal traces were found. A single quartz flake was noted in an erosion feature at 29.32997º S 18.74865º E; and, intriguingly, a single quartz biface (ESA) was found in a deflation area at 29.33123º S 18.74606º E. No other artefacts or notable features were found in association with these. Such completely isolated single-artefact finds could not be considered as constituting “sites” in a conventional archaeological or heritage sense. These observations noted fall under Type 1 for Classes 1-7, again reflecting low heritage significance, low potential and absence of contextual and key types of evidence.

In all instances the impact of the PV Facility, if any, would be local. Impacts on heritage and archaeological resources may be mitigated and hence classed as ‘short term’ but the original in situ context is usually altered in a ‘permanent’ way. If the archaeological or heritage significance of the resources in question is considered to be low – which is the case here – then the significance of the permanent loss is low.

The probability of impacts on heritage including archaeological resources is Improbable. Subject to pre-construction ground-truthing, no ‘Phase 2’ mitigation work is regarded as necessary in terms of present development layout.

However, in the event that any heritage feature (which may be sub-surface, such as an unmarked grave) is encountered during the development or operational life of the facility, work is to be halted immediately and contact made with SAHRA (Ms C. Scheermeyer at 021-4624502) and/or the Northern Cape Heritage Authority Ngwao Bošwa jwa Kapa Bokone (Mr A. Timothy) who would arrange for the evaluation of the find for possible mitigation.

From an archaeological perspective the observed heritage resources are of very low significance (low occurrence). Criteria used here for impact significance assessment rate the impacts as Low (even taking into consideration the fact that for heritage traces, unlike biological processes, impacts tend to be irreversible, of permanent duration and high magnitude).

12.6.2. Impact tables summarising the significance of impacts on heritage sites, or objects (with and without mitigation).

Pre-construction/construction/operation/decommissioning

Destruction of heritage resources/ sites – PV facility: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project Specific (2)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (48)				
Mitigation: » In the event that heritage resources are found, the South African Heritage Resources Agency and Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority) should be informed and necessary permits obtained » Although unlikely, where necessary, arrangements for in situ preservation should be made with the heritage authorities				
Destruction of heritage resources/sites: impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Activity Specific (1)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (36)				

12.6.3. Impacts on Palaeontology

The Mid Proterozoic basement rocks of the Namaqua-Natal Province are entirely unfossiliferous (Almond & Pether 2008). The fossil record of the Kalahari Group as a whole is generally sparse and low in diversity; no fossils are recorded here in the recent Pofadder geology sheet explanation by Agenbacht (2007). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying Dwyka Group may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (e.g. Hodotermes, the harvester termite), ostrich egg shells (Struthio) and shells of land snails (e.g. Trigonephrus) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (e.g. Corbula, Unio) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels. The younger fluvial and alluvial sands and gravels within the proposed development area are unlikely to contain any substantial fossil or subfossil remains.

The overall palaeontological sensitivity of the Precambrian basement rocks, as well as of the Kalahari Group and younger sediments mapped within the study region, ranges from zero to low (Almond & Pether 2008). The proposed development has a small footprint and deep excavations are not envisaged for photovoltaic installations. The paleontological sensitivity is also relatively low for sediments such as the Precambrian basement rocks, Kalahari group rocks and younger sediments, meaning that the proposed developments will have minimal impact (Almond & Pether, 2008). For these reasons, no further palaeontological specialist palaeontological studies or mitigation are recommended for this development.

However, should substantial fossil remains be exposed during construction; however, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.

12.6.4. Impact tables summarising the significance of impacts on Palaeontology sites, or objects (with and without mitigation).

Pre-construction/construction/operation/decommissioning

Destruction of fossils: impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Small (2)	Project Specific (2)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (48)				
Mitigation: » In the event that fossils are found, the South African Heritage Resources Agency and Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority) should be informed and necessary permits obtained » Although unlikely, where necessary, arrangements for in situ preservation should be made with the heritage authorities. » Should human remains be uncovered during construction/ excavations, this must be reported to the nearest police station.				
Destruction of fossils with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Insignificant (1)	Activity Specific (1)	Life of Operation (4)	Life of Operation (4)	Highly Unlikely (2)
Result: Low (36)				

12.6.5. Comparative Assessment of Power Line Alternatives

With regard to magnitude and extent of the potential impacts of power lines, it has been noted that their erection generally has a relatively small impact on Stone Age sites. Sampson's (1985) observations show this from surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon). A more permanent road would tend to be far more destructive (modification of the landscape surface within a continuous strip), albeit relatively limited in spatial extent, i.e. width. On archaeological grounds there is no reason to prefer one alternative route for the power line for Phase 4 over the other.

12.6.6. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure is not expected to pose additional impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary (common to all alternatives) would have localised impacts on the affected properties. This section of the route has however been previously disturbed through construction activities associated with the existing pipeline and it is therefore considered unlikely that heritage resources of significance would be found in this area. There is therefore no preferred alternative in terms of this infrastructure from a heritage perspective.

12.6.7. Implications for Project Implementation

» No "Heritage Sensitive Areas" were identified on the Phase 4 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Phase 4 and will not be impacted by the development footprint of the PV facility.
» It was concluded that there are no heritage "No Go Areas" within the site and that the development could go ahead as planned.
» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» Should substantial archaeological or paleontological (fossils) remains be exposed during construction, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
» No further palaeontological specialist palaeontological studies or mitigation are recommended for this development.

12.7. Assessment of Potential Visual Impacts

Potential visual impacts of Phase 4 of the PV Facility area discussed in this Section, cumulative visual impacts of multiple phases of this project and approved projects in the area are dealt with separately under Section 12.10.

12.7.1. Visual Character and Quality of the Study Area

The Zuurwater site is located approximately 9km south-west from the town of Aggeneys in the Northern Cape Province of South Africa. The site is located in a sparsely populated and remote area. The Black Mountain Mine is located approximately 9km to the north-north-east of the site. The site is located adjacent to the N14 highway, which runs west to east between the town of Springbok and Pofadder. Eskom's existing Aggenies Subsation is located approximately 5km to the east of the site. The area is very flat, with large open plains. The skyline is broken by small rocky outctrops called inselbergs. The visual character of the area is characterised by a changing landscape character associated with the interface between natural areas and modified rural / pastoral or agricultural zones. The skyline is broken by the small inselbergs to the west of the site, which are the only major natural features in the landscape. The landscape is disturbed to the east of the site due to the presence of a large Eskom substation and the mining activities at Black Mountain; however these features are relatively far from the site. Due to this the visual quality rating for the area could be described as medium, due to the lack of natural features in the landscape and some disturbances to the landscape in the east.

12.7.2. Sense of Place

An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places. Lynch defines 'sense of place' as "the extent to which a person can recognise or recall a place as being distinct from other places – as having a vivid or unique, or at least a particular, character of its own" (Lynch, 1992:131). The area around the proposed Zuurwater site is barren and sparse in terms of natural features. In terms of being distinct from other areas, this site is situated along the main road between Springbok and Pofadder; the landscape between these two towns is flat and barren, with some small hills breaking the skyline. Thus this site is not different from the surrounding landscape in its current form. Altering the site through developing the PV arrays may change the sense of place for the site. This change could impact on the sense of place, as the sense of place of the site could allow for the site to be unique in the area. Currently, the sense of place for the site is low.

12.7.3. Visual Receptors

The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon. Sensitivity is also dependent on the viewer's perception of the area and their ability to adapt to changes in the environment. This can also include how frequently they are exposed to the view, i.e. static views from houses would have a higher sensitivity than transient views experienced by motorists. The following potentially sensitive areas exist in the study area:

» The farmers located adjacent to the site (landowners);
» Aggeneys residents; and
» Road users travelling west and east along the N14.

Based on the analysis undertaken, the following individuals could potentially be more sensitive to the development:
» Local residents; and
» Road users travelling along the N14.

It must be noted that whilst on site, traffic flow along the N14 was considered. Whilst a traffic count was not undertaken, it was noted that there were very few motorists travelling between Aggeneys and Springbok. However, it was not known if traffic volumes increase during holiday seasons. The viewer sensitivity are ranked from High (5) to Low (1) based on the probable perceptions of the viewers and their willingness to change.

12.7.4. Visual Exposure / Viewshed

Visual exposure is determined by the zone of visual influence or "the viewshed". A viewshed is a subset of a landscape unit (envelope) and is the topographically defined area that includes all the major observation sites from which the proposed development will be visible. The boundary of the viewshed demarcates the zone of visual influence. It must be noted for the study of the visual impact of the proposed activities at the Zuurwater Site, each of the activities were investigated separately. Each of the activities was modelled on a hypothetically flat surface. Areas on this surface, where the given activity may be visible, are highlighted. The viewshed is shown in Figure 12.4.

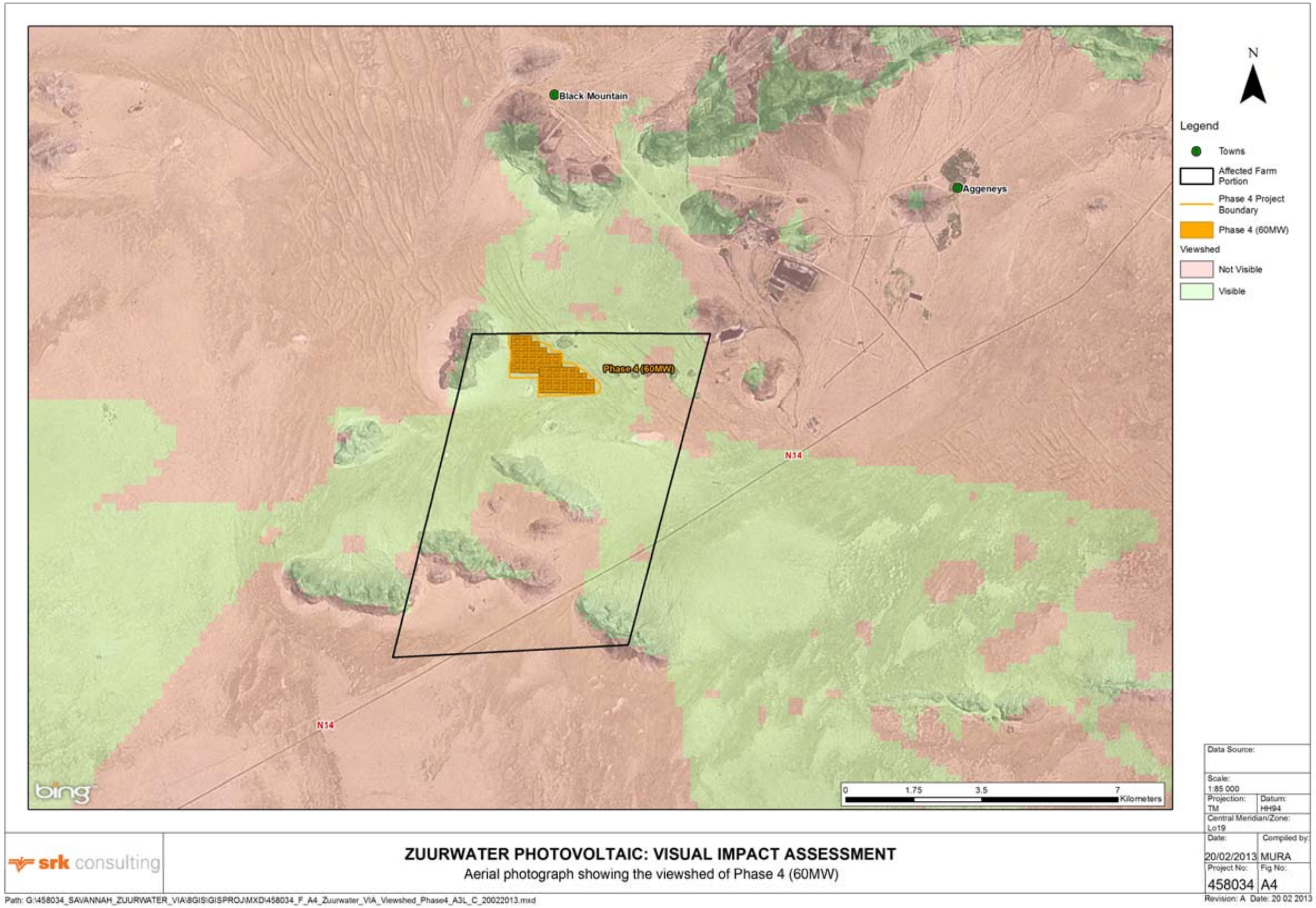

Figure 12.4: Viewshed for Phase 4 of the PV Facility on Portion 3 of the Farm Zuurwater

The Phase 4 PV arrays are proposed north of Phase 1. Phase 4 is positioned approximately 5km from the N14 and 11km from the town of Aggeneys. This places the N14 viewers into the middle ground category of the visibility and distance rating. However these users can be considered to be transient, whilst the majority of potential viewers (Aggeneys residents) lie with the background category. Thus, the rating is calculated as Background. There are not a lot of natural or other types of features in the landscape to aid in shielding views of the overall Zuurwater site. Phase 4 is located in the open; however some rocky outcrops and inselbergs in the proximity of this phase may provide some VAC. The VAC is therefore calculated as MEDIUM (3). The current site is vacant and used for grazing purposes. The landscape compatibility for the PV tables is therefore low (5). The landscape between Springbok and Pofadder comprises generally of flat, natural and agricultural land with small koppies intermittently rising from the flat landscape. The establishment of a clean renewable energy source (such as solar, wind or hydro power) in the area would be significantly different to what is there. This change, to a feature which is adding value to the landscape may reduce the viewer sensitivity. The sensitivity rating therefore is estimated to be Medium-Low (2).

During the pre-construction and construction phases of the development of the Zuurwater site, there is potential for a visual impact. This impact could stem from the clearing of sections of the landscape, as well as setting aside areas for the assembling of the infrastructure on the site. It is expected that these visual impacts will be localised to the N14 in the beginning, expanding to a larger area of influence as the size of the excavations increase. During the operational phase, as indicated in the viewshed, the PV panels would be visible from a large distance from the site. The nature of the natural vegetation (i.e. low growing) and the flat topography in the area allows for unobstructed views from various viewpoints in the landscape. It must however be noted that existing infrastructure – Eskom power lines and substation – do aid in reducing the impact of the PV panels in places.

During the decommissioning or post closure phase of the project, all of the infrastructure will be removed, recycled or re-used in other projects off-site. The visual impacts of the site are expected to be scarring of the landscape where the existing farm roads were used, as well as where the PV panels were placed. With correct management measures, this scarring and visual impact could be reduced.

12.7.5. Impact tables summarising the significance of visual impacts of the PV facility (with and without mitigation)

Preconstruction/construction/decommissioning

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	One to ten years (3)	Temporary (2)	Possible (4)
Result: Medium (60)				
Mitigation: » Minimise the size of the laydown area and work areas » Implement strict procedures for location and management of the construction site, laydown and work areas » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Minimise reflective surfaces » Appropriate choice of colour for buildings » Ensure the site is kept neat and tidy (free of litter and refuse) at all times » Any disturbance to the sparse vegetation on site should be kept to a minimum				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Project specific (2)	One to ten years (3)	Temporary (2)	Seldom (3)
Result: Low (40)				

Operation

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium-High (88)				
Mitigation: » Put in place measures for the efficient management of the facility » Avoid littering » Minimise the removal of vegetation				

» Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Ensure that the PV panels do not cause disruption of passing traffic on the N14. » Ensure fence boundaries and on-site buildings are maintained, in order to keep the site looking neat » Keep the site free of debris and litter, and alien invasive species				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Unlikely (3)
Result: Medium (70)				

12.7.6. Visual Impact of the Power line

It is proposed that the PV panels will be connected to the existing Eskom grid and so will entail the connection via an overhead power line to the existing substation. During the pre-construction and construction phases of the proposed new power line, there is a potential for a visual impact. This impact could stem from the clearing of sections of the landscape, as well as setting aside areas for the assembling of the infrastructure on the site. It should however be noted that the overall development footprint for the construction of the power line will be significantly smaller than that of the PV panels.

It is expected that these visual impacts will be localised to the N14 near the existing substation site, however due to the slight undulations in the topography as well as the distance of viewers from the majority of the proposed alignment, much of the preconstruction and construction activities should be shielded from view. During the operational phase, as was shown in the viewshed, the proposed power line is predicted to be visible over a large area. However, due to the presence of existing power line infrastructure, and the proposal that the power line from the Phase 4 area follow an existing power line for part of the route to the substation, the change to the overall visual landscape is expected to be minimal.

During the decommissioning or post closure phase of the project, all of the infrastructure used could be removed, recycled or re-used in other projects off-site or integrated into the existing electrical reticulation system. If the infrastructure is removed, the overall visual impact could be seen to be minimal due to the overall footprint disturbed being limited to the servitude of the power line alignment.

12.7.7. Impact tables summarising the significance of visual impacts of the power Line (with and without mitigation)

Preconstruction/construction/decommissioning

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	One to ten years (3)	Temporary (2)	Possible (4)
Result: Medium (60)				
Mitigation: » Minimise the size of the laydown area and work areas » Implement strict procedures for location and management of the construction site, laydown and work areas » Avoid littering » Minimise the removal of vegetation » Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Minimise reflective surfaces » Appropriate choice of colour for buildings » Ensure the site is kept neat and tidy (free of litter and refuse) at all times » Any disturbance to the sparse vegetation on site should be kept to a minimum				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Project specific (2)	One to ten years (3)	Temporary (2)	Seldom (3)
Result: Low (40)				

Operation

Visual impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Harmful (4)	Local (3)	Life of Operation (4)	Life of Operation (4)	Likely (4)
Result: Medium-High (88)				
Mitigation: » Put in place measures for the efficient management of the facility » Avoid littering » Minimise the removal of vegetation				

» Rehabilitate disturbed construction areas to original agricultural potential and re-vegetate using appropriate indigenous grasses » Ensure fence boundaries and on-site buildings are maintained, in order to keep the site looking neat » Keep the site free of debris and litter, and alien invasive species				
Visual impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
Slightly Harmful (3)	Local (3)	Life of Operation (4)	Life of Operation (4)	Unlikely (3)
Result: Medium (70)				

12.7.8. Comparative Assessment of Power Line Alternatives

Both alternatives for the Phase 4 power line fall within the broader development area and follow the existing Aggeneis-Nama 220kV power line to the Aggeneis substation. **Alternative 2** alignment follows the Phase 1 power line alignment, thus decreasing the extent of the visual impact associated the power lines from the larger facility. Therefore **Alternative 2** is the preferred alteranative from a visual perspective.

12.7.9. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure would not pose additional visual impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is therefore no preferred alternative in terms of these alternatives from a visual perspective.

12.7.10. Mitigation of Visual Impacts

The role of mitigation is critical in finding a design / rehabilitation solution that will be visually acceptable. Potential mitigation measures have been taken into consideration during the design phase, as discussed above and is also provided by natural features in the area. Only effective, economically feasible, appropriate and visually acceptable mitigation measures should be considered and these should form part of an EMPr to be implemented should the project be approved. Sound planning and design techniques are essential to implement creative alternatives to meet the project's objectives. These techniques must be viewed as principles or objectives and not rigid standards with limited flexibility.

» During the pre-construction and construction phases of the project, assembly areas and work camps must be kept free of litter. These sites would be visible from the N14 and thus in order to reduce the visual impact of these sites should be kept presentable and neat;
» Along the N14 are a series of man-made soil berms, these berms act as a visual barrier between sections of the N14 and the PV facility. If practical, these berms could be extended to run along the N14 boundary fence-line to act as a visual barrier between the motorists using the N14 and the PV Facility.
» Buildings on the site should be painted a colour which is consistent with the surrounding landscape. Colours which have a high contrast to the area around the site should be avoided. In order to avoid potential glare, which may cause a distraction to road users of the N14, all surfaces, if possible, should have a matte finish;
» Due to the relatively undisturbed and landscape lacking in vegetative cover, it is recommended that the sites, the sites should be kept neat (no stockpiles of soil or refuse) and litter free, as well as alien vegetation control measures put in place;
» With regards to lighting, the following should be considered:
    o Lighting on the fence line and security lighting should be faced inwards, except for nocturnal safety lighting; and
    o Lighting internally, if practical, should be low foot-level lighting, fitted with low intensity bulbs should be used.
» These lighting recommendations should be considered only if they do not pose a threat to site safety.
» In terms of post-closure rehabilitation it is important to restore the environment to a condition whereby the natural functioning of the ecosystem can take place;
» During construction activities, dust control measures should be implemented, i.e. have a water tanker available, and reduce onsite driving speeds;
» External signage should be kept to a minimum and where possible attached to existing buildings to avoid free-standing signs in the landscape.

12.7.11. Implications for Project Implementation

» Visual impacts associated with the PV facility and associated infrastructure (including the power line) are expected to be of low significance largely due to the absence of many visual sensitive receptors from the area as well as the presence of existing power line and the proposal that the power line to the substation be constructed in parallel to this existing power line.
» Visual Impacts are difficult to mitigate, however, possible mitigation measures are recommended in Section 6.8.8 above and are included in the EMP.

- In addition, to limit scarring of the landscape, rehabilitate disturbed construction areas and re-vegetate using appropriate indigenous grasses
- Ensure that the PV panels do not cause disruption of passing traffic on the N14.

12.8. Economic impacts

Potential economic (and social) impacts include:

- Disruption of grazing
- Disruption of N14 and other infrastructure
- Economic development
- Creation of employment
- Stability of energy supply
- Expansion of community development projects
- Impacts on public safety
- Noise during construction
- Increased traffic and road safety hazards
- Increased risk of crime, disease with influx of workers and opportunity seekers
- Social divisions over limited jobs and perceived preferential access
- Occupational health and safety
- Impacts from waste (construction, solid, domestic and e-Waste)
- Visual impact

These impacts associated with Phase 4 are discussed below. Cumulative impacts of multiple phases of this project and approved projects in the area are dealt with separately under Section 12.10.

During construction approximately 250-300 jobs will be created over a 15 - 18 month period for this phase of the PV Project. During the operation phase approximately 7-15 full-time employees will be employed during. PVAfrica Development (Pty) Ltd is committing 1.5% and 0.6% of its annual project revenues over 20 years to socio-economic development and enterprise development in local communities respectively. During construction, temporary camps will house construction staff. There are no communities in the immediate vicinity of the site and within the servitude (27.5 metres on either side) of the power line.

12.8.1. Disruption of Grazing Activities

The farm as a whole has a relatively low grazing / agricultural potential in the national context, given the low rainfall and high evaporation rates experienced in the area. In this region of the country, commercial livestock ranches are generally large, often comprising tens of thousands of hectares. Net returns are negative for a given year depending on variables including feed costs, weather variables and livestock prices. Return on investments has been low for smaller land owners, and negative net returns can occur based on smaller farming units for three out of twenty years on average. The agricultural specialist report provides information on the extent to which the proposed project will decrease the stocking rate of the Portion 3 of the Farm Zuurwater. During construction, the preparation of the site and the presence of construction equipment will result in disruption of grazing. During the operational phase – the area occupied by the PV panels cannot be used for agriculture. Decommissioning is likely to result again in a temporary more intense disruption of grazing, owing to the presence of vehicles and equipment for the removal of infrastructure.

Pre-construction/construction

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	4	5
Result: Medium-High (90)				
Mitigation: » Implement stormwater management and other erosion prevention measures » Construction vehicles are to remain within the proposed development area » Avoid and minimise the removal of natural vegetation/ grazing				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	3	5
Result: Low-medium (64)				

Operation

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: Medium-high (80)				
Mitigation: » Rehabilitate disturbed land within the development area to original agricultural potential and consider allowing grazing (with conservative stocking rates) between the panels if and where possible. » Prevent disruption of natural vegetation/ grazing both within and around the development area » Maintain stormwater management and other erosion prevention measures » Operational vehicles are to remain within the proposed development area » Implement measures to prevent livestock coming into contact with or entangled by any electrical wiring that might cause short circuits, injury or death.				

Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	4	4	3
Result: Medium (63)				

Decommissioning

Impact on grazing activities without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	3	5
Result: Medium-high (80)				
Mitigation: » Maintain and enhance stormwater management and other erosion (including wind) prevention measures » Implement measures to rehabilitate compaction of soil resulting from the concrete footings, other PV infrastructure and vehicle access. » Undertake rehabilitation to original agricultural potential » Reinstitute conservative stocking rate within development footprint following rehabilitation				
Impact on grazing activities with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	4
Result: Low (42)				

12.8.2. Economic development

The Northern Cape is a region of marked economic underdevelopment and unemployment, and given the arid and remote nature of the environment, opportunities are limited. Mining, a key contributor to the regional economy, has a limited lifespan entirely dependent on life of mine. This project represents the chance of harnessing the underutilized high solar irradiation levels of this region of the Northern Cape, and the diversification of the local economy. The location within the immediate study area of the Eskom power lines forming part of the national grid feeding Namibia and Springbok also enhances the economic feasibility of the project. Solar power is also one of the development opportunities which have been identified by authorities at the national and regional levels.

Numerous positive economic spinoffs from the project are envisaged for all project stages. Job creation will be at its highest during the construction phase of the project (250-300 employees – required for construction of One Phase of 75MW, following by decommissioning (100 people). During preconstruction and operation, although at a reduced scale, jobs created are likely to make a major contribution to the local economy. Permanent, highly skilled and semi-skilled jobs will be created in the operational phase which will contribute to economic stability of the area. Local sourcing of services and materials (where feasible), will contribute to secondary benefits of the project, and could potentially result in the creation of small enterprises and service providers who could in turn generate employment.

Decommissioning will result in some job creation, as well as opportunities through the reuse/ recycling of certain components from the dismantled facility. At the end of decommissioning, there will be job losses and loss of income to the local economy unless the life of the project can be extended such as through retrofitting. Job losses will arise at the end of decommissioning.

Pre-construction/construction

Impact on local economic development without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	3
Result: Low (+42)				
Mitigation / enhancement: » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies and methods where practical				
Impact local economic development with mitigation/enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	3	4	4
Result: Medium (+72)				

Operation

Impact local economic development without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	3
Result: Low (+42)				
Mitigation / enhancement: » Procure materials, goods and services from local/ regional suppliers where feasible				

» Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies where practical				
Impact on local economic development with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	4	3	3
Result: Medium (54)				

Decommissioning

Impact on local economic development without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	5	3	4
Result: Medium-high (-63)				
Mitigation / enhancement: » Investigate opportunities for reuse of materials and extension of the life of the operation such as through retrofitting » Procure materials, goods and services from local/regional suppliers where feasible » Implement skills and career development through the decommissioning process » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				
Impact on local economic development with mitigation/enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	5	2	3
Result: Low-medium (-60)				

12.8.3. Creation of employment

The Northern Cape experiences high levels of unemployment, contributed to by long distance to markets, the high aridity levels of the area. There is high dependence on mining operations which will have limited lifespans dependent on availability of mineral resources and international markets.

The greatest number of jobs are anticipated to be created during the construction phase of the project (±250-300 jobs per phase and six phases), followed by decommissioning (100 jobs). Preconstruction will be of limited duration, but the operational phase (7 to 15 jobs) will give rise to long-term (approximately 20 years) highly skilled and semi-skilled jobs.

Decommissioning will result in temporary employment. Jobs will be lost unless the life of the project can be extended through refurbishment and/or retrofitting continued operation.

Pre-construction

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	2	1	5
Result: Low (+48)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop local skills » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	2	1	5
Result: Medium (+60)				

Construction

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	3	3	4
Result: Medium (+70)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop skills of employees » Implement labour-intensive technologies where practical				

Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	3	5
Result: Medium-high (+88)				

Operation

Impact of job creation without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (+96)				
Mitigation / enhancement: » Employ people from the local region where feasible » Procure materials, goods and services from local/ regional suppliers where feasible » Liaise with local business initiatives and enterprise development agencies to build on existing local enterprises » Identify opportunities where training can be carried out to develop skills of employees » Implement labour-intensive technologies where practical				
Impact of job creation with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
5	4	4	4	5
Result: High (+117)				

Decommissioning

Impact of job creation without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
5	4	5	5	5
Result: Very high (140)				
Mitigation: » Investigate opportunities for reuse of materials and extension of the life of the operation such as through retrofitting » Procure materials, goods and services from local/regional suppliers where feasible » Implement skills and career development through the decommissioning process » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility				

» Implement measures for assisting employees with seeking alternative employment				
Impact of job creation with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	2	3	4
Result: Low-medium (70)				

12.8.4. <u>Stability of energy supply</u>

Eskom, South Africa's key power producer, has been under pressure in recent years to meet electricity demands which has impacted negatively on stability of power supply. The country has been experiencing power outages, exacerbated by the regular need for key coal-based power stations to undergo maintenance. The proposed project stands to make a positive contribution to South Africa's stability of power supply during its operational phase through diversification from reliance on coal-generated power and distribution to areas of high electricity utilisation. This positive impact will be enhanced through efficient management and operation of the PV facility. A negative aspect of power generated by PV is that it is limited to daylight hours.

Decommissioning of the PV facility after 20 years of operation will cause power generation to cease, which will result in negative impact on stability of power supply. This situation could be delayed should it be found that it is feasible to refurbish/ retrofit infrastructure to allow for either total or partial continued operation. Decommissioning should occur in a phased manner and in close communication with Eskom, so as to avoid and minimize instability of power supply.

Operation

Impact of the project on stability of energy supply without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	5	4	4	4
Result: Medium-high (+88)				
Mitigation / enhancement: » Conduct regular maintenance of the plant to avoid and minimise operational down-time » Maintain close liaison with Eskom regarding any possible scheduled or unscheduled down-time				
Impact on stability of energy supply with mitigation / enhancement:				
Severity	**Spatial**	**Duration of**	**Duration of**	**Frequency of**

	extent	**impact**	**activity**	**impact**
3	5	4	5	5
Result: High (+120)				

Decommissioning

Impact on stability of energy supply without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	5	5	5	5
Result: Very high (-140)				
Comment / mitigation: » Investigate the possibility of refurbishment and/or retrofitting for total and/or partial continued operation » Carry out careful planning of the phasing of the decommissioning process » Maintain communication with national energy regulator and power producer (Eskom)				
Impact on stability of energy supply with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	5	5	3	5
Result: High (-104)				

12.9. Social Impacts

12.9.1. <u>Expansion of Community Development Projects</u>

During preconstruction, construction, operation and decommissioning, there is potential to increase coordination with local projects and initiatives falling under provincial community development authorities, local authorities and other organisations encouraging community development. This process will ensure that project activities are harmonised with local spatial and development plans (e.g. Integrated Development Plans, Spatial Development Frameworks and Local Economic Development Plans). Building lines of communication will assist with such aspects as disruption of municipal and other services, and the maximisation of opportunities such as building on support programmes such as HIV/Aids prevention. PVAfrica Development (Pty) Ltd plans to ensure that there is liaison, cooperation and assistance provided to organisations such as community trusts functioning in the immediate vicinity of the proposed project.

Pre-construction/construction/operation

Impact on community development projects without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	4	3	3
Result: Low-medium (+54)				
Mitigation / enhancement: » Carry out early identification of existing community initiatives which can be expanded » Conduct consultation with stakeholders regarding community development projects requiring enhancement » Carry out targeted support to existing community development projects in line with identified needs				
Impact on community development projects with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (+96)				

Decommissioning

Impact on community development projects without mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	4	4	4
Result: Medium-high (-96)				
Mitigation / enhancement: » Carry out early identification of existing community initiatives which can be expanded » Conduct consultation with stakeholders regarding community development projects requiring enhancement » Carry out targeted support to existing community development projects in line with identified needs » Implement skills and career development through the decommissioning process where feasible » Encourage small scale enterprise development, including through reuse of materials made available through dismantling of the PV facility » Implement measures for assisting employees with seeking alternative employment				

Impact on community development projects with mitigation / enhancement:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	4	3	3
Result: Low-medium (54)				

12.9.2. Impacts on Public Safety

The proposed development site is situated far from neighbouring towns, with the town of Aggeneys (the closest settlement) being approximately 9km away. Although there are no communities in close proximity to these servitudes there is one farming family resident on the farm. There are further passers-by in the form of low-volume traffic on the N14. Potential safety hazards during preconstruction, construction and decommissioning include:

» Injury from machinery, equipment and construction vehicles through following unauthorized access to the construction area(s)
» Road accidents involving construction vehicles
» Electrocution from high voltage power lines and substations

The operational project technology is not known to pose any risks to the health of the public, although if not managed could pose a safety hazard should members of the public trespass on to the site. The hazards posed through unauthorized access during the operational phase potentially include electric shocks and/or electrocution through third party tampering with equipment and installations such as live wiring. Since 24 hour security and warning signage will be in place on site, the likelihood of incidents occurring is considered to be very remote.

Pre-construction / construction/ decommissioning

Impact on public safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	3	3	3
Result: Low (48)				
Comment / mitigation : » Institute and maintain 24 hour security and access control to the project site » Set up signage warning of on-site hazards » Clearly demarcate construction areas » Construct and maintain security fencing on the perimeter and around electrical substations » Develop and implement emergency response procedures				

Impact on public safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	3	2	2
Result: Very low (24)				

Operation

Impact on public safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: High (80)				
Comment / mitigation: » Institute and maintain 24 hour security and access control to the site » Set up signage warning of on-site hazards » Clearly demarcate operational areas » Construct and maintain security fencing on the perimeter and around electrical substations » Verify the technical competency of staff operating and managing the facility » Implement and carry out regular review of emergency response procedures				
Impact on public safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	1	4	2	2
Result: Low (32)				

12.9.3. Increased noise

The proposed development site is situated in a predominantly natural and remote area with very low ambient noise levels. The neighbouring Black Mountain Mine has limited if any influence on noise levels on the site, and the town of Aggeneys is also situated too far away to have significant influence on ambient noise levels. The relatively close proximity of the development site to the N14 will, however, assist with the attenuation of noise levels.

The primary source of noise during the preconstruction, construction and decommissioning phases will be through the operation of trucks and machinery associated with the construction process. These are the phases where noise impacts are anticipated to be most intense through the operation of trucks for clearing of vegetation (preconstruction), transportation of construction materials (construction) and dismantled materials (decommissioning). There will also be noise impacts generated from the operation of vehicles supplying logistics support, such as supply of water for domestic use. Noise impacts during the operational phase are anticipated to be lower the more limited use of vehicles and equipment for cleaning of panels, vehicles for transport of water and those for supply of services/logistical support. Ambient noise will also be contributed to by the presence of workers during preconstruction, construction, operation and decommissioning.

Pre-construction/ construction /decommissioning

Noise impacts without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	4	4
Result: Medium (80)				
Comment / mitigation : » Implement regular maintenance of vehicles » Minimise construction activities between 6pm and 6am in sites close to homestead » Ensure placement of accommodation/ construction camp away from the resident farmer’s household » Enforce strict speed limits for vehicles moving on the property » Develop and put into effect a code of conduct for employees				
Noise impacts with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	3	3	3
Result: Medium (54)				

Operation

Noise impacts without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	2	4	4	4
Result: Low (56)				
Comment / mitigation: » Implement regular maintenance of vehicles » Minimise construction activities between 6pm and 6am in sites close to homestead » Enforce strict speed limits for vehicles moving on the property » Develop and put into effect a code of conduct for employees				
Impact with mitigation:				
Severity	**Spatial**	**Duration of**	**Duration of**	**Frequency of**

	extent	**impact**	**activity**	**impact**
1	2	3	4	3
Result: Low (49)				

12.9.4. Increased risk of crime, disease with influx of workers and opportunity seekers

A major outbreak of HIV/Aids has swept South Africa in recent decades, and communicable diseases also have a high incidence in the country. Desperation for sources of income can also draw people into prostitution. As with other new developments, the proposed project is likely to set up expectations of employment opportunities which could potentially result in in-migration of job-seekers. This could result in an increase in the crime rate and may exacerbate the risk of spread of disease unless measures are put in place to discourage risky behaviour by job-seekers and employees and contractors. It is anticipated that the risk of spread of disease as well as crime will be highest during the preconstruction, construction and decommissioning phases of the project, and that during the operational phase when there is a stable workforce, the risks will be lowest. It is possible that crime could be linked to such activities as tampering with security features and theft of equipment.

Preconstruction/construction/decommissioning

Impact due to influx of workers without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	4	4
Result: Medium-high (88)				
Comment / mitigation: » Enhance and/or support local and provincial authority initiatives on HIV/Aids and communicable disease awareness » Employ local people where possible » Include conditions for contractors to provide HIV/Aids education and introduce rotation to enable contract workers not residing in the area to visit their homes regularly » Provide recreational facilities such as soccer fields for construction workers and facilitate access to nearby towns for shopping, religious gatherings, etc. » Manage expectations of job creation through the information and communication programme » Maintain close liaison with local and provincial law enforcement agencies » Incorporate into the code of conduct for employees including punitive measures for theft and related crimes				
Impact due to influx of workers with mitigation:				

Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	2
Result: Low (28)				

Operation

Impact due to influx without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	3	4	3	3
Result: Medium (60)				
Comment / mitigation: » Enhance and/or support local and provincial authority initiatives on HIV/Aids and communicable disease awareness » Employ local people where possible » Manage expectations of job creation through the information and communication programme » Maintain close liaison with local and provincial law enforcement agencies » Incorporate into the code of conduct for employees punitive measures for theft and related crimes				
Impact due to influx of workers with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

12.9.5. <u>Social divisions over limited jobs and perceived preferential access</u>

High unemployment rates within the vicinity of the study area are likely to increase expectations, and perhaps result in unrealistic anticipation, of job creation by the project. The public participation process highlighted the desire amongst community members that job creation should be maximised by the project. The requirement for highly technical and skilled employees during all project phases means that the number of jobs created at community level could be relatively limited. It is possible that divisions within communities could be sown should it be perceived that outsiders are preferentially obtaining jobs, and that employment opportunities are limited for local people. Should there be corruption and nepotism associated with employment, this will exacerbate the problems. The risk of these impacts arising is most likely during the preconstruction, construction and decommissioning project phases when employment levels are at their highest on the project. However, the DoE requirements include use of locally available skills and social beneficiation as part of the development and operation of the project. In addition, the developer should manage expectations from local communities by being transparent.

Preconstruction/ construction/ decommissioning

Social division/ impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	4	3	4	5
Result: Medium (99)				
Comment / mitigation: » Employ local people where possible » Establish and maintain transparency in recruitment procedure » Ensure transparency in recruitment procedures » Maintain effective communication with local community structures and stakeholders during all project phases to address potential and real tensions. » A communication and information programme should be used to maximise procurement from local service providers » Include management and enhancement measures for local and BBBEE employment in the EMP				
Social division/ impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	3	3	2	3
Result: Low (40)				

Operation

Social division/ impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	4	4	4
Result: Medium (56)				
Comment / mitigation: » Employ local people where possible » Establish and maintain transparency in recruitment procedures » Ensure transparency in recruitment procedures » Maintain effective communication with local community structures and stakeholders » A communication and information programme should be used to maximise procurement from local service providers » Include management and enhancement measures for local and BBBEE employment in the EMP				

Social division/ impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	2	2
Result: Low (32)				

12.9.6. <u>Health and Safety Impacts</u>

The development of the PV plant will involve activities that potentially could be unsafe to workers on the project. These activities include clearing of the development site, digging of trenches, laying of cables and backfilling. These activities all require the use of heavy duty vehicles, machinery and equipment. Additionally, there is a risk posed by road accidents during the transportation of components and materials, both on access routes and national/ provincial roads, as well as within the development site. There is furthermore the risk of exposure to diseases including HIV/Aids and communicable diseases such as tuberculosis (TB).
During the operational phase, occupational health and safety impacts could include injury (including electric shocks or electrocution) to workers from routine monitoring and maintenance, as well as when responding to emergencies such as fire, electrical malfunctions or structural failure of equipment such as the collapse of a PV panel during a wind storm. Dangerous conditions could result from corrosion of electrical components, erosion, flooding and third party damage. During decommissioning, there is the risk of injury caused by mishandling or malfunction of electrical components, injury during dismantling of equipment and movement of vehicles or collisions, and events such as suffocation from collapse of trench walls.

Preconstruction/construction/decommissioning

Health and safety impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	3	4	4
Result: Medium (64)				
Comment / mitigation: » Adhere to OHS legal requirements and measures contained in the EMP » Establish and implement OHS procedures for employees on site, including use of Personal Protection Equipment (PPE) » Conduct regular staff training on OHS » Implement an employee code of conduct which incorporates safety issues including prohibition of operating vehicles and machinery after use of substances which could impair reflexes				
Health and safety impact with mitigation:				
Severity	**Spatial**	**Duration of**	**Duration of**	**Frequency of**

	extent	**impact**	**activity**	**impact**
2	1	3	4	3
Result: Low (42)				

Operation

Health and safety impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	2	4	4	4
Result: Medium (80)				
Comment / mitigation: » Adhere to OHS legal requirements and measures contained in the EMP » Establish and implement OHS procedures for employees on site, including use of Personal Protection Equipment (PPE) » Conduct regular staff training on OHS » Implement an employee code of conduct which incorporates safety issues including prohibition of operating vehicles and machinery after use of substances which could impair reflexes				
Health and safety impact with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	4	4	3
Result: Low (49)				

12.9.7. Impacts from waste (construction, solid, domestic and e-Waste)

Several categories of waste will be generated in each of the project phases (preconstruction; construction; operation and decommissioning). If not appropriately managed, waste generated could result in impacts on air, soil and water quality, as well as visual (aesthetic) quality. Sanitation and wastewater facilities will cater for the anticipated employees during preconstruction; construction; operation and decommissioning. Domestic solid waste generation can be expected to be proportional to the number of workers during each project phase, and thus the highest volumes are likely to be generated during the construction phase. During preconstruction and construction, domestic solid and liquid waste will be the primary source. The volumes of non-domestic and domestic waste will be at their lowest during the operational phase of the project, although on-going PV plant maintenance is likely to result in limited quantities of components requiring replacement. Waste will be disposed of at a suitably registered municipal landfill site.

Decommissioning is anticipated to commence around 20 years after the initial commencement of construction. It is at this stage of the project that the greatest volume of waste is anticipated to be generated. Reuse of materials will be prioritised, and failing this being an option, will be recycled and only as a last resort discarded in licensed landfills. Recyclable materials (glass, metals and certain grades of plastics) will be recycled via existing recycling operations. Non-solid waste will be disposed of at an appropriately registered landfill site. Concrete slabs forming the foundation for the PV modules are planned to be crushed, for use as fill on construction site/road-building projects. Alternatively, crushed concrete will be used for rehabilitation of the disused quarry on the site (such as in the form of gabions). Waste rock (if any), will also be used for the rehabilitation of the disused quarry on the site. e-Waste will be disposed of in a suitably registered landfill site. It is expected that the value received for recyclable waste will be used to subsidise the cost of decommissioning.

Preconstruction/construction

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	5	4	4
Result: Medium-high (96)				
Comment / mitigation: » Implement measures to ensure that disposal at appropriately licenced landfill sites is carried out » Use construction waste rock/soil for rehabilitation of the disused quarry on the Farm Zuurwater » Apply the hierarchy of waste management to project activities » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard » Consider the NEM: Waste Act				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	5	3	3
Result: Low (48)				

Operation

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	4	3	2
Result: Low (35)				

Comment / mitigation: » Implement measures to ensure that disposal of waste, including e-waste, is carried out at appropriately licensed landfill sites » Use construction waste rock/soil for rehabilitation of the disused quarry on the farm Zuurwater » Apply the hierarchy of waste management to operational activities » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard » Implement measures to ensure the efficient maintenance of infrastructure to maximise the lifespan of components » Consider the NEM: Waste Act				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
1	1	4	3	2
Result: Low (30)				

Decommissioning

Impact due to waste without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	3	4
Result: Low-medium (70)				
Comment / mitigation: » Apply the hierarchy of waste management to decommissioning activities, thus minimizing waste volumes generated » Clear the development site of all waste generated during decommissioning » Implement measures to ensure disposal to appropriately licensed landfill sites. Dispose e-Waste at a suitably registered landfill site » Use construction waste rock/soil for rehabilitation of disused quarry » Ensure that sanitation facilities are well managed and used appropriately so as not to pose a health and environmental hazard				
Impact due to waste with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	1	2	2	3
Result: Very low (25)				

12.9.8. Comparative Assessment of Power Line Alternatives

There is no difference in social / economic impacts from either power line options; therefore there is no preference from a social perspective on either power line alternatives.

12.9.9. Comparative Assessment of Water Reservoir and associated pipeline Alternatives

In terms of the reservoir location and associated water pipeline alternatives, these are contained within the boundary of the development area and would therefore not pose additional impacts on the social environment. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary would have localised impacts on the affected properties. This section of the route is however common to all alternatives. There is no preference regarding the reservoir location and associated water pipeline route.

12.9.10. Implications for Project Implementation

- The social benefits of the project outweigh the potential negative and localised social impacts / disturbances due to the project.
- Potential negative impacts include the threats to public safety from construction and traffic activity, increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. It is important that potential negative effects are managed as per the mitigations provided and contained in the EMP to prevent them developing into unacceptable cumulative impacts.
- Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements described in the impact assessment are instituted.
- Construction and operational noise, traffic and waste to be well-managed to prevent negative social impacts.
- The DoE requirement for suitable social beneficiation schemes is supported for the development of the project.

12.10. Impact on Traffic

The study area is serviced by a national road (the N14) which is in good condition, and which links the major centres (notably Upington to the east, and Springbok to the west). The N14 further links with traffic travelling to and from Namibia situated to the north of the site. All of the smaller municipalities and communities are further situated either adjacent, or close to the N14. This road is thus of extremely high importance in ensuring economic and social linkages are maintained in this region of the Northern Cape.

The baseline traffic volumes have been found to be very low, and the projected number of project vehicles for all project phases are further regarded by the traffic specialist in the previous report by SRK Consulting as being very low. It was determined that services are at a very good Level of Service “A”, even with the project-generated traffic. SANRAL requested a buffer on either side of the N14. A buffer of 60m on the N14 has been applied by the developer. Construction activities will increase traffic on the N14, if that is well managed the impact of the facility on traffic can be manageable.

12.10.1. Traffic Implications of the Proposed Development

The existing traffic flows plus added traffic / road users related to the Zuurwater solar energy facility are expected to generate low traffic flows on the N14. The N14 will still operate at a Level of Service A road, even with this additional traffic. The new, left- and right-turning traffic from the N14 into the formal accesses to the facility is not considered to be of high volumes and no exclusive right-turn lanes or left-turn deceleration lanes will be required to accommodate the facility generated traffic. The access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic.

12.10.2. Location of Access Roads to the Site

From a geometric and road safety perspective, the location of the existing and proposed access road to the facility on the N14 at km92,227 and at km94,072 is considered to be acceptable although there are numerous potential alternative locations should this existing access not be acceptable to the developer, the landowner or SANRAL for any reason.

12.10.3. Road Safety

Road safety conditions along the N14 in the vicinity of the site are considered to be good with an accident rate that is not noticeably higher than the average for the N14. The speed limit on the N14 in the vicinity of the Zuurwater site is 120 km/h and sight distance conditions to and from both directions at the location of the proposed access is considered to be acceptable for this speed limit. There is no evidence of pedestrian or public transport activity nor wild or domestic animal activity within the road reserve in the vicinity of the site. As the volume of traffic that enters and leaves this existing access point is expected to increase, particularly when there will be both construction and operational activities occurring at the same time, advanced warning of this side road activity will be required.

12.10.4. Driver Distraction Due to the PV Panels

Probably one of the biggest potential impacts of this photovoltaic power generation facility is driver distraction, firstly from the novelty impact of the facility as there are not many such facilities currently in South Africa and secondly from potential glare and / or reflection off the panels which may distract drivers as they are travelling past the facility at 120km/h. Setting the arrays back by 60m from the road reserve will reduce the potential impact of the panels. The majority of the PV panels will be located to the north of the N14 and will be north facing away from the N14 and therefore it will not be possible for the panels to reflect onto the N14. On the basis of the above, it will not be possible for any reflection from the panels to occur onto the N14 from the north or south.

It is recommended that temporary high visibility advanced warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 in both directions approaching the position of the two accesses to the facility during construction and that permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) are erected on the N14 at both accesses once construction is completed and the facility is fully operational. Whilst theoretically there is no potential for reflections from the panels and infrastructure to affect passing motorists on the N14, it is recommended that reflections from the arrays are monitored from the first installation to confirm this. No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed Zuurwater solar energy facility, cumulatively.

12.10.5. Impact Tables Summarising Impacts on Traffic

Pre-construction/construction/decommissioning

Impact on traffic without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
4	3	3	3	4
Result: Low-medium (70)				
Comment / mitigation: » Implement efficient scheduling of goods delivery and water » Implement measures for conduct of employee and contractor drivers » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences » Maintain communication with SANRAL regarding their requirements for measures to be instituted » Implement a 60m buffer on the N14.				

» No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic				
Impact on traffic with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	3	2
Result: Low (35)				

Operation

Impact without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	2	4	4	3
Result: Low-medium (63)				
Mitigation: Implement efficient scheduling of goods delivery and water » Implement measures for conduct of employee and contractor drivers » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences » Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic				
Impact on traffic with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	4	3	2
Result: Low (40)				

Pre-construction / construction /decommissioning

Impact on road safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	3	4	4
Result: Medium-High (80)				

Comment / mitigation : » Implement efficient scheduling of goods and water delivery » Install temporary high visibility advanced warning signs Types W107 and W108 (intersection ahead) on the N14 in both directions at project commencement » Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic » Implement measures for conduct of employee and contractor drivers » Establish and enforce a strict code of conduct for employees and contractors which includes adherence to traffic rules				
Impact on road safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
2	2	3	2	2
Result: Low (28)				

Operation

Impact on road safety without mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**
3	4	4	4	4
Result: Medium-high (88)				
Comment / mitigation: » Enforce a strict code of conduct for employees and contractors which includes adherence to traffic rules » Install permanent high visibility advance warning signs Types W107 and W108 (Intersection Ahead) on the N14 once operation commences Maintain communication with SANRAL regarding their requirements for measures to be instituted » No exclusive right-turn lanes or left-turn deceleration lanes are deemed necessary. Access approach from the site to the N14 only needs to be single lane which will be able to accommodate both the left-turning and right-turning traffic » Implement efficient scheduling of goods and water delivery » Maintain communication with SANRAL regarding their requirements for measures to be instituted				
Impact on road safety with mitigation:				
Severity	**Spatial extent**	**Duration of impact**	**Duration of activity**	**Frequency of impact**

2	2	4	2	2
Result: Low (32)				

12.11. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers 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 undertakings in the area[31]. Based on information available at the time of undertaking the EIA, the impact of solar facilities on the landscape is therefore likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of solar plant applications. The Northern Cape is earmarked as a potential solar energy hub for South Africa. In the case of the proposed Phase 4 of the Zuurwater Solar Energy Facility, there are other phases to the project and other solar energy facilities proposed in the Khai Ma Local Municipality. Other phases/ projects on Portion 3 of the Farm Zuurwater under the same applicant (PVAfrica Development (Pty) Ltd) are shown in Table 12.1 and are shown in Figure 12.5.

Table 12.1: Other phases/ projects on Portion 3 of the Farm Zuurwater under the same applicant (PVAfrica Development (Pty) Ltd)

Project	Applicant / Developer	DEA Ref. No	Location	Status
16. Proposed Photovoltaic Plant on the Farm Zuurwater near Aggenys - Unit 4 (75MW)	PVAfrica Development (Pty) Ltd (previously SATO Holdings)	14/12/16/3/2334/4	Section of Farm Zuurwater No. 62	Authorised in August 2012
17. Proposed Photovoltaic Plant on the Farm Zuurwater near Aggenys - Unit 5 (75MW	PVAfrica Development (Pty) Ltd (previously SATO Holdings)	14/12/16/3/2334/5	Section of Farm Zuurwater No. 62	Authorised in August 2012
18. Phase 1 of the Zuurwater PV Facility (75MW)	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/470	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 6
19. Phase 2 of the Zuurwater PV Facility	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/471	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 8
20. Phase 3 of the Zuurwater PV Facility (60MW)	PVAfrica Development (Pty) Ltd	14/12/16/3/3/2/472	Section of Farm Zuurwater No. 62	Considered in this EIA report – Chapter 12

[31] Definition as provided by DEA in the EIA Regulations.

The other authorised / proposed projects/ developments in the Khai Ma Local Municipality are listed in Table 12.2.

Table 12.2: Projects/ Developments Proposed in the Khai Ma Local Municipality

Project	Applicant / Developer	DEA Ref. No	Location	Status
19. Aggeneys Solar Photovoltaic (PV) power plant (84MW)	Orlight SA (Pty) Ltd	12/12/20/2630	Portion 1 of Aroams 57 RD	Environmental Authorisation (EA) issued
20. 10MW Photovoltaic Plant at Black Mountain Mine	Aurora Power Solutions (Pty) Ltd in partnership with Black Mountain Mining	12/12/20/2151	At Black Mountain Mine	Final Basic Assessment Report Submitted to DEA
21. Boesmanland Solar Farm	Boesmanland Solar Farm (Pty) Ltd.	12/12/20/2602	Next to Black Mountain Mine (Portion 6, a portion of Portion 2 of the Farm 62 Zuurwater)	Final EIA submitted to DEA in 2013 Decision – pending
22. Pofadder Wind and Solar Energy Facility	South Africa Mainstream Renewable Power Development (Pty) Ltd	» 14/12/16/3/3/2/348 (Wind) » 14/12/16/3/3/2/347 (Solar)	Near Pofadder	Scoping Phase complete, EIA in process
23. Eskom Aggeneis – Oranjemond 400kV power line	Eskom	12/12/20/2041	From Aggeneis Substation to – Oranjemond Substation	Environmental Authorisation (EA) issued in May 2012.
24. Proposed Gamsberg Zinc Mine and Associated Infrastructure	Black Mountain Mining	» DENC Reference Number: NC/EIA/NAM/KHAI/AGG/2012-NCP/EIA/0000155/2012 » DEA Reference Number: 12/9/11/L955/8 » DMR Reference Number: NCS 30/5/1/2/2/1/518	To the east of the Farm Zuurwater No. 62 on farms Bloemhoek 61 Portion 1, Gams 60 Portion 1, Aroams 57 RE and Gams 60 Portion 4	EIA in process

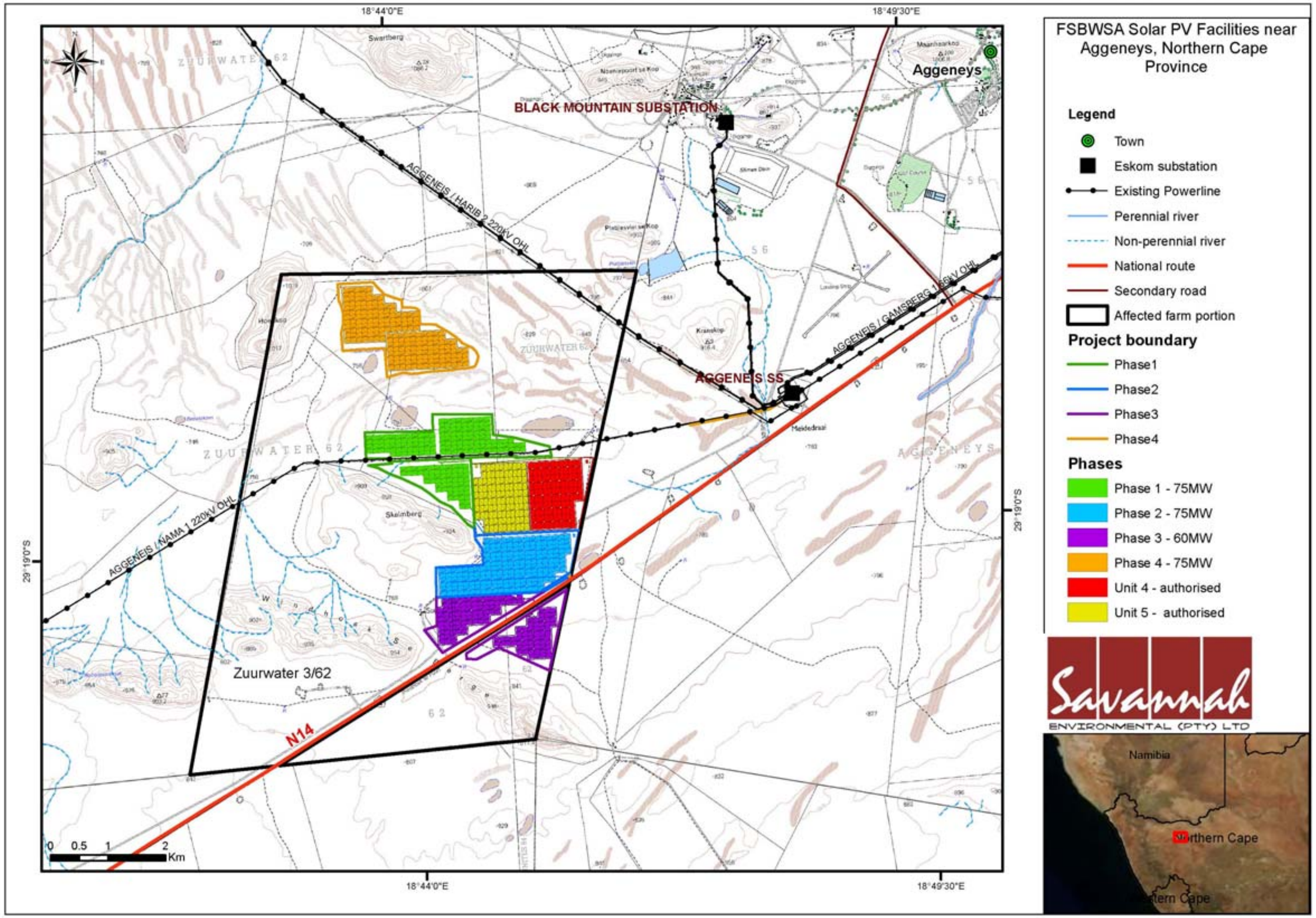

Figure 12. 12: Map showing Phase 1 – Phase 4 and two authorized phases of the proposed solar projects on Portion 3 of the Farm Zuurwater No. 62

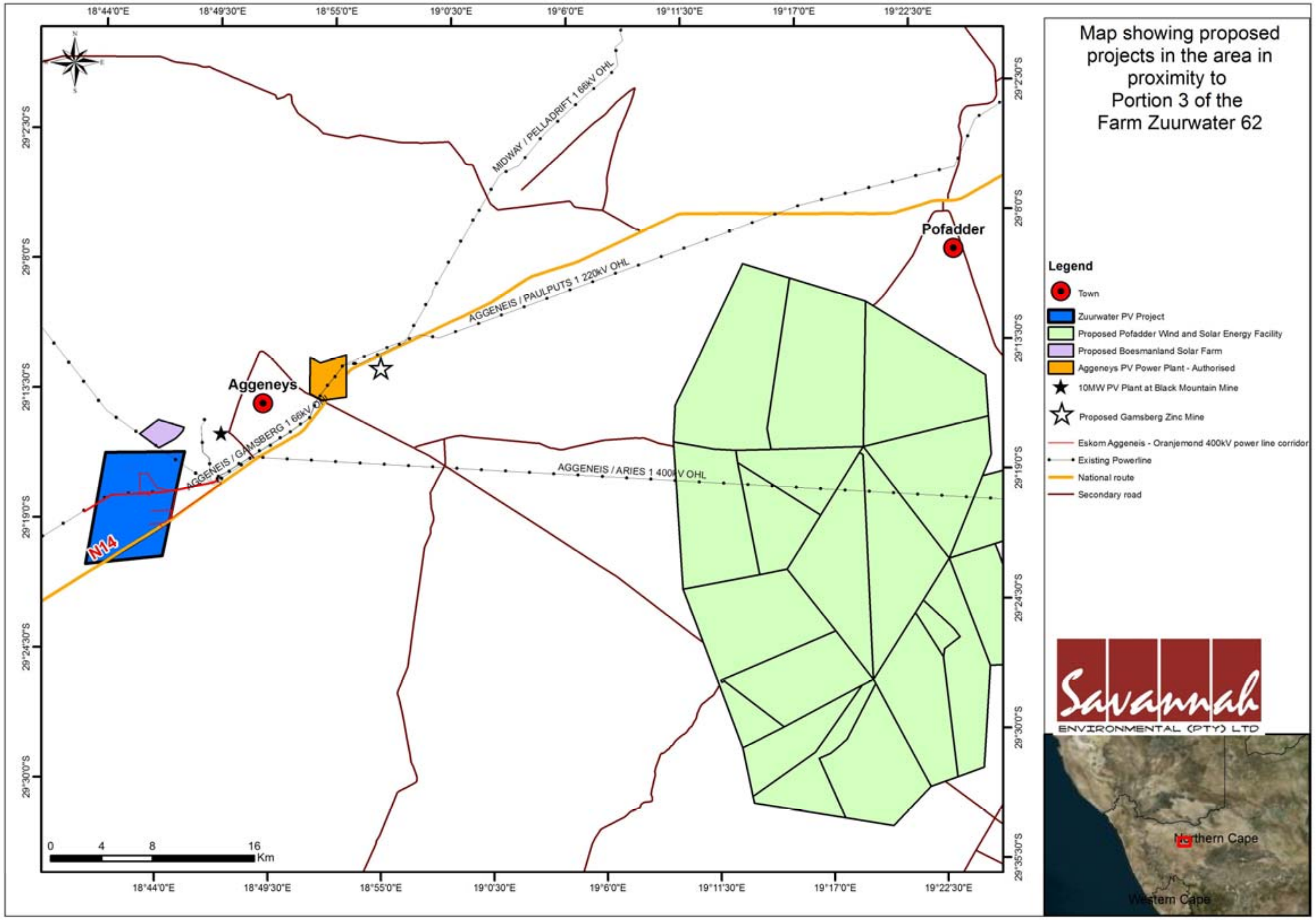

Figure 12.5: Map showing other proposed and authorised project within the vicinity of the Zuurwater Project

None of the above-mentioned solar projects have been awarded preferred bidders status at the time of writing this EIA report. Cumulative impacts discussed below and have been considered within the detailed specialist studies, where applicable (refer to Appendices F - J).

The potential ***cumulative impacts*** as a result of the proposed Phase 4 of the Zuurwater Project and other projects in the area are expected to be associated predominantly with:

» *Visual impact* - The visual impact associated with the proposed Phase 4 of the Zuurwater Project and 5 other Phases of the Zuurwater project will be sequential and additive, due to the visibility of solar panels from 6 or more solar energy facilities on Portion 3 of the Farm Zuurwater No. 62. From a visual perspective, the overlapping viewsheds can be considered favourable, as it represents the consolidation and concentration of potential visual impacts within a clustered region (i.e. the development of a solar energy facility node, rather than dispersing the impact to other areas). A cumulative viewshed in shown in Figure 12.6. The development of numerous similar facilities in the broader area could impact on the visual character and sense of place of the region. The cumulative impact will however to some extent be moderate due to the relatively low incidence of visual receptors in the region.

» *Flora, fauna, and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of avifauna may become cumulative if other renewable energy facilities are developed in the region. Should Phase 4 of the Zuurwater project and 5 other phases of the project and other solar projects in the Namaqualand region be developed, cumulative negative ecological impacts may occur. The significance of this impact is expected to be of a moderate significance and can result in a cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion). However, if negative impacts on ecology are effectively mitigated and managed for each project, through sound environmental management during construction and operation and by formal conservation and active management of the natural areas on site, then the negative impacts on ecosystems on each site can be within acceptable levels, and therefore in keeping with the principles of sustainable development.

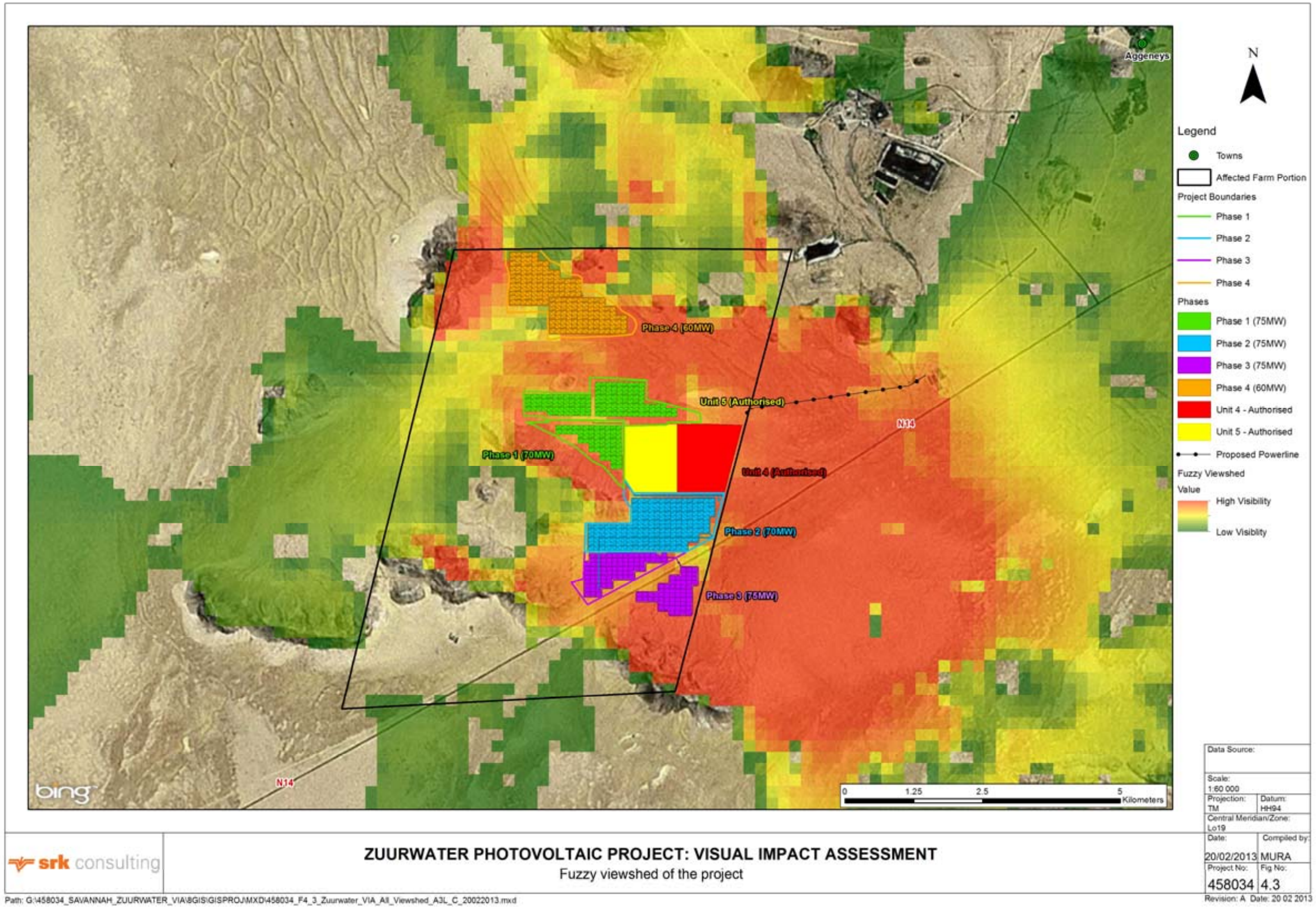

Figure 12. 6: Cumulative Viewshed for the various Phases of the Zuurwater Solar Energy Facility

» *Land-Use and agricultural potential* – The broader farm portion is 4997ha. Development of 6 phases on the broader farm will result in the loss of ~24% of Portion 3 of the farm Zuurwater 62. The remainder of the farm portion can be continued to be utilised for agricultural activities. Due to the limited crop production in the wider study area, the development of multiple solar energy facilities within the Khai Ma Local Municipality will not affect food security in the region. . Due to the vast amounts of land available in the Northern Cape Province, as well as the low agricultural potential and carrying capacity of the land, cumulative impacts on land-use or agricultural potential are of acceptable levels.

» *Cumulative geology, soil and erosion potential* - although the impact of soil removal for the proposed activity has a moderate – low significance, the cumulative impact of soil removal in the area is considered low due to undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate. The cumulative impact of siltation and dust in the area is considered low, with the legal obligation of good soil management for each project.

» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Current mining such as the Black Mountain Mine, presents a noise source, however the potential for cumulative impacts related to noise is low largely due to the low occurrence of sensitive receptors in the area.

» *Infrastructure* - Increased pressure on existing roads and other infrastructure may occur due to various projects being developed. This will require consultation with parties such as Eskom and SANRAL to prevent significant impacts on existing infrastructure in the area/ with the local municipality.

» *Heritage* –Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to 'sense of place' will occur from various projects in the region. The potential for the loss of or discovery of heritage artefacts in the Namaqualand region will also increase.

» *Impact on the Social and Economic Environment* - The establishment of a number of solar energy facilities in the area may impact negatively on the social environment as a result of issues associated with, for example, influx of people to the area and increased traffic volumes. Cumulative positive socio-economic impacts from a number of renewable energy facilities in terms of job creation and economic growth and development of infrastructure will occur at a local and district municipality level that is in need of this growth and development. This would be a significant positive impact. The adoption of management measures

will maximise the cumulative impact for local communities. Each project developed will contribute a percentage of annual profits from the solar project to social beneficiation in the local community, as required by the Department of Energy. Over at least 20 years, there will be a cumulative social benefit from multiple phases and likely from other renewable development in the surrounding areas. It is important that the social development efforts are managed effectively and efficiently in co-operation with key stakeholders over time so that they contribute progressively to enhancing the lives of surrounding communities.

12.12. Assessment of the Do Nothing Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Phase 4 of the Zuurwater Solar Energy Facility. Should this alternative be selected, there would be no 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 won't be any transfer of skills to people in terms of the construction and operation of the solar energy facility. 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.

At a broader scale, the benefits of this solar energy facility would not be realised. 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 power supply 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.

12.13. Summary of Impacts

The following table provides a summary of the impact rating of the potential impacts identified and assessed through the EIA. As can be seen from this table, there are positive and negative impacts of high significance expected to be associated with the construction, operation and decommissioning of the proposed facility. With the used of mitigation measures impacts can be mitigated. All identified impacts can therefore be mitigated to acceptable levels.

Table 12.3: Summary of Impact Ratings For Potential Impacts Associated with Phase 4 of the Zuurwater PV Facility

Impact	Significance Rating					
	Preconstruction /Construction		Operational		Decommissioning	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Ecological Impacts						
Ecological impacts on fauna and flora and ecosystems	Medium (63)	Medium (56)	High (110)	Medium (72)	Medium (63)	Medium (56)
Impact of water reservoir on ecology	Medium – High (81)	Medium (72)	Medium – High (81)	Medium (72)	Medium – High (81)	Medium (72)
Impact of the power line and substation on threatened birds during operations	-	-	High (110)	Medium-High (90)	-	-
Alteration of seasonal recharge patterns of nearby pans and washes	Medium (90)	Low (63)	Medium (90)	Low (63)	Medium (90)	Low (63)
Soils and Agricultural Potential						
Potential soil erosion	Medium-High (96)	Low (42)	Medium (80)	Low (32)	Medium (56)	Low (30)
Contamination of soils	Medium-High (80)	Low (42)	Medium-High (80)	Low (42)	Medium-High (80)	Low (42)
Dust due to loose soils	Medium (72)	Medium (64)	Medium (63	Low (42)	Medium (72)	Medium (64)
Impacts on Land Capability and Agricultural Potential	Medium (80)	Low (49)	Medium (80)	Low (49)	Medium (64)	Low (25)
Impacts on Heritage & Palaeontology						
Destruction of heritage resources/ sites	Low (48)	Low (36)	Low (48)	Low (36)	Low (48)	Low (36)
Destruction of fossils	Low (48)	Low (36)	Low (48)	Low (36)	Low (48)	Low (36)
Visual impacts						
Visual impact of the PV	Medium (60)	Low (40)	Medium-High (88)	Medium (70)	Medium (60)	Low (40)

Impact	**Significance Rating**					
	Preconstruction /Construction		**Operational**		**Decommissioning**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Panels						
Visual Impact of the Power line	Medium (60)	Low (40)	Medium-High (88)	Medium (70)	Medium (60)	Low (40)
Economic Impacts						
Disruption of grazing	Medium-High (90)	Low-medium (64)	Medium-high (80)	Medium (63)	Medium-high (80)	Low (42)
Impact on local economic development	Low (+42)	Medium (+72)	Low (+42)	Medium (54)	Medium-high (63)	Low-medium (-60)
Creation of employment	Medium (+70)	Medium-high (+88)	Medium-high (+96)	High (+117)	Very high (140)	Low-medium (70)
Impact of the project on stability of energy supply	-	-	Medium-high (+88)	High (+120)	Very high (-140)	High (-104)
Social						
Impact on community development projects	Low-medium (+54)	Medium-high (+96)	Low-medium (+54)	Medium-high (+96)	Medium-high (96)	Low-medium (54)
Impact on public safety	Low (48)	Very low (24)	High (80)	Low (32)	Low (48)	Very low (24)
Noise	Medium (80)	Medium (54)	Low (56)	Low (49)	Medium-high (80)	Medium (54)
Increased traffic and road safety hazards	Medium-High (80)	Low (28)	Medium-high (88)	Low (32)	Medium-High (80)	Low (28)
Impact due to influx of workers	Medium-high (88)	Low (28)	Medium (60)	Low (32)	Medium-high (88)	Low (28)
Social divisions over limited jobs and perceived preferential access	Medium (99)	Low (40)	Medium (56)	Low (32)	Medium (99)	Low (40)
Health and safety impact	Medium (64)	Low (42)	Low (35)	Low (30)	Medium (64)	Low (42)
Waste (construction,	Medium-high (96)	Low (48)	Medium-high (80)	Low (48)	Low-medium	Very low (25)

Impact	**Significance Rating**					
	Preconstruction /Construction		**Operational**		**Decommissioning**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
solid, domestic and e-Waste)					(70)	
Impact on Traffic	Low-medium (70)	Low (35)	Low-medium (63)	Low (40)	Low-medium (70)	Low (35)

CONCLUSIONS AND RECOMMENDATIONS: PHASE 4 OF THE ZUURWATER SOLAR ENERGY FACILITY

(DEA REF. NO.: 14/12/16/3/3/2/473) CHAPTER 13

PVAfrica Development (Pty) Ltd is proposing to establish four commercial photovoltaic solar energy facilities on Portion 3 of the Farm Zuurwater No. 62 near Aggeneys, Northern Cape Province. The broader site is located within the Khai Ma Local Municipality (approximately 9 km south-west of Aggeneys. in the Northern Cape Province). ***This Chapter of the EIA report deals only with the conclusions and recommendations of the EIA for the Phase 4 of the larger "Zuurwater PV Facility".*** The purpose of the proposed facility is 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).

The proposed design for this phase is 75MW, covering an area of 222ha. This assessment was done for a 75 MW facility and for the facility's components including:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures to support the PV panels.
» Cabling between the project components.
» Power inverters between the PV arrays. The inverter and transformer are housed at the power conversion station (PCS).
» Photovoltaic Combining Switchgear (PVCS).
» Internal power collection system between the PVCS and the on-site substation.
» A new on-site substation and power line to transmit the power from Phase 3 into the Eskom grid via the Aggeneis MTS Substation. Two alternative power line routes were identified for investigation.
» A new temporary on-site water reservoir and associated water supply pipeline (shared infrastructure between all phases). Three alternative locations and associated pipeline routes were identified for investigation.
» Internal access roads.
» Office, workshop area for maintenance and storage.
» Temporary infrastructure including housing for workers, construction trailers, construction water storage ponds and a laydown area during the construction phase.

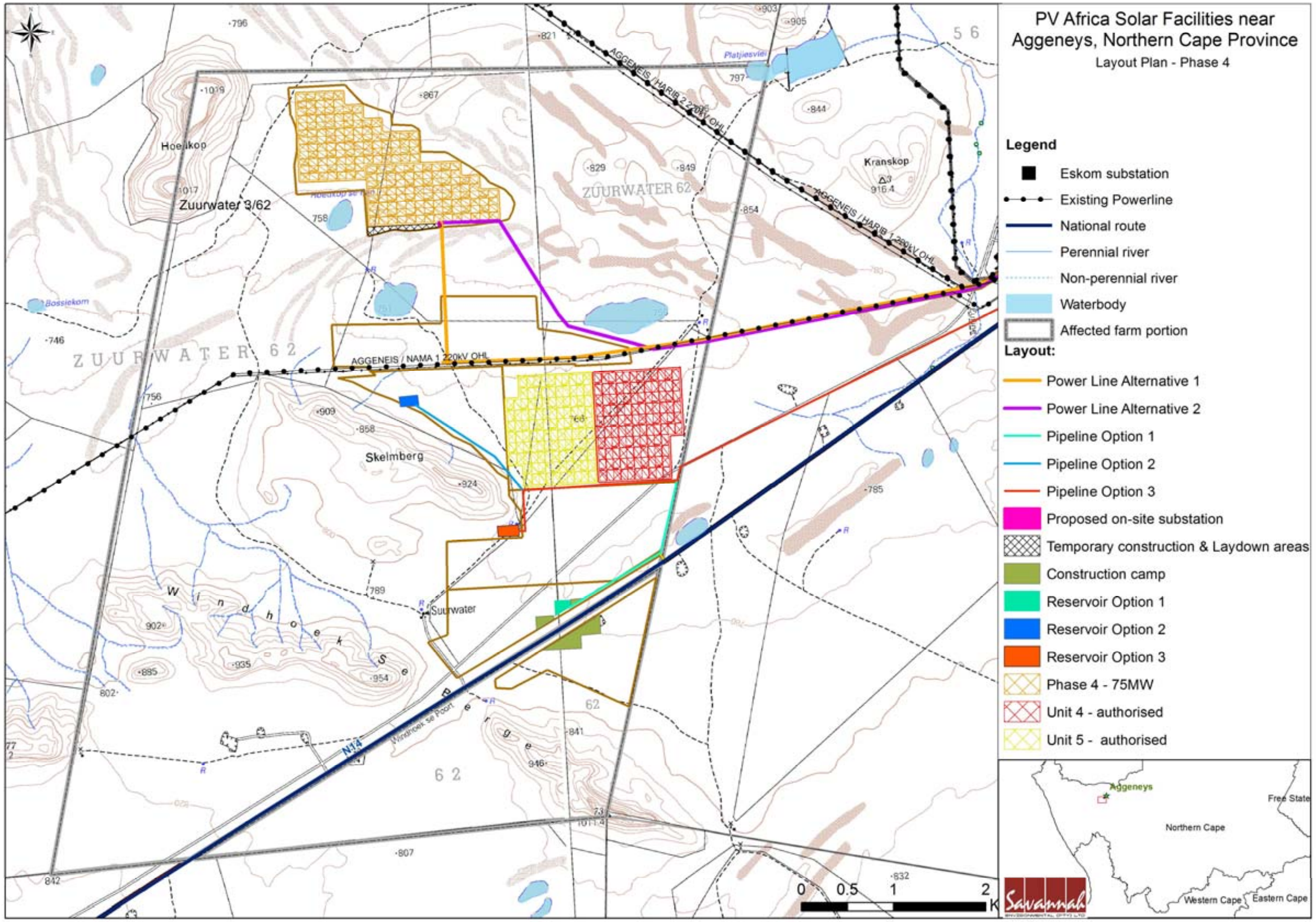

Figure 13.1: Locality map illustrating the location of the development site for Phase 4 (and other phases) of the Zuurwater PV Facility and layout of the proposed facility

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 planning 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), PVAfrica Development (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 Phase 4 of the Zuurwater Solar Energy Facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping[32] 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 undertaken to date 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, 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/ entire extent of Portion 3 of the Farm Zuurwater 62), as well as the extent of studies required within the EIA Phase were identified under an EIA report by SRK Consulting (2012), which was accepted by DEA. DEA also accepted the approach / plan of study as proposed by Savannah Environmental to utilise the existing information from the SRK Consulting's Scoping Report and only conduct an EIA phase study for the project.
» *EIA Phase* – potentially significant biophysical and social impacts[33] 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 K).

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 for the proposed Phase 4 project are provided in this Chapter.

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[32] The Scoping Phase was undertaken by SRK Consulting (SRK, December 2011) and DEA accepted the approach as proposed by Savannah Environmental to undertake an EIA phase assessment.
[33] Direct, indirect, cumulative that may be either positive or negative.

13.5 Evaluation of Phase 4 of the Zuurwater Solar Energy Facility and Associated Infrastructure

The preceding chapters of this report together with the specialist studies contained within Appendices E -J and Appendix P provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Phase 4 of the Zuurwater Solar Energy Facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the 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 assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws associated with the site proposed for Phase 4 of the Zuurwater Solar Energy Facility. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Phase 4 of the Zuurwater Solar Energy Facility, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Social and economic impacts.
» Cumulative impacts.

13.1.1. Impacts on Ecology

The entire Farm Portion will not be utilised for Phase 4 of the Zuurwater solar energy facility. The developmental footprint (panels and associated infrastructure) will cover an extent of ~222ha of the 4997ha farm portion. This amount to ~4.5% of the entire farm portion that will be utilised in the long-term and that would suffer long-term loss / disturbance (over 20 years), although a much larger area would be affected by all phases of the Zuurwater Solar Energy Facility. Permanently affected areas include the area for the PV panels and associated infrastructure, as well as the power line and water pipeline route. Areas of ecological sensitivity within the proposed development site for Phase 4 were identified through the EIA process. The ecological sensitivity map of Phase 4 of the PV Facility is shown in Figure 13.2. The ecological sensitivity assessment identified those parts of the study area that have high conservation value or that may be sensitive to disturbance. The habitats considered most sensitive on the farm are the Rocky north-facing slopes, south facing slopes, inselbergs, pans and Bushmanland sandy grassland. Outliers of Important Biodiversity areas that fall within the proposed development footprint were investigated to ensure that no red data species occur within these areas and to ensure that these parts of the development do not cause unnecessary damage to biodiversity of conservation concern. Phase 4 falls within grasslands on sandy hummocks and has been rated as having medium ecological sensitivity.

Note that Phase 4 does not occur within any pans/ season washes/ water courses, however any impacts on soils and vegetation will indirectly impact on these pans. Outliers of Important Biodiversity areas that fall within the proposed development footprint were investigated to confirm that no red data species occur within these areas in order to ensure that these parts of the development do not cause unnecessary damage to biodiversity of conservation concern. The majority of the site for the development of Phase 4 of the PV Facility has been classified as having a medium ecological sensitivity: Areas that provide limited ecosystem services and are also of low economic value to the landowner. Species diversity may be low. Species of conservation concern may be present on such areas, but these are not restricted to these habitats and can be relocated with ease. From an ecological perspective, it should thus be feasible to develop the area as proposed whilst retaining the conservation value and ecological function of the area. Therefore the proposed development can proceed without significantly changing ecosystem processes or causing a significant loss to sensitive biodiversity, provided the recommended mitigation measures as contained in the draft EMPr and ecological impact assessment are implemented. The impacts on **ecology** have been rated as **medium significance**, with the implementation of mitigation measures.

The power line may **impact on birds** due to collision or electrocution. Nine bird species of international and/or national conservation concern (Red Data species, IUCN/Birdlife International 2011, Barnes 2000), ranging from Near Threatened to Vulnerable, were considered as possible to occur on site. This impact is rated to be of **medium-high significance** and can be mitigated with the implementation of mitigation measures such as the installation of bird diverters on the power line. It is also recommended that a walk through survey of the power line be undertaken by an avifauna specialist prior to construction of the power line in order to confirm any additional mitigation which may be required to be implemented. The Phase 4 Power Line **Alternative 2** is the ecologically preferred power line option as the power line will run adjacent to the PV arrays and the existing Eskom power line, thus keeping the entire footprint more compact, which will limit further habitat and vegetation fragmentation.

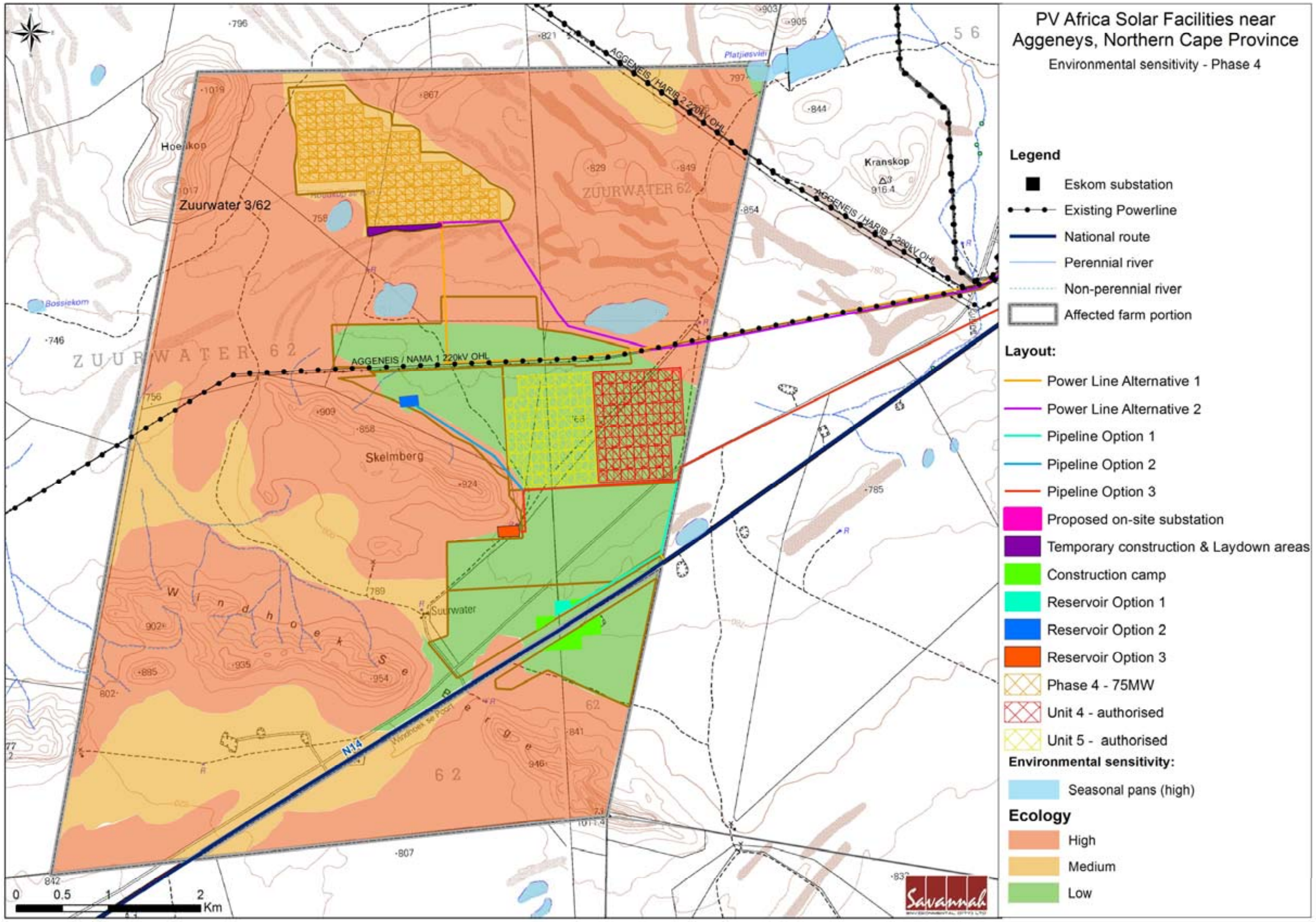

Figure 13.2: Environmental Sensitivity map for Phase 4 of the Zuurwater Solar Energy Facility

The reservoir and associated water pipeline infrastructure is proposed in close proximity to the PV panel areas and the impacts on ecological resources are expected to be similar to those identified for this area. It is recommended that the proposed development avoids the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity. Therefore, **Alternative 1** is recommended as the preferred alternative in this regard.

13.1.2. Impact on Soils, Land Capability and Agricultural Potential

The impacts on **soils** have been rated as **medium significance**, with the implementation of mitigation measures. The regic sands and dunes which occur on the broader farm (Portion 3 of the Farm Zuurwater 62) are highly prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. It is, therefore, important that there should be strict adherence to the Environmental Management Programme and good soil management measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project. With the implementation of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

The study area has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The current land use is livestock farming on the farm, predominantly restricted to sheep, cattle and goats, with a few game species such as springbok and ostrich also occurring.

The impacts on **soils and agricultural potential** have been rated as being of **medium significance**, with the implementation of mitigation measures. No preference is given to the alternative power line routes or reservoir and associated pipeline routes as soils in the area are relatively uniform.

13.1.3. Visual Impacts

The proposed development site is located approximately 9km south-west of the town of Aggeneys in the Northern Cape Province. The site is located in a sparsely populated and remote area. The Black Mountain Mine is located approximately 9km to the north-east of the site. The following potentially sensitive areas exist in the study area:

» The farmers located adjacent to the site (landowners);
» Aggeneys residents; and
» Road users travelling west and east along the N14.

The visual impact of the PV panels and associated infrastructure (including power line) for Phase 4 has been rated as **medium significance**. During the operational phase, the PV panels would be visible within 2 – 3 km from the site. The nature of the natural vegetation (i.e. low growing) and the flat topography in the area allows for unobstructed views from various viewpoints in the landscape. It must however be noted that existing infrastructure such as the Eskom power lines and the Aggeneis Substation do aid in reducing the impact of the PV panels and associated infrastructure in places. Due to the presence of existing power line infrastructure, and the proposal that both the power line alternatives from the Phase 4 area follow an existing power line for the majority of its length to the substation, the change to the overall visual landscape associated with both alternatives under consideration is expected to be minimal. **Alternative 2** alignment follows the Phase 1 power line alignment, thus decreasing the extent of the visual impact associated the power lines from the larger facility. Therefore **Alternative 2** is the preferred alternative from a visual perspective.

During the decommissioning or post closure phase of the project, all of the infrastructure will be removed, recycled or re-used off-site. The residual visual impacts of the site are expected to include scarring of the landscape in the areas affected by infrastructure. With the implementation of appropriate management measures such as rehabilitation of disturbed areas and planting of vegetation and visual screening methods at receptors / key viewpoints, this scarring and visual impact could be reduced and removed in the long-term.

13.1.4. Impacts on Heritage Resources

There were no “Heritage Sensitive Areas” identified on the Phase 4 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Phase 4 and will not be impacted by the development footprint of the PV facility. There are no heritage “no go areas” within the site development footprint for Phase 4.

With regard to magnitude and extent of the potential impacts of power lines, it has been noted that their erection generally has a relatively small impact on Stone Age sites. Sampson’s (1985) observations show this from surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon). A more permanent road would tend to be far more destructive (modification of the landscape surface within a continuous strip), albeit relatively limited in spatial extent, i.e. width. On archaeological grounds there is no reason to prefer one alternative route for the power line for Phase 3 over the other.

As the reservoir location and associated water pipeline alternatives are contained within the boundary of the development area and in close proximity to the proposed PV panel areas, this infrastructure is not expected to pose additional impacts to those associated with the proposed PV panel area. However, the upgrade of the existing pipeline between Aggeneis Substation and the property boundary (common to all alternatives) would have localised impacts on the affected properties. This section of the route has however been previously disturbed through construction activities associated with the existing pipeline and it is therefore considered unlikely that heritage resources of significance would be found in this area. There is therefore no preferred alternative in terms of this infrastructure from a heritage perspective.

The impact of the project on **heritage resource** is rated as **low significance**. However, a preconstruction walk-through survey by an archaeologist is to be undertaken for the PV facility and associated infrastructure. Should substantial archaeological or paleontological (fossils) remains be exposed during construction, SAHRA should be alerted as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional archaeologist or palaeontologist. No further specialist palaeontological studies or mitigation were recommended for this development.

13.1.5. Social and Economic Impacts

The proposed project could have negative and positive **social and economic impacts** of **medium significance**. Phase 4 of the Zuurwater Solar Energy Facility will provide opportunities for employment and skills development in the local area. Another potential spin-off from the development is the stimulation of the local economy, including development of industries specifically to provide services and goods for solar power production, and general retail businesses. Potential negative impacts include the threats to public safety from construction and traffic activity, increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. Other impacts on the social environment include impacts associated with noise during construction, as well as impacts on traffic and infrastructure (such as local roads). It is important that potential negative effects are managed as per the recommended mitigation measures to prevent these from developing into unacceptable cumulative impacts. Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements measures (as contained in the socio-economic specialist study and draft EMPr) are utilised.

13.1.6. Cumulative Impacts

The proposed Phase 4 of the Zuurwater Solar Energy Facility forms part of a larger solar energy facility comprising 6 phases with a total capacity of up to 365MW. In addition, there are other solar energy facilities proposed in the Khai Ma Local Municipality. None of these solar projects have been awarded preferred bidders status at the time of writing this EIA report.

The potential ***cumulative impacts*** as a result of the proposed Phase 4 of the Zuurwater Project and other projects in the area are expected to be associated predominantly with:

» *Visual impact* - The development of numerous similar facilities in the broader area could impact on the visual character and sense of place of the region. The cumulative impact will however to some extent be moderate due to the relatively low incidence of visual receptors in the region.

» *Flora, fauna, and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of avifauna may become cumulative if other renewable energy facilities are developed in the region. Should Phase 4 of the Zuurwater project and 5 other phases of the project and other solar projects in the Namaqualand region be developed, cumulative negative ecological impacts may occur. The significance of this impact is expected to be of a moderate significance and can result in a cumulative loss of biodiversity (particularly for protected plants and animal species and soil erosion). However, if negative impacts on ecology are effectively mitigated and managed for each project, through sound environmental management during construction and operation and by formal conservation and active management of the natural areas on site, then the negative impacts on ecosystems on each site can be within acceptable levels, and therefore in keeping with the principles of sustainable development.

» *Land-Use and agricultural potential* – The broader farm portion is 4997ha. Development of 6 phases on the broader farm will result in the loss of ~24% of Portion 3 of the farm Zuurwater 62. The remainder of the farm portion can be continued to be utilised for agricultural activities. Due to the limited crop production in the wider study area, the development of multiple solar energy facilities within the Khai Ma Local Municipality will not affect food security in the region. Due to the vast amounts of land available in the Northern Cape Province, as well as the low agricultural potential and carrying capacity of the land, cumulative impacts on land-use or agricultural potential are of acceptable levels.

» *Cumulative geology, soil and erosion potential* - although the impact of soil removal for the proposed activity has a moderate – low significance, the cumulative impact of soil removal in the area is considered low due to the undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate. The cumulative impact of siltation and dust in the area is considered low, with the legal obligation of good soil management for each project.

» *Noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. Current mining such as the Black Mountain Mine, presents a noise source, however the potential for cumulative impacts related to noise is low largely due to the low occurrence of sensitive receptors in the area.

» *Infrastructure* - Increased pressure on existing roads and other infrastructure may occur due to various projects being developed. This will require consultation with parties such as Eskom and SANRAL to prevent significant impacts on existing infrastructure in the area/ with the local municipality.

» *Heritage* –Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to 'sense of place' will occur from various projects in the region. The potential for the loss of or discovery of heritage artefacts in the Namaqualand region will also increase.

» *Impact on the Social and Economic Environment* - The establishment of a number of solar energy facilities in the area may impact negatively on the social environment as a result of issues associated with, for example, influx of people to the area and increased traffic volumes. Cumulative positive socio-economic impacts from a number of renewable energy facilities in terms of job creation and economic growth and development of infrastructure will occur at a local and district municipality level that is in need of this growth and development. This would be a significant positive impact. The adoption of management measures will maximise the cumulative impact for local communities. Each project developed will contribute a percentage of annual profits from the solar project to social beneficiation in the local community, as required by the Department of Energy. Over at least 20 years, there will be a cumulative social benefit from multiple phases and likely from other renewable development in the surrounding areas. It is important that the social development efforts are managed effectively and efficiently in co-operation with key stakeholders over time so that they contribute progressively to enhancing the lives of surrounding communities.

13.2. Comparison of Alternatives

13.2.1. Power Line Alternatives

In terms of the specialist studies undertaken, the following conclusions were made regarding the preferred power line alternative for Phase 4:

	Alternative 1	**Alternative 2**
Ecology	Not preferred	Preferred
Soils and agricultural potential	No preference	No preference
Visual	Not preferred	Preferred
Heritage	No preference	No preference
Social	No preference	No preference

Based on the above, it is clear that **Alternative 2** is the overall preferred alternative for the power line associated with Phase 4.

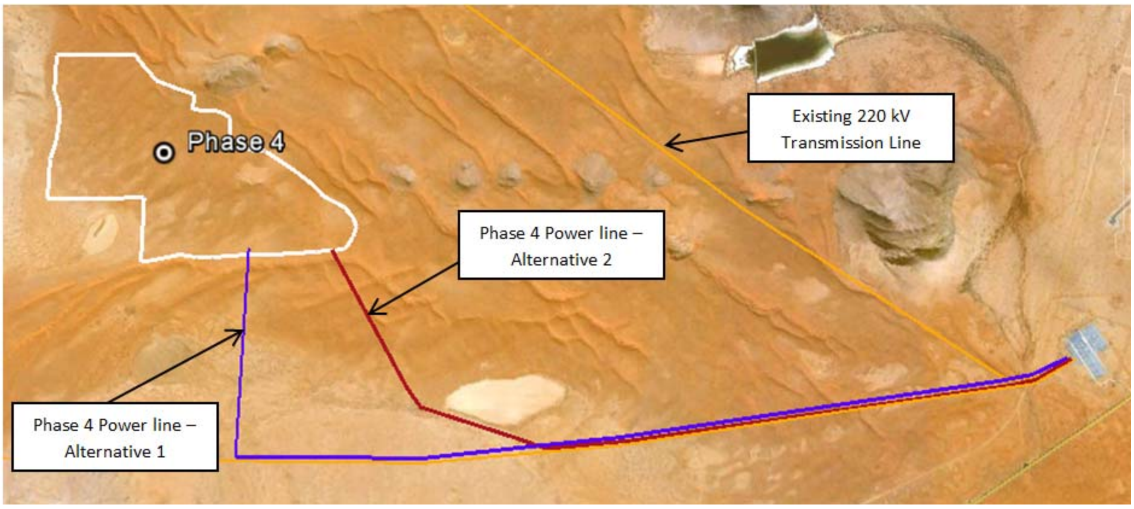

Figure 13.3: Grid Connection Routing Alternatives – Phase 4

13.2.2. Water Reservoir and Associated Pipeline Alternatives

In terms of the specialist studies undertaken, only the ecological assessment recommended a preferred reservoir and water pipeline alternative for implementation. In this regard, **Reservoir Alternative 1 and its associated pipeline is the ecologically preferred option** due to the location of Alternatives 2 and 3 on the lower slopes or aprons of Windhoek se Berge, Skelmberg or Hoedkop within Suurwater, which is considered to be an area of very high ecological sensitivity.

13.3. Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise from the project proceeding. This could include:

» Loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the PV project (which is limited to the development footprint of 267 hectares). The loss of biodiversity has been minimised by the careful location of the development to avoid key areas supporting biodiversity of particularly high conservation importance.

» Visual impacts associated with the PV panels and power line.
» Change in land-use and loss of agricultural land on the development footprint. The loss of agricultural land has been minimised through the careful placement of the development to avoid key grazing areas located in dune areas on the site.

These costs are expected to occur at a local level.

Benefits of the project include the following:

» Given the very high level of poverty, unemployment and remoteness as well as the limited range of economic opportunity presented in this arid region, the project is poised to bring about important economic benefit at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will transpire during the preconstruction/ construction and operational phases.
» The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix.
» South Africa's per capita greenhouse gas emissions being amongst the highest in the world due to reliance on fossil fuels, the proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW PV project, on a like for like basis.

The benefits of the project are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project.

13.6 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 a solar energy facility with a generating capacity of 75 MW on a site located on Portion 3 of the Farm Zuurwater 62, has been established by PVAfrica Development (Pty) Ltd. The positive implications of establishing Phase 4 of the Zuurwater Solar Energy Facility on the identified site include the following:

» The potential to harness and utilise solar energy resources within the Northern Cape.
» 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 National electricity grid in the Northern Cape 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.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project 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) for Phase 4 which is included within Appendix N.

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**.

13.7 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 Phase 4 of the Zuurwater Solar Energy 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 impacts of Phase 4 of the

Zuurwater Solar Energy Facility project can be 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:

» Phase 4 Power Line Alternative 2 must be implemented as the preferred power line alternative.
» Reservoir and pipeline Alternative 1 must be implemented as the preferred alternative.
» The draft Environmental Management Programme (EMP) as contained within Appendix N of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental management standards as detailed for this project. This EMP should be viewed as a dynamic document that should be updated throughout the life cycle of the facility, as appropriate.
» All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices E to J and Appendix P must be implemented.
» An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMPr for the duration of the construction period.
» The regic sands and dunes which occur on the site are highly prone to wind and water erosion. Further, the area surrounding the development site includes seasonal washes / pans with drainage lines. It is, therefore, important that there should be strict adherence to the EMPr and good soil management measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project. Therefore, a detailed stormwater management plan must be developed and implemented for the facility following final design.
» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» If any protected plant or tree species will be removed/destroyed by the developer, a collection/destruction permit to be obtained from Northern Cape Department of Environment and Nature Conservation and/or DAFF for the protected species found on site. A walk-through survey of the site development footprint (facility and the power line) will be required prior to construction commencing.

» A walk through survey of the power line to be undertaken by an avifauna specialist prior to construction of the power line in order to highlight spans requiring bird diverters.
» A pre-construction walk-through survey by an archaeologist to be undertaken for the PV facility and associated infrastructure.
» Should substantial archaeological or paleontological (fossils) remains be exposed during construction, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.
» Site rehabilitation of temporary laydown and construction areas to be undertaken immediately after construction.
» Should the facility be decommissioned, the development footprint must be rehabilitated.
» Alien invasive vegetation to be managed or removed (as required) during construction, operations, decommissioning and post-closure of the facility.
» The DoE requirement for suitable social beneficiation schemes is supported.
» Following the final design of the facility, a final layout must be submitted to DEA for review and approval prior to commencing with construction.
» Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

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