

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
FINAL ENVIRONMENTAL IMPACT REPORT

PROPOSED BOUNDARY SOLAR ENERGY FACILITY,
FREE STATE PROVINCE

DEA REF NO.: 14/12/16/3/3/2/555

FINAL EIA REPORT
FOR SUBMISSION TO DEPARTMENT OF
ENVIRONMENTAL AFFAIRS
APRIL 2014

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/555
Title	:	Environmental Impact Assessment Process Final Environmental Impact Assessment Report for the Proposed Boundary Solar Energy Facility near Boshof, Free State Province
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EIA INFORMATION LIST – DEA & LEGAL REQUIREMENTS

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As outlined in the Acceptance of the scoping report dated 12 December 2013, Savannah Environmental has compiled a table (refer to Table 1 below) which outline the requirements and where in the final EIR the requirements have been addressed for ease of reference.

TABLE 1: INFORMATION REQUESTED BY DEA

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
a)	<p>i. All comments and recommendations made by all stakeholders and Interested and Affected Parties (I&APs) in the Draft Scoping Report and submitted as part of the FSR must be taken into consideration when preparing an environmental impact assessment report in respect of the proposed development.</p> <p>ii. Please ensure that all mitigation measures and recommendations in the specialist studies are addressed and included in the final EIAr and Environmental Management Programme (EMPr).</p>	<p>i. Refer Chapter 6</p> <p>ii. Refer Chapter 6 and Appendix L (EMPr)</p>
b)	<p>i. Please ensure that comments from all relevant stakeholders are submitted to the Department with the Final EIAr. This includes but not limited to the Free State Department of Economic Development, Tourism and Environmental Affairs, the Department of Agriculture, Forestry & Fisheries (DAFF), the South African Civil Aviation Authority (SACAA), the Department of Transport, the Local Municipality, the District Municipality, the Department of Water Affairs (DWA), the Department of Communications, SENTECH, Eskom Holdings SOC Limited, the South African National Roads Agency Limited (SANRAL), the South African Heritage Agency (SAHRA) and the Square Kilometre Array (SKA).</p> <p>ii. You are also required to address all issues raised by organs of state and Interested And Affected Parties (I&APs) prior to the submission of the EIAr to the Department.</p> <p>iii. Proof of correspondence with the various stakeholders must be included in the FEIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.</p> <p>iv. The EAP must, in order to give effect to Regulation 56(2), give registered interested and affected parties access to, and an opportunity to comment on the report in writing within 21 days before submitting the final environmental impact assessment report to the Department.</p>	<p>i. Refer to Appendix D4 - Comments Received</p> <p>ii. Refer to Chapter 6 (assessment of impacts) and Appendix D5 - Comments & Response Report</p> <p>iii. Refer to Appendix D2 (stakeholder correspondence) and D3 (organs of state correspondence)</p> <p>iv. This has been completed. Refer to Section 4.2.2 and Section 4.2.3 of this report</p>
c)	<p>Please ensure that the Final EIAr includes at least one legible A3 regional map of the area and the site layout map to illustrate the PV positions and associated infrastructure. The maps must be of acceptable quality and as a minimum, have the following attributes:</p> <ul style="list-style-type: none"> » Maps are relatable to one another; » Cardinal points; » Co-ordinates; 	<p>Refer to Appendix N</p>

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	<ul style="list-style-type: none"> » Legible legends; » Indicate alternatives; » Latest land Cover; » Vegetation types of the study area; and, » A3 size locality map. 	
d)	<ul style="list-style-type: none"> i. It is noted that the application forms and the FSR included activity 04; 10; 12; 13; and, 14 of GNR 546 dated 18 June 2010. If this activity is applicable, the impacts associated with this activity must be assessed in the Environmental Impact Assessment phase. ii. In addition, written comment from the provincial Department of Environmental Affairs indicating that this activity applies must be obtained. The respective geographical areas as defined in GNR 546 dated 18 June 2010 must be indicated The Environmental Impact Assessment report must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for. 	<ul style="list-style-type: none"> i. Refer to Appendix B for the acknowledgement and acceptance of the amended application form. Impacts associated with the proposed project are assessed within Chapter 6. ii. Written comment from the provincial Department have been requested (refer to Appendix D3), No comments have been received to date
e)	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.	Refer Section 2.5.4.
f)	The total footprint of the proposed development should be indicated. Exact locations of the PV positions, power lines and associated infrastructure should be mapped at an appropriate scale.	Refer Section 2.2 and Appendix N
g)	Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained? Proof of these agreements must be provided.	Refer Section 2.2 (table 2.1) and Appendix D4 (Local Municipality confirmation of capacity to supply services)
h)	A visual impact assessment must be conducted to determine the significance of the visual impact and mitigation measures must be proposed and included in the EIAr and the EMPr.	Refer to Appendix K
i)	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Refer to Appendix N
j)	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Refer to Appendix N
k)	A shapefile of the preferred development layout footprint must be submitted to this Department.	Refer to CD copy
l)	<p>The Environmental Management Programme (EMPr) to be submitted as part of the EIAr must include the following:</p> <ul style="list-style-type: none"> i. All recommendations and mitigation measures recorded in the EIAr and the specialist studies conducted. ii. The final site layout map. iii. Measures as dictated by the final site layout map and micro-siting, iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process. v. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map. vi. An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien 	<ul style="list-style-type: none"> i. Refer to Appendix L (EMPr) ii. Refer to Appendix L (EMPr) iii. Refer to Appendix L (EMPr) iv. Refer to Appendix L (EMPr) v. Refer to Appendix L (EMPr) vi. Refer to Appendix B of the EMPr vii. Refer to Appendix E of the EMPr viii. Refer to Appendix E of the EMPr ix. Refer to Appendix L (EMPr) – Chapter 7 – Objective C20 x. Refer to Appendix L (EMPr) – Chapter 7 – Objective C10 for a traffic management & transportation plan

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	<p>species and ensure that the continuous monitoring and removal of alien species is undertaken.</p> <p>vii. plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.</p> <p>viii. A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.</p> <p>ix. An open space management plan to be implemented during the construction and operation of the facility</p> <p>x. A traffic management plan for the site access roads to ensure that no hazards would results from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations</p> <p>xi. A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment</p> <p>xii. A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off</p> <p>xiii. An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion</p> <p>xiv. An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the sailor storm water systems</p> <p>xv. Measures to protect hydrological features such as streams, rivers, pans, wetlands, darns and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.</p>	<p>xi. See point above</p> <p>xii. Development and implementation of an appropriate stormwater management plan is required (Appendix L – EMPr)</p> <p>xiii. Refer to Appendix C of the EMPr</p> <p>xiv. Refer to Appendix L (EMPr) – Chapter 7 – Objective C16 & C17</p>
m)	<p>The EIAR must include a cumulative impact assessment of the facility if there are other similar facilities in the region. The specialist studies e.g. biodiversity, visual, noise etc. must also assess the facility in terms of potential cumulative impacts.</p>	<p>Refer to Chapter 7 of this report for the assessment of cumulative impacts.</p>

LEGAL REQUIREMENTS IN TERMS OF THE EIA REGULATIONS

Table 2 below details how the legal requirements of Section 31 of the EIA Regulations (EIA Report content) have been addressed within this report

NEMA REGULATIONS GNR 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT (refer to the following parts in the report)
(a) details of— (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	Section 1.5 and Appendix A
(b) a detailed description of the proposed activity	Chapter 2
(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is— (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken	Chapter 2
(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	Chapter 5
(e) details of the public participation process conducted in terms of sub-regulation (1), including— (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties	<ul style="list-style-type: none"> i. The Plan of study for the EIA Phase was proposed to achieve the following: <ul style="list-style-type: none"> » Provide an overall assessment of the social and biophysical environment affected by the Boundary Solar Energy Facility (Chapter 6 and specialist reports – Appendix E-K) » Assess potentially significant impacts (direct, indirect and cumulative, where required) – Chapter 6 & 7. » Identify and recommend appropriate mitigation measures for potentially significant environmental impacts (Chapter 6 & 7) » Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded (section 4.2 and Appendix D1-D6) ii. Appendix C iii. Appendix D5 iv. Appendix D4
(f) a description of the need and desirability of the proposed activity;	Section 2.1
(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity	Section 2.4

NEMA REGULATIONS GNR 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT (refer to the following parts in the report)
or alternatives may have on the environment and the community that may be affected by the activity	
(h) an indication of the methodology used in determining the significance of potential environmental impacts	Section 4.2.5
(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process	Section 2.4, Chapter 6
(j) a summary of the findings and recommendations of any specialist report or report on a specialised process	Section 8.6
(k) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues	Appendix D4
(l) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapter 6
(m) an assessment of each identified potentially significant impact, including— (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated	Chapter 6 and 7
(n) a description of any assumptions, uncertainties and gaps in knowledge	Section 4.2.3 and specialist reports (Appendix E-K)
(o) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Section 8.5
(p) an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Section 8.5
(q) a draft environmental management programme containing the aspects contemplated in regulation 33	Appendix L
(r) copies of any specialist reports and reports on specialised processes complying with regulation 32	Appendix E-K
(s) any specific information that may be required by the competent authority.	Refer to Table 1 of the EIR.

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Rodicon Trading and Investments (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility with a net generating capacity of up to 75MW, as well as associated infrastructure on a site located in the Free State Province approximately 15km south-east of Kimberley and 40km south-west of Boshof (refer to **Figure 1**). This project is to be referred to as the Boundary Solar Energy Facility. Based on a pre-feasibility analysis and site identification process undertaken by Rodicon Trading and Investments (Pty) Ltd, a favourable area has been identified for consideration and evaluation through an Environmental Impact Assessment (EIA).

The proposed project development site is considered suitable and favourable by the developer for the construction of a solar PV facility 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.
- » **Topographic conditions:** The local site conditions are optimum for a development of this nature. A level surface area (i.e. with a minimal gradient in the region of 1%) is preferred for the installation of PV panels. The site slope and aspect of the proposed development area is predominantly flat.
- » **Extent of the site:** Significant land area is required for the proposed development. The site is larger than the area required for development which allows for the avoidance of any identified environmental and/or technical constraints.
- » **Proximity:** This site is located in close proximity to an existing Eskom substation, which minimises the need for a long power line connection. This is preferred from an environmental and technical perspective.

The nature and extent of the Boundary Solar Energy Facility, as well as the potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Final EIA Report.

The Final EIA Report consists of nine chapters, which include:

- Chapter 1:** Provides background to the proposed facility and the environmental impact assessment.
- Chapter 2:** Provides a description of the proposed project and infrastructure.
- Chapter 3:** Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.

- Chapter 4:** Outlines the process that was followed during the EIA Phase, including the consultation process that was undertaken and input received from interested parties.
- Chapter 5:** Describes the existing biophysical and socio-economic environment.
- Chapter 6:** Presents the assessment of environmental impacts associated with the proposed facility and associated infrastructure.
- Chapter 7:** Presents the cumulative impacts of development of the proposed Boundary Solar Energy Facility
- Chapter 8:** Presents the conclusions of the EIA, as well as an environmental impact statement on the proposed project.
- Chapter 9:** Provides a list of references and information sources used in undertaking the studies for this EIA Report.

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses those identified potential environmental impacts and benefits associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a Final EIA Report prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project, provided stakeholders with an additional opportunity (21 days) to verify that the issues they had raised to date have been captured and adequately considered within the study. This Final EIA Report has incorporated all issues and responses received throughout the EIA process. Any changes made from the Draft EIA Report to this Final EIA Report **have been underlined throughout** this Final EIA Report for ease of reference.

EXECUTIVE SUMMARY

Rodicon Trading and Investments (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility with a net generating capacity of up to 75MW, as well as associated infrastructure on a site located in the Free State approximately 15km south-east of Kimberley and 40km south-west of Boshof (refer to Figure 1). The project is proposed to be developed on the Farm Karreeboom 1716 which covers an area of approximately 1624ha. The proposed facility and associated infrastructure (i.e. the development footprint) would occupy an area of approximately 260ha of the 1624ha.

The solar energy facility proposes to generate up to 75 MW of electricity and will be comprised of the following infrastructure:

- » Solar panels (fixed/tracking technology) with an export capacity of up to 75MW.
- » Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, alternative making use of ground screws to support the PV panels.
- » Cabling between the structures, to be lain underground where practical.
- » Central inverter/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to

alternating current (AC) electricity at grid frequency.

- » An on-site substation (120m x 70m) and overhead power line (1700m) to facilitate the connection between the solar energy facility and the existing Boundary Substation located on the site (Farm Karreeboom 1716)
- » Internal access roads (5m wide roads).
- » Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (\pm 200m x 150m))

The nature and extent of this facility, as well as potential environmental impacts associated with the construction and operation of a facility of this nature are explored in more detail in this Environmental Impact Assessment (EIA) Report

In summary, the following conclusions have been drawn from the specialist studies undertaken (refer to **Figure 2** for the sensitivity map):

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 an export capacity of 75 MW on a site located on the Farm Kareeboom 1716 has been established by Rodicon Trading and Investments (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Free State include the following:

- » The potential to harness and utilise solar energy resources within the Free State Province
- » The project will assist the South African government in reaching

their set targets for renewable energy.

- » The project will assist the South African government in the implementation of its green growth strategy and job creation targets.
- » The project will assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business
- » The National electricity grid in the Free State and Northern Cape Province will 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 are high and can only be reduced by not impacting on the surrounding areas unnecessarily. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix L**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable** provided all measures are taken to **protect and preserve** surrounding environment.

OVERALL RECOMMENDATION

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the developmental impacts of the Boundary 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:

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

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

- » There is little or no difference between the impacts associated with the two technology alternatives assessed for the proposed Boundary Solar Facility, either of the technologies (i.e. fixed/tracking) could be authorised.
- » Heritage remains of the historically recorded OFS Custom House situated just east of the Cape Colony/OFS boundary were found and a recommendation is made that this particular locale be excluded and treated as "No Go Areas from the proposed development.
- » One small pan was mapped and must be excluded from the development footprint. A buffer of 50 m around this is recommended to maintain ecological functioning of the system, and a buffer of 250m is required to reduce impacts to avifauna.
- » The smaller patches of very dense populations of protected geophytic species should be excluded from the development footprint. These are indicated as high ecological sensitivity on the sensitivity map.
- » Following the final design of the facility, a final layout must be submitted to DEA for review and

- approval prior to commencing with construction.
- » If any protected plant or tree species are required to be removed/destroyed as part of the construction of the development, a collection/destruction permit to be obtained from DAFF for the protected trees and FS DETEA for other protected plants.
 - » It is recommended that weeds and invasives in the remaining natural veld on the eastern portion of the study area be eradicated and controlled, but that the area is excluded as much as possible from the development. All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended. A rigorous alien invasive plant monitoring and management plan must therefore be implemented right up to the decommissioning phase.
 - » Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.
 - » All infrastructures, including access roads and other on-site infrastructure be planned so that the clearing of vegetation is minimised.
 - » Site rehabilitation of temporary laydown and construction areas to be undertaken immediately after construction.
 - » Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.
 - » Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.
 - » Compile a comprehensive stormwater management method statement, as part of the final design of the project and implement during construction and operation.
 - » All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
 - » An independent Environmental Control Officer (ECO) must be appointed by the project developer prior to the commencement of any authorised activities.
 - » Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

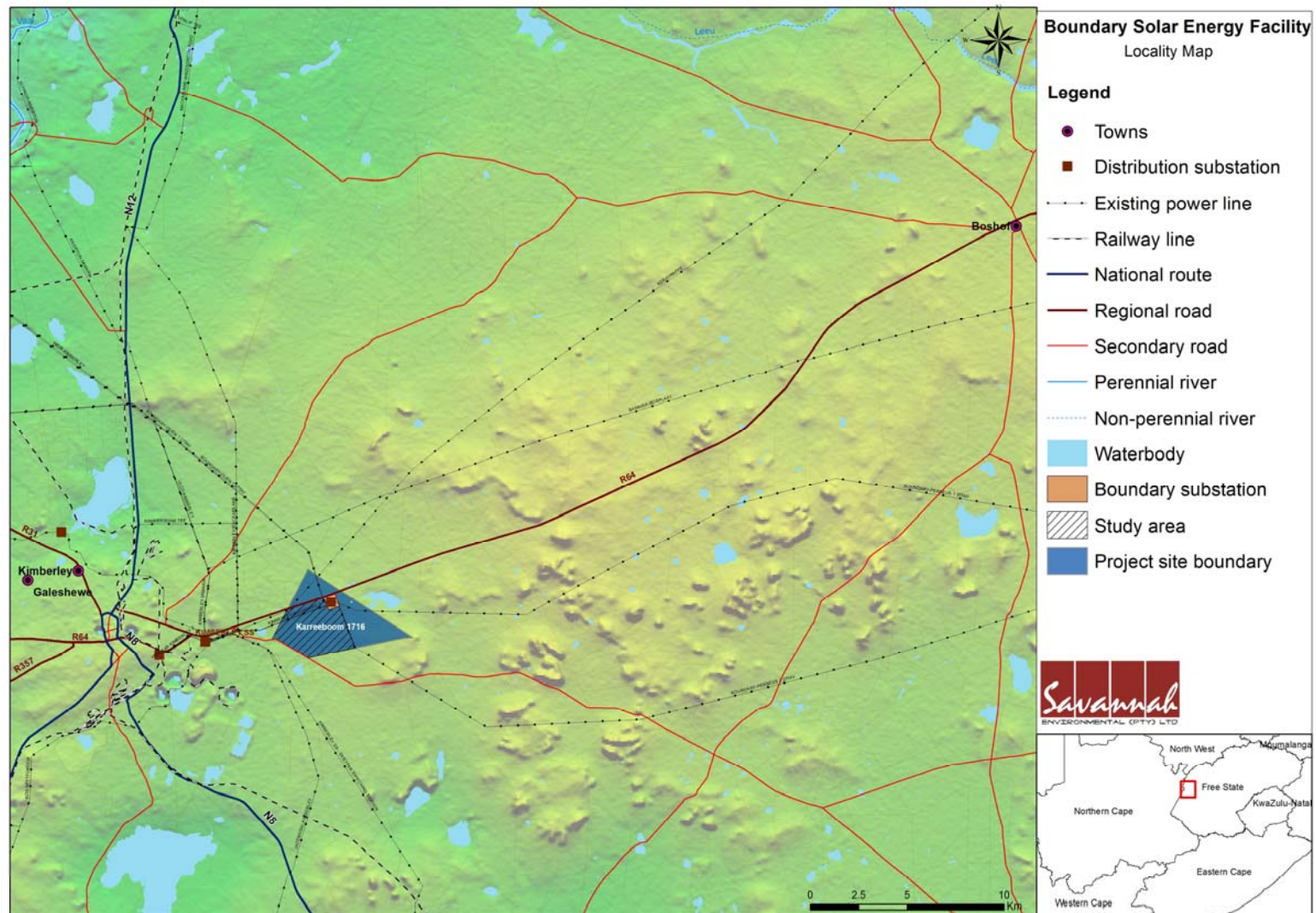


Figure 1: Locality Map of the proposed Boundary Solar Energy Facility

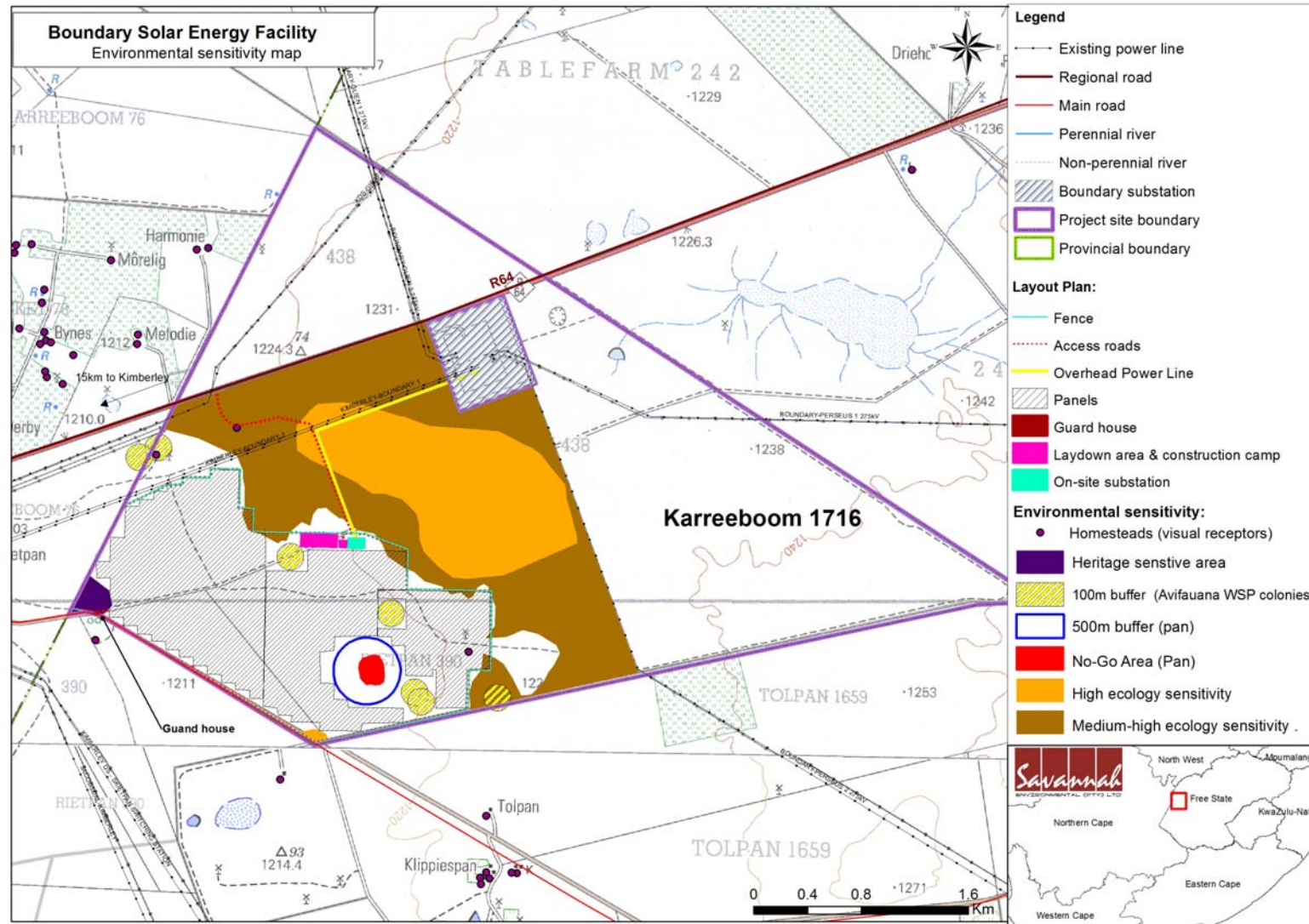


Figure 2: Environmental Sensitivity Map for the proposed Boundary Solar Energy Facility

TABLE OF CONTENTS

	PAGE
EIA INFORMATION LIST – DEA & LEGAL REQUIREMENTS	II
LEGAL REQUIREMENTS IN TERMS OF THE EIA REGULATIONS	V
PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT	VII
EXECUTIVE SUMMARY	IX
APPENDICES	XVIII
DEFINITIONS AND TERMINOLOGY	XIX
ABBREVIATIONS AND ACRONYMS	XXIII
CHAPTER 1 INTRODUCTION	1
1.1. BACKGROUND TO THE PROJECT.....	1
1.2. SUMMARY OF THE PROPOSED DEVELOPMENT	2
1.3. CONCLUSIONS FROM THE SCOPING PHASE	3
1.4. REQUIREMENT FOR AN ENVIRONMENTAL IMPACT ASSESSMENT PROCESS	4
1.5. OBJECTIVES OF THE EIA PROCESS	8
1.6. DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER AND SPECIALIST TEAM	8
CHAPTER 2 DESCRIPTION OF THE PROPOSED PROJECT	10
2.1. NEED AND DESIRABILITY OF THE PROPOSED PROJECT	10
2.2. DESCRIPTION OF THE PROPOSED BOUNDARY SOLAR ENERGY FACILITY	16
2.3. SOLAR ENERGY AS A POWER GENERATION TECHNOLOGY	19
2.3.1 <i>How do Grid Connected Photovoltaic Facilities Function?</i>	20
2.4. PROJECT ALTERNATIVES	22
2.4.1 <i>Site Alternatives</i>	22
2.5.2 <i>Layout Alternatives</i>	24
2.5.3 <i>Technology Alternatives</i>	24
2.5.4. <i>Do Nothing Alternative</i>	26
2.5. PROPOSED ACTIVITIES DURING THE PROJECT DEVELOPMENT STAGES	28
2.5.1. <i>Design and Pre-Construction Phase</i>	28
2.5.2. <i>Construction Phase</i>	28
2.5.3. <i>Operational Phase</i>	31
2.5.4. <i>Decommissioning Phase</i>	31
CHAPTER 3 REGULATORY AND LEGAL CONTEXT	33
3.1 NATIONAL POLICY AND PLANNING CONTEXT.....	33
3.1.1 <i>White Paper on the Energy Policy of South Africa, 1998</i>	33
3.1.2 <i>Renewable Energy Policy in South Africa, 1998</i>	34
3.1.3 <i>National Integrated Resource Plan, 2010 - 2030</i>	35
3.1.4 <i>Electricity Regulation Act, 2006</i>	37
3.2 PROVINCIAL AND LOCAL PLANNING CONTEXT	37

3.2.1.	<i>Free State Province Provincial Growth and Development Strategy</i>	37
3.2.2	<i>Lejweleputswa District Municipality Integrated Development Plan</i>	40
3.2.3	<i>Tokologo Local Municipality IDP (2012-2017)</i>	41
3.3.	ALIGNMENT OF BOUNDARY SOLAR ENERGY FACILITY WITH THE POLICIES AND PLANNING	42
3.4.	REGULATORY HIERARCHY FOR ENERGY GENERATION PROJECTS	42
3.4.1.	<i>Regulatory Hierarchy</i>	43
3.4.2	<i>Legislation and Guidelines that have informed the preparation of this EIA Report</i>	44
CHAPTER 4 APPROACH TO UNDERTAKING THE EIA PHASE		56
4.1.	PHASE 1: SCOPING PHASE	56
4.2.	PHASE 2: ENVIRONMENTAL IMPACT ASSESSMENT PHASE	57
4.2.1.	<i>Tasks completed during the EIA Phase</i>	58
4.2.2	<i>Authority Consultation</i>	58
4.2.3	<i>Public Involvement and Consultation</i>	59
4.2.4	<i>Identification and Recording of Issues and Concerns</i>	63
4.2.5	<i>Assessment of Issues Identified through the Scoping Process</i>	63
4.2.6	<i>Assumptions and Limitations</i>	65
CHAPTER 5 DESCRIPTION OF THE RECEIVING ENVIRONMENT		66
5.1	REGIONAL SETTING: LOCATION OF THE STUDY AREA	66
5.2	TOPOGRAPHY	66
5.3	GEOLOGY	67
5.4	CLIMATE	68
5.5	LAND COVER / LAND-USE	68
5.6	ACCESS	69
5.7	FLORA	69
5.8	PLANT SPECIES OF CONSERVATION CONCERN	70
5.9	FAUNA	71
5.10	SOILS	72
5.11	AGRICULTURAL POTENTIAL	72
5.12	WATER RESOURCES	75
5.13	HERITAGE RESOURCES	75
5.14	PALAEONTOLOGY	77
5.15	VISUAL QUALITY OF THE STUDY AREA	77
5.16	SOCIO-ECONOMIC ENVIRONMENT	78
	<i>Administrative and Social profile</i>	78
5.17	DESCRIPTION OF THE ENVIRONMENT - SUMMARY OF THE ENVIRONMENTAL & SOCIAL CHARACTERISTICS OF THE PROJECT DEVELOPMENT PHASES	79
CHAPTER 6 ASSESSMENT OF POTENTIAL IMPACTS		81
6.1.	ALTERNATIVES ASSESSMENT	84
6.2.	METHODOLOGY FOR THE ASSESSMENT OF POTENTIALLY SIGNIFICANT IMPACTS	84
6.2.1	<i>Potential Impacts on Ecology</i>	85

6.2.2	<i>Potential Impacts on Avifauna</i>	104
6.2.3	<i>Potential Impacts on Soils and Agricultural Potential</i>	109
6.2.4	<i>Assessment of Potential Impacts on Heritage & Palaeontology</i> ...	113
6.2.5	<i>Assessment of Potential Visual Impacts</i>	117
6.2.6	<i>Assessment of Potential Social Impacts</i>	125
6.2.7	<i>Assessment of impacts resulting from the decommissioning phase</i> ..	135
6.3.	ASSESSMENT OF THE DO NOTHING ALTERNATIVE	137
6.4.	ASSESSMENT OF SUMMARY OF IMPACTS	139
CHAPTER 7 ASSESSMENT OF CUMULATIVE IMPACTS		144
7.1	<i>Approach Taken to Assess Cumulative Impacts</i>	144
7.2	<i>Cumulative Impacts on Ecology</i>	148
7.3	<i>Cumulative Impacts on Avifauna</i>	149
7.4	<i>Cumulative impacts on soil and agricultural potential</i>	149
7.6	<i>Cumulative Visual Impacts</i>	149
7.7	<i>Cumulative Impacts on Social and Economic Environment</i>	150
7.7	<i>Conclusion regarding Cumulative Impacts</i>	150
CHAPTER 8 CONCLUSIONS AND RECOMMENDATIONS		152
8.1.	SUMMARY OF BOUNDARY SOLAR ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE	155
8.1.1.	<i>Impacts on Ecology</i>	155
8.1.2.	<i>Impact on avifauna</i>	156
8.1.3.	<i>Impact on Soils, Land Capability and Agricultural Potential</i>	156
8.1.4.	<i>Visual Impacts</i>	157
8.1.5.	<i>Impacts on Heritage and Paleontological Resources</i>	157
8.1.6.	<i>Social and Economic Impacts</i>	157
8.1.7.	<i>Impacts associated with the Power Line</i>	158
8.2	ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS	158
8.3	COMPARISON OF TECHNOLOGY ALTERNATIVES	159
8.4	ENVIRONMENTAL COSTS OF THE PROJECT VERSUS BENEFITS OF THE PROJECT....	160
8.5.	OVERALL CONCLUSION (IMPACT STATEMENT)	161
8.6.	OVERALL RECOMMENDATION	164
CHAPTER 9 REFERENCES		167

APPENDICES

Appendix A:	EIA Project Consulting Team CVs
Appendix B:	Correspondence with National and Provincial Authorities
Appendix C:	I&AP Database
Appendix D:	Public Participation Information
» Appendix D1:	Site notices and Adverts
» Appendix D2	Stakeholder Correspondence
» Appendix D3	Organs of States Correspondence
» Appendix D4:	Comments Received
» Appendix D5	Comments & Response Report
» Appendix D6	Minutes of meetings
Appendix E:	Ecology Report
Appendix F:	Avifaunal Report
Appendix G:	Heritage Report
Appendix H:	Palaeontology Report
Appendix I:	Social Report
Appendix J:	Soil & Agricultural Potential Report
Appendix K:	Visual Report
Appendix L:	Draft Environmental Management Programme
Appendix M:	Site selection motivation
Appendix N:	Maps

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.

Drainage: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may or may not be present

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.

Perennial and non-perennial: Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.

Riparian: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

Photovoltaic effect: Electricity can be generated using photovoltaic solar panels which are comprised of individual photovoltaic cells that absorb solar energy to directly 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.

Watercourse: as per the National Water Act means -
(a) a river or spring;

- (b) a natural channel in which water flows regularly or intermittently;
- (c) a wetland, lake or dam into which, or from which, water flows; and
- (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

Wetlands: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin et al., 1979).

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CO ₂	Carbon dioxide
DEA	National Department of Environmental Affairs
DEADP	Department of Environment Affairs and Development Planning
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management 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
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

Rodicon Trading and Investments (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility with a net generating capacity of up to 75MW, as well as associated infrastructure on a site located in the Free State Province approximately 15km south-east of Kimberley and 40km south-west of Boshof (refer to Figure 1.1). This project is to be known as the Boundary Solar Energy Facility. Based on a pre-feasibility analysis and site identification process undertaken by Rodicon Trading and Investments (Pty) Ltd, a favourable area has been identified for consideration and evaluation through an Environmental Impact Assessment (EIA).

The proposed project development site is considered suitable and favourable by the developer for the construction of a solar PV facility 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.
- » **Topographic conditions:** The local site conditions are optimum for a development of this nature. A level surface area (i.e. with a minimal gradient in the region of 1%) is preferred for the installation of PV panels. The site slope and aspect of the proposed development area is predominantly flat.
- » **Extent of the site:** Significant land area is required for the proposed development. The site is larger than the area required for development which allows for the avoidance of any identified environmental and/or technical constraints.
- » **Proximity:** This site is located in close proximity to an existing Eskom substation, which minimises the need for a long power line connection. This is preferred from an environmental and technical perspective.

The nature and extent of the Boundary Solar Energy Facility, as well as the potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Final EIA Report. The Final EIA Report consists of nine chapters, which include:

Chapter 1: Provides background to the proposed facility and the environmental impact assessment.

Chapter 2: Provides a description of the proposed project and infrastructure.

- Chapter 3:** Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.
- Chapter 4:** Outlines the process that was followed during the EIA Phase, including the consultation process that was undertaken and input received from interested parties.
- Chapter 5:** Describes the existing biophysical and socio-economic environment.
- Chapter 6:** Presents the assessment of environmental impacts associated with the proposed facility and associated infrastructure.
- Chapter 7:** Presents the cumulative impacts of development of the proposed Boundary Solar Energy Facility
- Chapter 8:** Presents the conclusions of the EIA, as well as an environmental impact statement on the proposed project.
- Chapter 9:** Provides a list of references and information sources used in undertaking the studies for this EIA Report.

1.2. Summary of the Proposed Development

The project falls within the jurisdiction of the Tokologo Local Municipality which in turn falls under the jurisdiction of the Lejweleputswa District Municipality of the Free State Province. The site is proposed on Farm Karreeboom 1716. The farm portion covers an area of 1626 ha. The location of the proposed Boundary project site is shown in **Figure 1.1**.

The scope of the EIA applies to the development footprint for the Boundary Solar Energy project and associated infrastructure, including access roads, power line, cabling, substation, offices, etc. The facility is proposed to include several arrays of photovoltaic (PV) solar panels with a generating capacity of up to 75 MW and includes the following associated infrastructure:

- » Solar panels (fixed/tracking technology) with an export capacity of up to 75MW.
- » Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, alternative making use of ground screws to support the PV panels.
- » Cabling between the structures, to be lain underground where practical.
- » Central inverter/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- » An on-site substation (120m x 70m) and overhead power line (1700m) to facilitate the connection between the solar energy facility and the existing Boundary Substation located on the site (Farm Karreeboom 1716).
- » Internal access roads (~5m wide roads).

- » Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (\pm 200m x 150m).

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

The scope of the proposed Boundary Solar Energy 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 the project development site (i.e. Farm Karreeboom 1716) was evaluated within the Scoping phase of the EIA process. The following were identified and evaluated (shown in **Figure 1.2**):

- » **Ecologically sensitive areas on the site** – Areas identified to have higher ecological sensitivity are depressions and wetlands such as larger drainage lines, dams and pans. Areas with deeper sandy soils are expected to have a higher density of protected tree species and were mapped within the farm portion. Furthermore, potentially sensitive areas include those that are expected to be prone to bare patch formation (indicated by distinct banded patterning of vegetation) and more rocky areas with assumed higher species diversity. Depending on their location within the general landscape, these could have a rating of medium-low sensitivity.
- » **Drainage within the site** – Areas which are potentially small pan or artificial dam areas within the farm portion, a larger salt pan which borders on the north-eastern side of the farm, and another located a short distance from the southern border of the site. No distinct drainage line could be identified, and water is assumed to move into the pans from below-ground seepage off surrounding plains, especially where soils may be shallow.
- » **Visual / Social Receptors:** From the preliminary viewshed analyses the proposed facility would have a fairly contained area of potential visibility (i.e. within a 3.5km radius of the site). This area of exposure is generally restricted to vacant natural land, but may contain some potentially sensitive visual receptors such as dwellings and travellers on the R64.

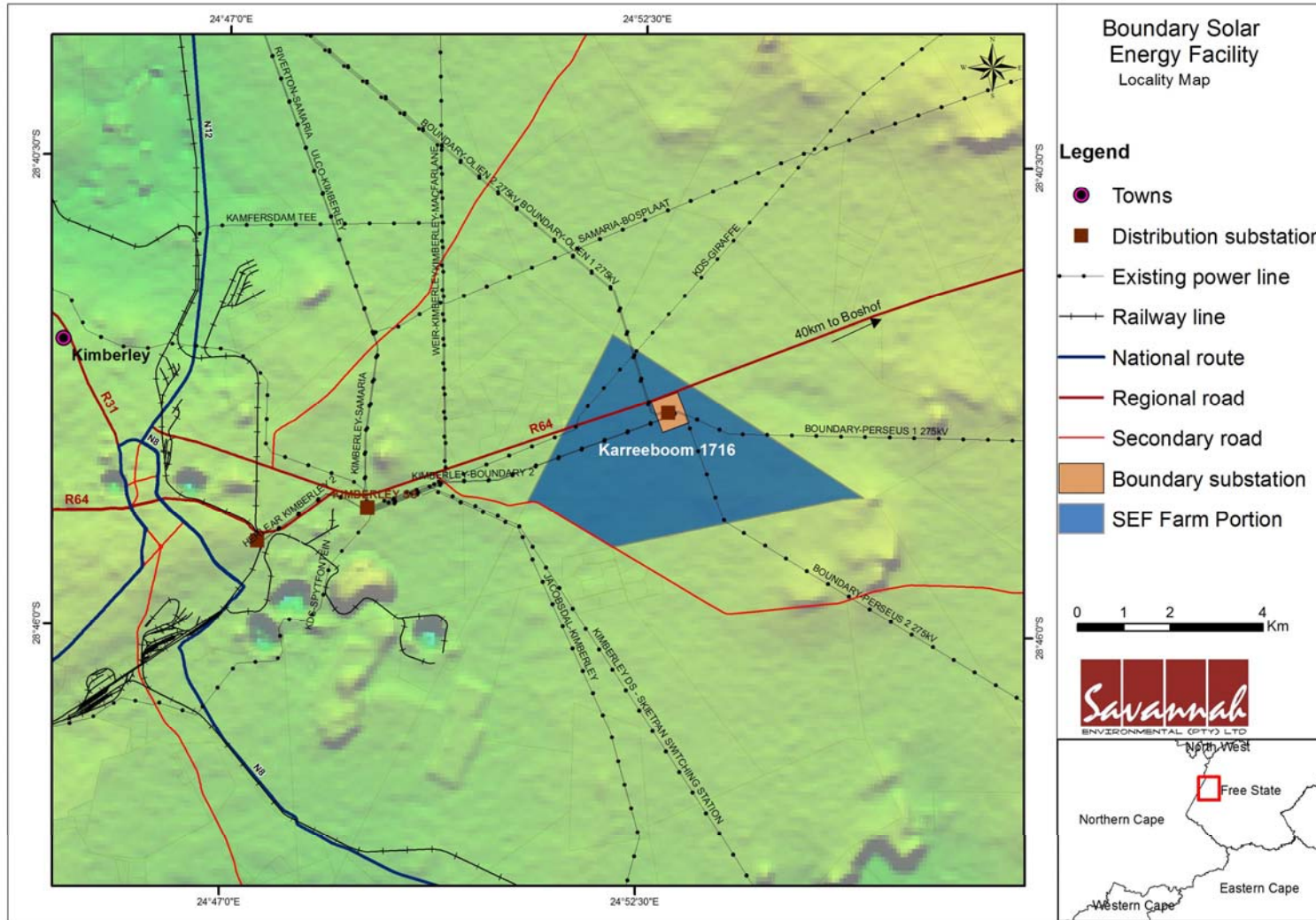


Figure 1.1: Locality map for the proposed site for the Boundary Solar Energy Facility, indicating the proximity to grid connection infrastructure.

- » **Agricultural Potential:** Agricultural potential is fairly uniform across the site and there are therefore no preferred locations for the development within the site.
- » **Heritage:** The terrain on which the proposed Boundary Solar Energy Facility would be located is likely to include traces of Stone Age utilisation of the landscape with palimpsests of material spanning Pleistocene and Holocene times. Some occurrences may turn out to be significant, depending on a site specific survey. Where there are dolerite outcrops or hills, rock engravings may occur. Nineteenth- and twentieth-century cultural history may occur in the form of stone kraals, ruins of dwellings, extant dwellings and infrastructure (those over 60 years old are explicitly protected by the Act), and graves. Intangible heritage values attached to places may be recoverable from current or former inhabitants (farmers, farm-workers).

Three areas of potential environmental sensitivity relate mostly to the ecological aspects of the site and are illustrated in the sensitivity map (refer to **Figure 1.2**). It was recommended that infrastructure should be placed so as to consider the identified sensitive areas to minimise impacts. Subsequently, the sensitive environmental features that were identified during the Scoping phase have been taken into consideration through the layout design of the solar energy facility by the developer. The proposed layout of infrastructure is discussed further in Chapter 2.

From the conclusions of the Scoping Phase of the EIA process, the potentially significant issues identified as being related to the **construction** of the Boundary Solar Energy Facility include:

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

The potentially significant issues related to the **operation** of the Boundary Solar Energy Facility include, *inter alia*:

- » Visual impacts and impacts on “sense of place” on nearby residential areas and observers travelling on main roads;
- » Positive socio-economic impacts; and

- » Generation of clean, renewable energy (positive).

The potentially significant issues related to the decommissioning of the Boundary Solar Energy Facility will include, inter alia:

- » Soil erosion during decommissioning activities; and
- » Socio-economic impacts, both positive and negative (including job creation, nuisance impacts).

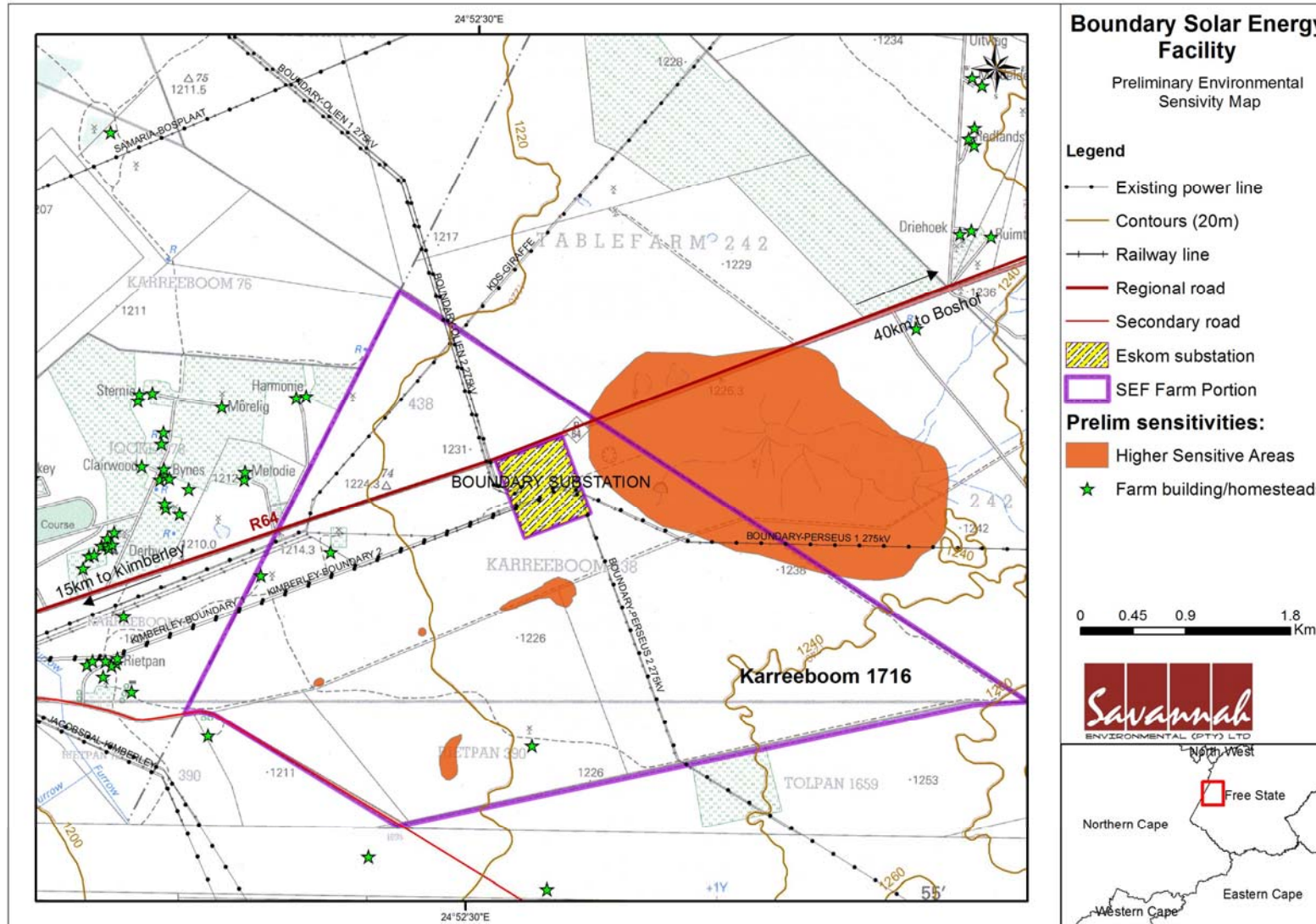


Figure 1.2: Scoping Environmental Sensitivity Map for the proposed Boundary Solar Energy site showing high sensitive ecological areas and potential visual receptors

1.4. Requirement for an Environmental Impact Assessment Process

The proposed solar energy facility is subject to the requirements of the EIA Regulations (as amended) 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 authority¹ and Free State Department of Economic Development, Tourism and Environmental Affairs (DETEA) will act as a commenting authority. An application for authorisation has been accepted by DEA for the proposed project under application reference number **14/12/16/3/3/2/555**.

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 an independent assessment of the impacts and sufficient information in order to make an informed decision on the environmental acceptability of the project.

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 of GN R543 (and as amended), a Scoping Phase and an EIA are required to be undertaken for this proposed project as the proposed project includes the following "listed activities" in terms of GN R544, R545 and R546 (GG No 33306 of 18 June 2010).

¹ In terms of the Energy Response Plan, the DEA is the competent authority for all energy related applications.

Table 1: Activities applied for to be authorised²

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	Applicability of proposed project to listed activity
GN544, 18 June 2010	10	The construction of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts	<i>The facility will require the construction of a distribution substation as well as an overhead distribution power line connecting to the Eskom substation, or power line.</i>	An on-site substation (120m x 70m) and overhead power line (1700m) to facilitate the connection between the solar energy facility and the existing Boundary Substation located on the site
GN 544, 18 June 2010	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, measures from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	<i>The construction of the proposed solar facility may impede on watercourse on the site due to infrastructure such as access road and bridges</i>	There are drainage lines and a pan on the proposed site.
GN544, 18 June 2010	18	The infilling or depositing of any material of more than 5	<i>The proposed activity may require the infilling and deposition of materials within</i>	There are drainage lines and a pan on the proposed site.

² An application was amended to include and remove listed activities based on the findings of the scoping study which was conducted. Some listed activities were deemed unnecessary whereas some were crucial in the assessment of the proposed facility; table 1.1 shows all the relevant applicable activities. The amended application form was submitted to DEA and accepted (March 2014) (refer to Appendix B).

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	Applicability of proposed project to listed activity
		cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from (i). a water course	<i>watercourses.</i>	
GN 544, 18 June 2010	22	The construction of a road, outside urban areas; (ii) where no reserve exists where the road is wider than 8 metres.	<i>The facility will require construction of new access roads</i>	The proposed facility falls outside an urban area and internal roads of ~5-8m will be constructed where no reserve exists where the road is wider than 8 metres.
GN545, 18 June 2010	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	<i>The PV facility will have a generating capacity of up to 75MW.</i>	The proposed PV facility will have an export capacity 75 MW to be exported to the Eskom national grid.
GN545, 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more;	<i>The PV facility and associated infrastructure will have a developmental footprint of more than 20 ha.</i>	The establishment of the proposed 75 MW facility will transform a portion of the farm (exceeding 20ha) from grazing (currently undeveloped) to a PV facility.
GN546, 18 June 2010	14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation	<i>The solar energy facility will be located outside urban areas and may require the clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous</i>	The establishment of the proposed 75 MW facility and access roads will require the clearance of indigenous vegetation within the site over an area of 260 ha.

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	Applicability of proposed project to listed activity
		(a) In Free State: i. All areas outside urban areas	<i>vegetation cover.</i>	

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 was completed in **November 2013** with the submission of a Final Scoping Report to the DEA, and the acceptance of scoping was received from DEA on **12 December 2013**. The scoping phase included desk-top studies and served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. 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) was included in the evaluation of impacts.

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

1.6. Details of the Environmental Assessment Practitioner and Specialist Team

Savannah Environmental was appointed by Rodicon Trading and Investments (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 Rodicon Trading and Investments (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:

- » *Sheila Muniongo* - the principle author of this report holds an Honours Bachelor degree in Environmental Management and 3 years experience in the environmental field. Her key focus is on environmental impact assessments, public participation, environmental management programmes, and mapping through ArcGIS for variety of environmental projects. She is currently involved in several EIAs for renewable energy projects EIAs across the country.
- » *Karen Jodas* - a registered Professional Natural Scientist and holds a Master of Science degree. She has 16 years 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.
- » *Gabriele Wood*: the public participation consultant for this project, hold an Honours Bachelor degree in Anthropology and has 6 years experience in Public Participation and Social consulting, including professional execution of public participation processes for a variety of projects as well as managing and co-ordinating public participation processes for Environmental Impact Assessments (EIA).

In order to adequately identify and assess potential environmental impacts associated with the proposed project, the following specialists were appointed to conduct specialist impact assessments:

- » Ecology – Marianne Strohbach (Savannah Environmental);
- » Soils and Agricultural Potential – Johann Lanz (Johann Lanz Consulting);
- » Heritage - David Morris (McGregor Museum);
- » Palaeontological Assessment– Lloyd Rossouw (Palaeo Field Services);
- » Visual – Karen Hansen (Karen Hansen Landscape Architect);
- » Social – Tony Barbour (Environmental Consulting and Research); and
- » Avifauna - Doug Harebottle (Doug Harebottle Consulting).

Refer to **Appendix A** for the curricula vitae for the EAPs from Savannah Environmental as well as the specialists.

DESCRIPTION OF THE PROPOSED PROJECT

CHAPTER 2

This chapter provides an overview of the proposed Boundary Solar Energy Facility near Boshof, Free State Province. The project scope 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 describes the project alternatives considered, including the “Do-Nothing” alternative - that is the alternative of not establishing the solar energy facility.

2.1. Need and desirability of the proposed project

According to the DEA Draft Guideline on Need and Desirability (October 2012) in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for an area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF.

a) Free State Province Provincial Growth and Development Strategy (2004-2014)

The Free State Provincial Growth and Development Strategy (FSPGDS) is a nine-year strategy (2004-2014) which aims to achieve the objectives of Vision 2014. As a provincial policy framework, it sets the tone and pace for shared growth and development in the Province. It addresses the key social, economic, environmental and spatial imperatives in the Province. Underlying the FSGDS are the following imperatives:

- » The need to effectively use scarce resources within the Province, while addressing the real causes of development challenges.
- » The need to accelerate service delivery based on a common provincial development agenda as the basis for provincial strategic direction.
- » The need to identify investment opportunities and provide an environment of certainty critical for private-sector investment.
- » The need to promote intergovernmental coordination between the three spheres of government.
- » The need to facilitate facilitates the implementation of the People's Contract within the Province.
- » The need to provide a common vision as the basis for common action amongst all stakeholders, both inside and outside government.

- » The need to provide a framework for budgets, implementation, performance management and spatial development.

Of specific relevance to the proposed Boundary Solar Energy Facility, the FSPGDS also identifies a number of natural constraints to economic growth and development. These include, low rainfall coupled with the limited soil potential and the impact of this on agriculture, limited water availability and depletion of mineral resources. What is of interest is that none of the natural constraints impact on the renewable energy sector, specifically the solar energy sector. Solar energy, specifically PV solar energy, therefore provides the Free State with an opportunity to diversify its economy in a way that is not affected by natural constraints such as low rainfall and limited water supplies.

b) Lejweleputswa District Municipality Integrated Development Plan

The LDM IDP is informed by and aligned with the Free State Provincial Growth and Development Strategy (FSGDS) and other governmental programmes and policies. In this regard the FSPGDS identified four key priority areas, two of which are relevant to the proposed solar energy facility project, namely:

- » Economic development, employment and investment; and
- » Social and Human Development.

The IDP identifies a number of priority areas, of which the following are regarded as relevant:

- » Local Economic Development; and
- » Basic Service Delivery and Infrastructure Investment.

The proposed solar energy facility will contribute towards the above-mentioned priority areas through local economic upliftment and job creation.

c) Tokologo Local Municipality (TLM) Integrated Development Plan

The vision for the TLM is "A progressive municipality, which through co-operative governance, creates conditions for economic growth, social development and meet the basic needs of the community and improve the quality of life of all residents". A Community Needs assessment undertaken as part of the IDP revision lists a number of needs that are relevant to the proposed project, including, job-creation, up-grading of community facilities and infrastructure, support for local economic development and SMMEs, and bursaries for learners. The need to protect the natural environment is also identified as a key objective in the IDP. The IDP also notes that the bulk electrical network in the TLM is well established. However, development has been hampered by the quality/ stability of the supply.

The Boundary Solar Energy project will be able to meet with some of these needs as identified by the TLM IDP through job-creation, infrastructural development and support for local economic development and SMMEs.

d) Strategic Integrated Projects (SIPs)

In 2010, a National Development Plan was drafted to address socio economic issues affecting development in South Africa. These issues were identified and placed under 18 different Strategic Integrated Projects (SIPs) to address the spatial imbalances of the past by addressing the needs of the poorer provinces and enabling socio-economic development. Amongst these is the green energy in support of South African Economy i.e. SIP 8. The SIP aims at supporting sustainable green energy initiatives on national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP, 2010).

In fulfilment of SIP 8 (green energy) and to meet the targets set in the Integrated Resource Plan (IRP 2010), the Department of Energy has introduced the REIPPP Programme, which is now in its fourth year. The proposed Boundary Solar Energy Facility could potentially contribute towards SIP 8 by addition of clean energy to the grid (should the project become a preferred bidder) and the project will create significant socio-economic benefits at a local, regional and national scale.

e) Renewable Energy Development Zones (REDZ)

The DEA in discussion with the DoE has been mandated by MinMec to undertake a Strategic Environmental Assessment (SEA). The DEA has subsequently appointed CSIR to manage wind and solar PV SEA processes. The SEAs will be undertaken in order to identify geographical areas most suitable for the rollout of wind and solar PV energy projects and the supporting electricity grid network. The CSIR has released a map (Figure 2.1) with initial identification of focus areas best suited for the roll-out of wind and solar photovoltaic (PV) energy projects in South Africa. These results form part of the strategic environmental assessment (SEA) that the CSIR is conducting for wind and solar energy, on behalf of the national Department of Environmental Affairs (DEA). The aim of the assessment is to designate renewable energy development zones (REDZs) within which such development will be incentivised and streamlined.

The proposed Boundary Solar Energy Facility falls within the identified focus areas most suitable for the rollout of the development of solar energy projects within the Free State Province as shown on Figure 2.1.

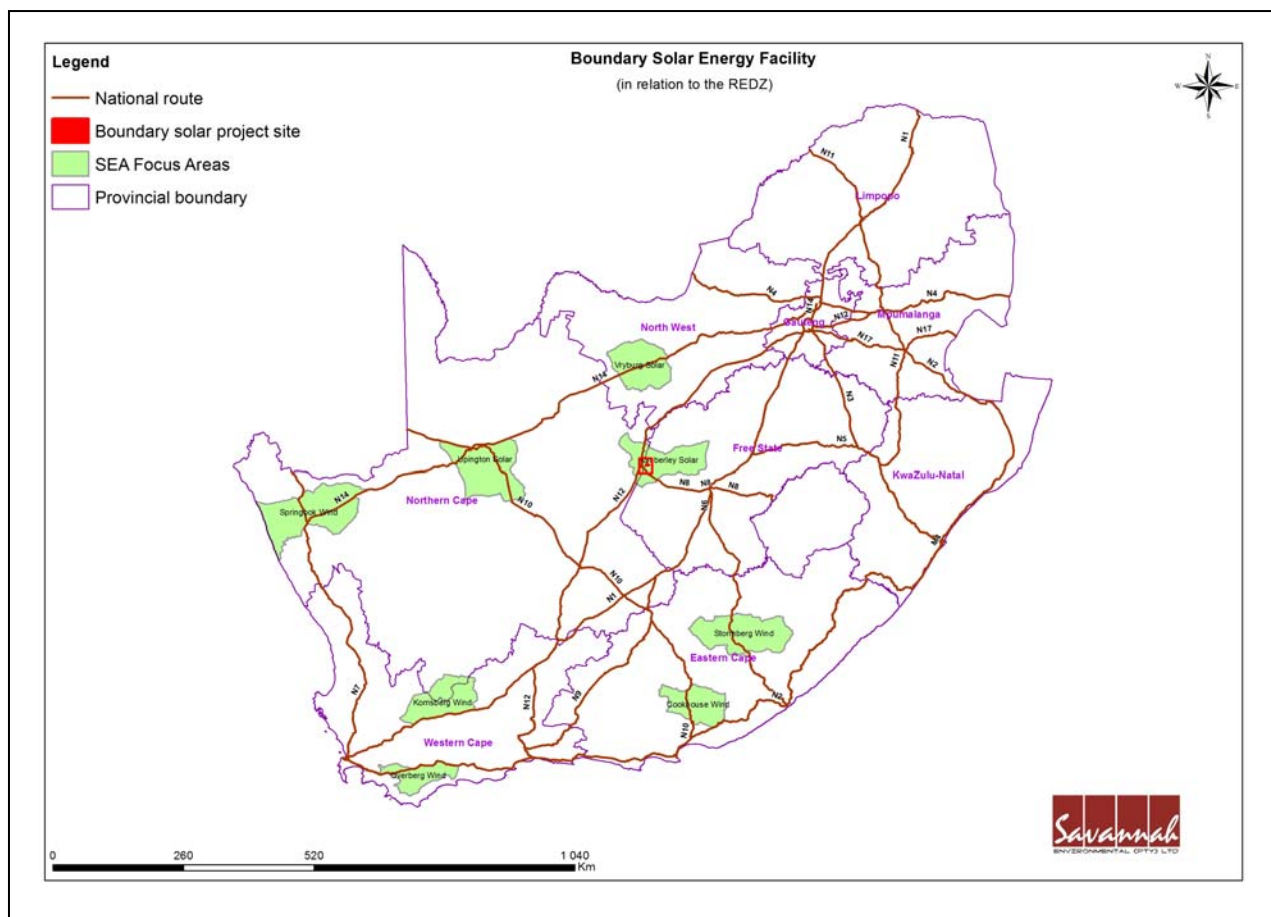


Figure 2.1: Renewable Energy Development Zones (REDZ) (CSIR 2014)

f) Financial Viability and Community Needs

In terms of the energy yield predicted from the facility, the developer considers the Boundary PV project to be financially viable. The "need and desirability" of the local community as reflected in an IDP for the area, is also considered in the EIA. In the South African context, developmental needs (community needs) are often determined through the above planning measures (IDP, SDF and EMF). The Boundary Solar Energy Facility project is in line with the Tokologo Local Municipality and Lejweleputswa District Municipality Integrated Development Plan (IDP) as discussed above. In terms of the needs on the local community, the IDPs identified the need for development, social services, education and employment opportunities in this area. The Boundary Solar project could potentially contribute positively to these community needs. The project will create employment and business opportunities, as well as the opportunity for skills development for the local community. In addition, indirect benefits and spend in the local area will benefit the local community.

g) The Need for the Boundary Solar Energy Facility Project at a National level

The need for harnessing renewable energy resources (such as solar energy for electricity generation) is linked to increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry, a target of 17.8 GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010 and incorporated in the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme initiated by the DoE. This programme has been designed so as to contribute towards a target of 3725 MW to be generated from renewable energy sources, required to ensure the continued uninterrupted supply of electricity, towards socio-economic and environmentally sustainable growth, and to start and stimulate the renewable industry in South Africa. The energy procured through this programme 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 17,8GW of power from renewable energy amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Rodicon Trading and Investments (Pty) Ltd proposes the establishment of the Boundary Solar Energy Facility to add new capacity to the national electricity grid. The development of the project would benefit the local/regional/national community by developing a renewable energy project. Surrounding communities would also benefit from the development through job creation and spin-offs. In addition, according to Department of Energy (DoE) bidding requirements the developer must plan for a percentage of the profit per annum from the solar energy facility to go back into the community through a social beneficiation scheme. Therefore there is a potential for creation of employment and business opportunities, and the opportunity for skills development of for the local community.

h) The Desirability for the Boundary Solar Energy Facility Project on the proposed project site

The use of solar irradiation for electricity generation is essentially a non-consumptive use of a natural resource. A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The proposed site located on Farm Karreeboom 1716 was selected for the development of a solar energy facility based

on its predicted climate (solar resource), suitable proximity in relation to the existing and available electricity grid, and minimum technical constraints from a construction and technical perspective. Rodicon Trading and Investments (Pty) Ltd considers this area, and specifically the demarcated site on the farm Farm Karreeboom 1716 was, to be highly preferred for the development of a solar energy facility. The reasons include:

- » There are no arable lands in the studied area or directly adjacent to it, which could be impacted upon by the proposed development.
- » The current land-use on the site is agriculture (cattle grazing). The development of the Boundary Solar Energy Facility will allow current livestock grazing to continue on areas of the farm portions which will not be occupied by solar panels and associated infrastructure. Therefore the current land-use will be retained on much of the site (i.e. 85% of the site), while also generating renewable energy from the sun. As the landowner will benefit from a portion of the revenue from the facility, the development of the project provides an alternative source of income, contributing towards the sustainability of the current farming operations. This presents a win-win situation for the landowner, the economical use of the site, and the developer.
- » The power can be readily evacuated to strengthen the local Eskom grid. The Eskom Boundary Substation is located on the proposed site and according to the Eskom planning office; Boundary Substation has sufficient excess capacity available to support a solar facility development larger than the prescribed maximum of 75 MW.
- » A number of essential service infrastructure elements are currently present in the vicinity of the site, including a number of existing Eskom power lines crossing the farm, from the south (Boundary-Perseus No.2 275kV), east (Boundary-Perseus No.1 275kV) and west (Kimberley-Boundary 132kV), connecting to the Boundary Substation on the farm. The R64 regional road connecting Kimberley to Boshof traverses through the northern side of the proposed site. Close to the northern border of the farm, south of the R64, appears to be an old disused gravel pit. The site is 10 km west of the N8 which according to the FS PSDF (2013) is referred to as an 'active tourist route'; this tourism corridor links Bloemfontein and Lesotho, passing Ladybrand, Thaba Nchu, and Botshabelo.

i) How the principles of environmental management as set out in section 2 of NEMA have been taken into account in the planning for the proposed project

The principles of NEMA have been considered in this assessment through compliance with the requirements of the relevant legislation in undertaking the assessment of potential impacts, as well as through the implementation of the principle of sustainable development where appropriate mitigation measures have

been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of minimisation of pollution and environmental degradation.

The EIA process has been undertaken in a transparent manner and all effort has been made to involve interested and affected parties, stakeholders and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority.

The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management.

2.2. Description of the Proposed Boundary Solar Energy Facility

The facility is proposed to accommodate either static or tracking photovoltaic (PV) arrays to harness the solar resource on the site. The facility is proposed to have an export capacity of up to 75 MW. An area of approximately 260 ha in extent will be occupied by the PV panels and associated infrastructure. A layout of the proposed Boundary Solar Energy Facility and associated infrastructure has been provided by the project developer, and is indicated in **Figure 2.2**. This is the layout which has been assessed within this EIA Report. **Table 2.1** summarises the dimensions of the project components.

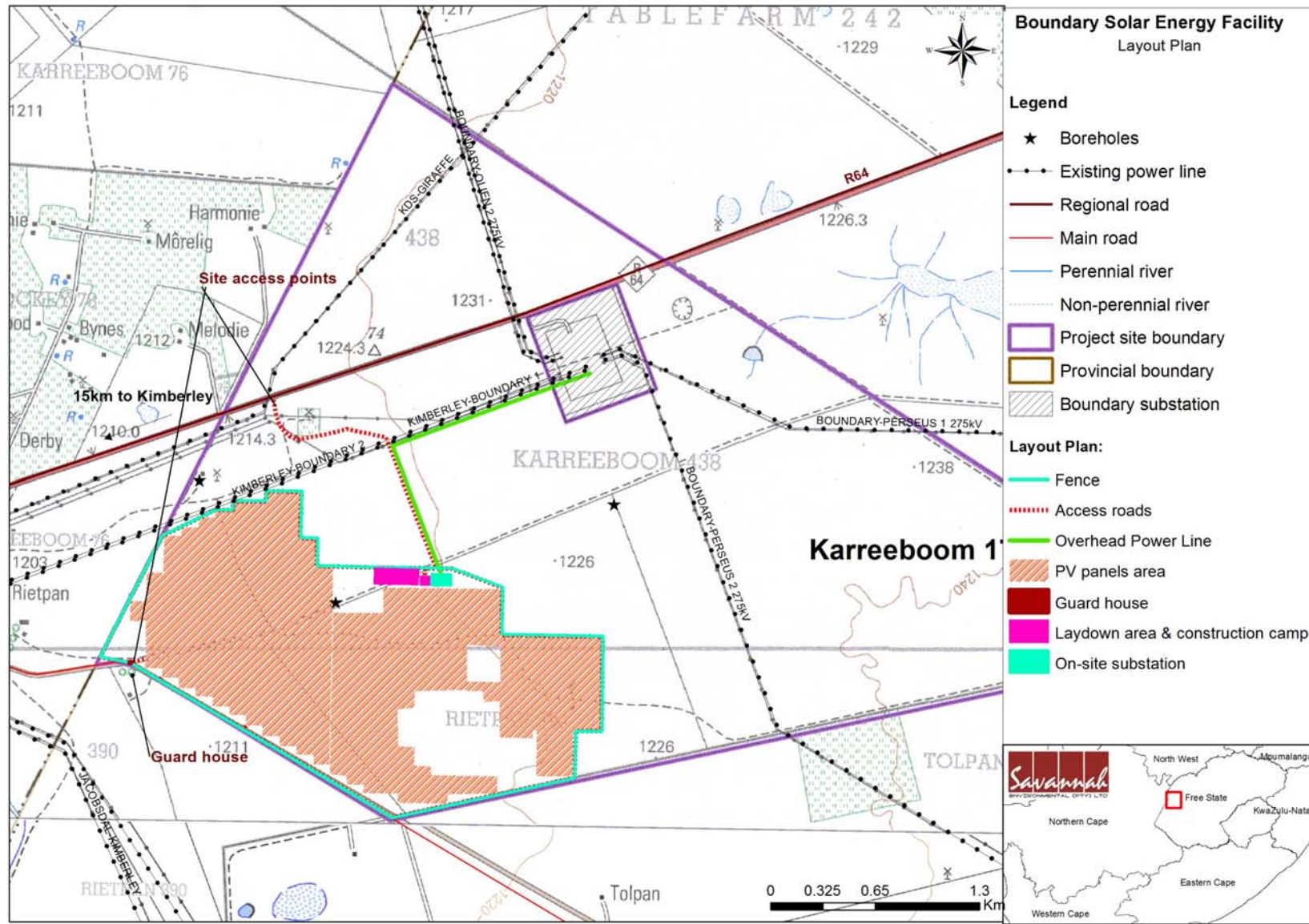


Figure 2.2: Layout for the proposed Boundary Solar Energy (PV) Facility, indicating the project location on the Farm Karreeboom 1716

Table 2.1: Technical details for the proposed Boundary Solar Energy Facility

Component	Description/ Dimensions
Location of the site	~15km south-east of Kimberley and 40km south-west of Boshof. Located in the Free State Province
Municipal Jurisdiction	» Tokologo Local Municipality » Lejweleputswa District Municipality
Extent of the proposed development footprint	~ 260ha
Extent of site available for development	~1626 ha
Site access	Site can be accessed via the Rietpan road running south-west of the site boundary or alternatively directly off the R64 regional road between Kimberley to Boshof
Generating capacity	75 MW
Proposed technology	Ground-mounted photovoltaic panels utilising static or tracking technology
Cabling	Cabling between the projects components is to be lain underground between 2 – 4 meters deep where practical.
Panel Spec (installed capacity)	86.25 MW
Panel Dimensions	± 1m x 2m
Number of Panels	± 350 000
Number of inverters and Height	± 60 inverter stations/mini substations at a height of ± 3m
Main Transformer capacity	Varies according to detailed design and client requirement, 1 x 80 MVA transformation capacity is typical
Final Height of installed panels from ground level	3.5m
Width and length of internal roads	Width: ~5 m Length: 5000m
Construction camp & laydown area	± 200m x 150m
Substation	A new 132 kV on-site substation (120m X 70m in extent) to evacuate the power from the facility into the Eskom grid
Power line connection	» Servitude width – 32 m » Servitude length – 1700m » Height of towers – 31-40m
Mounting Structure	Mounting structure (up to 3.5m in height) to be either rammed steel piles or piles with pre-manufactured concrete footings, ground screws to support the PV panels
Services required	» Sewage and Refuse material disposal - all

Component	Description/ Dimensions
	sewage and refuse material generated during the establishment of the proposed site will be collected by a contractor to be disposed of at a licensed waste disposal site » Water and electricity – water will be obtained from the municipality or a licence will be obtained from DWA for abstracting water from local boreholes. Electricity will be generated from generators for any electrical work on site.
Infilling or depositing material	Any infilling material that may be required for project development will be obtained from: » Option 1: Cut and fill material from construction activities on the site (i.e. from the Farm Karreeboom 1716). » Option 2: Material from existing borrow pits on site (i.e. from the Farm Karreeboom 1716). » Option 3: Contractor to source suitable grade material from an approved/registered borrow pit in the broader Kimberley region. Any excess/spoil material will be disposed of to a licensed landfill site.

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.

2.3.1 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



Figure 2.4: Picture of the installation of a typical PV array

The **Support Structure**

The photovoltaic (PV) modules will be mounted to steel support structures, 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 50cm from the ground.

The **Inverter**

The photovoltaic effect produces electricity in direct current (DC). Therefore an inverter (refer to Figure 2.5) must be used to invert 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 33kV 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, collect the power from the arrays for transmission to the project's substation.



Figure 2.5: Image of a typical inverter

Water Requirements

An operational PV plant has no direct water requirement associated with the generation of electricity. Water is required primarily for the construction of the facility and well as for human consumption (sanitation) during operation. In many instances, water is used to clean off 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 15 000 m³ of water during the construction phase, although a higher volume could be required in the hotter periods of the year when dust suppression would be required on a more frequent

basis. A volume of approximately 5 000 m³ per annum would be required during the operational phase. Rodicon Trading and Investments (Pty) Ltd is considering three alternative sources to meet the water requirements for the proposed Boundary Solar Energy Facility, namely:

1. Source water from the Local Water Services Provider (Tokologo Local Municipality).
2. During occasional thunderstorms, significant amounts of rainfall can be collected off rooftops in rainwater tanks. This water can be used to supplement existing water supplies, however may require adequate treatment to make it potable. Rainfall in the area is, however, unpredictable and seasonal, and water sourced in this way will not be permanently available.
3. Source water from groundwater, i.e. borehole/s on the site (Farm Karreeboom 1716). Please note that this option is the least preferred option, subject to testing as required by the Department of Water Affairs, given water constraints in the region.

2.4. Project Alternatives

In accordance with the requirements of the EIA Regulations³, 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; and
- » The No-go alternative.

2.4.1 Site Alternatives

Only one technically and economically feasible alternative larger site for the establishment of the proposed project has been identified by the developer for investigation in an EIA process, i.e. Farm Karreeboom 1716. This is based on an investigation by the developer of various sites within the area (refer to Appendix M for the full motivation on site selection). The following factors have been considered in determining a preferred site for PV solar development including:

Site Location: The site is situated in close proximity to the city of Kimberley. This is a town marked with high levels of unemployment and poverty. Other surrounding towns include Boshof; which experiences similar levels of unemployment and poverty. As a consequence, local labour would be easy to

³ GNR543 27(e) calls for the applicant to identify feasible and reasonable alternatives for the proposed activity.

source. This fits in well with the REIPPP Programme economic development criteria for socio-economic upliftment. Currently, a large proportion of local labour is used in the agricultural industry. A few negatives related to agricultural employment are that it is very seasonal and it is not always in close proximity to their homes, forcing workers to travel large distances on a daily basis to reach their place of employment. Over the years, employment in the mining sector in this region has shown a dramatic decrease. The Eskom Boundary Substation is located on the proposed site and according to the Eskom planning office; Boundary Substation has sufficient excess capacity available to support a solar facility development larger than the prescribed maximum of 75 MW.

Site extent: Space is a constraining factor for a large-scale PV solar facility installation. A 75 MW plant will require, on average, an area of approximately 300ha. There is sufficient space for the full extent of the proposed project within the area under consideration (Farm Karreeboom 1716 has a total size of ~1626 ha).

Land availability: This specific farm is currently used for cattle grazing, with cattle farming and game farming are being the predominant commercial farming in the area. Sheep farming and other forms of small livestock farming prove to be challenging as the property is located adjacent to the R64 regional road and sheep farming is exposed to livestock theft. Due to vegetation, topography and landscape, properties to the east of the proposed site are mainly used for game farming and hunting. This could prove to be problematic during the hunting season as experienced in previous projects in the Boshof areas. Properties to the east have visible environmental issues with a large population of Camel Thorn trees and although the proposed site has Camel Thorn trees, the population is much less than surrounding areas east of the site.

Site access: The proposed development site is accessible directly off the R64; alternatively the site can be accessed via a main road (Rietpan road) running south-west of the site boundary. The site is located near Kimberley city centre and Boshof on the R64 regional road, this road is in a good condition and traffic is minimal on this section of the road. The site is therefore appropriately located for easy transport of components and equipment as well as labour movement to and from the site. Large volumes of material and components would need to be transported to the project site during the construction phase of the project. The accessibility of the site was therefore a key factor in determining the viability of the solar energy facility, particularly taking transportation costs (direct and indirect) into consideration and the impact of this on project economics and therefore the ability to submit a competitive bid under the DoE's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

Climatic conditions: The economic viability of a photovoltaic plant is directly dependent on the annual direct solar irradiation values. The region where the Boundary Solar PV project is proposed has the second-best solar radiation index after Upington (FS-PSDF, 2013).

Site slope and aspect: 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. The proposed Boundary site is proposed site is situated on a level plain with a gentle slope of approximately 1% at a westerly aspect across the site.

Grid Connection: The facility will require an on-site substation (approximately 120x70m in extent) and associated power line to evacuate the power from the facility into the Eskom Boundary Substation located on the proposed site. The Eskom Boundary Substation is located on the proposed site and according to the Eskom planning office; has sufficient excess capacity available to support a solar facility development larger than the prescribed maximum of 75 MW.

Based on the above considerations, as well as discussions with Eskom, Rodicon Trading and Investments (Pty) Ltd considers the proposed site as a technically preferred site for the development of a Solar PV Energy Facility.

2.5.2 Layout Alternatives

Alternative sites within the proposed farm portion were considered during the scoping processes, and were excluded based on environmental sensitivity including biodiversity, hydrology and avifauna. The location of the layout 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 or farm portion 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 Programme, 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 technology 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 technologies (CSP). PV is also preferred when compared to CSP technology because of the lower visual profile.

The environmental impacts of the PV technology choices are not the same. Therefore, the selection of technology will affect environmental impacts of the proposed development. The primary differences which affect the potential for environmental impacts relate to the extent of the facility, or land-take (disturbance or loss of habitat), as well as the height of the facility (visual impacts). The impacts associated with the operation and decommissioning of the facility will be the same irrespective of the technology chosen. Two solar energy technology alternatives are being considered for the proposed project and include:

- » Fixed Mounted PV systems (static/fixed-tilt panels); and
- » Tracking PV systems (with solar panels that rotate around a defined axis to follow the sun's movement).

Fixed Mounted PV System

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

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

Tracking PV System

Tracking PV Systems (single axis or dual axis trackers) are fixed to mountings which track the sun's movement. There are various tracking systems. A 'single axis tracker' will track the sun from east to west, while a dual axis tracker will in addition be equipped to account for the seasonal waning of the sun. These systems utilise moving parts and more complex technology, which may include solar irradiation sensors to optimise the exposure of PV panels to sunlight.

Tracking PV panels follow the sun's rotational path all day, every day of the year giving it the best solar panel orientation and thereby enabling it to generate the maximum possible output power. The PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance. The two proposed technology alternatives will be assessed further in Chapter 6.

2.5.4. Do Nothing Alternative

The no-go option would mean that the proposed development to install the Boundary PV facility and associated infrastructure would not be 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 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.

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 carbon emissions. The No-Development option would represent a lost opportunity for South Africa to supplement its current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a High negative social cost.

However, at a provincial and national level, it should be noted that the proposed Boundary Solar Energy Facility is not unique. In this regard, a significant number of other renewable energy developments are currently proposed in the FSP and other parts of South Africa. Foregoing the proposed Boundary Solar Energy Facility would therefore not necessarily compromise the development of

renewable energy facilities in South Africa. However, the socio-economic benefits for local communities in the TLM would be forfeited.

2.5. Proposed Activities during the Project Development Stages

In order to construct the 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.

2.5.1. 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.

2.5.2. Construction Phase

The construction the proposed project 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, selected compacting and grading, and setup of modular offices and other construction facilities.

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.

Trenching would occur within each array to bury the electrical cables. The trenches would be up to ~ 1.8m in width and 2m deep, for a total combined length of approximately 10 km. 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)⁴ 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 Access Roads to the Site

The site can be accessed from the R64 regional road connecting Kimberley to Boshof which traverses through the northern side of the proposed site. Within the site itself, access will be required to the individual facility components for construction purposes (and later limited access for maintenance). Upgrade of access roads within the site will be required and new access roads will be required ($\pm 5\text{m}$ wide). Access track construction would normally comprise of compacted rock-fill with a layer of higher quality surfacing stone on top. The strength and durability properties of the rock strata at the proposed site are not known at this stage; this will need to be assessed via a geotechnical study to be conducted by the project proponent. Depending on the results of these studies, it may be possible in some areas, to strip off the existing vegetation and ground surface and level the exposed formation to form an access track surface. The final layout of the access roads will be determined following the identification of site related sensitivities.

⁴ 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 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

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:** Vegetation clearance and construction of access roads (where required)
- Step 4:** Construction of foundations
- Step 5:** Assembly and erection of infrastructure on site, connect conductors
- Step 6:** Rehabilitation of disturbed area and protection of erosion sensitive areas

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

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

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.

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.

2.5.3. Operational Phase

The solar energy facility is expected to be operational for a minimum of 20 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 Maintenance 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.

2.5.4. Decommissioning Phase

Depending on the continued economic viability of the facility following the initial 25-year operational period, the 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 disassembled 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.

Future plans for the site and infrastructure after decommissioning

The plant capacity would have degraded by $\pm 15\%$ over 20 years, the plant will have the opportunity to generate power for a Merchant Market operation (i.e. the client would sell power on bid basis to the market. This system is not yet operational but would most likely emerge in the next 10 - 15 years). Another possibility is to replace panels with newer higher efficiency panels and negotiate a further Power Purchase Agreement with Eskom.

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 the Boundary Solar Energy Facility 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 Boundary Solar Energy Facility on Farm Karreeboom 1716, located near Kimberley.

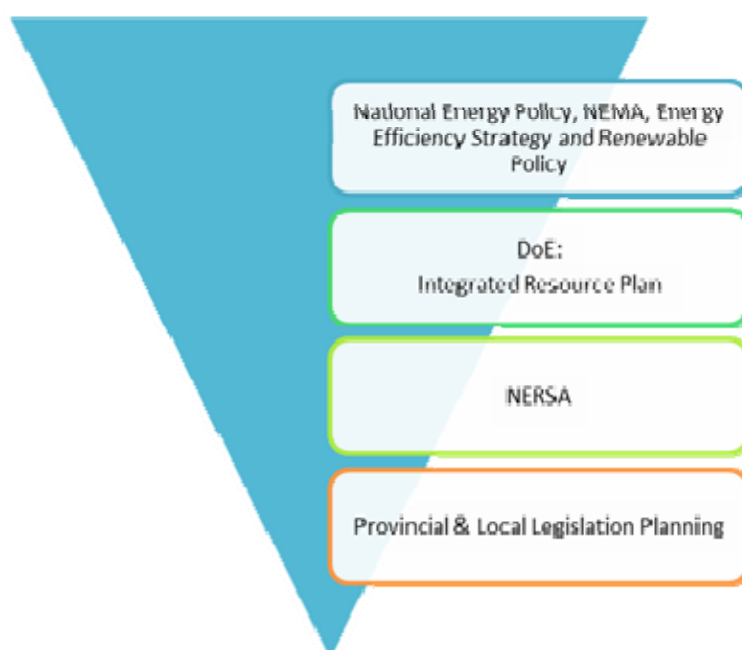


Figure 3.1: Hierarchy of electricity policy and planning documents

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 in the use of renewable energy 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 Boundary 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 National Integrated Resource Plan, 2010 - 2030

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

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

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

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

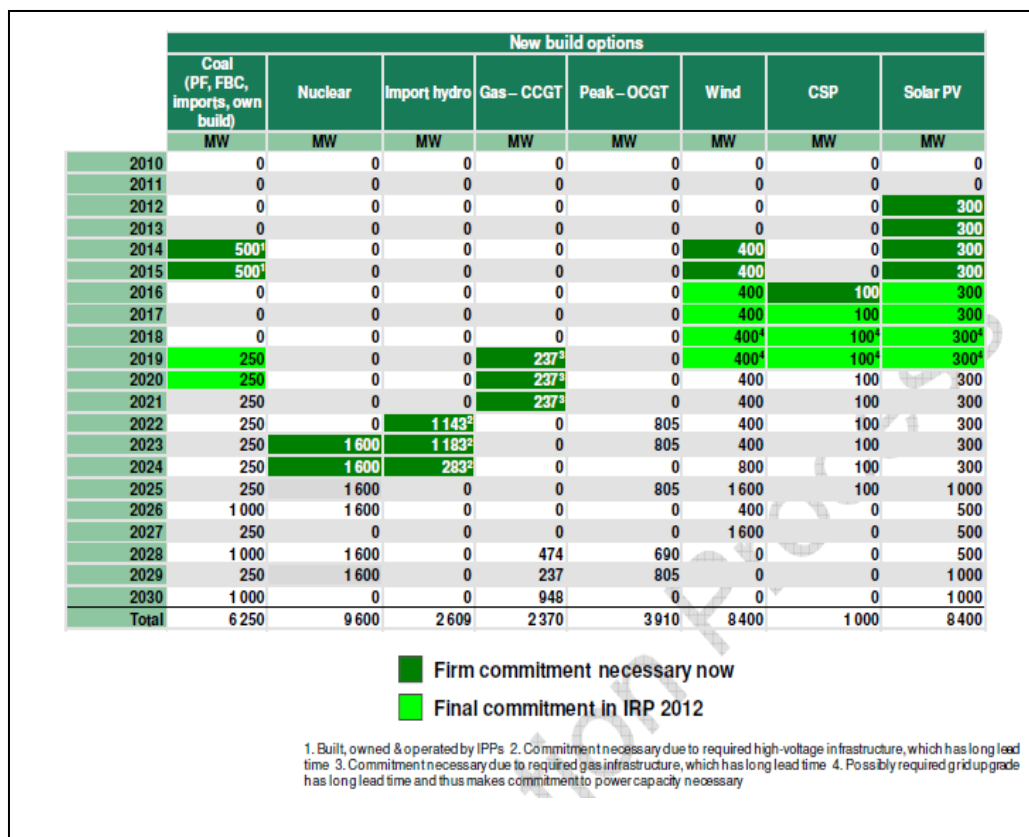


Figure 3.2 National Energy Development Commitments before the next IRP

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

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources. The Policy-Adjusted IRP has therefore resulted in an increase in the contribution from renewables

from 11,4 GW to 17,8 GW. The key recommendations pertaining to PV solar energy contained in the IRP 2010 to 2013 (March 2011) include:

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

The Integrated Resource Plan (IRP) 2010-30 was promulgated in March 2011. It was indicated at the time that the IRP should be a “living plan” which would be revised by the Department of Energy (DoE) every two years. Since the promulgation of the Integrated Resource Plan (IRP) 2010-30 there have been a number of developments in the energy sector in South and Southern Africa. In addition the electricity demand outlook has changed markedly from that expected in 2010.

The Department of Energy have now completed an IRP 2010 Update (which was available for comments until 7 February 2014). It is expected that the final IRP 2010 Update will be submitted to Cabinet for final approval by March 2014, and subsequently promulgated and published in the Government Gazette.

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.

3.2 Provincial and Local Planning Context

3.2.1. Free State Province Provincial Growth and Development Strategy

The Free State Provincial Growth and Development Strategy (FSPGDS) is a nine-year strategy (2004-2014) which aims to achieve the objectives of Vision 2014. As a provincial policy framework, it sets the tone and pace for shared growth and

development in the Province. It addresses the key social, economic, environmental and spatial imperatives in the Province. Underlying the FSGDS are the following imperatives:

- » The need to effectively use scarce resources within the Province, whilst addressing the real causes of development challenges.
- » The need to accelerate service delivery based on a common provincial development agenda as the basis for provincial strategic direction.
- » The need to identify investment opportunities and provide an environment of certainty critical for private-sector investment.
- » The need to promote intergovernmental coordination between the three spheres of government.
- » The need to facilitate the implementation of the People's Contract within the Province.
- » The need to provide a common vision as the basis for common action amongst all stakeholders, both inside and outside government.
- » The need to provide a framework for budgets, implementation, performance management and spatial development.

The implementation of the FSGDS is informed by the following vision, mission, and value statements.

Vision: A unified prosperous Free State that the fulfils the needs of all its people

Mission: Serving the people of the Province by working effectively with our social partners through:

- » Economic growth, development, and employment.
- » Human and social development.
- » Justice and crime prevention.
- » Efficient governance and administration.

The FSPGDS states the importance of applying the principles of sustainable development, specifically:

- » Acknowledge the ecological limitation of the environment;
- » Ensure integrated development planning and implementation;
- » Actively address economic and social inequalities;
- » Promote economic infrastructure investment and development spending in areas of potential and need according to the principles of the NSDP;
- » Acknowledge the importance of BEE, as well as the need to broaden access to the economy; and
- » Promote labour intensive approaches to development.

The FSPGDS identifies a number of key provincial priorities. The priorities that are relevant to the proposed solar energy facility include:

- » Economic development, employment, and investment; and
- » Human and social development. Economic growth is underpinned by a good socio-economic environment.

The following key objectives are set for economic development, employment and investment:

- » To achieve an economic growth rate of 6%-7% per annum;
- » To reduce unemployment from 30% to 15%;
- » To reduce the number of households living in poverty by 5% per annum; and
- » To provide adequate infrastructure for economic growth and development.

Regarding the above objectives and the discussion of development trajectories, trade-offs, and barriers, the key strategic approaches towards the economy are divided into economic driving and economic enabling strategies. The key economic drivers that are relevant to the renewable energy sector are:

- » Expanding the manufacturing sector in key sub-sectors; and
- » Developing tourism.

To enhance these drivers, the following enabling strategies are followed:

- » Emphasising SMME development;
- » Providing economic infrastructure;
- » Promoting human resource development; and
- » Creating an enabling environment.

SMME development: The FSPGDS acknowledges the key role played by SMMEs in terms of economic development and job creation. To bolster economic growth and create employment opportunities, SMME development is high on the agenda of government.

Tourism: The emphasis in respect of tourism is to optimise its benefits. More specifically, the weekend tourism market for the north and north-eastern parts of the Province should be explicitly marketed. Emphasis is on nature tourism and heritage tourism. Events tourism should be focused on in the larger urban areas of Bloemfontein and Welkom. Human resource development and economic growth: Providing the skills for a growing economy will be done by means of the learnership, providing skills through the FET sector and internships.

The FSPGDS also identifies a number of barriers to economic growth and infrastructure that need urgent attention in order to foster economic growth. The barriers that are pertinent to the renewable energy sector include:

- » The lack of appropriate skills.
- » Access to capital.
- » Poor institutional arrangements in respect of business support.
- » Lack of basic infrastructure and the maintenance of basic infrastructure.
- » Lack of appropriate R&D to foster the emphasis in the NSDP on innovation and economy, appropriate R&D is vital to the economic development of the Province. Not only should partnerships with local research institutions be fostered, but various national institutions also exist to assist in this regard;
- » The HIV and AIDS pandemic.

The FSPGDS also identifies a number of natural constraints to economic growth and development. These include, low rainfall coupled with the limited soil potential and the impact of this on agriculture, limited water availability and depletion of mineral resources. What is of interest is that none of the natural constraints impact on the renewable energy sector, specifically the solar energy sector. Solar energy, specifically PV solar energy, therefore provides the Free State with an opportunity to diversify its economy in a way that is not affected by natural constraints such as low rainfall and limited water supplies.

Agriculture dominates the Free State landscape, with cultivated land covering 32 000 square kilometres, and natural veld and grazing a further 87 000 square kilometres of the province. Due to the climate change, Free State's agricultural potential has been declining and this has led to an increase in the level of unemployment. The proposed solar energy facility will create jobs during its construction and operation phase and this will decrease the level of unemployment currently being experienced in this province. Furthermore the proposed project will boost the local economy and attract tourists in the area.

3.2.2 Lejweleputswa District Municipality Integrated Development Plan

The LDM IDP is informed by and aligned with the Free State Provincial Growth and Development Strategy (FSGDS) and other governmental programmes and policies. In this regard the FSPGDS identified four key priority areas, two of which are relevant to the proposed solar energy project, namely:

- » Economic development, employment and investment; and
- » Social and Human Development.

The IDP identifies a number of priority areas, of which the following are regarded as relevant:

- » Local Economic Development;
- » Basic Service Delivery and Infrastructure Investment; and
- » The proposed solar energy facility will boost the local economy through job creation and supporting local business.

3.2.3 Tokologo Local Municipality IDP (2012-2017)

The vision for the TLM is "A progressive municipality, which through cooperative governance, creates conditions for economic growth, social development and meet the basic needs of the community and improve the quality of life of all residents". The Mission statement linked to the vision notes that the:

"Tokologo Local Municipality is committed to provide a better life for all residents within its area of jurisdiction through:

- » Creating conditions for economic growth and sustainability;
- » Improving access to basic services;
- » Promoting social upliftment through improved education, skills development and job opportunities;
- » Ensuring cooperative, transparent and democratic governance through community participation and involvement;
- » Creating a healthy and safe environment; and
- » Improving sport and recreation facilities".

The IDP notes that Local Economic Development within the municipal area will require strategic and focused efforts in those economic areas where TLM already shows stability and growth. An economic SWOT analysis was undertaken as part of the IDP revision. The key findings that are of relevance to the project include:

Strengths

- » One of the most fertile agricultural regions of the Free state;
- » Strong and versatile agricultural sector;
- » Skilled and semi-skilled labour force;
- » Well-developed infrastructure; and
- » Tourism destinations.

Weaknesses

- » High rate of poverty, especially women and children;
- » High unemployment and dependency rates; and
- » High levels of illiteracy.

Opportunities

- » Development of skills;

- » Transfer of skills;
- » Availability of labour; and
- » Development of a holistic LED Strategy for Tokologo.

Threats/constraints

- » Limited job opportunities.

A Community Needs assessment undertaken as part of the IDP revision lists a number of needs that are relevant to the proposed project, including, job-creation, up-grading of community facilities and infrastructure, support for local economic development and SMME's, and bursaries for learners. The need to protect the natural environment is also identified as a key objective in the IDP.

The IDP also notes that the bulk electrical network in the TLM is well established. However, development has been hampered by the quality/ stability of the supply.

In terms of land uses the proposed site is located outside the area between Boshof and Dealsville identified as a Tourism Development Corridor identified in the TLM Spatial Development Framework. The proposed Solar Energy Facility is therefore unlikely to have a negative impact on tourism potential of the TLM.

3.3. Alignment of Boundary Solar Energy Facility with the Policies and Planning

From the above policies it can be said that the proposed **Boundary Solar Energy Facility** is in line with both the local and the provincial policies. The proposed project will contribute towards the promotion of SMMEs in order to strengthen the Local Economic Sector and bring job opportunities to the locals which are some of the top priority in these policies.

3.4. 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.

3.4.1. 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:

- » *Free State Department of Economic Development, Tourism and Environmental Affairs (DETEA)*: This Department is the commenting authority for the project.
- » *Department of Police, 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.
- » *Free State Department of Agriculture*: This Department is responsible for all matters which affect agricultural land.
- » *Free State Department of Mineral Resources (DMR)*: Approval from this department 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 Free State Province, both the local and district municipalities play a role. The local municipality is the Tokologo Local Municipality, which forms part of the Lejweleputswa 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.

3.4.2 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 (GNR R543 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)
 - * Integrated Environmental Management Information Series (published by DEA)
- » Tokologo Local Municipality Integrated Development Plan (2012-2017)
- » Lejweleputswa District Municipality, Integrated Development Plan (2011/2012)
- » International guidelines – the Equator Principles and the International Finance Corporation and World Bank Guidelines.

Several other Acts, standards or guidelines have also informed the project process and the scope of issues assessed in this report. A listing of relevant legislation is provided in **Table 3.1** and **Table 3.2**.

Table 3.1: Relevant legislative permitting requirements applicable to the proposed Boundary Solar Energy Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	<p>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.</p> <p>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.</p> <p>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.</p>	<p>Department of Environmental Affairs – competent authority</p> <p>Free State Department of Economic Development, Tourism and Environmental Affairs - (DETEA) commenting authority</p>	<p>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).</p> <p>This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.</p>
National Environmental Management Act (Act No 107 of 1998)	<p>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.</p> <p>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.</p>	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)	<p>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.</p> <p>Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act.</p> <p>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.</p>	Department of Mineral Resources	A Section 53 application has been submitted the Free State 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 February 2014. 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
			<p>Measures in respect of dust control (S32) and the National Dust Control Regulations of February 2014.</p> <p>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.</p>
<p>National Heritage Resources Act (Act No 25 of 1999)</p>	<ul style="list-style-type: none"> » 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 or 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 	<p>South African Heritage Resources Agency</p>	<p>An HIA was undertaken for the proposed facility and a no go area have been highlighted. No development will take place in the no go areas. Should a heritage resource be impacted upon, a permit may be required from SAHRA.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
<p>National Environmental Management: Biodiversity Act (Act No 10 of 2004)</p>	<p>Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction (S44).</p> <ul style="list-style-type: none"> » 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). 	<p>Department of Environmental Affairs</p>	<p>Under this Act, a permit would be required for any activity that is of a nature that may negatively impact on the survival of a listed protected species.</p> <p>An ecological study has been undertaken as part of the EIA Phase. There is a pan and areas of protected trees and the potential for them to be affected has been considered. This report is contained in Appendix E.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	<ul style="list-style-type: none"> » This Act also regulates alien and invader species. 		
<p>Conservation of Agricultural Resources Act (Act No 43 of 1983)</p>	<ul style="list-style-type: none"> » 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). 	<p>Department of Agriculture</p>	<p>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.</p> <p>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.</p>
<p>National Forests Act (Act No. 84 of 1998)</p>	<p>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'.</p>	<p>National Department of Forestry</p>	<p>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 <i>Acacia</i> species and other small trees and geophytes scattered in on certain section of the site. Should protected trees need to be removed; a permit will</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			be required to be obtained from DAFF.
National Veld and Forest Fire Act (Act 101 of 1998)	<p>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.</p> <p>In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.</p>	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)	<p>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.</p> <p>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</p>	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
	<p>Group IV: any electronic product; and Group V: any radioactive material.</p> <p>The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.</p>		
<p>Development Facilitation Act (Act No 67 of 1995)</p>	<p>Provides for the overall framework and administrative structures for planning throughout the Republic.</p> <p>S(2-4) provide general principles for land development and conflict resolution.</p>	<p>Local Municipality</p>	<p>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.</p>
<p>National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)</p>	<p>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.</p> <p>The Minister may amend the list by –</p> <ul style="list-style-type: none"> » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. <p>In terms of the Regulations published in terms of this Act (GN 921), A Basic Assessment or</p>	<p>National Department of Water and Environmental Affairs (hazardous waste)</p> <p>Provincial Department of Environmental Affairs (general waste)</p>	<p>As no waste disposal site is to be associated with the proposed project, and waste volumes stored on site would not exceed the specified volumes, a waste license will no be required for the project.</p> <p>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. The DWAF (1998) Waste Management Series. Minimum Requirements for the Handling, Classification and</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	<p>Environmental Impact Assessment is required to be undertaken for identified listed activities.</p> <p>Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that:</p> <ul style="list-style-type: none"> » The containers in which any waste is stored, are intact and not corroded or in » any other way rendered unfit 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. 		<p>Disposal of Hazardous Waste will also need to be considered.</p>
<p>Subdivision of Agricultural Land Act (Act No 70 of 1970)</p>	<p>Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the Province</p>	<p>Department of Agriculture</p>	<p>Subdivision will have to be in place prior to any subdivision approval in terms of S24 and S17 of the Act.</p>
<p>National Road Traffic Act (Act No 93 of 1996)</p>	<ul style="list-style-type: none"> » The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed 	<ul style="list-style-type: none"> » South African National Roads Agency Limited (national roads) » Provincial Department of Transport 	<p>An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	<p>procedures to be followed in applying for exemption permits are described and discussed.</p> <ul style="list-style-type: none"> » 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. 		<p>dimensioned loads.</p> <ul style="list-style-type: none"> » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the facility and substation components may not meet specified dimensional limitations (height and width).
Provincial Legislation			
<p>Free State Provincial Spatial Development Framework (2013)</p>	<p>As a provincial policy framework, it sets the tone and pace for shared growth and development in the Province. It addresses the key social, economic, environmental and spatial imperatives in the Province. According to the FS (PSDF – 2013), the Free State renewable energy is a key focus area of the Free State Development Corporation, especially the solar energy sector.</p>	<p>Free State Department of Economic Development, Tourism and Environmental Affairs - (DETEA)</p>	<p>A permit is not required but this provincial legislation has been incorporated in this report and will remain applicable through the life cycle of the proposed project.</p>

Table 3.2: Standards and guidelines applicable to the Boundary Solar Energy Facility

Theme	Standard/Guidelines	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
	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) – National norms and standard for the storage of waste.	<ul style="list-style-type: none"> » Provides uniform national approach relating the management of waste facilities. » Ensure best practice in management of waste storage Provides minimum standards for the design and operation of new and existing waste storage.
Water	Best Practise Guideline (G1) Stormwater Management DWA 2006	Provides guidelines to the management of storm water
Water	South African Water Quality Guidelines	Provides water quality guidelines
Others	Tokologo Local Municipality, Integrated Development Plan (2010/2011) and Lejweleputswa District Municipality, Integrated Development Plan (2011/2012.)	According to the Municipal Systems Act of 2000, all Municipalities have to undertake an Integrated Development Planning (IDP) process to produce Integrated Development Plans (IDPs). As the IDP is a legislative requirement it has a legal status and it supersedes all other plans that guide development at local government level.

APPROACH TO UNDERTAKING THE EIA PHASE

CHAPTER 4

An EIA process is regulated by the EIA Regulations 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 proposed facility 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 GNR543, GNR544; GNR545; and GNR546 of Section 24(5) of NEMA (Act No. 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

4.1. Phase 1: Scoping Phase

The Scoping Study, which was completed in November 2013 and accepted by the DEA, 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).

I&APs were provided with the opportunity to receive information regarding the proposed project, to participate in the process and to raise issues or concerns. Furthermore, the Draft Scoping Report was made available at the Kimberley and Boshof Public Libraries and on the Savannah Environmental website for I&AP review and comment (for a 30-day commenting period). All the comments, concerns, and suggestions received during the Scoping Phase and the review period were included in the Final Scoping Report.

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

» Circulation of the Draft and Final Scoping Report

During the scoping phase, the following registered I&APs and State Departments were informed in writing of the availability of the Draft Scoping Report or

provided with a copy of the report. They were also informed in writing of the availability of the Final Scoping Report and were requested to submit comment directly to DEA. Comments received after the submission of the Final Scoping Report has been addressed in the EIA Reports.

- » Free State Department of Economic Development, Tourism and Environmental Affairs (DETEA);
- » Department of Police, Transport and Public Works;
- » Provincial Department of Water Affairs;
- » Free State Department of Agriculture;
- » South African Heritage Resources Agency;
- » Department of Agriculture, Forestry and Fisheries;
- » South African National Roads Agency Limited (SANRAL);
- » Department of Energy;
- » Civil Aviation Authority;
- » Square Kilometre Array (SKA) Project;
- » Tokologo Local Municipality & Lejweleputswa District Municipality;
- » Landowners, surrounding landowners;
- » Eskom Transmission and Distribution ;
- » Wildlife Environment Society of South Africa; and
- » BirdLife South Africa.

4.2. Phase 2: Environmental Impact Assessment Phase

The EIA Phase for the Boundary Solar Energy Project aims to achieve the following:

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

The EIA Report addresses potential direct, indirect, and cumulative⁵ impacts (both positive and negative) associated with all phases of the project including design,

⁵ "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).

construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

4.2.1. Tasks completed during the EIA Phase

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

- » Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
- » Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
- » 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 Final 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 Final 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 DETEA) has continued throughout the EIA process. On-going consultation included the submission of a final Scoping Report with a Plan of Study for the EIA phase, which was accepted by DEA in November 2013.

The following has been undertaken as part of this EIA process:

- » A 40-day public review period of the Draft EIA Report for organs of state.

- » An additional 21 days public review period for all registered I&APs (including organs of state) of the final EIA Report, prior to submission of a final EIA Report to DEA.
- » 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.).
 - * Parastatals and Non-Governmental Organisations (South African Civil Aviation Authority (SACAA), Eskom SOC Limited, and Square Kilometre Array (SKA)).
 - * Tokologo Local Municipality & Lejweleputswa District Municipality.

If required, an opportunity for DEA and FS DETEA representatives to visit and inspect the proposed site, and the study area. A record of the authority consultation in the EIA process is included within **Appendix B and D**.

4.2.3 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.

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 has been 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 30-day public review period from 17 February 2014 – 18 March 2014. The comments received from I&APs has been captured within a Comments and Response Report (Appendix D). The Final EIA Report was made available for public review for an additional 21 days. Comments received from I&APs have also been captured within the Comments and Response Report, for submission to the authorities for decision-making.

In terms of the requirement of Chapter 6 of the EIA Regulations of June 2010, the following public participation tasks have been undertaken:

- » 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 to 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.
- » Release of a Final EIA Report for Public Review for a 30-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.

Below is a summary of the key public participation activities conducted to date in the process.

» **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**

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	<ul style="list-style-type: none"> » Free State Department of Economic Development, Tourism and Environmental Affairs (DETEA); » Department of Police, Transport and Public Works ; » Provincial Department of Water Affairs; » Free State Department of Agriculture; » South African Heritage Resources Agency ; » Department of Agriculture, Forestry and Fisheries; » South African National Roads Agency Limited; (SANRAL) » Department of Energy; » Civil Aviation Authority; and » Square Kilometre Array (SKA) Project.
Municipalities	<ul style="list-style-type: none"> » Tokologo Local Municipality ; and » Lejweleputswa District Municipality
Public stakeholders	<ul style="list-style-type: none"> » Landowners, surrounding landowners, occupiers of land, farmer's unions.
Parastatals & service providers	<ul style="list-style-type: none"> » Eskom Transmission and Distribution.
NGOs/Business forums	<ul style="list-style-type: none"> » Wildlife Environment Society of South Africa; and » 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**

In order to notify and inform the public of the proposed project and invite members of the public to register as interested and affected parties (I&APs), the project, and EIA process was advertised in the following newspapers

- * The Volksblad (22 July 2013); and
- * Snuffelblad (19 July 2013).

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

- * Volksblad – (06 September 2013); and
- * Snuffelblad – (06 September 2013).

A third advert was placed announcing the availability of the Draft Scoping report for public review. This advert appeared in the following newspapers:

- * Volksblad – (27 September 2013); and
- * Diamond Fields Advertiser – (26 September 2013).

During the EIA phase, a fourth round of newspaper adverts has been placed to inform the public of the availability of the Draft EIA Report and the public meeting in the following newspapers:

- * Volksblad – (18 February 2014); and
- * Diamond Fields Advertiser – (21 February 2014).

» **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 process as outlined in the table below:

Consultations in Scoping phase:	Date
Public meeting	18 September 2013
Focus Group Meeting with Lejweleputswa District Municipality	18 September 2013
Focus Group Meeting with Tokologo Local Municipality	18 September 2013
Focus Group Meeting with impacted and adjacent landowners	19 September 2013
Consultations in EIA phase:	Date
Public meeting	05 March 2014

Focus Group Meeting with landowners	05 March 2014
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4.2.4 Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into a Comments and Response Report. The Comments and Response Report includes 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. The Comments and Response Report is included in **Appendix D**.

One major concern raised by the surrounding landowners relates to the limited water availability in the area. Adjacent landowners as well as other interested & affected parties in the area are not in favour of the option of the project abstracting water from groundwater resources. The client still needs to investigate this option in consultation with DWA. However, this will be the least preferred option and will be subjected to testing as required by the Department of Water Affairs.

4.2.5 Assessment of Issues Identified through the Scoping Process

Issues that 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
Marianne Strohbach (Savannah Environmental)	Ecological impact assessment	Appendix E
Doug Harebottle (Doug Harebottle Consulting)	Avifaunal impact assessment	Appendix F
David Morris (McGregor Museum)	Heritage impact assessment	Appendix G
Lloyd Rossouw (Palaeo Field Services)	Palaeontology impact assessment	Appendix H
Tony Barbour (Environmental Consulting and Research)	Social impact assessment	Appendix I
Johann Lanz (Johan Lanz Consulting)	Soils and Agricultural Potential	Appendix J
Karen Hansen (Karen Hansen Landscape Architect)	Visual impact assessment	Appendix K

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the proposed

Boundary Solar Energy project. Issues were assessed in terms of the following criteria:

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

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

$$S = (E+D+M) P; \text{ where}$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

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

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

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

4.2.6 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.
- » The development site identified by the developer represents a technically suitable site for the establishment of the proposed solar energy facility.
- » The proposed connection to the National Grid is viable.
- » Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.
- » This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

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

DESCRIPTION OF THE RECEIVING ENVIRONMENT

CHAPTER 5

This chapter of the Final EIA Report provides a description of the environment that may be affected by the proposed Boundary Solar Energy Facility and associated infrastructure. This information is provided in order to assist the reader in understanding the receiving environment within which the proposed facility is situated. Features of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices E – K**.

5.1 Regional Setting: Location of the Study Area

The project falls within the jurisdiction of the Tokologo Local Municipality, which in turn falls under the jurisdiction of the Lejweleputswa District Municipality of the Free State Province. The facility is proposed on the farm Karreeboom 1716, which is in the Free State approximately 15km south-east of Kimberley and 40km south-west of Boshof. The farm portions cover an area of 1626ha. The proposed PV energy facility forms part of a larger development of up to 75MW in generating capacity. The centre of the site is less than 2 km south of the R64 and the site can be accessed directly from the R64 or Rietpan main road. A number of Eskom electricity transmission lines cross the site and connect to the existing electricity substation located on the south side of the R64, within the application site. The co-ordinates for the central point of the project considered in this report are as follows:

- * Latitude: 28°54'1.59"S
- * Longitude: 24°57'2.61"E

5.2 Topography

The terrain consists of level to slightly undulating plains, sloping slightly in a south-westerly direction. The proposed site is on a level plain with a gentle slope of approximately 1% at a westerly facing across the site. The site slopes from the east at about 1260m above sea level (asl), down to the west at 1215 to 1220m asl. 'Olifantsrug' (1280m asl) is the highest point locally, and lies to the immediate east of the site.

5.3 Geology

The geology of the region has been described by Bosch (1993). The area in question is underlain by sediments of widely different geological ages (Figure 5.1, portion of 1:250 000 scale geological map 2824 Kimberley, Council for Geoscience, Pretoria, 1991) (Cole 2005; Johnson *et al.* 2006; Partridge *et al.* 2006). From oldest to youngest, the geology in and around the affected area is made up of Permian Ecca shales (Tierberg Formation, Pt), Jurassic dolerite intrusions (Jd, Karoo Dolerite Suite), Quaternary calcretes, surface limestones, calcified pandunes (Qc) and aeolian sands (Qs) (Kalahari Group). The wind-blown sands represent the latest geological phase and are made up of the characteristically red-brown Kalahari sands (Hutton sands). The geological map indicates that, except for dolerite intrusions, the affected area at Karreeboom 438 is mainly covered by Quaternary-age surface deposits made up of thick mantle of aeolian sand (red-brown Kalahari sands, Qs). No exposures of Tierberg Formation outcrop are indicated within the affected area.

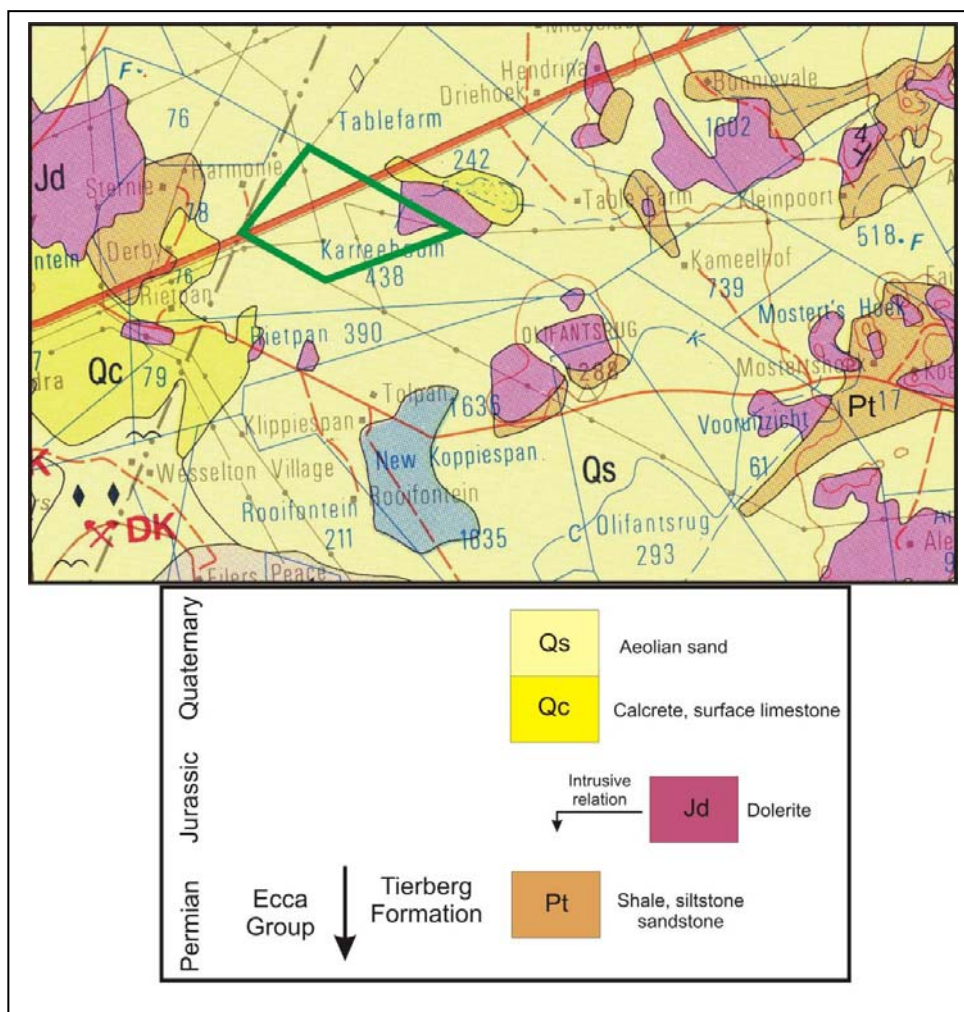


Figure 5.1: Map of the geology underlying the project area on farm Karreeboom 1716 and its surroundings

5.4 Climate

The climate for the Boundary Solar Energy Facility project site has been derived from climatic data summarised for Kimberley located about 15 km north-west of the Project site. The area receives approximately 400 - 450 mm of rain on average per year. From May to September, rainfall is minimal with most rainfall occurring from November to April, peaking between January and March. Temperatures in summer peak during December and January at a daily average of 33°C to 37°C, with an average of 17°C to 20°C for June. During July, night temperatures are on average -4°C to 2°C, with frost being a common winter occurrence.

5.5 Land Cover / Land-Use

The farming area along the R64 between Boshof and Kimberley is used for commercial and game farming operations. Beef cattle is the main farming activity, however, sheep and goats are also farmed on a smaller scale. There are also a number of established commercial hunting lodges / farms located in the area, such as Bonnievale, Amakulu and Tarentaalrand). Due to the proximity of the site to the town of Kimberley there are also a number of small holdings and lifestyle type estates in the vicinity of the site, such as Camelot, Night Breeze and New Klippiesspan properties adjacent to the subject property. The majority of owners commute to work in Kimberley. At the same time, commercial farms near Kimberley tend not to be lived on, with the owners residing in Kimberley. The current land-use for the proposed development site is cattle farming. No farm houses are located on the property. A small shed and two pre-fabricated asbestos houses are located ~250 m south of the R64 west of the substation. Only one of the structures is inhabited and accommodates the only labourer living on the farm. Farming infrastructure is minimal and consists of fencing, kraals and borehole watering points. A farm dam is located on the portion of the property north of the R64. The land uses on the adjacent properties consist of livestock farming, commercial game farming and hunting and rural residential estates/ smallholdings.

There are vast areas of mining activities around Kimberley; Petra Diamond mine is located 3km away from the site. A race course with other recreational uses is located within 2km of the site, a small residential area attached to Wesselton Mine known as Wesselton Village is located 3.5km away to the south-west of the site. Existing Eskom power lines cross the farm from the south (Boundary-Perseus 2 275kV), east (Boundary-Perseus 1 275kV) and west (Kimberley-Boundary 132kV), connecting to the Boundary Substation on the farm. The R64 regional road connecting Kimberley to Boshof traverses through the northern side of the proposed site. The site is 10 km west of the N8 which according to the FS

PSDF (2013) is referred to as an 'active tourist route'; this tourism corridor links Bloemfontein and Lesotho, passing Ladybrand, Thaba Nchu, and Botshabelo.

5.6 Access

The R64 between Kimberley and Boshof traverses the northern corner of the farm. Direct access to the site can be obtained from this road. In addition, a district gravel road (Rietpan road) runs in close proximity to the south-west corner of the proposed site. Within the site itself, there are several existing tracks and Eskom line maintenance tracks that can be used for internal access roads.

5.7 Flora

The study area is situated in the Savanna biome, Eastern Kalahari Bushveld. The vegetation unit covering the study area is Kimberley Thornveld (Figure 5.2). The vegetation type is considered as of least conservation concern, but within the larger vegetation type more sensitive vegetation associations, habitats and species of conservation concern have been found to be present. The tree and shrub layer is well developed, albeit occurring in a very patchy mosaic. Tree species dominating within this vegetation unit are *Boscia albitrunca*, *Acacia erioloba*, (both species protected by the NFA), *A. tortilis*, and *A. karroo*. Dominant shrubs include *Tarchonanthus camphoratus* and *A. mellifera* subsp. *detinens*. Both these shrub species may increase significantly once the herbaceous layer is weakened, with the possibility of forming impenetrable thickets. The grass layer can be patchy and open with large areas of uncovered soil during the dry season. *Eragrostis lehmanniana* is considered the most dominant grass species of this vegetation type, with *Digitaria eriantha* and *Themeda triandra* the most valuable grasses for grazing (Mucina & Rutherford 2006).

During a detailed vegetation survey of the study area, three vegetation associations could be identified as follows:

- » Association 1: *Pentzia* species – *Trichodiadema pomeridianum* dwarf shrublands in slight isolated depressions with very fine-textured, shallow soils.
- » Association 2: *Acacia tortilis* – *Schmidtia pappophoroides* sparse woodlands are found on deeper sandy soils. The deeper the soils, the denser and larger the grasses and trees present, with an associated increase in grazing capacity and the presence of the two nationally protected species within the study area: *Acacia erioloba* (Camel Thorn) and *Harpagophytum procumbens* (Devil's Thorn). The conservation and value of these woodlands thus also increases with soil depth, with the more sensitive woodlands distributed on the eastern half of the study area.
- » Association 3: *Chrysocoma ciliata* – *Eragrostis lehmanniana* dwarf shrublands are found on shallow to very shallow loamy sands overlying calcretes.

Of the three vegetation associations within the study area, all can potentially be used for the development. However, within the associations are smaller areas with a significantly higher density of species of conservation concern, which should be avoided as much as possible to reduce the impact of the development on the larger ecosystem.

The presence of alien invasive plants is currently very low on the study site. However, several such species are very common along all major transport routes to and around the proposed development area. The risk of new invasions is therefore very high as ground is disturbed through construction activities.

5.8 Plant species of Conservation Concern

The following red data species have been recorded from the area (Grid 2824) according to the red data species list of SANBI and the ADU database:

Species	RD Status	Suitable Habitat	Possibility of being present	Threat
<i>Acacia erioloba</i>	Declining, P	Sandy savannas	Confirmed	Habitat loss, wood harvesting
<i>Boophone disticha</i>	Declining, P	Savanna	Confirmed	Medicinal trade
<i>Crinum bulbispermum</i>	Declining, P	Plains with seasonally high moisture levels	Slight	Medicinal trade Habitat loss
<i>Drimia sanguinea</i>	Near Threatened, P	Sandy plains	Slight	Medicinal trade
<i>Rennera stellata</i>	Vulnerable, end	Pan edges	Slight	Habitat loss
<i>Oxalis setosa</i>	Data Deficient - Taxonomically Problematic, end		Slight	Habitat loss

The following species observed on the study site during this survey are protected:

The Nature Conservation Ordinance (NCO) 8 of 1969 and subsequent amendments

<i>Asclepias meyeriana</i>	<i>Nerine spp</i>
<i>Ledebouria cooperi</i>	<i>Helichrysum lucilloides</i>
<i>Ledebouria undulata</i>	<i>Boophane disticha</i>
<i>Orthanthera jasminiflora</i>	<i>Ammocharis coranica</i>
<i>Schizocarphus nervosus</i>	

National Forest Act (Act No. 84 of 1998)

» Camel Thorn: *Acacia erioloba*

National Environmental Management Act: Biodiversity Act (NEMA:BA) (Act No. 10 of 2004) and amendments

- » Devils' Claw: *Harpagophytum procumbens*

5.9 Fauna

There are a number of amphibians, reptiles, birds and mammal species of conservation concern that could occur in the study area according to various existing databases (SANBI, ADU) and Apps (2000), and these are discussed below:

- » **Amphibians:** *Giant Bull Frog (Pyxicephalus adspersus)* – *Near Threatened*
This species occurs widely in South Africa, where it is considered locally common, favouring drier savannah (Channing, 2001; Channing *et al.*, 2004). It is a fossorial species, spending most of the year buried underground in subterranean cocoons. They emerge after the first rains, to breed in shallow, temporary waters in pools, pans, and depressions. The main threats to the species include harvesting for local consumption and the loss of suitable breeding habitat due to urbanisation (Channing, 2001; Channing *et al.*, 2004). This species is likely to occur on the greater project area due to the availability of suitable breeding and foraging habitats.
- » **Reptiles:** Of the species expected to occur within the study area, 4 are endemic: Distant's Ground Agama (*Agama aculeata distanti*), Aurora House Snake (*Lamprophis aurora*), Marico Gecko (*Pachydactylus mariquensis*) and Greater Padloper (*Homopus femoralis*). Although none of these species are of particular conservation concern, all are protected provincially under Schedule 1 of the Nature Conservation Ordinance 8 of 1969. It should however be noted that most species have not had their population status evaluated at this stage.
- » **Birds:** The avifauna comprises a rich Savannah-Thornveld assemblage which reflects the major habitat types within the Kimberley district. Based on atlas data from the first (SABAP1) and second (SABAP2) bird atlas projects, up to 279 species can be recorded within the general area of the proposed facility. On a finer scale, at least 107 species can be recorded within a ± 10 km radius, while the site survey produced a list of 56 species for the actual Solar Energy Facility. Sixteen Red Data species and 43 southern African endemics or near-endemics have been recorded within the Quarter-Degree Grid Cell in which the Solar Energy Facility is located; two Red Data species (Lesser Kestrel and White-backed Vulture) and 20 southern African endemics/near-endemics were recorded during the site survey. The most conservation worthy species include: White-backed Vulture, Cape Vulture, Secretarybird,

Martial Eagle, Kori Bustard and Blue Crane; these species are also highly susceptible to disturbance and/or power line collision/electrocution risk. Other priority species likely to be impacted include Lanner Falcon, Lesser Kestrel, Verreaux's Eagle, Northern Black Korhaan, Spur-winged Goose and White-browed Sparrow-weaver, the latter with breeding colonies located in the Solar Energy Facility site.

- » **Mammals:** Three of the species that could potentially occur in the study area (most likely only roaming in rural or conservation areas) are red data species, listed as *Near Threatened*, Brown Hyena (*Hyaena brunnea*), Honey Badger (*Mellivora capensis*) and South African Hedgehog (*Atelerix frontalis*) and 15 are protected provincially under Schedule 1 of the Nature Conservation Ordinance 8 of 1969, Cape Fox (*Vulpes chama*), Bat-eared Fox (*Otocyon megalotis*), Striped Polecat (*Ictonyx striatus*), Slender Mongoose (*Galerella sanguinea*), Yellow Mongoose (*Cynictis penicillata*), Suricate (*Suricata suricatta*), Small-spotted Genet (*Genetta genetta*), Aardwolf (*Proteles cristatus*), African Wild Cat (*Felis silvestris lybica*), Black-footed Cat (*Felis nigripes*), Aardvark (*Orycterus afer*) and the 3 aforementioned red list species.

5.10 Soils

There are three land types across the site, namely Ae15, Ae45 and Fb1. Ae15 occupies the majority of the site, with Ae45 and Fb1 occurring only on a smaller portion of the site of the western margin of the site (Figure 5.3). The field data shows that the depth limitations across the site are rock and hardpan carbonate horizons, and according to the current South African soil classification system; the soils are classified predominantly as Hutton, Coega and Plooyburg forms. Land capability is the combination of soil suitability and climate factors. Most of the site (land type Ae15) has a land capability classification, on the 8 category scale, of class 7 – non-arable, low potential grazing land. The remaining two land types have a land capability classification of class 5 – non-arable, moderate potential grazing land. The most important limitations are shallow soils limited in depth by rock and calcrete, and aridity. The land on site has a low to moderate susceptibility to water erosion, and is classified as class 5 water erosion hazard (on 8 class scale). It is classified as susceptible to wind erosion.

5.11 Agricultural Potential

One of the primary activities in the region is farming; the current land-use for the proposed development site is cattle farming. The grazing capacity on most of the site is classified as between 14 and 17 hectares per large stock unit, but a portion in the east is classified higher (between 11 and 13 hectares per large stock unit). The proposed site is on land of limited agricultural potential that is only suitable

as non-arable, moderate to low potential grazing land. No agriculturally sensitive areas occur within the development footprint. Agricultural potential is fairly uniform across the farm and the choice of placement of the facility on the farm therefore has minimal influence on the significance of agricultural impacts.

The site does not currently accommodate any centre pivots, irrigation schemes or active agricultural fields. There are no arable lands in the studied area or directly adjacent to it, which could be impacted upon by the proposed development.

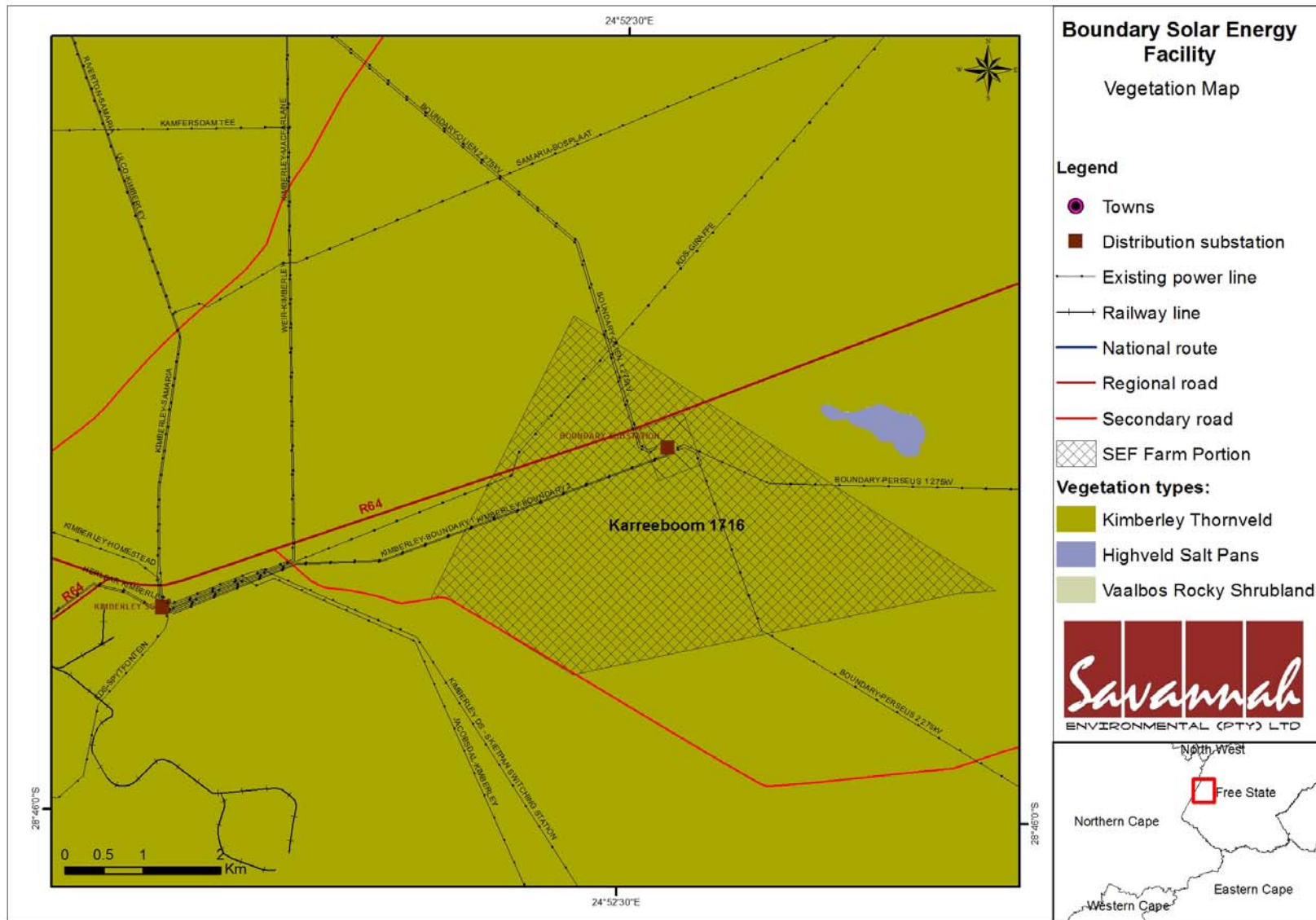


Figure 5.2: Map of the vegetation types as defined by Mucina and Rutherford (2006) on and around the proposed project area.

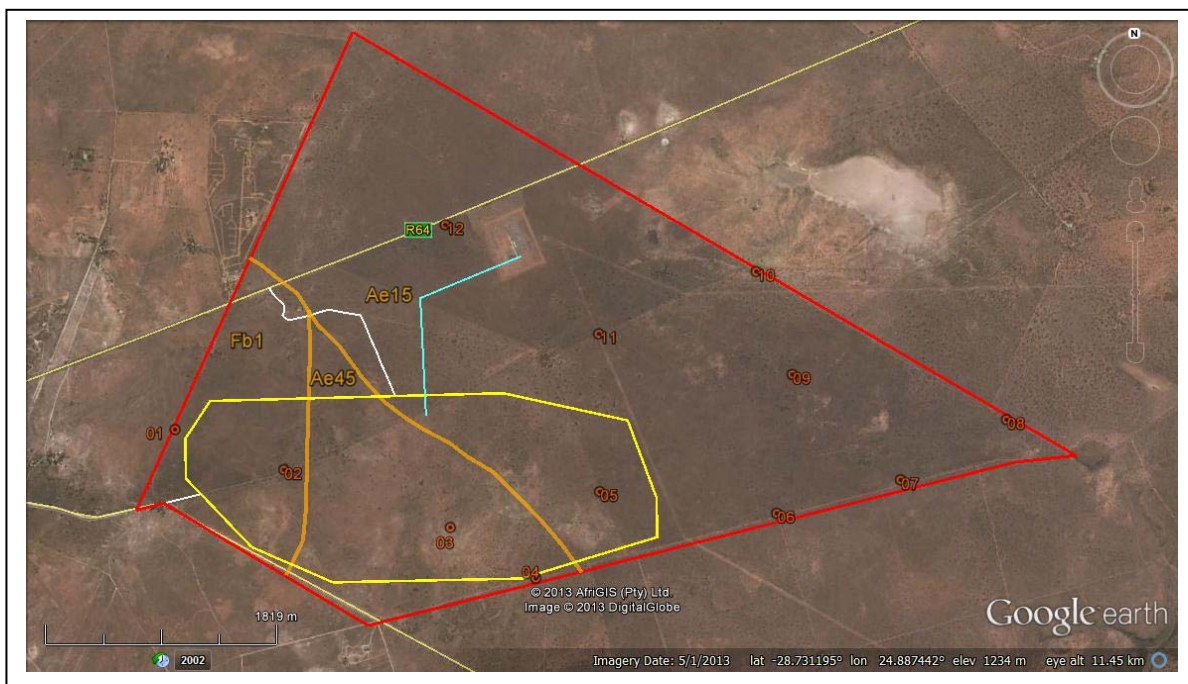


Figure 5.3: The distribution of the land types across the proposed site

5.12 Water Resources

The northern and eastern section of the farm is covered with deeper loamy sands, which are gradually replaced by calcrete plains and depressions overlain with very shallow more loamy soils.

One small pan could be located close to the southern periphery of the study area, but no drainage lines exist, indicating only below-surface seepage over bedrock after large enough occasional precipitation events.

5.13 Heritage Resources

Field survey observations

Engravings: The scoping phase prediction of engravings potentially being found in the event of dolerite koppies or exposures occurring could be discounted, as no such hills or exposures were noted.

Colonial era: Nineteenth- and twentieth-century cultural history remains were found in the form of low densities of mainly rusted metal items and bottle glass alongside the former public road running west to east across the study area. More substantially and of much greater historical significance were remains of what is believed to be the OFS Custom House (Figure 5.4).

Stone Age: It had been predicted, on the basis of observations in the surrounding area, that the terrain selected for the proposed Boundary Solar Energy Facility

was likely to include traces of Stone Age utilisation of the landscape, with palimpsests of material spanning Pleistocene and Holocene times.

The current (ruined) structures are of second half of twentieth century date, the associated midden material including recent glass, metal and plastic contents including ointment jars and bottle screw-tops. It is possible that an earlier generation of farming infrastructure once existed here. These structures may have served as dwellings for farm labourers. The structures and associated artefacts in a nearby midden suggest a second half of twentieth century occupation prior to abandonment. No graves were found during the survey.

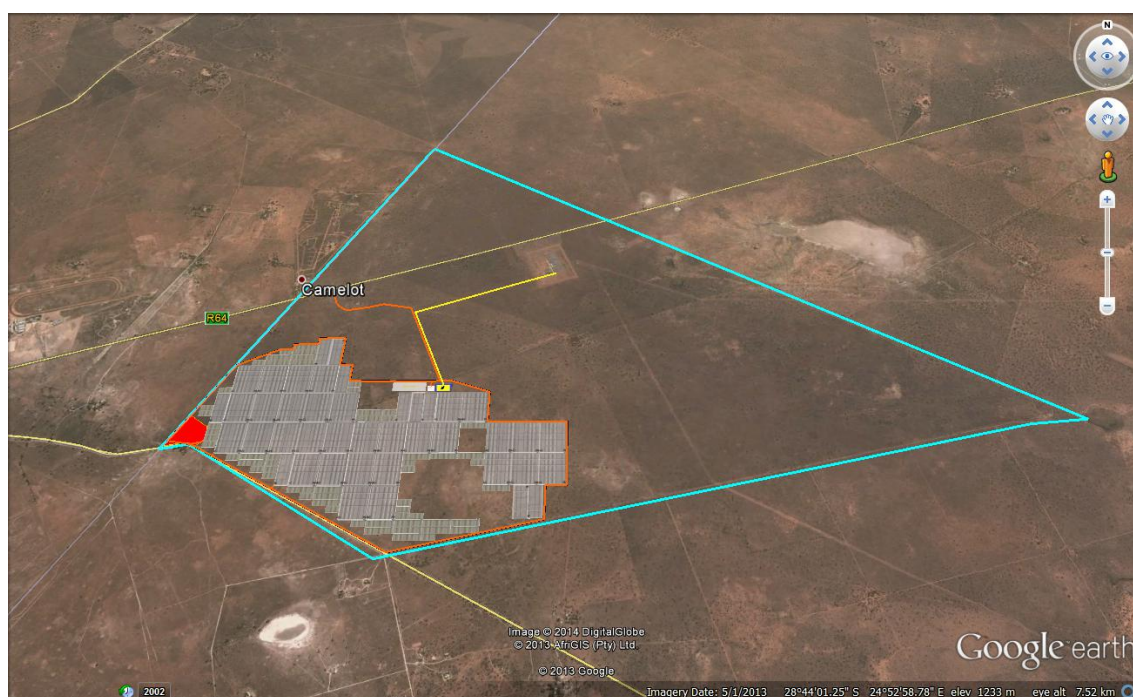


Figure 5.4. Heritage No go area (red), project boundary (blue), access roads (orange), overhead power line (yellow)

GPS point 300 (Figure 5.4) is a limestone-walled feature, possibly a small kraal, while the line of features numbered 302, 303 and 304 are clear rectangular building foundations most likely representing the actual custom post. Points 299, 301 and 305-6 are traces of middens, the most substantial of which is at 306. These places constitute a sensitive heritage feature which should not be disturbed by the development. The red area in Figure 5.4 should be regarded as sensitive – including the gum trees outside of the property which probably date from the time of the Custom House.

5.14 Palaeontology

'Paleontological' means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

The geology of the region has been described by Bosch (1993). The area in question is underlain by sediments of widely different geological ages. From oldest to youngest, the geology in and around the affected area is made up of Permian Ecca shales (Tierberg Formation., *Pt*), Jurassic dolerite intrusions (*Jd*, Karoo Dolerite Suite), Quaternary calcretes, surface limestones, calcified pandunes (*Qc*) and aeolian sands (*Qs*) (Kalahari Group). The wind-blown sands represent the latest geological phase and are made up of the characteristically red-brown Kalahari sands (Hutton sands). Common intrusive features like springhare hollows and aardvark dugouts were investigated for tell-tale signs of excavated palaeontological material. Pedestrian survey indicates that the photovoltaic panels, associated buildings and access roads will be constructed on Quaternary-aged residual soils largely represented by calcrete-rich aeolian sand (red-brown Kalahari sands, *Qs*). There is no indication for the accumulation and preservation of intact fossil material within the Quaternary sediments (unconsolidated topsoils). Impact on Quaternary sediments within the footprint will be extensive, but impact on potential in situ Quaternary fossils, within the confines of the affected area is considered unlikely.

5.15 Visual Quality of the Study Area

The character of the landscape is defined as open, undulating, sparsely populated land, extensively agricultural. Vertical elements in the immediate landscape are some individual trees, lines of power line towers across the site and telegraph poles. There are no formally protected areas in the immediate vicinity. A landscape may be valued for many reasons, which may include landscape quality, scenic quality, tranquillity, wilderness value, or consensus about its importance either nationally or locally, and other conservation interests and cultural associations. This site landscape has a commercial value for its use for agriculture; the site has no identifiable sense of place, it merges with adjacent lands.

The visual signposts to signal the exact location of the application site are not very evident but derive from R64 running through the site and the substation. The site would be held in view by users of the R64, and by users of other local roads as shown on Figure 5.4. People living in farmsteads locally may become visually aware of the development. The landscape character of the site, and surrounds, is open grassland with few centres of habitation, an Eskom substation

and power line infrastructure, and gravel roads. Views are long and open to all compass points. The simplicity of the forms and the long open views in the agricultural areas bring visual clarity to the landscape. But as Kimberley is approached the landscape character becomes more peri-urban and more cluttered. The character changes again to industrial 3km south of the site in the open-cast mining area, inducing more visual clutter.



Figure 5.4: A view over the application site from R64 almost 3km away from the site boundary

5.16 Socio-Economic Environment

Administrative and Social profile

Lejweleputswa District Municipality

The Lejweleputswa District Municipality (LDM) is located in the north western part of the Free State and is one of five district municipalities in the Free State. The district covers an area of 31686 km² and is made up of 5 local municipalities, of which the Tokologo Local Municipality which covers the study area is one).

According to the FSPGDS (2006-14), Lejweleputswa DM is the major contributor in the Free State Gross Geographic Product (GGP) and is also an important agricultural area. The district is predominantly known as the Free State Goldfields which forms a part of the larger Witwatersrand basin. The economy of the region is dominated by the gold mining industry and agriculture sectors in particular maize production.

Tokologo Local Municipality (TLM)

The TLM covers an area of 9 326 km² and is located in the western part of the Free State Province within Lejweleputswa District Municipality (LDM). The TLM consists of three former Transitional Local Councils, namely Boshof, Dealesville and Hertzogville, as well as a portion of a former Transitional Rural Council (Moddervaal) which contained approximately 1480 farms.

Boshof is the administrative seat of the TLM and is located approximately 124km west of Bloemfontein and 53km east of Kimberley, along the R64 (old Bloemfontein/Kimberley Road). The majority of the commercial and industrial

activities in the TLM are based in Boshof. The associated townships of Kareehof and Seretse are predominantly dormitory towns dominated by low income households with limited economic activities, save for corner shops and informal traders.

Population: Socio-economic data from Census 2011 indicates that the population in the TLM decreased marginally from 32 455 in 2001 to 28 986 in 2011. The dependency ratio improved from 62.4% to 58.9%.

Employment and Level of education: In terms of employment, unemployment increased from 26.8% in 2001 to 27.5% in 2011. The main contributor was the increase in youth unemployment from 33.1% to 35.8%. In terms of employment, there was improvement in the education levels, with the number of people with no schooling decreasing from 31.5% to 20.8%. This does, however, still represent a high level of people over the age of 20 with no schooling. While the percentage of the population over the age of 20 with matric also increased from 12% in 2001 to 17.8% in 2011, this is still well below the provincial average of 26.7%. Education levels in the TLM are therefore low. This can be attributed to the rural nature of the area.

Municipal basic service: The level of services provided by government also improved, with households supplied with flush toilets linked to sewage increasing from 13.9% to 18.5%, households with piped water within the house increasing from 19% to 22.7% and households provided with electricity growing from 73.1% to 84.2%. It is therefore reasonable to say that the quality of life of the residents of the TLM has improved since 2001. However, having said this, the services levels in the TLM are substantially lower than those for the Free State Province as a whole. The percentages for flush toilets, piped water and household with electricity for the Free State Province as a whole in 2011 were 64.9%, 44.8% and 89.9% respectively. The level of household services in the TLM is therefore low.

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

The table 5.1 below provides a summary of the environmental and social characteristics of Boundary Solar Energy Site located on the farm Karreeboom 1716.

Table 5.1: Summary of the Environmental and Social characteristics of the site earmarked for the Boundary Solar Energy Facility farm Karreeboom 1716.

Environmental Characteristics	Boundary Solar Energy Facility and associated infrastructure
1. Land Use	» Grazing land (livestock)
2. Land Capability	» There is no cultivation or irrigation, or any evidence of past cultivation on

Environmental Characteristics	Boundary Solar Energy Facility and associated infrastructure
	the site. The grazing capacity on most of the site is classified as between 14 and 17 hectares per large stock unit, but a portion in the east is classified higher (between 11 and 13 hectares per large stock unit).
3. Climate	» Semi-arid
4. Topography	» Slopes from the east at about 1260m above sea level (asl), down to the west at 1215 to 1220m asl and appears to be gently undulating. 'Olifantsrug' (1280m asl) is the he highest point locally, and lies to the immediate east of the site.
5. Hydrology, Riparian Zones and Watercourses	» One small pan could be located close to the southern periphery of the study area, but no drainage lines exist
6. Land Types	» Ae15 occupies the majority of the site » Ae45 and Fb1 occurring only on a smaller portion of the site of the western margin of the site
7. Agricultural Potential	» Low agricultural potential » The natural grazing capacity is lower in general
8. Vegetation types	» Kimberley Thornveld (regarded as Least Threatened)
10 Heritage and Palaeontology	» Heritage materials from Colonial frontier, stone age are notable feature on site and in the larger surrounding area , the historical were remains of the OFS Custom House is on site » Quaternary-aged residual soils largely represented by calcrete-rich aeolian sand (red-brown Kalahari sands, Qs).
11 Social Characteristics	» Dominant extensive agricultural sector, » Potential for growth in tourism, but no strong growth in this sector at present. » Low levels of education and skills, low incomes with high dependency on social grants » High levels of unemployment (relative to national levels), out-migration of youth for employment elsewhere » Good roads networks with a lack of public transport in rural areas, » HIV/AIDS and alcohol abuse are key health concerns » Petty crime linked to alcohol and substance abuse is prevalent

ASSESSMENT OF POTENTIAL IMPACTS

CHAPTER 6

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed Boundary Solar Energy Facility (refer to **Figure 6.1**). This assessment has considered the construction of a 75 MW facility and all related and ancillary infrastructure, including:

- » Solar panels (fixed/tracking technology) with an export capacity of up to 75MW.
- » Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, alternatively making use of ground screws to support the PV panels.
- » Cabling between the structures, to be lain underground where practical.
- » Central inverter/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- » An on-site substation (120m x 70m) and overhead power line (1700m) to facilitate the connection between the solar energy facility and the existing Boundary Substation located on the site (Farm Karreeboom 1716)
- » Internal access roads (5m wide roads).
- » Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (\pm 200m x 150m))

The proposed Boundary Solar Energy Facility will have a development footprint of approximately 260 ha.

The development of the Boundary Solar Energy Facility will comprise the following phases:

- » *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access road, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; and undertaking site rehabilitation and establishment and implementation of a storm water management plan. The construction phase for the Boundary Solar Energy Facility is expected to take approximately 16 months.
- » *Operation* – will include operation and maintenance of the facility and the generation of electricity. The operational phase is expected to extend for 20 - 25 years.
- » *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the

components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

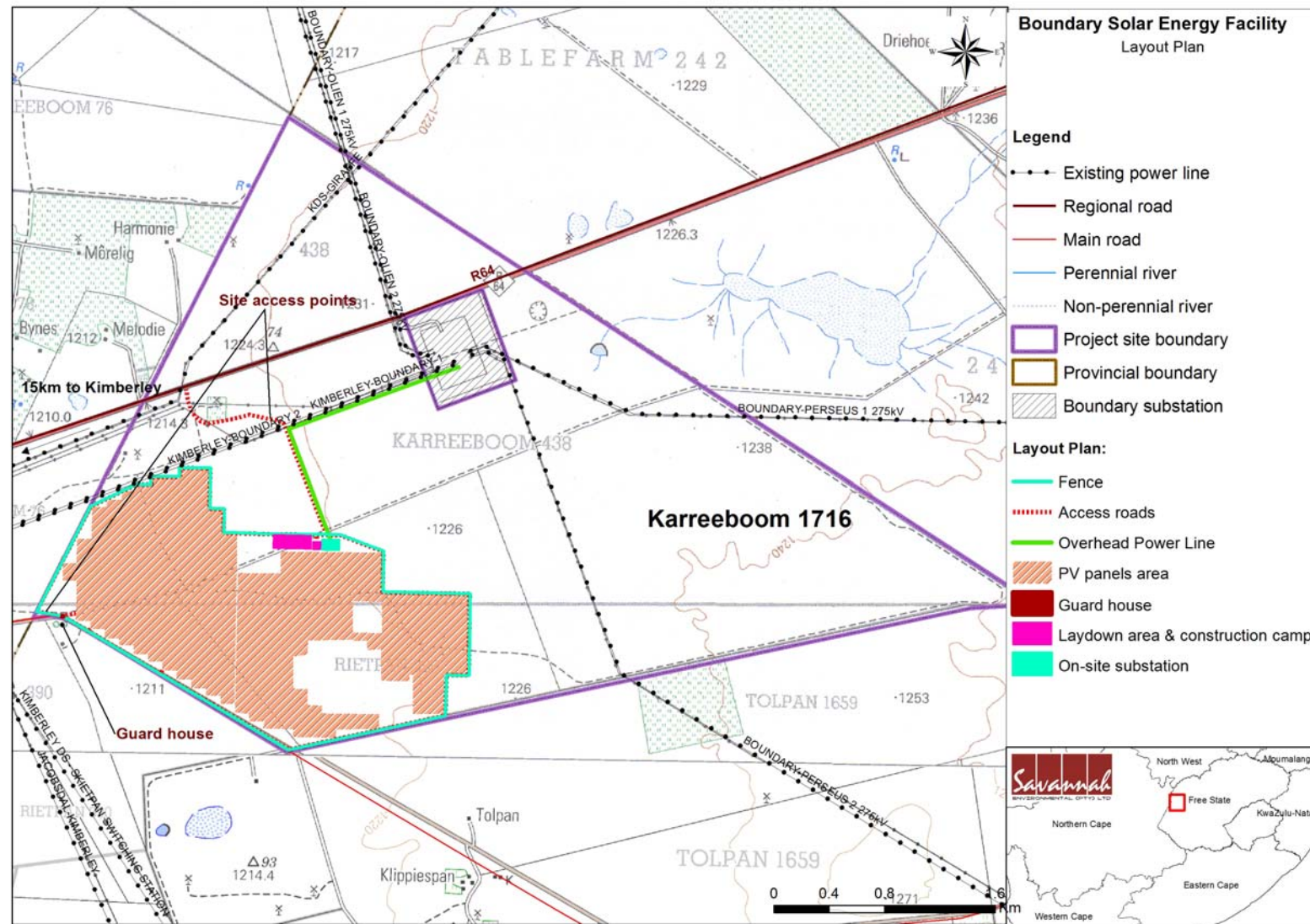


Figure 6.1: Layout map showing Boundary Solar Energy Facility and associated infrastructure on the farm Karreeboom 1716

6.1. Alternatives Assessment

Technology Alternatives

Impacts on the environment associated with the project will be influenced by the type of PV panel array to be used. PV technologies being considered for the proposed project are fixed and tracking. The most important differences which relate to the ecological environment (Tsoutsos *et al.* 2005, Turney and Fthenakis 2011, Strohbach 2012) are summarised in the table below:

Aspect influenced	Fixed panel	Tracking panel
Size of land needed	Smaller (~260ha)	Larger (~260ha)
Shading and associated change of vegetation	More continuous and intense shading. Less stable and dense vegetation expected, reduced buffering capacity of extreme weather events by vegetation expected	More variable and less intense overall shading. More stable and denser vegetation cover expected, smaller reduction of buffering capacity of extreme weather events expected
Effect on runoff and accelerated erosion	Larger continuous panel area, more concentrated runoff, constant runoff edges potentially create more erosion, especially where vegetation is weakened	Smaller continuous panel areas, runoff more dissipated, moderate variation of runoff edges that are expected to create less erosion where vegetation is weakened
Mounting height of panel	PV panels may be as low as 50 cm above ground to allow for higher panels, increasing the limits of permissible vegetation due to maintenance and fire risks	Expected to be more than 1 m off the ground, increasing the possibility of low vegetation establishment and small fauna movement without compromising safety
Height of top of panel	3.5m	3.5-4m

Each of the impacts assessed below provides a comparative assessment of the two technology alternative.

6.2. Methodology for the Assessment of Potentially Significant Impacts

The sections which follow provide a summary of the findings of the assessment of potential impacts associated with the construction and operation of the proposed Boundary Solar Energy Facility on a development footprint of ~260ha on the identified site farm Karreeboom 1716 (covering an area of 1626 ha in extent). The assessment of potential issues presented in this chapter has involved key input

from specialist consultants, the public and the project developer. Issues were assessed in terms of the criteria detailed in Chapter 4 (section 4.3.3). 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. Cumulative impacts are assessed in further detail in Chapter 7.

6.2.1 Potential Impacts on Ecology

The study area is situated in the Savanna biome, Eastern Kalahari Bushveld. The vegetation unit covering the study area is Kimberley Thornveld. Vegetation overall is considered as of least conservation concern, but within the larger vegetation type more sensitive vegetation associations, habitats and species of conservation concern have been found to be present. Areas with deeper sandy soils have a higher density of protected and other large tree species – these can be considered as keystone plants due to their importance to the continued persistence of other fauna and flora and their influence on ecosystem function. One small pan could be detected in the study area, which must be excluded from the development footprint. A buffer of 50 m around this pan is recommended. The ecological sensitivity of the site is mapped in Figure 6.2.

Several protected geophytic species occur within the study area – smaller patches of very dense populations should be excluded from the development footprint. During a detailed vegetation survey of the study area, three vegetation associations could be identified as follows:

- » Association 1: *Pentzia* species – *Trichodiadema pomeridianum* dwarf shrublands in slight isolated depressions with very fine-textured, shallow soils.
 - » Conservation status: Medium
 - » Sensitivity: **Medium – low** (High: Isolated patches with a very high density of *Nerine* and *Ammocharis* species. Pan: No-Go Area)
- » Association 2: *Acacia tortilis* – *Schmidtia pappophoroides* sparse woodlands are found on deeper sandy soils. The deeper the soils, the denser and larger the grasses and trees present, with an associated increase in grazing capacity and the presence of the two nationally protected species within the study area: *Acacia erioloba* (Camel Thorn) and *Harpagophytum procumbens* (Devil's Thorn).
 - » Conservation status: Medium
 - » Sensitivity: **Medium - High** (Sensitivity is highest on the eastern side where soils are deeper and support larger trees.)
- » Association 3: *Chrysocoma ciliata* – *Eragrostis lehmanniana* dwarf shrublands are found on shallow to very shallow loamy sands overlying calcretes.
 - » Conservation status: Medium
 - » Sensitivity: **Low**

Of the three vegetation associations within the study area, all can potentially be used for the development. However, within the associations are smaller areas with a significantly higher density of species of conservation concern, which should be avoided as much as possible to reduce the impact of the development on the larger ecosystem.

Solar energy facilities require relatively large areas of land for placement of infrastructure. The proposed Boundary Solar Energy Facility and associated infrastructure requires ~260ha for the establishment of the proposed panels and associated infrastructure. The main expected negative impact from an ecological perspective will be due to loss of vegetation, loss of species of conservation concern, and loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E - Ecology Report** for more details).

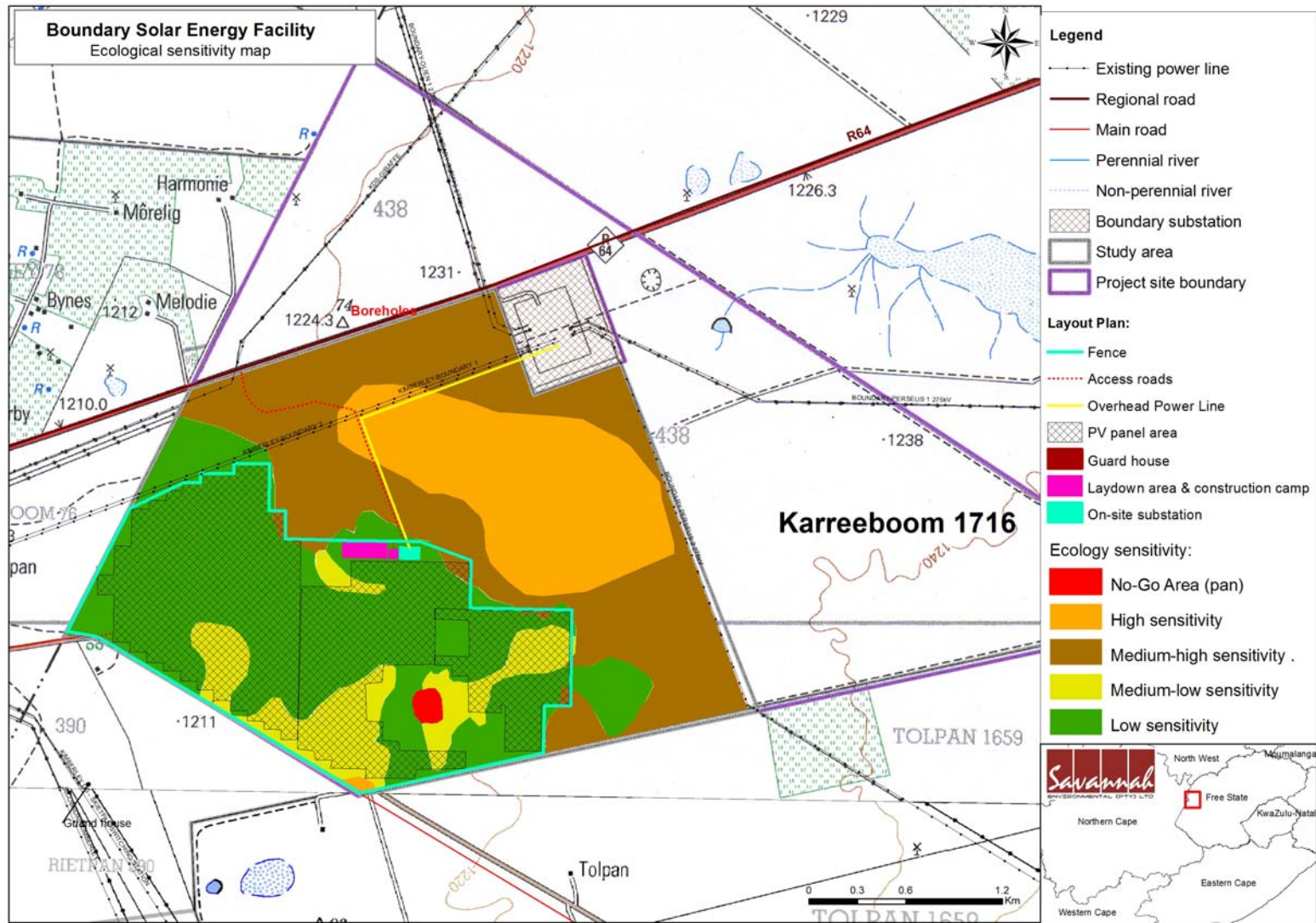


Figure 6.2: Sensitivity map indicating sensitive ecological areas within the proposed Boundary Solar Energy Facility

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

<p>Nature: Upgrading and/or creation of site access and internal maintenance roads</p> <p>Loss of vegetation, increase in runoff and erosion, possible disturbance and increased establishment of alien invasive species, possible disturbance and reduction of habitat or injury to burrowing vertebrates, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of revegetation potential of soil surface, increase in dust levels as a result.</p> <p><i>Note: relatively large access roads already exist on the land portion, as well as provide access to the farm Karreeboom 1716</i></p>		
<p>Listed activities: GN 544 18 June 2010 activity 22 (ii) GN 546, 18 June 2010 activity 14(i)</p>		
	Without mitigation	With mitigation
Extent (E)	Local (2)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Low (4)	Minor (2)
Probability (P)	Definite (5)	Definite (5)
Significance (S = E+D+M)*P	Medium (50)	Medium (35)
Status (positive, neutral or negative)	Negative	Negative Notes: reduced impact on existing roads and tracks
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably well	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Avoid as much as possible of the eastern tree-rich sections of the study area by optimising the less sensitive western areas » Design the access route to go as far as possible along existing tracks » After the final layout has been approved, conduct a thorough footprint investigation to detect any protected plant species and animal burrows <ul style="list-style-type: none"> * Map (by GPS) as far as possible <i>larger</i> concentrations of large trees and protected species that could be avoided or must be relocated * Protected plant species: must be relocated * Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor 		

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

Cumulative impacts:

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

Residual impacts:

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

Nature: Fencing area – may also serve as fire-break and assumed to run alongside maintenance track

Loss of vegetation and specifically protected or red data species, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping and sheet erosion, increased runoff and storm water volumes, temporary disturbance of burrowing fauna, possible reduction of habitat and forage availability to

terrestrial vertebrates and livestock.		
Listed activities: none GN 546, 18 June 2010 activity 14(i)		
	Without mitigation	With mitigation
Extent (E)	Local (2)	Local (1)
Duration (D)	Long-term (4)	Long term (4)
Magnitude (M)	Low (4)	Minor (2)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M) *P	Medium (50)	Low (28)
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably well	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Avoid all vegetation around natural pans and limit cutting of large trees where possible » After the final layout has been approved, conduct a thorough footprint investigation to detect any protected plant species and animal burrows <ul style="list-style-type: none"> * Map (by GPS) as far as possible <i>larger</i> concentrations of large trees and protected species that could be avoided or must be relocated * Protected plant species: must be relocated * Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor » During the design phase, the possible impact of burrowing vertebrates and rodents on the development must be determined, and fencing must be designed to either exclude such fauna if it will be detrimental or enable occasional migration of smaller vertebrates onto and across the site (which could be beneficial to small vertebrate populations) » Minimise area affected, especially during construction » During construction: strictly prohibit any off-road driving or parking of vehicles and machinery outside the footprint areas » Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind » Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before flowers or other regenerative material can be produced » If the area will be used as fire-break as well, maintain a suitably low grass layer by regular mowing or appropriate plant species selection, but do not leave soil bare. Alternatively, ensure that the soil has a covering of gravel or small rock that prevents erosion. 		
Cumulative impacts:		

- » Possible erosion of cleared areas and associated accelerated erosion from surrounding areas
- » Possible loss of ecosystem functioning due to increase in invasive species
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region

Residual impacts:

- » Altered vegetation composition
- » Compacted topsoil
- » Possibility for erosion and invasion by alien invasive

Nature: Construction and operation of PV panels on natural vegetation within development footprint (**tracking panel option**)

Removal of or excessive damage to existing vegetation cover (approx. 3ha per MW), , Loss of vegetation and/or species of conservation concern, loss of and alteration of many niche microhabitats, altered vegetation cover, site-specific altered distribution of rainfall and resultant runoff patterns, increase in runoff from PV panels and/or bare areas and accelerated erosion, loss of habitat and resource availability for terrestrial fauna, possible increase of storm water and dust effects during periods of extreme weather events, e.g. increased erosion or dust due to lower buffering capacity of sparser vegetation

Listed activities:

GN 545, 18 June 2010 activity 1 & 15
GN 546, 18 June 2010 activity 14(i).

	Without mitigation	With mitigation
Extent (E)	Regional(3)	Local (2)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	High (8)	Moderate (6)
Probability (P)	Definite (5)	Definite (5)
Significance (S = E+D+M)*P	High (75)	Medium (60)
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Moderate Probability
Can impacts be mitigated?	Reasonably but with limited full restoration potential	

Mitigation:

- » Avoid all vegetation around natural pans, and maintain a buffer of at least 50 m.
- » Avoid as much as possible of the eastern tree-rich sections of the study area by optimising the less sensitive western areas.

- » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by ECO/construction staff to identify the relevant species and take the following actions:
 - Protected plant species: must be relocated.
 - Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
- » Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area.
- » Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr.
 - Shred all trees and shrubs cleared and used the chips as mulch for dust and erosion control.
 - Use only species that were part of the original indigenous species composition as listed in the specialist report.
- » Use excavated materials to fill up and close old excavation pits.
- » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr.
 - It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally.
 - The higher level of shading anticipated from the PV panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if a desirable vegetation cover fails to establish within 24 months after construction.
- » Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, e.g. *Rhigozum trichotomum*, *Lycium* and *Phaeoptilum* species.
- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning.
- » If filling material is to be used, this should be sourced from areas free of invasive species.
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil.
- » Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan.
- » Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro topography and revegetation efforts accordingly.
- » The rehabilitation plan for all affected areas after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover.
- » Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind.

Cumulative impacts:

- » If mitigation measures are not strictly implemented the following could occur:
 - Considerable loss of biodiversity and keystone trees.
 - Erosion of areas around the panels and continued erosion of the development area.
 - Spread and establishment of invasive species.
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region.
- » Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns that may affect lower-lying ecosystems.

Residual impacts:

- » Altered topsoil characteristics;
- » Loss of and alteration of microhabitats;
- » Altered vegetation composition, lower vegetative cover and loss of species diversity;
- » Increased habitat fragmentation and displacement of terrestrial vertebrates; and
- » Higher risk of invasion by alien plant species.

Nature: Construction and operation of PV panels on natural vegetation within development footprint (**fixed panel option**).

Loss of vegetation and/or species of conservation concern, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from PV panels and higher volumes of storm water and accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased erosion or dust due to lower buffering capacity of sparser vegetation. Ecological impacts are greater.

Listed activities:

GN 545, 18 June 2010 activity 1 & 15
GN 546, 18 June 2010 activity 14(i).

	Without mitigation	With mitigation
Extent (E)	Regional (3)	Local (2)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	High (9)	High (8)
Probability (P)	Definite (5)	Definite (5)
Significance (S = E+D+M) * P	High (80)	High (70)
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Medium Probability

<p>Can impacts be mitigated?</p>	<p>Reasonably but with limited full restoration potential</p>	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Avoid all vegetation around natural pans, aim to maintain a buffer of about 50 m around the pan. » Avoid as much as possible of the eastern tree-rich sections of the study area by optimising the less sensitive western areas. » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by ECO/construction staff to identify the relevant species and take the following actions: <ul style="list-style-type: none"> o Protected plant species: must be relocated. o Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor. » Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area. » Clear as little vegetation as possible, aim to maintain all indigenous vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr. <ul style="list-style-type: none"> o Shred all trees and shrubs cleared and used the chips for dust and erosion control. o use only species that were part of the original indigenous species composition as listed in the specialist report. » Use excavated materials to fill up and close old excavation pits » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr <ul style="list-style-type: none"> o Revegetation should occur naturally where topsoils were not severely altered. o The higher level of shading anticipated from fixed panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if vegetation fails to establish sufficiently. o Alternatively, soil surfaces where no revegetation seems possible will have to be covered with gravel or small rock fragments to increase porosity of the soil surface, slow down runoff and prevent wind- and water erosion. » Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, e.g. <i>Rhigozum trichotomum</i>, <i>Lycium</i> and <i>Phaeoptilum</i> species. » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning. » If filling material is to be used, this should be sourced from areas free of invasive species. » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil. » Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan. 		

- » Monitor the area below and around the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro-topography and revegetation efforts accordingly.
 - Due to the fixed nature and larger runoff surfaces of the PV panels, the development area should be adequately landscaped and rehabilitated to contain expected accelerated erosion.
 - Runoff may have to be specifically channelled or storm water adequately controlled to prevent localised rill and gully erosion.
- » Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind.
- » The rehabilitation plan for all affected areas after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover.

Cumulative impacts:

- » If mitigation measures are not strictly implemented the following could occur:
 - Considerable loss of biodiversity and keystone trees;
 - Possible accelerated erosion of areas around the panels and continued erosion of the development area ; and
 - possible spread and establishment of invasive species.
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region.
- » Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns.

Residual impacts:

- » Altered topsoil characteristics;
- » Loss of and alteration of microhabitats;
- » Altered vegetation composition, lower vegetative cover and loss of species diversity;
- » Potential for increased dust and its impact on surrounding environments and biodiversity; and
- » Higher risk of invasion by alien plant species.

Nature: Construction of a power line as part of the grid connection to Boundary Substation (~1700m)

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

Listed activities:

GN 544, 18 June 2010 activity 10(i), 11(ii) & 18(1);
GN 546, 18 June 2010 activity 14(i).

	Without mitigation	With mitigation
Extent (E)	Local (2)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Minor (2)	Small (0)

Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	Medium (40)	Low (20)
Status (positive, neutral or negative)	Negative	Slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Aim to minimise the destruction of indigenous large trees. » After the final layout has been approved, conduct a thorough footprint investigation to locate any protected plant species and animal burrows: <ul style="list-style-type: none"> o Map (by GPS) as far as possible <i>larger</i> concentrations of large trees and protected species that could be avoided or must be relocated; o Protected plant species: must be relocated; and o Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor. » During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas: <ul style="list-style-type: none"> o For construction and maintenance access create jeep tracks only as far as is feasible. » Limit clearing of indigenous vegetation to pylon positions only. » Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution. » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed. 		
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> » Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna.) 		
<p>Residual impacts:</p> <ul style="list-style-type: none"> » Localised alteration of soil surface characteristics; and » Localised loss of flora and displacement of fauna. 		

Nature: Construction of substation and other associated infrastructure and buildings.

Loss of vegetation and/or species of conservation concern, loss of microhabitats, reduced vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna .

Listed activities: GN 545, 18 June 2010 activity 1 GN 546, 18 June 2010 activity 14(i)		
	Without mitigation	With mitigation
Extent (E)	Local (2)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Moderate (6)	Low (3)
Probability (P)	Definite (5)	Definite (5)
Significance (S = E+D+M) *P	Medium (60)	Medium (40)
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Avoid as much as possible of the eastern tree-rich sections of the study area by optimising the less sensitive western areas » During the design phase, ensure that a buffer of at least 50 m, preferably more, is maintained around pans » Aim to minimise the destruction of indigenous large shrubs and trees <ul style="list-style-type: none"> o Shred all trees and shrubs cleared and used the chips for dust and erosion control » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by ECO/construction staff to identify the relevant species and take the following actions: <ul style="list-style-type: none"> o Protected plant species: must be relocated o Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor » Limit disturbance to footprint area as far as practically possible » During construction: stay within demarcated footprint areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas » Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil » Temporarily stored topsoil must be re-applied within 6 months, topsoil stored for longer need to be managed according to a detailed topsoil management plan 		

- » Rehabilitate and revegetate all areas outside footprint area that have been disturbed
- » After decommissioning remove all foreign material prior to starting the rehabilitation
- » The rehabilitation plan for all temporarily affected areas and for the development area after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

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

Residual impacts:

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

Nature: Temporary construction camps and laydown sites where machinery and material is kept during construction.

Loss of vegetation and/or species of conservation concern, alteration and loss of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed or compacted surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible contaminated topsoil, possible contaminated ground water or wetlands, possible increased dust levels

Listed activities:

GN 546, 18 June 2010 activity 14(i).

	Without mitigation	With mitigation
Extent (E)	Local (2)	Local (1)
Duration (D)	Moderate-term (3)	Short-term (2)
Magnitude (M)	Moderate (6)	Low (3)
Probability (P)	Definite (5)	Definite (5)
Significance (S = E+D+M)*P	Medium (55)	Medium (30)

Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Avoid all vegetation around natural pans » During the design phase, ensure that a buffer of at least 50 m, preferably more, is maintained around pans » Avoid as the eastern tree-rich sections of the study area » Aim to minimise the destruction of indigenous large shrubs, no indigenous trees with a stem diameter over 15 cm should be removed for temporary construction camps <ul style="list-style-type: none"> o Shred all trees and shrubs cleared and used the chips for dust and erosion control » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by ECO/construction staff to identify the relevant species and take the following actions: <ul style="list-style-type: none"> o Protected plant species: must be relocated o Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor » Place infrastructure as far as possible on sites that have been disturbed by past farming activities already » Stay within demarcated temporary construction areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas » Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately, strictly prohibit any pollution/littering according to the relevant EMPr » No fires may be lit for cooking or any other purposes » Facilities may not be used as staff accommodation » No vehicles may be washed, serviced or repaired on the property » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil » Temporarily stored topsoil must be re-applied within 6 months, topsoil stored for longer need to be managed according to a detailed topsoil management plan » After construction remove all foreign material prior to starting the rehabilitation » The rehabilitation plan for all temporarily affected areas must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed 		

Cumulative impacts:

- » If mitigation measures are not strictly implemented the following could occur:
 - Considerable loss of biodiversity and keystone trees
 - Erosion of the development area
 - Contamination of ground water
 - Spread and establishment of invasive species
 - Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns

Residual impacts:

- » Altered topsoil characteristics
- » Loss of and alteration of microhabitats
- » Altered vegetation composition
- » Higher risk of invasion by alien plant species
- » Potential for increased dust and its impact on surrounding environments and biodiversity

Nature: Borrow-pits and/or topsoil stockpiles that may be required during or after construction.

Loss of vegetation and/or species of conservation concern, loss of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, possibly higher accelerated erosion, possible loss of topsoil resources, reduction of habitat and resource availability for terrestrial fauna, possible source of dust as a result.

Listed activities: n/a

	Without mitigation	With mitigation
Extent (E)	Local (2)	Local (1)
Duration (D)	Long-term (4)	Short-term (2)
Magnitude (M)	Moderate (6)	Low (4)
Probability (P)	Highly Probable (4)	Probable (3)
Significance (S = E+D+M)*P	Medium (48)	Low (21)
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- » Avoid all vegetation around natural pans, maintaining a minimum buffer of 50 m
- » Avoid the eastern tree-rich sections of the study area

- » After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
 - * Protected plant species: must be relocated
 - * Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- » Aim to remain on previously transformed or disturbed sites
 - o Shred all shrubs cleared and used the chips for dust and erosion control
- » Stay within demarcated areas and access routes for extraction and/or movement of materials
- » Strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
- » Prevent spillage of pollutants, contain and treat any spillages immediately, strictly prohibit any pollution
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil, manage stored topsoil according to a dedicated topsoil management plan
- » Temporarily stored topsoil must be re-applied within 6 months, topsoil stored for longer need to be managed according to a detailed topsoil management plan
- » Monitor erosion of areas and control where necessary
- » After construction remove all foreign material prior to starting the rehabilitation
- » Fill up borrow pits that may be created first with overburden or subsoils, covered with topsoil, following a detailed rehabilitation plan
- » The rehabilitation plan for all temporarily affected areas must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- » If mitigation measures are not strictly followed the following could occur:
 - o Continued erosion of the altered surfaces with associated degradation of the site and surrounding areas
 - o Spread and establishment of invasive species
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
- » Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns

Residual impacts:

- » Altered topsoil characteristics
- » Loss of and alteration of microhabitats
- » Altered vegetation composition, lower vegetative cover and loss of species diversity
- » Potential for increased dust and its impact on surrounding environments and biodiversity
- » Higher risk of invasion by alien plant species

<p>Nature: Transportation of materials to site, movement of vehicles on site during construction and maintenance</p> <p>Loss of vegetation, increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species that could further damage ecosystem functionality</p>		
<p>Listed activities: n/a</p>		
	Without mitigation	With mitigation
Extent (E)	Regional (4)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Low (4)	Small (0)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	Medium (60)	Low (20)
Status (positive, neutral or negative)	Negative	Neutral
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Avoid all natural pans, and a buffer of at least 50 m around such areas » Avoid as much as possible of the eastern tree-rich sections of the study area » Strictly restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed » Parking areas should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur » Wheels of large machinery should be checked prior to entering the site and cleared of seed material of alien invasive plants if transport routes go through infested areas (especially of species with spiny or bur-like seeds). Such seed must be destroyed. » Strict speed limits must be set and adhered to <ul style="list-style-type: none"> o Animals accidentally injured by moving vehicles or machinery must be taken to a local veterinarian to be treated or put down in a humane manner » Dust levels must be controlled and minimised » Driving between dusk and dawn should be permissible during emergency situations only » Prevent spillage of any fuels, oils or other chemicals, strictly prohibit other pollution » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to 		

prevent re-establishment
Cumulative impacts: <ul style="list-style-type: none">» Possible pollution of surrounding areas if no mitigation is implemented» Possible spread of alien invasive species beyond the site if no mitigation is implemented» Possible increased road collisions and road kill of fauna
Residual impacts: <ul style="list-style-type: none">» Related to access roads and internal maintenance tracks

b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

Tracking PV technology is ecologically a preferred technology alternative. Considering the aridity of the area and the difficulty of new vegetation establishment, the impact of tracking systems would seem less than that of a fixed panel array, even if the latter may occupy less space. This effect will become especially pronounced after decommissioning, when it is expected that seedbanks under a fixed panel system will have vanished and topsoil quality most likely will have deteriorated to such an extent due to absence of vegetation that re-establishment of vegetation will be very difficult. The difference in the potential impacts on ecology associated with the two technology alternatives. Therefore, **tracking PV technology** is nominated as the preferred alternative.

c) Implications for Project Implementation

- » Excluding all vegetation around natural pans and maintain a 50 m buffer around them in planning the development footprint. This will ensure that important ecosystem services of these areas can be maintained.
- » The proposed photovoltaic facility development on the site will create a localised reduction of species, including slow-growing indigenous trees and shrubs, geophytes and other species restricted to certain habitats. This effect is and will be further exacerbated by surrounding and regional developments.
- » Potentially significant negative impacts on the ecological environment could be soil- and associated degradation on and beyond the development area, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction. With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of these impacts can be significantly reduced.
- » The impact on fauna is expected to be small for the development. Presence of indigenous terrestrial vertebrates within the study area is relatively low due to absence of permanent surface water and current surrounding housing developments and mining areas. Animals that may be permanently present can be relocated or will move away during construction, and may resettle after

construction, depending on safety specifications necessitated by the development. No restricted or specific habitat of vertebrates exists on the study area and will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas as recommended.

6.2.2 Potential Impacts on Avifauna

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

Considering the layout proposed for the Boundary Solar Energy Facility development (refer to Figure 6.2) together with the associated available bird and habitat data, no highly sensitive species or processes (e.g. raptor breeding sites) should be severely impacted by the proposed development. However, it is strongly suggested that buffer areas be considered for:

- » A small ephemeral pan located on site , a 250 m buffer around it is proposed; and
- » The White-browed Sparrow-weaver colonies located in or adjacent to the actual impact zone where the PV arrays will be constructed. A buffer zone of 100 m is proposed around each colony and removal of these colonies or the trees in which the colonies are located should be avoided, wherever possible. Further to this, the construction of the PV arrays should ideally be carried out in 'treeless' areas where vegetation sensitivities may be lower and where they fall outside of the sparrow-weaver buffers. It is likely that with the buffer zone in place the birds will habituate to development and operational activities of the facility.

The two alternative PV technologies do not differ in any significant way as far as avifaunal habitat which they will affect, or the interaction between birds and the infrastructure is concerned. Therefore, there is **no significant difference** in the potential impacts on avifauna associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

The proposed above-ground power line running from the PV facility to the Eskom Boundary Substation is relatively short and provided the power line marking mitigation measures are adhered to should not pose any severe threat to the avifauna that use this area as flight paths. The proposed road and fence infrastructure should have a low-medium impact on the general avifauna..

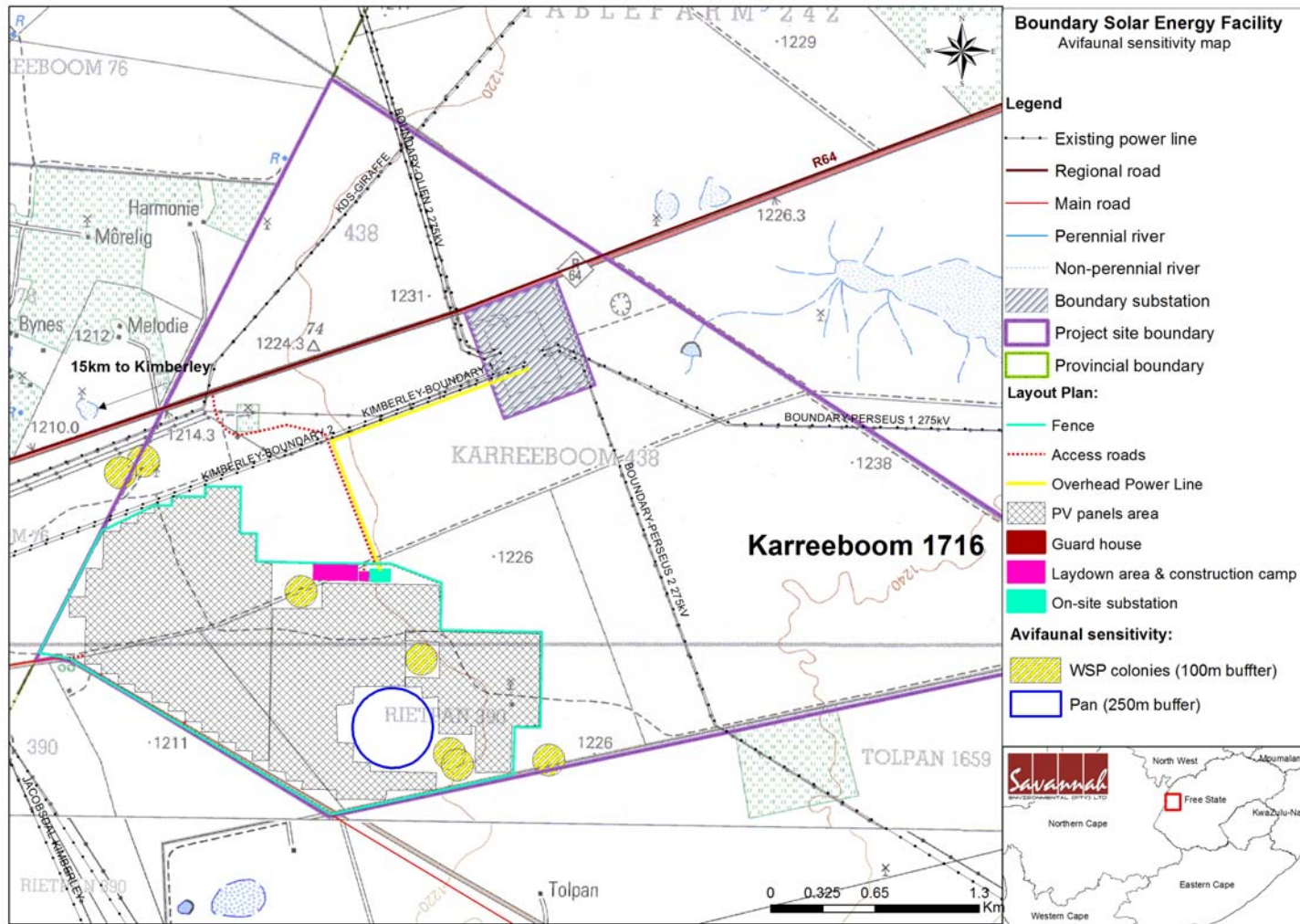


Figure 6.2: Avifaunal sensitive areas (i.e. 100m buffer around the WSP colonies and 250m buffer around a pan) within the proposed Boundary Solar Energy Facility

Nature: Habitat loss as a result of construction activities would result in a loss of avifaunal habitats		
Listed activities: GN 544 activity 10(i) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent:	Local (2)	Local (1)
Duration	Very short (1)	Very short (1)
Magnitude	Moderate (4)	Moderate (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	Low (28)	Low (24)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation <ul style="list-style-type: none"> » Restricting the construction footprint to the minimum, including keeping access roads to a minimum; » Avoiding construction in areas where large, well established trees are present and, where possible, trees that are occupied by White-browed Sparrow Weaver colonies. It is recommended that a 100 m buffer should be applied around trees that have active sparrow-weaver colonies. 		
Cumulative impacts Cumulative impacts are expected to be low-moderate considering the proposed development is in close proximity to similar development in the area and a large number of existing power lines and a substation that is present on the project site. The existing infrastructure has already impacted on the environment used by birds, and they would have adjusted to these changes to some extent. The project presents a consolidation of impacts in one area.		
Residual impacts For those habitats that will be lost/impacted the associated avifauna will need to find alternative habitats which will most likely be in areas adjacent to the project development area.		

Nature: Disturbance as a result of construction activities resulting in disturbance to bird communities		
Listed activities: GN 544 activity 10(i); & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent:	Local (2)	Local (1)
Duration	Very short (1)	Very short (1)

Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	Medium (36)	Medium (24)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation		
<ul style="list-style-type: none"> » Reducing and maintaining noise disturbance to a minimum particularly with regards to any drilling for foundations. Drilling should, wherever possible, be limited to periods outside of the breeding seasons of the resident avifaunal community and in particular for priority species. » Excluding development or disturbance from sensitive areas. 		
Cumulative impacts		
Cumulative impacts are expected to be low-moderate considering the proposed development is in close proximity to similar development in the area and a large number of existing power lines and a substation that is present on the project site. The existing infrastructure has already impacted on the environment used by birds, and they would have adjusted to these changes to some extent. The project presents a consolidation of impacts.		
Residual impacts		
No residual impacts are envisaged.		

Operational impacts

Nature: Disturbance and displacement as a result of operational activities through displacing birds caused by disturbance. There will be little maintenance activity on the site during operation.		
Listed activities: GN 544 activity 10(i); & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a) (i)		
	Without mitigation	With mitigation
Extent:	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	24 (Low)	15 (Low)
Status	Negative	Neutral
Reversibility	Low	Low
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation		
» Minimising the disturbance associated with the operation of the facility (e.g. vehicular		

<p>traffic), by scheduling maintenance activities to avoid and/or reduce disturbance in sensitive areas at sensitive times (e.g. breeding season).</p> <p>» Following the construction phase the extent of access roads within the facility should be kept to a minimum.</p>
<p>Cumulative impacts No major cumulative impacts are envisaged.</p>
<p>Residual impacts No residual impacts are envisaged.</p>

<p>Nature: Mortality as a result of operational activities through bird deaths from collision with the new overhead power line (1700m) associated with the Solar Energy Facility.</p>		
	Without mitigation	With mitigation
<p>Listed activities: GN 544 activity 10(i); & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)</p>		
Extent:	Regional (3)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (39)	Medium (30)
Status	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	
<p>Mitigation</p> <p>» Minimising the length of any new power lines installed, and ensuring that all new lines are marked with bird flight diverters along their entire length; and</p> <p>» It is imperative that all new power line infrastructures is adequately insulated and bird friendly when configured. This is particularly true for waterfowl and large terrestrial birds which may undertake large-scale diurnal and/or seasonal movements. At a local and regional scale these movements are poorly understood which makes it difficult to make informed decisions regarding placement and marking of power line infrastructure.</p>		
<p>Cumulative impacts In combination with other solar energy facilities and power lines across the project area, an additional barrier would be created for birds resulting in possible further displacement and or adjustment of flight paths for species that use the area as a flight corridor. The existing infrastructure has already impacted on the environment used by birds, and they would have adjusted to these changes to some extent. The project presents a consolidation of impacts.</p>		
<p>Residual impacts The only major residual impact envisaged here would be related to the possible loss of breeding individuals to the local population for those birds that are killed. For the raptors and large terrestrial birds this could have dire consequences for potential breeding productivity.</p>		

b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

In terms of impacts arising from disturbance and displacement as a result of construction activities, there is **no significance** difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

c) Implications for Project Implementation

- » White-browed Sparrow-weaver breeding colonies are regionally significant and any impact on these breeding populations should be avoided at all costs – a 100m buffer around the colonies.
- » Appropriate marking of power lines will be required in order to reduce the potential of bird collisions with new power lines.

6.2.3 Potential Impacts on Soils and Agricultural Potential

There are three land types across the site. Soils across the site are generally shallow to deep, red, loamy sands on underlying rock or calcrete. As an indication of agricultural potential on the site, the grazing capacity on most of it is classified as between 14 and 17 hectares per large stock unit, but a portion in the east is classified higher (between 11 and 13 hectares per large stock unit). Agricultural potential is fairly uniform across the farm and the choice of placement of the facility on the farm therefore has minimal influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the proposed development footprint.

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; and
- » 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 and erosion;
- » Loss of agricultural land use;
- » Generation of alternative land use income; and
- » Degradation of veld vegetation .

The two alternative PV technologies do not differ in any significant way as far as soils and agricultural potential is concerned. Therefore, there is **no significant difference** in the

potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

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

Nature: Loss of agricultural land use caused by the direct occupation of land by footprint of energy facility infrastructure; and having the effect of taking affected portions of land out of agricultural production.		
Listed activities: GN 544 activity 10(i); 11(x)(xi) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Small (1)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	Medium (30)	Medium (30)
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Cumulative impacts: The overall loss of agricultural land in the region due to other developments. The significance is low due to the limited agricultural potential of the area.		
Residual impacts: No mitigation possible so same as impacts without mitigation		

Nature: Generation of alternative land use income by the alternative land use of energy facility rental on low productivity agricultural land, in combination with continued farming on the rest of the farmland having the effect of: providing land owners with increased cash flow and rural livelihood.		
Listed activities: GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Minor (3)	Minor (3)
Probability	Highly probable (4)	Highly probable (4)
Significance	Medium (32)	Medium (32)
Status	Positive	Positive
Reversibility	High	High
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	No
Cumulative impacts: None	
Residual impacts: None	

Nature: Soil Erosion caused by the alteration of run-off characteristics due to hard surfaces and access roads; and having the effect of: loss and deterioration of soil resources.		
Listed activities: GN 544 activity 10(i); 11(x)(xi) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (3)
Probability	Probable (3)	Very improbable (1)
Significance	Low (27)	Low (8)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Implement an effective system of run-off control, where it is required, that collects and disseminates run-off water from hardened surfaces and prevents potential down slope erosion. This should be in place and maintained during all phases of the development.		
Cumulative impacts: None		
Residual impacts: Low		

Impacts associated only with the construction phase of the development

Nature: Loss of topsoil caused by: poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.). And having the effect of: loss of soil fertility on disturbed areas after rehabilitation.		
Listed activities: GN 544 activity 10(i); 11(x)(xi) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Minor (3)	Minor (2)
Probability	Probable (3)	Very improbable (1)
Significance	Low (24)	Low (7)

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

Nature: Degradation of veld vegetation surrounding construction activities caused by trampling due to vehicle passage.		
Listed activities:		
GN 544 activity 10(i); 11(x)(xi) & 22 (ii)		
GN 545 activity 1 & 15		
GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent	Low (1) - Site	Low (1) - Site
Duration	Short (2)	Short (2)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Improbable (2)
Significance	Low (15)	Low (8)
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
Minimize road footprint beyond construction site and prohibit vehicular passage off designated roads.		
Cumulative impacts: None		
Residual impacts: Low		

b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

In terms of impact arising from soils and agricultural potential, there is **no significance** difference in the potential impacts associated with the two technology alternatives tracking panels can occupy more land than fixed panel technology; however a total of 260ha would be available for the proposed Boundary facility on the farm Karreeboom 1716, regardless of the type of technology used. The agricultural potential for this site is low, in terms of impact arising from soils and agricultural potential, there is no significance difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

c) Implications for Project Implementation

- » Agricultural potential is uniform across the farm and the choice of placement of the facility on the farm therefore has minimal influence on the significance of agricultural impacts.
- » No agriculturally sensitive areas occur within the proposed development footprint and have no implications on project development.

6.2.4 Assessment of Potential Impacts on Heritage & Palaeontology

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

The following heritage sites were recorded within the site:

- » GPS point 300 (refer to appendix G) is a limestone-walled feature, possibly a small kraal, while the line of features numbered 302, 303 and 304 are clear rectangular building foundations most likely representing the actual custom post. Points 299, 301 and 305-6 are traces of middens, the most substantial of which is at 306. These places constitute a sensitive heritage feature which should not be disturbed by the development; this feature is known as the old the Custom House.
- » GPS points 320-321 (refer to appendix G) are the locations of an abandoned domestic structure and outside toilet with associated ash midden and other farm features such as former gardens. The current (ruined) structures are of second half of twentieth century date, the associated midden material including recent glass, metal and plastic contents including ointment jars and bottle screw-tops. It is possible that an earlier generation of farming infrastructure once existed here.
- » No graves were found during the survey.

The two alternative PV technologies do not differ in any significant way as far as the impacts on heritage resources is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

Nature: Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected) on the no-go heritage area.		
Listed activities: GN 544 activity 10(i); 11(x)(xi); 22 GN 545 activity 1 & 15 GN 546 activity & 14(a)(i)		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)

Duration	Permanent (5)	Permanent (5)
Magnitude	Very High (10)	Very High (10)
Probability	Definite (5)	Probable (3)
Significance	High (90)	Medium (54)
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	Yes, with regional impact given the uniqueness of this site regulating the Free State/Cape Colony/Diamond Fields frontier.	Unique resources would be lost: there is reason to motivate exclusion of this western-most part of the proposed development to preserve it for future study and heritage use.
Can impacts be mitigated?	Yes – Recommend exclusion of this western-most portion of the proposed development area; reservation as a no-go area.	On-going management as per EMPr
Mitigation: There is reason to motivate exclusion of this western-most part of the proposed development, to preserve it for future study and possible heritage use.		
Cumulative impacts: Cumulative Impacts: where any archaeological contexts occur the impacts are once-off permanent destructive events. Infrastructure development may lead to spatially extended impacts in the vicinity, hence the need to demarcate areas for zero impact.		
Residual Impacts: Depleted archaeological record.		

Nature: Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected) for the remainder of the proposed development footprint.		
Listed activities: GN 544 activity 10(i); 11(x)(xi) & 22 GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent	Local(1)	-
Duration	Permanent (5)	-
Magnitude	Minor (2)	-
Probability	Improbable (2)	-
Significance	Low (1)	-
Status (positive or negative)		-

Reversibility	No	-
Irreplaceable loss of resources?	Yes, where present – but occurrence is generally extremely low density and of low significance.	Not regarded as necessary
Can impacts be mitigated?	Yes – but not considered necessary.	Not regarded as necessary
Mitigation: Artefact densities are low over the development footprint area in question. Unlike biological processes, heritage destruction generally has a once-off permanent impact and in view of this the figures given in the “Without mitigation” column err on the side of caution. Even so, the criteria for significance indicated in this matrix give a Low significance weighting (<30 points). Mitigation measures are not considered necessary.		
Cumulative impacts: Cumulative Impacts: where any archaeological contexts occur the impacts are once-off permanent destructive events.		
Residual Impacts: -		

b) Palaeontology impacts associated with the construction and operation phase of the proposed facility

The affected terrain is made up of flat, open veld with no visible outcrop. There are no springs or alluvium within the confines of the area where the photovoltaic solar facility and associated infrastructure will be constructed; however there is a pan present next to where the layout is proposed. In the absence of some of the above erosional features, common intrusive features like springhare hollows and aardvark dugouts were investigated for tell-tale signs of excavated paleontological material. Pedestrian survey indicates that the photovoltaic panels, associated buildings and access roads will be constructed on Quaternary-aged residual soils largely represented by calcrete-rich aeolian sand (red-brown Kalahari sands, Qs). There is no indication for the accumulation and preservation of intact fossil material within the Quaternary sediments (unconsolidated topsoils). Impact on Quaternary sediments within the footprint will be extensive, but impact on potential *in situ* Quaternary fossils, within the confines of the affected area is considered unlikely.

The two alternative PV technologies do not differ in any significant way as far as the impacts on palaeontology resources is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

Nature: Possible loss of Quaternary soils (topsoil resources), disturbance of intact sediments during the construction of the solar facility		
Listed activities: GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation

Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Moderate (6)
Probability	Probable (4)	Improbable (2)
Significance	Medium (60)	Low (26)
Status (positive or negative)	Negative	Neutral
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: Evaluation of routes through field assessment (phase 1, this report).		
Cumulative impacts: Possible impact on paleontological resources if construction activities go beyond area demarcated for development. Possible impact on basement rocks, generally considered to be of low paleontological sensitivity.		
Residual impacts: Disturbance of in situ Quaternary soils.		

Nature: Possible loss of Quaternary soils (topsoil resources), disturbance of intact sediments. Possible disturbance of Ecca Group bedrock during the construction of power lines.		
Listed activities: GN 544 activity 10(i); 11(x)(xi) & 22 GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Low (4)
Probability	Probable (4)	Improbable (2)
Significance	Medium (36)	Low (22)
Status (positive or negative)	Negative	Neutral
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: Evaluation of routes through field assessment (phase 1, this report).		
Cumulative impacts: Possible impact on basement rocks, generally considered to be of low paleontological sensitivity.		
Residual impacts: Disturbance of in situ Quaternary soils.		

Nature: Possible loss of Quaternary soils (topsoil resources), disturbance of intact sediments during the construction of access roads.
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Listed activities: GN 544 activity 10(i); 11(x)(xi); 18(i) & 22 GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (4)	Improbable (2)
Significance	Medium (52)	Low (22)
Status (positive or negative)	Negative	Neutral
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: Evaluation of routes through field assessment (phase 1, this report).		
Cumulative impacts: Possible impact on paleontological resources if road construction activities go beyond area demarcated for development.		
Residual impacts: Disturbance of in situ Quaternary soils.		

c) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

In terms of impacts arising from Heritage and Palaeontology, there is **no significance** difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

d) Implications for Project Implementation

- » The western portion of the site needs to be excluded from the development footprint as a result of heritage finds known as the remains of the historically recorded OFS Custom House situated just east of the Cape Colony/OFS boundary.
- » The terrain is not considered paleontological vulnerable and there are no major paleontological grounds to suspend the proposed development.

6.2.5 Assessment of Potential Visual Impacts

The R64 traverses the site. The Boundary Substation is located on farm Karreeboom 1716, as well as a number of power lines which traverse the site. The site would be held in view by users of the R64, and by users of other local roads. People living in farmsteads locally may become visually aware of the development.

The following potentially sensitive areas exist in the study area:

- » Farmsteads located adjacent to the site;
- » Road users travelling north along the R64;

- » Residential Areas i.e. Camelot;
- » Road users travelling along the local road (Rietpan road); and
- » Recreation - Flamingo Park Racecourse.

Of all the above, it more likely that the local residents and road users travelling along the R64 will be impacted to a greater extent. Due to the flat topography and terrain of the area, the project site is exposed, with little in the surrounding landscape (such as trees and buildings) that can shield the development from view. The visual exposure of the facility is therefore rated high for the immediate vicinity of the site, and to the north west and the south of the site. The viewshed is shown in Figure 6.3. Other infrastructure such as the existing Eskom Boundary Substation located on the site presents an existing change in the visual environment. The landscape character of the site, and surrounds, is open grassland with few homesteads or townships. The simplicity of the forms and the long open views in the agricultural areas bring visual clarity to the landscape. There is power line infrastructure and gravel roads which break the continuity of view. As Kimberley is approached the landscape character becomes more peri-urban and more cluttered. The character changes again to industrial 3km south of the site in the opencast mining area, inducing more clutter.

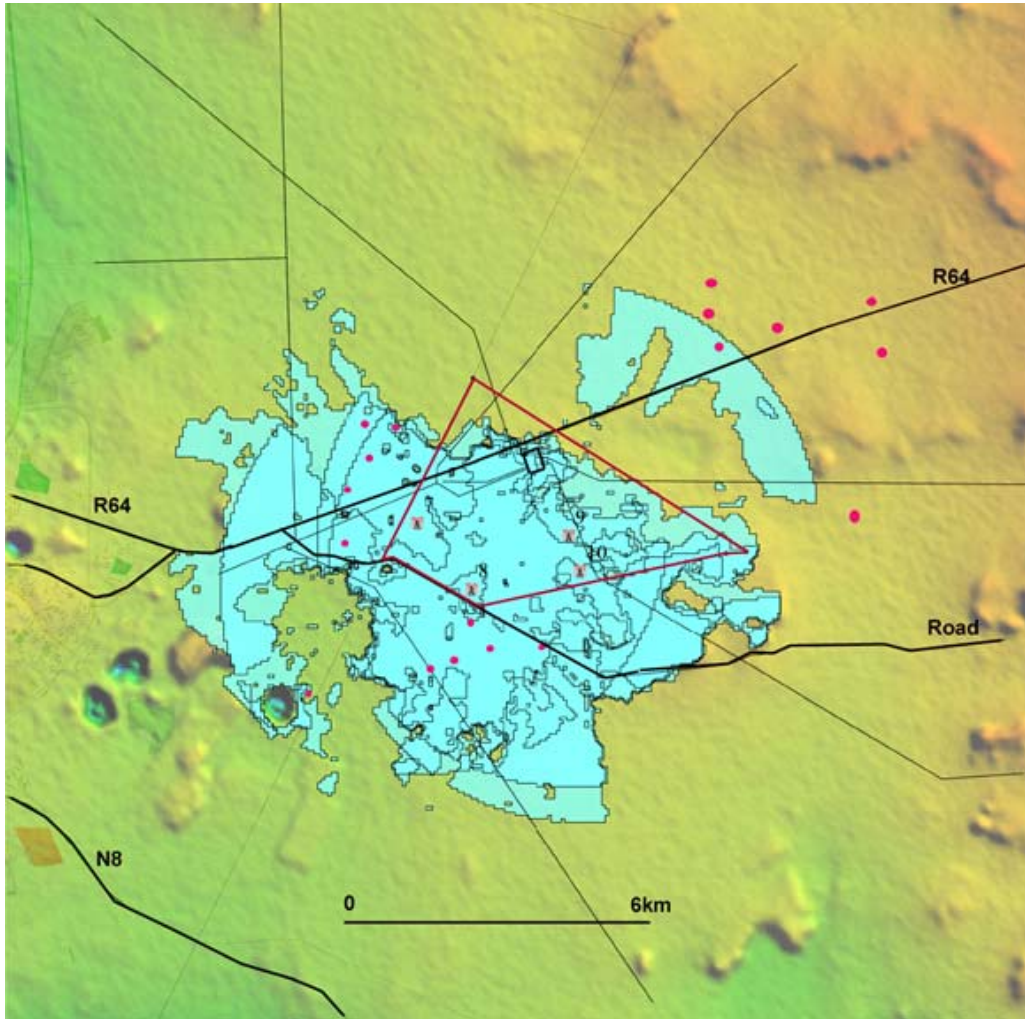


Figure 6.3: Visual envelope calculated at a radius of 5km from the proposed preferred layout and showing the site boundary, (dark red), locations of farmsteads, (red circles), the R64, a local road, and a large number of transmission lines radiating from the Eskom Boundary Substation. The areas impacted are coloured cyan.

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

Construction phase impacts:

Nature: Visual impact of construction activities on sensitive receptors such as homesteads and road users of the R64 road within 5km (this includes the impact from initial site works, construction camp, site set up, setting out, laying services and ground works).		
Listed activities: GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	<i>Without mitigation</i>	<i>With mitigation</i>
<i>Extent</i>	Local (2)	Local (2)
<i>Duration</i>	Short -term (2)	Short-term (2)
<i>Magnitude</i>	Moderate (6)	Moderate-Low (4)
<i>Probability</i>	Highly Probable (4)	Highly Probable (4)
<i>Significance</i>	Medium (40)	Medium (32)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	High	High
<i>Irreplaceable loss of resources?</i>	No	No
<i>Can impacts be mitigated?</i>	Yes	
<i>Mitigation:</i> <ul style="list-style-type: none"> » Establish screening structures to shield construction works from sensitive receptors; » Keep disturbed areas to a minimum. » No clearing of land to take place outside the demarcated footprint. » Buildings and similar structures must be in keeping with regional planning » Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion. 		
<i>Cumulative impacts:</i> Boundary substation and its associated industrial-type infrastructure such as electrical power lines and pylons already exist in the immediate surroundings, as well as similar developments within 20km of the site. Therefore, the cumulative impact will be increased with the establishment of the PV plant		
<i>Residual Impacts:</i> The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Nature: Visual impact of power line construction activities on sensitive receptors such as homesteads and road users of the R64 road within 5km.
Listed activities:

GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	<i>Without mitigation</i>	<i>With mitigation</i>
<i>Extent</i>	Local (2)	Local (2)
<i>Duration</i>	Short -term (2)	Short-term (2)
<i>Magnitude</i>	Moderate (4)	Moderate-Low (3)
<i>Probability</i>	Highly Probable (4)	Highly Probable (4)
<i>Significance</i>	Medium (32)	Low (28)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	High	High
<i>Irreplaceable loss of resources?</i>	No	No
<i>Can impacts be mitigated?</i>	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Keep disturbed areas to a minimum. » No clearing of land to take place outside the demarcated footprint. » Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be gravel roads, maintained to prevent dust plumes and erosion. 		
Cumulative impacts:		
Boundary substation and its associated industrial-type infrastructure such as electrical power lines and pylons already exist in the immediate surroundings. Therefore, the cumulative impact would be increased with the establishment of additional power lines		
Residual Impacts:		
The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Operational phase impacts:

Nature: visual impact on the sense of place for people living and working locally, change of local site character from agriculture to industrial		
Listed activities:		
GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)		
	<i>Without mitigation</i>	<i>With mitigation</i>
<i>Extent</i>	Regional (3)	Regional (3)
<i>Duration</i>	Long - term (4)	Long – term (4)
<i>Magnitude</i>	Moderate (6)	Moderate-Low (4)
<i>Probability</i>	Highly Probable (4)	Highly Probable (4)
<i>Significance</i>	Medium (52)	Medium (44)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	High	High

Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Keep disturbed areas to a minimum. » No clearing of land to take place outside the demarcated footprint. » Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion. 		
Cumulative impacts:		
Boundary substation and its associated industrial-type infrastructure such as electrical transmission lines and pylons already exist in the immediate surroundings, as well as similar developments within 20km of the site. Therefore, the cumulative impact will be increased with the establishment of the PV plant		
Residual Impacts:		
The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Nature: visual impact of the additional power lines and their extension beyond the site boundary on the sense of place for people living and working locally, change of local site character from agriculture to industrial		
Listed activities:		
GN 544 activity 10(i)		
GN 545 activity 1 & 15		
GN 546 activity 14(a)(i)		
	Without mitigation	With mitigation
Extent	Regional (3)	Regional (3)
Duration	Long - term (4)	Long – term (4)
Magnitude	Moderate low (4)	Low (2)
Probability	Highly Probable (4)	Highly Probable (3)
Significance	Medium (44)	Low (27)
Status (positive or negative)	Negative	Negative
Reversibility	Regional (3)	Regional (3)
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Keep disturbed areas to a minimum. » No clearing of land to take place outside the demarcated footprint. » Utilise existing roads and tracks to the extent possible maintained to prevent dust plumes and erosion. 		
Cumulative impacts:		
The proposed power lines would provide a cumulative impact increasing the existing industrial land uses.		

Residual Impacts:

The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant and power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

Nature: Visual impact of the operation of PV panels (fixed panel option)

Listed activities:

GN 544 activity 10(i)
GN 545 activity 1 & 15
GN 546 activity 14(a)(i)

	<i>Without mitigation</i>	<i>With mitigation</i>
Extent	Local (2)	Local (2)
Duration	Long - term (4)	Long – term (4)
Magnitude	Moderate low (3)	Low (2)
Probability	Highly Probable (4)	Highly Probable (3)
Significance	Medium (36)	Low (24)
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

- » No clearing of land outside the demarcated footprint
- » Rehabilitate cleared areas

Cumulative impacts:

The proposed infrastructure would provide a cumulative impact increasing the existing industrial land uses.

Residual Impacts:

The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant and power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

Nature: Visual impact of the operation of PV panels (tracking panel option)

Listed activities:

GN 544 activity 10(i)
GN 545 activity 1 & 15
GN 546 activity 14(a)(i)

	<i>Without mitigation</i>	<i>With mitigation</i>
Extent	Local (2)	Local (2)
Duration	Long - term (4)	Long – term (4)
Magnitude	Moderate low (4)	Low (1)
Probability	Highly Probable (4)	Highly Probable (3)
Significance	Medium (40)	Low (21)
Status (positive or negative)	Negative	Negative

Reversibility	High	High
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> » No clearing of land outside the demarcated footprint » Rehabilitate cleared areas 		
Cumulative impacts:		
The proposed infrastructure would provide a cumulative impact increasing the existing industrial land uses.		
Residual Impacts:		
The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant and power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

Sensitive receptors on the roads or in close by homesteads will be able to see either fixed or tracking panels on the site Farm Karreeboom 1716 due to the flat topography of the project. Tracking panels can result in a higher visual intrusion than fixed panels due to the more mechanically complex structure. However, for this particular site there is **very little difference in the significance** in the potential impacts associated with the two technology alternatives.

c) Implications for Project Implementation

- » There is little in the local landscape that can shield this development as views are long and open to most compass points; the site trees vary in density and frequency.
- » Visual impacts associated with the PV facility and associated infrastructure (including the power line) are expected to be of moderate significance largely the scale of the development, the numbers and types of receptors directly affected and its compatibility with the local landscape.
- » Visual Impacts are difficult to mitigate, however, possible mitigation measures are recommended in Appendix K of the visual report.
- » In addition, to limit scarring of the landscape, rehabilitate disturbed construction areas and re-vegetate using appropriate indigenous grasses

6.2.6 Assessment of Potential Social Impacts

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

Impacts associated with the construction phase of a project are usually of a short duration, temporary in nature, but could have long term effects on the surrounding environment. The operational life of a PV facility is between 20 - 25 years, after which the facility would possibly be upgraded to continue its lifespan if feasible, or decommissioned. The impacts usually associated with the operational phase are therefore perceived by affected parties to be more severe.

The key social issues associated with the *construction phase* are the following:

Potential positive impacts

- » Creation of employment and business opportunities, and opportunity for skills development and on-site training.

Potential negative impacts

- » Impacts associated with the presence of construction workers on local communities;
- » Impacts related to the potential influx of job-seekers;
- » Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site;
- » Increased risk of grass fires associated with construction related activities; and
- » Noise, dust and safety impacts of construction related activities and vehicles.

The two alternative PV technologies do not differ in any significant way as far as the impacts on the social environment is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

The following listed activities are applicable to all the social impacts in the construction phase:

GN 544 activity 10(i)

GN 545 activity 1 & 15

GN 546 activity 14(a)(i)

Nature: Creation of employment and business opportunities during the construction phase		
	Without Enhancement	With Enhancement
Extent	Local – Regional (3)	Local – Regional (4)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	High (8)

Probability	Highly probable (4)	Highly probable (4)
Significance	Medium (44)	Medium (56)
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	
Enhancement :		
Employment		
<ul style="list-style-type: none"> » Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area. » Where feasible, efforts should be made to employ local contractors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. » Before the construction phase commences the proponent and its contractors should meet with representatives from the Tokologo Local Municipality to establish the existence of a skills database for the area. If such a database exists it should be made available to the contractors appointed for the construction phase. » The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase. » Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. 		
Business		
<ul style="list-style-type: none"> » The proponent should seek to develop a database of local companies, specifically Broad Based Black Economic Empowerment (BBBEE) companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work. » The proponent, in consultation with the Tokologo Local Municipality and the local Chamber of Commerce, should identify strategies aimed at maximising the potential benefits associated with the project. 		
Cumulative impacts:		
Opportunity to up-grade and improve skills levels in the area.		
Residual impacts:		
Improved pool of skills and experience in the local area.		

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers		
	Without Mitigation	With Mitigation
Extent	Local (2)	Local (1)

	(Rated as 2 due to potential severity of impact on local communities)	(Rated as 1 due to potential severity of impact on local communities)
Duration	Short term for community as a whole (2) Long term-permanent for individuals who may be affected by STDs etc. (5)	Short term for community as a whole (2) Long term-permanent for individuals who may be affected by STDs etc. (5)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)
Probability	Probable (3)	Probable (3)
Significance	Low for the community as a whole (24) Moderate-High for specific individuals who may be affected by STDs etc. (51)	Low for the community as a whole (21) Moderate-High for specific individuals who may be affected by STDs etc. (48)
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation:		
<ul style="list-style-type: none"> » Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks; » The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; » The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis; » The contractor should make necessary arrangements to enable workers from outside the area to return home on a regular basis during the 18 month construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks; » The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the 		

<p>construction Boundary Solar Energy Facility is completed. This would reduce the risk posed by non-local construction workers to local family structures and social networks; and</p> <p>» As per the agreement with the local farmers in the area, no construction workers, will be permitted to stay overnight on the site. Security personnel will be housed in the vicinity of the site.</p>
<p>Cumulative impacts:</p> <p>Impacts on family and community relations that may, in some cases, persist for a long period of time. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.</p>
<p>Residual impacts:</p> <p>Impacts on family and community relations that may, in some cases, persist for a long period of time. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.</p>

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires		
	Without Mitigation	With Mitigation
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2)
Duration	Short term (2)	short term (2)
Magnitude	Moderate due to reliance on agriculture for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Low (24)
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and crop losses etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
<p>Mitigation:</p> <p>» The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences;</p> <p>» A fire-break should be constructed around the perimeter of the site prior to the commencement of the construction phase;</p> <p>» Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;</p>		

<ul style="list-style-type: none"> » Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months; » Contractor to provide adequate firefighting equipment on-site, including a fire fighting vehicle; » Contractor to provide fire-fighting training to selected construction staff; » No construction staff, with the exception of security staff, to be accommodated on site over night; and » As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the firefighting costs borne by farmers and local authorities.
Cumulative impacts: No, provided losses are compensated for.
Residual impacts: None anticipated

Nature: Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site		
	Without Mitigation	With Mitigation
Extent	Local (2)	Local (1)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (15)
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Site clearing activities should be phased so as to minimise the total area cleared at any given time. Progressive rehabilitation should also be carried out during the construction phase; » The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends and holiday periods; » The contractor must ensure that damage caused by construction related traffic to the internal access roads is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor; » Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers; and » All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits. 		
Cumulative impacts: If damage to roads is not repaired then this will affect the farming		

activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were no responsible for the damage.

Residual impacts: Once construction is completed, this will not be an impact.

The following key social issues are of relevance to the *operational phase*:

Potential positive impacts

- » Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
- » Benefits associated with the establishment of a Community Trust; and
- » The establishment of renewable energy infrastructure.

Potential negative impacts

- » Impact on adjacent hunting operations;
- » The visual impacts and associated impact on sense of place;
- » Potential impact on tourism; and
- » Potential impact on groundwater supplies.

Nature: Creation of employment and business opportunities associated with the operational phase		
	Without Enhancement	With Enhancement
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	Medium (30)	High (65)
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement:		
<ul style="list-style-type: none"> » As part of the Social Economic Development programme the proponent is committed to implement a training and skills development programme for the duration of the 20 year operating period. The programme should seek to maximise the number of locals that benefit from the programme. » The proponent, in consultation with the Tokologo Local Municipality, should investigate the options for the establishment of a Community Development Trust. 		
Cumulative impacts: Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area		
Residual impacts: Improved pool of skills and experience in the local area.		

Nature: Establishment of a community trust funded by revenue generated from the sale

of energy. The revenue can be used to fund local community development		
	Without Enhancement	With Enhancement⁶
Extent	Local (2)	Local and Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	Medium (30)	High (70)
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement:		
<ul style="list-style-type: none"> » Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; » Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the Solar Energy Facility plant. 		
Cumulative impacts: Promotion of social and economic development and improvement in the overall well-being of the community		
Residual impacts: Improve development within the community and better infrastructure		

Nature: Promotion of clean, renewable energy		
	Without Mitigation	With Mitigation (The provision of renewable energy infrastructure is in itself a mitigation measure)
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium (48)	Medium (48)
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	
Enhancement:		
<ul style="list-style-type: none"> » Use the project to promote and increase the contribution of renewable energy to the national energy supply; 		

⁶ Enhancement assumes effective management of the Community Trust

<ul style="list-style-type: none"> » Maximise the public's exposure to the project via an extensive communication and advertising programme; » Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.
Cumulative impacts: Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.
Residual impacts: See cumulative impacts

Nature: Potential visual impacts associated with the Solar Energy Facility may impact on the experience of hunters on adjacent farms		
	Without Mitigation	With Mitigation
Extent	Local (1)	Local (1)
Duration	Long term-permanent if disturbed areas are not effectively rehabilitated (5)	Short term if damaged areas are rehabilitated and panels removed (2)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (15)
Status	Negative	Negative
Reversibility	Yes, panels can be removed	Yes, panels can be removed
Irreplaceable loss of resources?	No, disturbed areas can be rehabilitated	No, disturbed areas can be rehabilitated
Can impact be mitigated?	Yes	Yes
Mitigation:		
<ul style="list-style-type: none"> » Investigate the need for the establishment of a no-hunting buffer along the boundary of the affected properties; and » Buffer of natural vegetation should be maintained along the boundary of the property to screen the PV panels from the adjacent affected properties. 		
Cumulative impacts: Reduced number of hunters and overall negative impact on the local economy and livelihoods of farmers who are dependent upon income from hunting		
Residual impacts: See cumulative impacts.		

Nature: Visual impact associated with the proposed solar facility and the potential impact on the areas rural sense of place.		
	Without Mitigation	With Mitigation
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (4)	Highly Probable (4)
Significance	Medium (32)	Low (28)
Status	Negative	Negative
Reversibility	Yes, solar facility can be removed.	
Irreplaceable loss	No	

of resources?		
Can impact be mitigated?	Yes	
Mitigation: Existing vegetation between the site and the R64 should be retained and where necessary additional vegetation screening should be established where required. The recommendations contained in the VIA should also be implemented, specifically with regard to Camelot Estate.		
Cumulative impacts: Potential impact on current rural sense of place		
Residual impacts: None anticipated if the visual impact will be removed after decommissioning, provided the solar facility infrastructure is removed and the site is rehabilitated to its original (current) status.		

Nature: Potential impact of the Solar Energy Facility on local tourism		
	Without Mitigation	With Enhancement / Mitigation
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24) (Applies to both – and +)	Low (24) (Applies to both – and +)
Status	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » PV panels should be located to ensure that visual impacts are minimised; and » Buffer of natural vegetation should be maintained along the boundary of the property to screen the PV panels from the adjacent affected properties.		
Cumulative impacts: Due to size and height of PV Solar Energy Facility and the fact that they are power line all across the surrounding areas where the project is proposed, the potential cumulative impacts are not rated significant.		
Residual impacts: Improved pool of skills and experience in the local area.		

Nature: Potential visual impact and impact on sense of place associated with power lines		
	Without Mitigation	With Mitigation
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)

Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (21)
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Mitigation: Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works. The measures listed above to address the potential impacts associated with the construction phase also apply to the construction of the power line.		
Cumulative impacts: Limited visual and impact on sense of place		
Residual impacts: The visual impact will be removed after decommissioning, provided the solar facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.		

Nature: Visual impacts associated with the establishment of more than one Solar Energy Facility and the potential impact on the areas rural sense of place and character of the landscape.		
	Without Mitigation	With Mitigation
Extent	Local and regional (2)	Local and regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (24)
Status	Negative	Negative
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Enhancement: The establishment of a number of large solar facilities in the area does have the potential to have a negative cumulative impact on the areas sense of place and the landscape. The environmental authorities should consider the overall cumulative impact on the rural character and the areas sense of place before a final decision is taken with regard to the optimal number of such plants in an area.		
Cumulative impacts: Impact on other activities whose existence is linked to linked to rural sense of place and character of the area, such as tourism, bird watching, and hunting.		
Residual impacts: See cumulative impacts		

b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

There is **no difference** in social / economic impacts from either technology alternatives; therefore there is no preference from a social perspective on the implementation of either technology.

c) Implication for project implementation

- » The findings of the SIA undertaken for the proposed Boundary Solar Energy Facility indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
- » The establishment of a Community Trust will also create an opportunity to support local economic development in the area.
- » The development of renewable energy has also been identified as a key growth sector by the TLM and also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
- » It is therefore recommended that the Boundary Solar Energy Facility as proposed be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the SIA report.

6.2.7 Assessment of impacts resulting from the decommissioning phase

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the Solar Energy Facility decommissioning phase is likely to involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in the 20-25 years post commissioning. The decommissioning phase is therefore likely to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning.

Given the relatively small number of people employed during the operational phase (~ 60), the potential negative social impact on the local economy associated with decommissioning would be limited. In addition, the potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative).

The project developer should also investigate the option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage

of the revenue generated from the sale of energy to the national grid over the 25-30 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. In terms of closure costs, the revenue from the sale of scrap metal from the PV plant should be allocated to cover the costs associated with closure and the rehabilitation of disturbed areas.

a) Impact table summarising the significance of decommissioning of the PV facility during the decommissioning

Nature: Social impacts associated with retrenchment including loss of jobs, and source of income		
	Without Mitigation	With Mitigation
Extent	Local and regional (3)	Local and regional (2)
Duration	Medium Term (2)	Very Short Term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium (44)	Low (16)
Status	Negative	Negative-Neutral
Reversibility	Yes, assumes retrenchment packages are paid to all affected employees	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> » The proponent should ensure that retrenchment packages are provided for all staff retrenched when the plant is decommissioned. » All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning; and » Revenue generated from the sale of scrap metal during decommissioning should be allocated to funding closure and rehabilitation of disturbed areas. 		
Cumulative impacts: Loss of jobs and associated loss of income etc. can impact on the local economy and other businesses. However, decommissioning can also create short term, temporary employment opportunities associated with dismantling etc.		
Residual impacts: Improved pool of skills and experience in the local area.		

6.3. Assessment of the Do Nothing Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Boundary Solar Energy Facility. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of a solar energy facility. Currently, the proposed site is used for cattle farming by the owner, moderate veld degradation are visible in the vegetation and can be attributed to moderately heavy grazing and possible drought conditions currently and in the past. Should the current land use activities continue, degradation of the site vegetation will continue without proper management strategy to improve or eradicate the degradation of vegetation on site.

In addition, the project is proposed on the same property/site with the Eskom Boundary Substation, and vegetation on the portion of the land where the substation is situated is cleared, they are a number of tracks within the site as well as power lines going into the Boundary substation and in these area, the cover has vegetation has been disturbed. Hence, the developer of the proposed Boundary Solar Facility finds this site suitable for this development (among other reasons as explained in chapter 2).

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

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

- » **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.
- » **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the

achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability.

- » **Exploitation of our significant renewable energy resource:** At present, valuable national resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
- » **Pollution reduction:** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions.
- » **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita carbon dioxide emissions.
- » **Support for international agreements:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
- » **Employment creation:** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.
- » **Acceptability to society:** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.
- » **Support to a new industry sector:** The development of renewable energy offers the opportunity to establish a new industry within the South African economy.

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

6.4. Assessment of Summary of Impacts

Table 6.2 summarises all potential impacts associated with the proposed Boundary Solar Energy Facility and its relevant EIA regulation listed activities.

Table 6.2: Summary of impacts associated with the proposed Boundary Solar Energy and applicable EIA Regulation Listed activity assessed.

Construction / Decommissioning Impacts	Significance of Impact			EIA Regulation Listed activity assessed
	Without mitigation	With mitigation	Status	
Ecology				
Loss of vegetation & increase in runoff and erosion,	M (50)	M (35)	Negative	GN 545, 18 June 2010 activity 1 & 15 GN 546, 18 June 2010 activity 14(i).
Loss of protected or red data species	M (50)	L (28)	Negative	GN 545, 18 June 2010 activity 1 & 15 GN 546, 18 June 2010 activity 14(i).
Loss of species of conservation concern	H (75)	M (60)	Negative	GN 545, 18 June 2010 activity 1 & 15 GN 546, 18 June 2010 activity 14(i).
Avifauna				
Avifaunal habitats loss	L (28)	L (24)	Negative	GN 544 activity 10(i) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Disturbance and displacement of avifauna	M (36)	L (24)	Negative	GN 544 activity 10(i) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Soil & agriculture potential				
Loss of agricultural land use	M (30)	M (30)	Negative	GN 544 activity 10(i); 11(x)(xi) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Generation of alternative land use income	M (32)	M (32)	Positive	GN 546 activity 14(a)(i)
Soil erosion	L (27)	L (8)	Negative	GN 544 activity 10(i); 11(x)(xi) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Loss of topsoil	L (24)	L (7)	Negative	GN 544 activity 10(i); 11(x)(xi) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 4ii(cc) & 14(a)(i)
Degradation of veld vegetation	L (15)	L (8)	Negative	GN 544 activity 10(i); 11(x)(xi) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)

Heritage & palaeontology				
The destruction, damage, excavation, alteration, removal or collection of any archaeological material(areas of heritage sensitive materials)	H (90)	M(54)	Negative	GN 544 activity 10(i); 11(x)(xi); 22 GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
The destruction, damage, excavation, alteration, removal or collection of any archaeological material (remainder of the of the site)	L(16)	n/a	Negative	GN 544 activity 10(i); 11(x)(xi); 22 GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Possible loss of Quaternary soils (topsoil resources), disturbance of intact sediments during the construction of the solar facility	M (60)	L (26)	Negative	GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Possible loss of Quaternary soils (topsoil resources), disturbance of intact sediments. Possible disturbance of Ecca Group bedrock when construction power lines	M (36)	L (22)	Negative	GN 544 activity 10(i); 11(x)(xi);18(i) & 22 GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Possible loss of Quaternary soils (topsoil resources), disturbance of intact sediments during the construction of access roads.	M (52)	L (22)	Negative	
Visual				
Visual impact of construction activities on sensitive receptors such as homesteads and road users of the R64 road within	M (40)	M (32)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Visual impact of power line construction activities on sensitive receptors such as homesteads and road users of the R64 road within 5km.	M (32)	L(28)		GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Social				
Creation of employment and business opportunities	M (32)	M (36)	Positive	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Potential impacts on family structures and social networks associated with the presence of construction workers	L (24)	L (21)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires	M (36)	L (24)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	L (24)	L(15)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)

Operational Impacts	Significance of Impact			EIA Regulation assessed	Listed activity
	Without mitigation	With mitigation	Status		
Ecology					
Loss of vegetation and/or species of conservation concern	H (75)	M (60)	Negative	GN 544 activity 10(i); 11(x)(xi) & 22 (ii); GN 545 activity 1 & 15 GN 546 activity 4ii(cc) & 14(a)(i)	
Increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species	M (60)	L (20)	Negative	GN 544 activity 10(i); 11(x)(xi) & 22 (ii); GN 545 activity 1 & 15 GN 546 activity 14(a)(i)	
Avifauna					
Disturbance and displacement of avifauna	L (21)	L (15)	Negative	GN 544 activity 10(i) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)	
Bird Mortality	M (39)	M (30)	Negative	GN 544 activity 10(i) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)	
Soil & agriculture potential					
Loss of agricultural land use	M (30)	M (30)	Negative	GN 544 activity 10(i); 11(x)(xi) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)	
Generation of alternative land use income	M (32)	M (32)	Positive	n/a	
Soil erosion	L (27)	L (8)	Negative	GN 544 activity 10(i); 11(x)(xi) & 22 (ii) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)	
Visual					
Visual impact on the sense of place for people living and working locally, change of local site character from agriculture to industrial	M (52)	M (44)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)	
Visual impact of the additional power lines and their extension beyond the site boundary on the sense of place for people living and working locally, change of local site character from agriculture to industrial	M (44)	L (27)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)	

Visual impact of the operation of PV panels (fixed panel option)	M (36)	L (24)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Visual impact of the operation of PV panels (tracking panel option)	M (40)	L (21)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Social				
Creation of employment and business opportunities	M (30)	H (65)	Positive	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development	M (30)	H (70)	Positive	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Promotion of clean, renewable energy	M (48)	M (48)	Positive	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Potential visual impacts associated with the Solar Energy Facility may impact on the experience of hunters on adjacent farms	L (24)	L (15)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Visual impact associated with the proposed solar facility and the potential impact on the areas rural sense of place.	M (32)	L (28)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Potential impact of the Solar Energy Facility on local tourism	L (24)	L (24)	Positive & Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)
Potential visual impact and impact on sense of place associated with power lines	L (24)	L (21)	Negative	GN 544 activity 10(i) GN 545 activity 1 & 15 GN 546 activity 14(a)(i)

L Low
 M Medium
 H High

ASSESSMENT OF CUMULATIVE IMPACTS

CHAPTER 7

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (Government Notice R543) as meaning “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”.

There has been a substantial increase in renewable energy developments recently in South Africa as legislation is evolving to facilitate the introduction of Independent Power Producers (IPPs) and renewable energy into the electricity generation mix. Due to the recent substantial increase in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and avoided where possible.

The Department of Energy has, under the REIPPP Programme released a request for proposals (RfP) to contribute towards Government’s renewable energy target of 3725 MW (1450 MW of which has been allocated to solar PV energy) and to stimulate the industry in South Africa. The bid selection process will consider the suggested tariff as well as socio-economic development opportunities provided by the project and the bidder.

There is a legislated requirement to assess cumulative impacts associated with a proposed development. This chapter looks at whether the proposed project’s potential impacts become more significant when considered in combination with the other known or proposed solar farm projects within the area.

7.1 Approach Taken to Assess Cumulative Impacts

Significant cumulative impacts that could occur due to the development of the solar energy facilities and its associated infrastructure in proximity to each other include impacts such as:

- » Loss of vegetation and impacts on ecology;
- » Impacts on avifauna;
- » Soil and agricultural potential impacts;
- » Heritage impacts;
- » Visual impacts; and
- » Social impacts.

Figure 7.1 shows the proposed location of the Boundary Solar Energy Facility in relation to all other known renewable energy applications. These projects were identified by CSIR using the Department of Environmental Affairs Geographic Information System digital data (CSIR, 2013). In the case of the proposed Boundary Solar Energy Facility, there are seven (7) renewable projects (all solar PV) proposed within a 20 km radius of the Boundary site (refer to Figure 7.1 and Table 7.1 below). At the time of writing this EIA report, the Mainstream Droogfontein Solar Park near Kimberley is under construction. Cumulative impacts discussed within this section have been considered within the detailed specialist studies, where applicable (refer to Appendices E-K).

Table 7.1: Proposed solar developments in the vicinity of the Boundary Solar Energy Facility

Project	Applicant/ Developer	DEA Ref. No	Location	Status	Distance from Boundary facility (km)
Droogfontein Solar Park (48.8MW)	South Africa Mainstream Renewable Power Development	12/12/20/2148	Farm Droogfontein No 62 located 15km North of Kimberley in the Northern Cape Province	Construction underway	20
Kabi Kimberly PV Solar Energy Facility and associated infrastructure (20MW)	Kabi Solar	12/12/20/2124	Kennilworth Estate no 71, east of Kimberley	Environmental Authorisation issued	10
Proposed construction of a 100MW photovoltaic solar power generation plant on the farm Kenilworth Estate No 71	BioTherm Energy (Pty) Ltd	12/12/20/2440	Kennilworth Estate no 71, east of Kimberley	Environmental Authorisation issued	10
Proposed ACSA PV installation at Kimberley Airport (5MW)	ACSA PV	12/12/20/2148	Kimberley Airport	EA issued	12
Proposed establishment	Oakleaf Investment	12/12/20/1862	Portions 3 & 4 of Wag 'n	EIA in progress	20

Project	Applicant/ Developer	DEA Ref. No	Location	Status	Distance from Boundary facility (km)
of the Wag 'n Bietjiespan Solar Farm (50MW)	Holdings 65 (Pty) Ltd		Bietjiespan 1586, near Boshof		
Proposed Blackwood Solar Energy Facility on a site near Boshof (75MW)	Blackwood Solar Energy Facility (Pty) Ltd	14/12/16/3/3/2/281	Portion 1 of farm Pandamsfontein 1593, 25 km south east of Kimberley.	EIA in progress	20
Renewable energy generation project (75MW)	Dioflash (Pty) Ltd	14/12/16/3/3/392	Farm Melrose East 149, Letsemeng Local Municipality, Northern Cape	EIA in progress	20

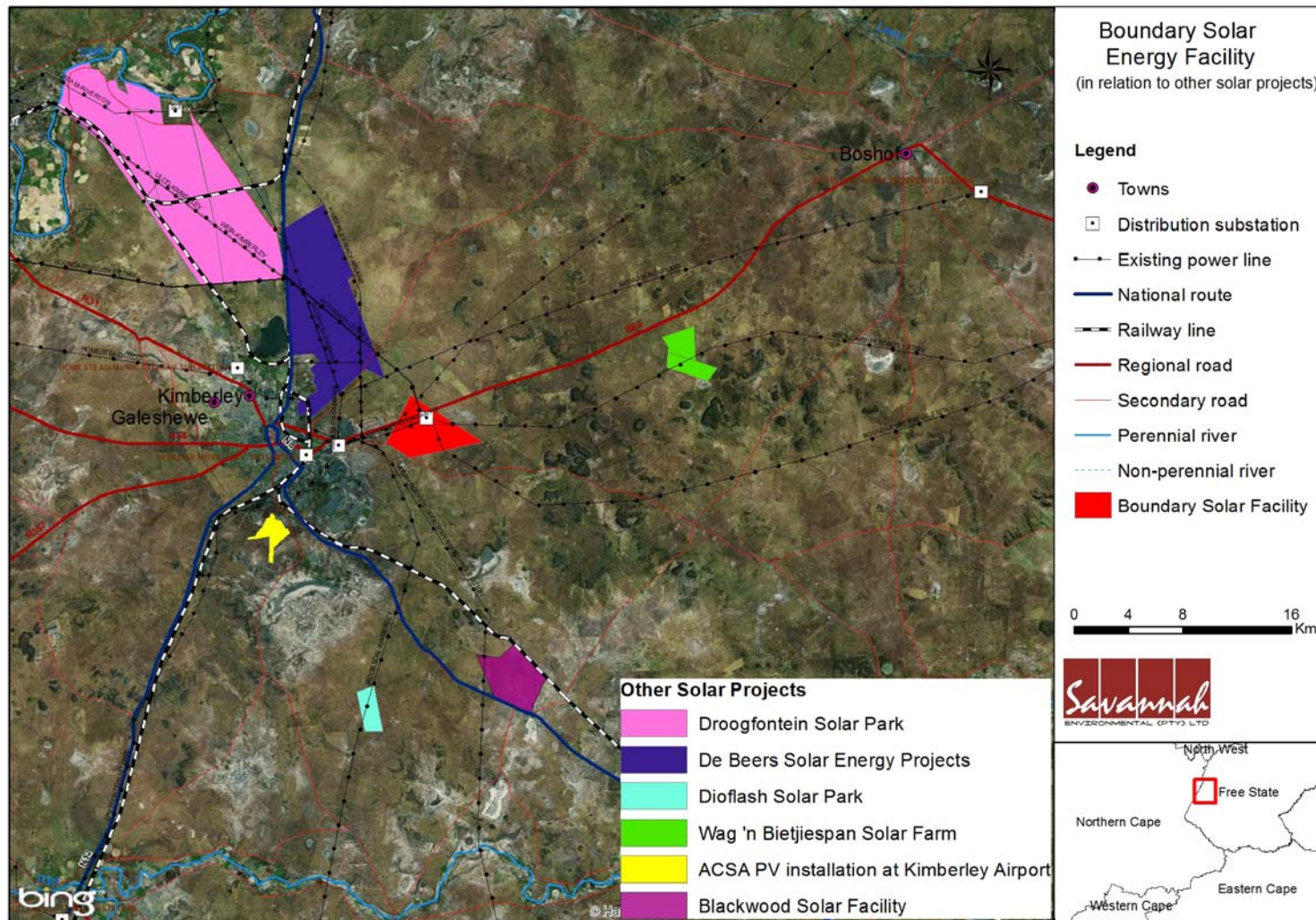


Figure 7.1: Map showing the proximity of other renewable energy facility projects to the proposed Boundary Solar Energy Facility in order to understand the potential or cumulative impacts

The combined effect of the solar energy facilities for this area will have a cumulative visual impact, impact on the landscape character, social impact, and impacts on ecology and soil erosion.

As there is uncertainty as to whether all the above mentioned developments will be implemented, it is also difficult to quantitatively assess the potential cumulative impacts. It is, however, important to explore the potential cumulative impacts qualitatively as this will lead to a better understanding of these impacts and the possible mitigation that may be required. As these cumulative impacts are explored in more detail the trade-offs between promoting renewable energy (and the associated benefits in terms of reduction in CO₂ emissions – a national interest) versus the local and regional environmental and social impacts and benefits (i.e. landscape, ecology, tourism, , employment etc.) will become evident. It is only when these trade-offs are fully understood, that the true benefits of renewable energy can be assessed.

In the sections below the potential cumulative impacts of seven solar facilities within the immediate vicinity of the proposed Boundary Solar Energy Facility are explored. The discussion and associated conclusions must be understood in the context of the uncertainty associated with the proposed developments and the qualitative nature of the assessment.

7.2 Cumulative Impacts on Ecology

Past mining activities in the wider Kimberley area have been blamed for a large-scale destruction of large specimens of *Acacia erioloba* trees. This has already impacted local population dynamics as well as microhabitats and resources associated with these species available to other fauna and flora species and should not be further exacerbated. Cumulative impacts of developments on population viability of species can be reduced significantly if new developments are kept as close as possible to existing developed and/or transformed areas or, where such is not possible, different sections of a development be kept as close together as possible. New power lines should follow routes of existing servitudes if such exist, renewable energy facilities should be constructed as close as possible to existing infrastructure or substations, and if several developments are planned within close proximity, these developments should be situated as close together as possible, not scattered throughout the landscape. Cumulative impacts on ecology will be of **low to moderate significance**, seeing that several more solar developments are planned north and east of Kimberley, around the Kimberley Airport and in the vicinity of Jacobsdal, many on similar habitats.

7.3 Cumulative Impacts on Avifauna

Cumulative impacts on avifauna are expected to be **low to moderate**, subject to implemented mitigation measures at each site, considering the proposed construction of similar developments in the area and the number of existing power lines and Eskom infrastructure that are present close to the project site. The existing infrastructure has already impacted on the environment used by birds, and they would have adjusted to these changes to some extent. The project presents a consolidation of impacts in one area.

7.4 Cumulative impacts on soil and agricultural potential

The broader farm portion, farm Karreeboom 1716, is 1626ha and the development of the proposed Boundary PV facility will result in the loss of ~18% of the farm for agricultural activities. The remainder of the farm portion can be continued to be utilised for agricultural activities. The overall loss of agricultural land in the region due to other similar developments is expected to be of **low** significance due to the limited agricultural potential of the area. Due to the limited crop production in the wider study area, the development of multiple solar energy facilities within the Tokologo Local Municipality will not affect food security in the region.

7.5 Cumulative impacts on heritage and palaeontology

Cumulative impacts in terms of archaeological contexts are once-off permanent destructive events. Infrastructure development may lead to spatially extended impacts in the vicinity, hence the need to demarcate areas for zero impact. Cumulative negative impacts on heritage resources palaeontology will be a **low significance** seeing that the potential for the loss of or discovery of heritage artefacts in the region will also increase with the increased numbers of similar developments in the area.

7.6 Cumulative Visual Impacts

The visual integrity of the area has already been impacted by the existing power lines within and around the site. In addition, at a broader level the visual integrity of the area has been negatively impacted by the mining activities and mining related infrastructure. The potential for cumulative impacts on the area's sense of place and landscape character is therefore **low** seeing that there are other development of similar facilities in the broader area that have impacted on the visual character and sense of place of the region.

7.7 Cumulative Impacts on Social and Economic Environment

Benefits to the local, regional and national economy through employment and procurement of services could be substantial should many of the renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore at municipal level, the cumulative impact could be positive and could incentivise operation and maintenance companies to centralise and expand their activities towards education and training and more closely to the projects.

The cumulative impact in terms of loss of agricultural land is unlikely to be significant due to the limited land take and in most cases agricultural activities would be allowed to proceed. Property prices in these areas are likely to increase as a result of the added value that energy generation offers. However, once the renewable energy sector is saturated, property prices that are dependent on the sense of place value rather than on the agricultural potential may be compromised due to the changes in landscape and sense of place. **Cumulative positive social and economic impacts and negative social impacts** (visual, sense of place, noise and disturbance during construction) will be of **moderate significance**.

7.7 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The CSIR has released an initial identification of geographical areas best suited for the roll-out of wind and solar photovoltaic (PV) energy projects in South Africa. The aim of the assessment is to designate renewable energy development zones (REDZs) within which such development will be incentivised and streamlined. The Boundary Solar Energy Facility falls within the identified geographical areas most suitable for the rollout of the development of solar energy projects within the Free State Province. This implies that projects of the same nature will be consolidated in

one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented.

It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 20km radius will be built due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Boundary Solar Energy Facility will be of **low to moderate significance**.

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 8

Rodicon Trading and Investments (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility with a net generating capacity of up to 75MW, as well as associated infrastructure on a site located in the Free State Province approximately 15km south-east of Kimberley and 40km south-west of Boshof (refer to Figure 8.1). The site is located within the Tokologo Local Municipality. 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).

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 17,8 GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

In response to the need, Rodicon Trading and Investments (Pty) Ltd, as an IPP, is proposing the establishment of a 75 MW photovoltaic solar energy facility and associated infrastructure for the purpose of commercial electricity generation. The proposed facility will require a development footprint area of approximately 260 ha (within a bigger farm portion which is 1626ha in extent), and will be comprised of the following primary elements (Figure 8.1):

- » Solar panels (fixed/tracking technology) with an export capacity of up to 75MW.
- » Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, alternative making use of ground screws to support the PV panels.
- » Cabling between the structures, to be lain underground where practical.
- » Central inverter/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- » An on-site substation (120m x 70m) and overhead power line (1700m) to facilitate the connection between the solar energy facility and the existing Boundary Substation located on the site (Farm Karreeboom 1716)
- » Internal access roads (5m wide roads).

- » Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (\pm 200m x 150m).

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), Rodicon Trading and Investments requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Free State Department of Economic Development, Tourism and Environmental Affairs (DEDTEA)) for the establishment of the Boundary 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 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* – identification of potential issues associated with the proposed project and environmental sensitivities (i.e. over the broader project development site - entire extent of Farm Karreeboom 1716), as well as the extent of studies required within the EIA Phase were defined.
- » *EIA Phase* – potentially significant biophysical and social impacts¹ and identified feasible alternatives put forward as part of the project have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to Appendix L).

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area. A summary of the recommendations and conclusions for the proposed Boundary Solar Energy Facility project is provided in this Chapter.

¹ Direct, indirect, cumulative that may be either positive or negative.

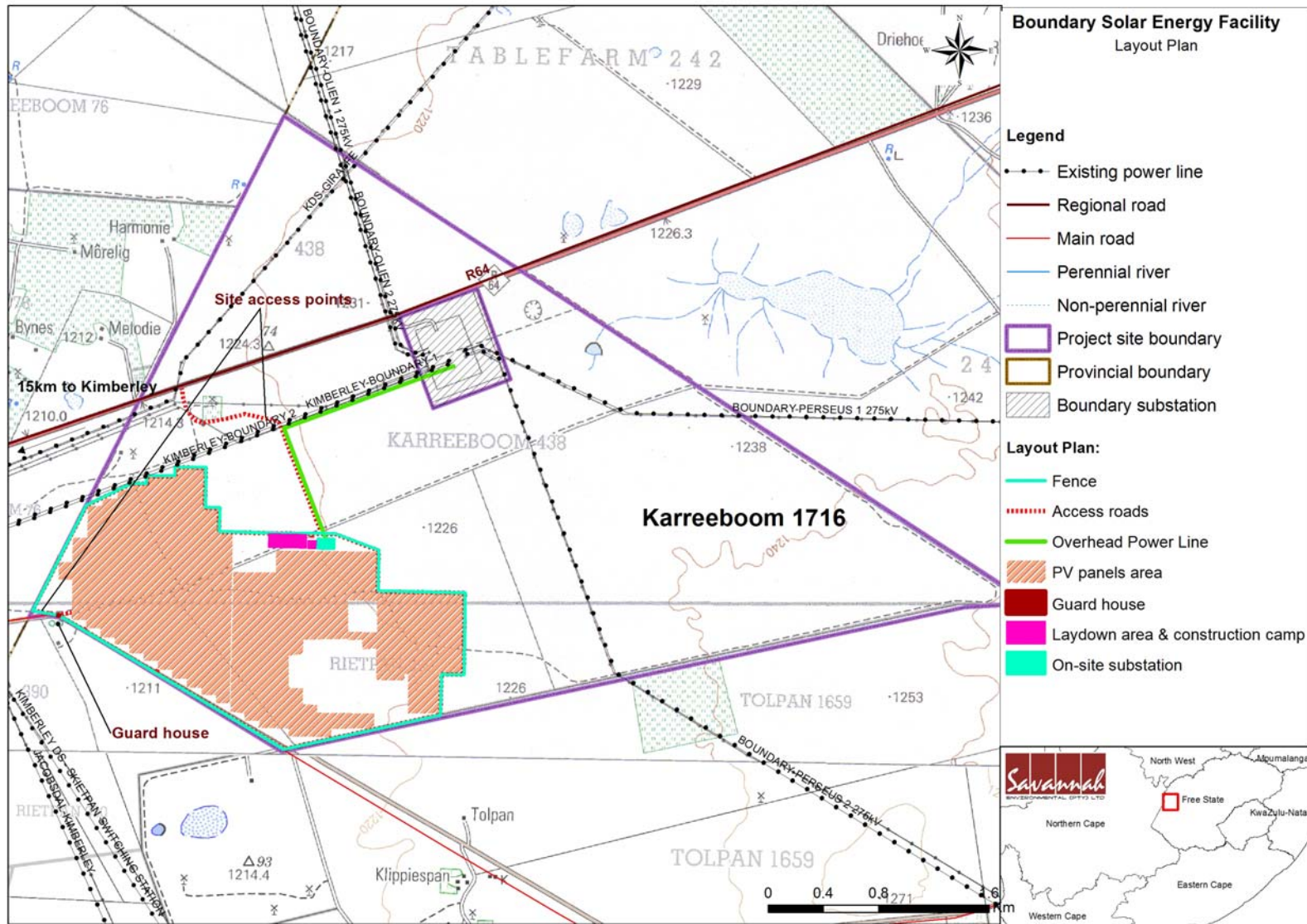


Figure 8.1: Map illustrating the location of the development footprint for Boundary Solar Energy Facility and associated infrastructure and the proposed layout of the proposed facility on the farm Karreeboom 1716.

8.1. Summary of Boundary Solar Energy Facility and Associated Infrastructure

The preceding chapters of this report together with the specialist studies contained within **Appendices E-K** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Boundary Solar Energy Facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, sensitive areas within the development footprint area were identified and flagged for consideration and avoidance by the facility layout (refer to Figure 8.2). Potential impacts which could occur as a result of the proposed project are summarised in the sections which follow.

The most significant environmental impacts identified and assessed to be associated with the proposed Boundary project include:

- » Impacts on ecology occurring on the site; and
- » Impacts on avifauna.

Other impacts which could have an impact on the environment include:

- » 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.);
- » Impacts on heritage and paleontological resources;
- » Social and economic impacts; and
- » Impacts associated with the power line.

8.1.1. Impacts on Ecology

Of the three vegetation associations within the study area, all can potentially be used for the development. However, within the associations are smaller areas with a significantly higher density of species of conservation concern, which should be avoided as much as possible to reduce the impact of the development on the larger ecosystem. Areas with deeper sandy soils have a higher density of protected and other large tree species – these can be considered as keystone plants due to their importance to the continued persistence of other fauna and flora and their influence on ecosystem function. One small pan could be detected in the study area, which

must be excluded from the development footprint. A buffer of 50 m around this pan is recommended. It is not expected that the development will compromise the survival of any specific flora or terrestrial vertebrate species on the study area or beyond if mitigation measures are fully implemented. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented.

8.1.2. Impact on avifauna

The White-browed Sparrow-weaver colonies located in or adjacent to the actual impact zone where the PV arrays will be constructed. As suggested in the impact assessment tables, a buffer zone of 100 m is proposed around each colony and removal of these colonies or the trees in which the colonies are located should be avoided, wherever possible. Further to this, the construction of the PV arrays should ideally be carried out in 'treeless' areas where vegetation sensitivities may be lower and where they fall outside of the sparrow-weaver buffers. It is likely that with the buffer zone in place the birds will habituate to development and operational activities of the facility.

Overall, development and construction of the solar energy facility is predicted to have some impact on the avifauna present on site. The predicted disturbances will vary between the construction and operational phases. It is difficult to predict at this stage how detrimental the impacts will have on bird populations in the short or long-term but based on the relatively small footprint of the solar energy facility, bird species present and flight path analyses, low-moderate impacts are probable as long as the mitigation measures proposed for this development are adhered to.

8.1.3. Impact on Soils, Land Capability and Agricultural Potential

The site is used only for the grazing of cattle. Agricultural potential is fairly uniform across the farm and the choice of placement of the facility on the farm therefore has minimal influence on the significance of agricultural impacts. There are no agriculturally sensitive areas that occur within the proposed development footprint. The major limitations to agriculture are the aridity and lack of access to water, as well as the shallow soils. The development will have low to medium negative impacts on agricultural resources and productivity. The conclusion of this assessment is that from an agricultural impact perspective the development can proceed as proposed, subject to the recommended mitigation measures provided being implemented.

8.1.4. Visual Impacts

Due to the flat topography and terrain of the area, there is little in the surrounding landscape (such as trees and buildings) that can shield the development from view. The landscape character of the site, and surrounds, is open grassland with few homesteads or townships. The visual exposure of the facility is therefore rated high for the immediate vicinity of the site. Other infrastructure such as the existing Eskom Boundary Substation located on the site presents an existing change in the visual environment. The study concluded that the significance of the overall visual impact of the proposed development would be moderate, due to its extent, long term duration and medium magnitude. Also considered were the scale of the development, the numbers and types of receptors directly affected and its compatibility with the local landscape. Mitigation measures are proposed which could moderate that visual impact. It is important that mitigation measures are complied with and it is advised that the environmental management programme set out principles for the implementation of these measures.

8.1.5. Impacts on Heritage and Paleontological Resources

Generally sparse heritage traces were found over most of the proposed development area. Remains of the historically recorded OFS Custom House situated just east of the Cape Colony/OFS boundary were found and a recommendation is made that this particular locale be excluded and treated as "No Go Areas from the proposed development. From an archaeological perspective the observed heritage resources over the bulk of the area surveyed, excepting the western-most fringe of the proposed development area, were found to be mainly of low density and low significance.

In terms of the palaeontology, the field assessment indicates that construction will primarily impact on Quaternary-age surface deposits. The likelihood of paleontological impact on superficial Quaternary sediments resulting from the construction of the photovoltaic panels and associated infrastructure at farm Karreeboom 1716 is considered extremely low. The terrain is not considered paleontological vulnerable and there are no major paleontological grounds to suspend the proposed development.

8.1.6. Social and Economic Impacts

The findings of the SIA indicate that the development of the proposed Boundary facility will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The enhancement measures listed in the report should be implemented in order to maximise the

potential benefits. In addition, the proposed establishment of a number of renewable energy facilities in the area will create socio-economic opportunities, which, in turn, will result in a positive social benefit. The significance of this impact is rated as high positive.

The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. The establishment of the proposed Boundary facility is therefore supported by the findings of the SIA. However, the potential impacts associated with large, solar energy facilities on an areas sense of place and landscape cannot be ignored. These impacts are an issue that will need to be addressed by the relevant environmental authorities, specifically given the large number of applications for solar facilities in the Free State and Northern Cape Province. In addition, the potential impact of the site on the areas sense of place and character is likely to be of low significance. It is therefore recommended that the facility as proposed be supported, subject to the implementation of the recommended mitigation measures and management actions contained in the report.

8.1.7. Impacts associated with the Power Line

The proposed overhead power line running from the PV facility into the Eskom substation is relatively short (1700m) and provided the power line marking mitigation measures prescribed by the avifauna assessment are adhered to, should not pose any severe threat to the avifauna, particularly priority species that use this area as flight paths. Based on this, no alternative layout is deemed necessary from an avifaunal perspective. Loss of vegetation as a result of removal of higher trees and shrubs is of low significance should the mitigation measures as included in the EMP be followed.

8.2 Assessment of Potential Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Boundary Solar Energy Facility falls within the identified geographical areas most suitable for the rollout of the development of solar energy projects within the Free State Province. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 20km radius will be built due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets. The cumulative impacts for the proposed Boundary Solar Energy have been assessed to be of low to moderate significance.

8.3 Comparison of Technology Alternatives

Impacts on the environment associated with the project will be influenced by the type of PV panel array to be used. PV technologies being considered for the proposed project are fixed and tracking, to be developed with a 260ha development footprint. For the majority of impacts, the two alternative PV technologies do not differ in any significant way. Therefore, there is no significant difference in the potential impacts associated with the alternatives. In terms of the specialist studies undertaken, the following conclusions were made regarding the preferred PV technology alternative:

	Fixed	Tracking
Ecology	Less preferred	Preferred
Avifauna	No preference	No preference
Soils and agricultural potential	No preference	No preference
Visual	Preferred	Less preferred
Heritage & palaeontology	No preference	No preference
Social	No preference	No preference

- » **Ecology** – Tracking PV technology is ecologically a preferred technology alternative, due to the aridity of the area and the difficulty of new vegetation establishment, the impact of tracking systems would seem less than that of a fixed panel array, even if the latter may occupy less space.
- » **Avifauna** – The two alternative PV technologies do not differ in any significant way as far as avifaunal habitat which they will affect, or the interaction between birds and the infrastructure is concerned.
- » **Soils and agricultural potential** - The agricultural potential for this site is low, in terms of impact arising from soils and agricultural potential, there is no significance difference in the potential impacts associated with the two technology alternatives.

- » **Visual** - Fixed technology is preferred being that it is less intrusive to sensitive receptors. However, for this particular site there is very little difference in the significance in the potential impacts associated with the two technology alternatives, with views being restricted to within 5km.
- » **Heritage and palaeontology** - There is no significance difference in the potential impacts associated with the two technology alternatives as the footprint remains unchanged.
- » **Social** - There is no difference in social / economic impacts from either technology alternatives.

There are no impacts of unacceptably high significance associated with either technology alternative assessed for the proposed Boundary Solar Facility. In addition, there is little or no difference between the impacts associated with the two technology alternatives, and there is therefore no strong preference for one technology. Both are considered to be environmentally acceptable for implementation at the Boundary Solar Energy Facility. The final technology selection should therefore be made on the basis of technical considerations?

8.4 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:

- » Direct 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 260 hectares). The cost of loss of biodiversity has been minimised on the Boundary PV site through 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. The cost of loss of visual quality to the area is reduced due to the area already been visually impacted by the Boundary Substation, power lines and surrounding mines.
- » Change in land-use and loss of land available for grazing on the development footprint.

These costs are expected to occur at a local and site level and are considered acceptable so long as the mitigation measures as outlined in the EMP are adhered to.

Benefits of the project include the following:

- » 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.

8.5. Overall Conclusion (Impact Statement)

The technical viability of establishing a solar energy facility with a net generating capacity of 75 MW on a site located on farm Karreeboom 1716 has been established by Rodicon Trading and Investments (Pty) Ltd. The positive implications of establishing the Boundary Solar Energy Facility on the identified site include the following:

- » The potential to harness and utilise solar energy resources within the Free State Province
- » The project will assist the South African government in reaching their set targets for renewable energy.
- » The project will assist the South African government in the implementation of its green growth strategy and job creation targets.
- » The project will assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business
- » The National electricity grid in the Free State and Northern Cape Province will 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 have been reduced by implementing the

mitigation measures recommended by the specialist team during the EIA process, and this specifically included the consideration of the facility layout in relation to sensitivities identified. The avoidance of areas of sensitivity is illustrated by the facility layout drawing included as Figure 8.2. The project has considered constraints, and is 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 the Boundary Solar Energy Facility 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** provided all measures are taken to protect and preserve surrounding environment.

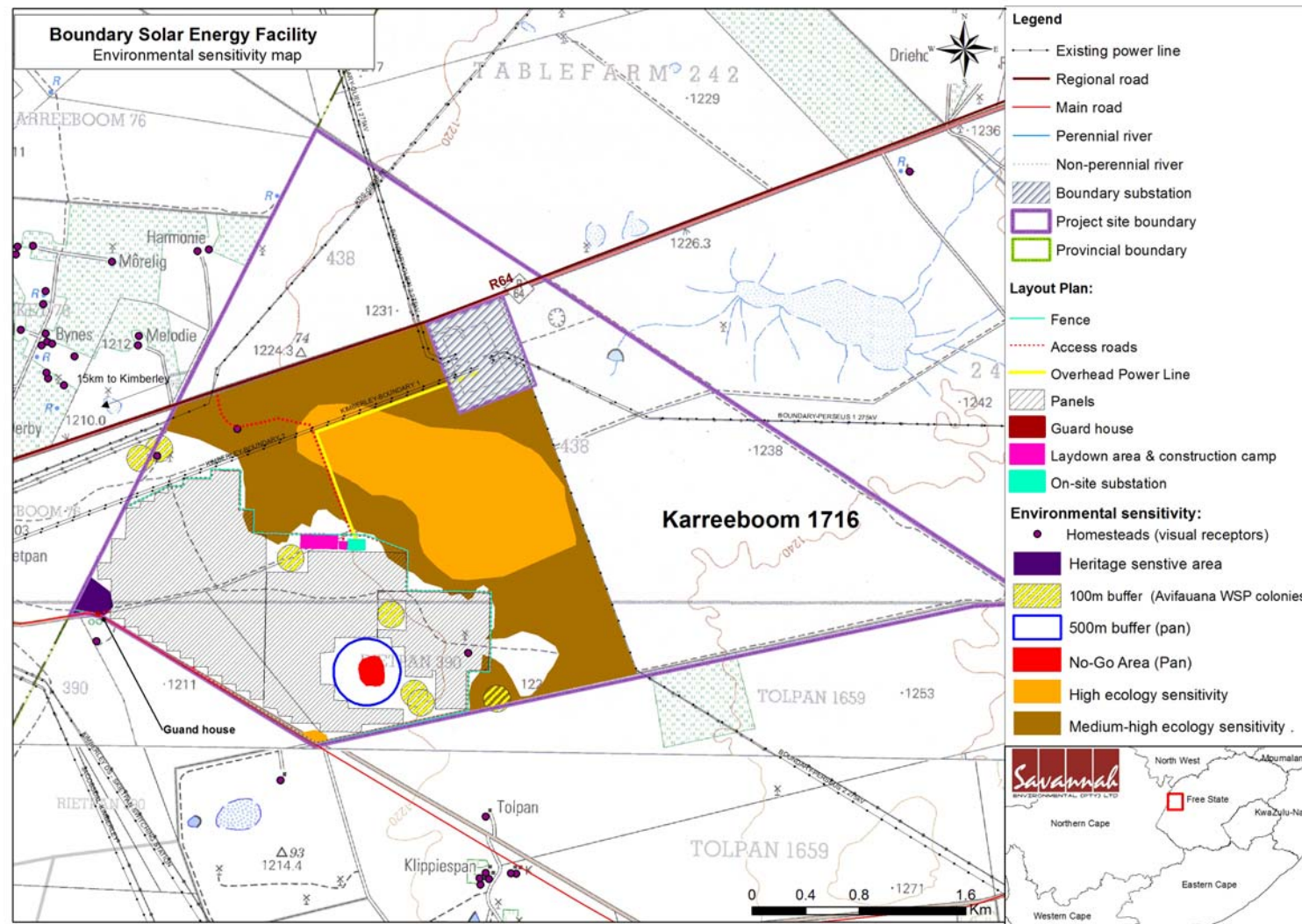


Figure 8.2: Sensitivity map of the proposed Boundary Solar Energy Facility

8.6. Overall Recommendation

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.

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the Boundary 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 layout plan as presented in Figure 8.2 has been designed to avoid the majority of the sensitive environments on the site:

- » Heritage remains of the historically recorded OFS Custom House situated just east of the Cape Colony/OFS excluded from the development footprint;
- » Areas with higher density of protected and other large tree species are avoided;
- » A pan on site is avoided with a 250m buffer; and
- » The White-browed Sparrow-weaver colonies are avoided with a 100m buffer around them.

Therefore this layout as presented is acceptable.

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

- » The draft Environmental Management Programme (EMPr) as contained within Appendix L of this report should form part of the contract with the Contractors

appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be the main key in achieving the appropriate environmental management standards as detailed for this project.

- » Heritage remains of the historically recorded OFS Custom House situated just east of the Cape Colony/OFS boundary were found and a recommendation is made that this particular locale be excluded and treated as "No Go Areas from the proposed development.
- » One small pan was mapped and must be excluded from the development footprint. A buffer of 50 m around this is recommended to maintain ecological functioning of the system, and a buffer of 250m is required to reduce impacts to avifauna.
- » The smaller patches of very dense populations of protected geophytic species should be excluded from the development footprint. These are indicated as high ecological sensitivity on the sensitivity map.
- » Following the final design of the facility, a final layout must be submitted to DEA for review and approval prior to commencing with construction.
- » If any protected plant or tree species are required to be removed/destroyed as part of the construction of the development, a collection/destruction permit to be obtained from DAFF for the protected trees and FS DETEA for other protected plants.
- » A water use license must be obtained should water be abstracted for the project from the groundwater resource. The viability and sustainability of this resource should however first be investigated in consultation with DWA.
- » It is recommended that weeds and invasives in the remaining natural veld on the eastern portion of the study area be eradicated and controlled, but that the area is excluded as much as possible from the development. All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended. A rigorous alien invasive plant monitoring and management plan must therefore be implemented right up to the decommissioning phase.
- » Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.
- » All infrastructures, including access roads and other on-site infrastructure be planned so that the clearing of vegetation is minimised.
- » Site rehabilitation of temporary laydown and construction areas to be undertaken immediately after construction.
- » Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be

removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.

- » Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.
- » Compile a comprehensive storm-water management method statement, as part of the final design of the project and implement during construction and operation.
- » All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
- » An independent Environmental Control Officer (ECO) must be appointed by the project developer prior to the commencement of any authorised activities.
- » 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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CHAPTER 9

Ecology Study

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