ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED LETHABO PV SOLAR ENERGY FACILITY NEAR SASOLBURG, FREE STATE PROVINCE

DEA REF NO.: 14/12/16/3/3/2/753

FINAL FOR SUBMISSION TO THE DEA
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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/753
Title	:	Environmental Impact Assessment Process Environmental Impact Assessment Report for the Proposed Lethabo PV Solar Energy Facility near Sasolburg, Free State Province
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PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Eskom Holding SOC (state owned company) Ltd is proposing to establish a 75MW photovoltaic solar energy facility and associated infrastructure on a site within the Lethabo Coal Fired Power station boundary, approximately 25 km north-east of Sasolburg in the Free State Province. Savannah Environmental has been appointed as the independent environmental consultants, to undertake the requisite Environmental Impact Assessment (EIA) Process. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The EIA Phase aims to address those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with the project including design, construction, operation and decommissioning, and recommend appropriate mitigation measures for potentially significant environmental impacts. The purpose of this EIA report is to assess the impacts associated with the currently proposed layout for the Lethabo PV Solar Energy Facility through detailed specialist studies and public consultation. This EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provided stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report incorporates all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project. The Final EIA report demonstrates that the conditions of the Acceptance of the Scoping Report, and the comments received during the review period of the EIA report (including those received from the Competent Authority) have been considered and addressed as required.

This Environmental Impact Assessment Report represents the findings EIA phase of the EIA process and contains the following sections:

- **Chapter 1** provides background to the Project and the environmental impact assessment, and an introduction to the rationale behind the selected site and technology proposed.
- **Chapter 2** provides the project description, need and desirability, site selection information and identified project alternatives.
- **Chapter 3** outlines the strategic legal context for the energy planning and the Project.
- **Chapter 4** outlines the approach to undertaking the environmental impact assessment process.

- **Chapter 5** describes the existing biophysical and socio-economic environment within and surrounding the Project development footprint.
- **Chapter 6** provides an assessment of the potential issues and impacts associated with the Project and presents recommendations for mitigation of significant impacts.
- **Chapter 7** provides an assessment of cumulative impacts.
- **Chapter 8** presents the conclusions and recommendations based on the findings of the EIA.
- **Chapter 9** provides a list of reference material used to compile the EIA Report.

DEA & LEGAL REQUIREMENTS

As outlined in the acceptance of the FSR dated June 2015, Savannah Environmental has compiled a tables (refer to Table 1 and 2 below) which outline the general site information and technical details of the proposed facility.

Table 1: A detailed description of the project site

Province	**Northern Cape Province**
District Municipality	Fezile Dabi District Municipality
Local Municipality	Metsimaholo Local Municipality
Ward number(s)	19
Nearest town(s)	Sasolburg & Vereeniging
Farm name(s) and number(s)	Farm 1814
Portion number(s)	0
SG 21 Digit Code (s)	F01600000000181400000

Table 2: Dimensions of typical structures required for the PV Facility

Component	**Description/ Dimensions**
Electricity Generating capacity	» Alternative site 1 – 75MW » Alternative site 2 – 35MW
Extent of the proposed development footprint	» Alternative site 1– 162ha » Alternative site 2– 52ha
Centre Point for each alternative proposed	» Alternative site 1: Longitude: 27°57'25.49"E Latitude: 26°44'23.61"S » Alternative site 2: Longitude: 27°58'26.27"E Latitude: 26°44'59.40"S
Site access	The main access to the site will be obtained via the R715 that runs parallel to the site. Internal access roads of up to 5m wide will also be required.
Proposed technology and Height of installed panels from ground level	Static - up to 3.5 m Tracking – single/double axis up to 6 m
Number of Panels	Dependant on module to be used. This will be confirmed before construction. Typically it would be: Alternative site 1 – » Approximately 300,000 PV modules (Polycrystalline technology) » Approximately 714,000 PV modules (Thin Film technology)

Component	Description/ Dimensions
	Alternative site 2: » Approximately 140,000 PV modules (Polycrystalline technology) » Approximately 333,300 PV modules (Thin Film technology)
Panel Dimensions	1,640 x 990 mm (Polycrystalline technology) 1,200 x 600 mm (Thin Film technology)
Panel direction	North facing
Number of inverters	Dependant on inverter to be used. This will be confirmed before construction. Typically it would be: » Alternative site 1 and 3 – 150 » Alternative site 2– 70
Main transformer / on-site substation capacity and size	All two alternatives – » Step-up up to 6.6/11 kV (for connection at station board) » Step-up up to 88/132 kV (for connection at HV yard) on site substation size approximately 50m x 50m
Associated buildings (size)	Approximately 150 m^2
New overhead power line	Servitude width – depending upon the overhead voltage level (between 9 m to 15.5 m : measured from the centre line of the power line) Length: approximately 800 - 1000 m Height of towers – maximum height of 12 to 25 m
Services required	» Sewage and Refuse material disposal - all 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. Electricity will be generated from generators for any electrical work on site or electricity will be obtained from an Eskom auxiliary supply, depending on the feasibility during construction.

The requirements of an Environmental Impact Assessment Report, in accordance with regulation 31 of GN 543 are presented in **Table 3**.

Table 3: Content of the EIA report

EIA Regulations requirements		Environmental Impact Assessment Report
(a)	Details of EAP and expertise to carry out an environmental impact assessment	Chapter 1
(b)	Description of the proposed activity	Chapter 1
(c)	Description of the property on which the activity is to be undertaken and the location of	Chapter 1

	the activity on the property	
(d)	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 (PPP) conducted: (i) Steps taken 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 and issues raised by interested and affected parties (I&APs) including response from EAP on issues; and (iv) Copies of any representations and comments received from registered I&APs. .	Chapter 4 and Appendix C
(f)	Need and Desirability of proposed activity	Chapter 2
(g)	Description of alternatives, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Chapter 2
(h)	Methodology used in determining the significance of potential environmental impacts	Chapter 4
(i)	Description and comparative assessment of alternatives	Chapters 1; 2 and 6
(j)	Summary of the findings and recommendations of specialist reports	Chapter 6, 7 and 8
(k)	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	Chapters 6, 7 and 8 and Appendix M
(l)	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	Chapters 6 and 7

	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	
(m)	Assumptions, uncertainties and gaps in knowledge	Appendix D-K, Chapter 4
(n)	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	Chapter 6;7 and 8
(o)	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	Chapter 6-8
(p)	Environmental management programme	Appendix M
(q)	Specialist reports	Appendix D-K
(r)	Specific information required by CA	Appendix B, Table 4
(s)	Other matters required in terms of sections 24(4)(a) and (b) of the Act, i.e. NEMA section 24 (4) Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment- (a) must ensure, with respect to every application for an environmental authorisation- (i) coordination and cooperation between organs of state in the consideration of assessments where an activity falls under the jurisdiction of more than one organ of state; (ii) that the findings and recommendations flowing from an investigation, the general objectives of integrated environmental management laid down in this Act and the principles of environmental management set out in section 2 are taken into account in any decision made by an organ of state in relation to any proposed policy, programme, process, plan or project; (iii) that a description of the environment likely to be significantly affected by the proposed activity is contained in such application; (iv) investigation of the potential consequences	Chapter 4 Chapter 6-8 Chapter 5

	for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts; and	Chapter 6-7
	(v) public information and participation procedures which provide all interested and affected parties, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and	Chapters 4
	(b) must include, with respect to every application for an environmental authorisation and where applicable-	
	(i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;	Chapter 6
	(ii) investigation of mitigation measures to keep adverse consequences or impacts to a minimum;	Chapter 6
	(iii) investigation, assessment and evaluation of the impact of any proposed listed or specified activity on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), excluding the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act;	Chapter 6
	(iv) reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information;	Chapter 4
	(v) investigation and formulation of arrangements for the monitoring and management of consequences for or impacts on the environment, and the assessment of the effectiveness of such arrangements after their implementation;	Appendix M
	(vi) consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3); and	Appendix L
	(vii) provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to	

	the listed or specified activity in question.	

The FSR described the potential environmental impacts, site alternatives, and Plan of Study (PoS) for the EIA. The FSR was submitted to DEA and accepted on the 9 of June 2015. Specific Information required by the Competent Authority (CA) is detailed in a summary provided in **Table 4**

Table 4: Specific Information required by the Competent Authority CA

Ref. in the DEA Acceptance letter	DEA Requirement	Environmental Impact Assessment Report
i.	Following a review of the SR and application form, the following information must form part of the EIAr as well as a separate document for ease of reference: • An amended application form with an indication of all the 2010 listed activities that are still listed; An indication of all the similarly listed activities in terms of G.N. R 982 of 04 December 2014; • An indication if there are any new activities that are listed in terms of G.N. R 982 of 04 December 2014; • An indication where in the report all the activities listed in terms of in terms of G.N. R 982 of 04 December 2014 have been assessed and mitigated for; and, • A letter/affidavit from the EAP indicating that the above is true and correct.	Appendix N Chapter 4 Appendix O
ii.	Please note that the Department's application form template has been amended and can be downloaded from the following link https://www.environment.gov.za /documents/forms	Appendix N
iii.	It is imperative that the relevant authority are continuously involved throughout the EIA process	Chapter 4 Appendix C
iv.	The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	Appendix M Chapter 6-7
v.	Cumulative impacts of a similar type of developments in the area must form part of the studies that must be assessed as part of the EIA process.	Chapter 7
vi.	The following activities applied for may trigger Section 19 and section 21 of the National Water Act No.36 of 1998: GN R 544 Activities 11(xi) and 18 (i). The EAP is advised to conduct a surface hydrological study as part of the EIAr.	Appendix K
vii.	The listed activities represented in the EIAr and the application form must be the same and correct.	Chapter 4 and Appendix N
viii.	The EIAr must provide the technical details for the proposed	Table 1-2

	facility in a table format as well as their description and/or dimensions.	
ix.	The EIAr must provide the four corner coordinate points for the proposed development site (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.	Chapter 2 Table 2.1 and 2.2
x.	The EIAr must provide the following: Clear indication of the envisioned area for the proposed solar energy facility; i.e. placing of photovoltaic panels and all associated infrastructure should be mapped at an appropriate scale. Clear description of all associated infrastructure. This description must include, but is not limited to the following: • Power lines; • Internal roads infrastructure ; • All supporting onsite infrastructure such as laydown area, guard house and control room etc. • All necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation.	Chapter 5 Chapter 8 Appendix L
xi.	The EIAr must also include a comments and response report in accordance with Regulation 28(m) of the EIA Regulations, 2010.	Appendix C
xii.	The EIAr must include the detail inclusive of the PPP in accordance with Regulation 54 of the EIA Regulation	Chapter 4 Appendix C
xiii.	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	Chapter 2
xiv.	An Avifaunal Assessment must be conducted to determine the impacts that the proposed activity (including the powerline) may have on avifauna. Mitigation measures must be proposed and included in the EIAr and the EMPr.	Chapter 6 Appendix D
xv.	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	Chapter 2
xvi.	The EIAr must provide a detailed description of the need and desirability, not only providing motivation on the need for clean energy in South Africa of the proposed activity. The need and desirability must also indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites.	Chapter 2
xvii.	A copy of the final site layout map. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible	Chapter 8 Appendix L

xviii.	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Chapter 6 Chapter 8 Appendix L
xix.	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Chapter 8
xx.	A shape file of the preferred development layout/footprint must be submitted to this Department.	Submitted with the FEIAr
	The Environmental Management Programme (EMPr) to be submitted as part of the EIAr	Appendix M

COMMENT ON THE EIA REPORT

Members of the public, local communities and stakeholders were invited to comment on the EIA report for the Lethabo PV facility dated March 2016, which was made available for a 30-day public participation period between **22 March 2016 – 25 April 2016** at the following places

» Sasolburg Public Library
» Vereeniging Library

The report was also available for download on:

» www.savannahsa.com

Comments were received through written submission via fax, post or e-mail. All comments received were captured and have been addressed as required in this Final EIAr and Appendix C of this report.

EXECUTIVE SUMMARY

Background

Eskom Holding SOC Ltd is proposing to establish a 75MW photovoltaic solar energy facility and associated infrastructure on a site within the Lethabo coal fired power station boundary, approximately 25 km north-east of Sasolburg in the Free State Province.

Based on a pre-feasibility analysis and site identification process undertaken by Eskom, a favourable area has been identified for consideration and evaluation through an environmental impact assessment process. The study area is situated in the jurisdiction of Fezile Dabi District Municipality and Metsimaholo Local Municipality.

The **Lethabo PV Solar Energy Facility** is proposed to accommodate several arrays of photovoltaic (PV) panels and associated infrastructure. From a local perspective, the site is preferred due to suitable topography, grid connection access, and by virtue of the extent of the site.

An EIA process and public participation process is being undertaken for the proposed project. The nature and extent of this facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this EIA Report.

Project Location

The project is located on Farm 1814 within the boundaries of the Lethabo Coal Fired Power Station approximately 25 km north-east of Sasolburg in the Free State Province.

Project Components

The facility is proposed to include several arrays of PV solar panels with a net generating capacity of up to 75MW. A development footprint of approximately ~162 ha will be required in order to accommodate the following infrastructure:

- Solar panels (fixed/tracking technology) with a net generating capacity of up to 75MW.
- Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, or ground screws to support the PV panels.
- Central invertor/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 or switching station.
- A power line to facilitate the connection of the solar energy facility from the on-site substation to Lethabo power

station or nearest grid connection within the Lethabo power station.
» Internal access roads.
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity.

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

Evaluation of the Proposed Project

The chapters contained of this report together with the specialist studies contained within **Appendices D - K** provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the Lethabo PV Solar Energy Project. The assessment of potential environmental impacts presented in this report is based on a layout of the PV facility and associated infrastructure provided by Eskom. This initial layout accommodates several arrays of tracking or static **PV panels** and associated infrastructure over the proposed site. The potential for impacts of major, high significance and no-go areas were identified which require mitigation. Mitigation to avoid impacts are primarily associated with the modification of the initial layout to prevent encroachments into the wetlands. These are discussed in more detail in the sections which follow. Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft Environmental **Management Programme (EMPr)** included within **Appendix** .

A summary of the potential impacts identified and assessed through the EIA process in terms of the preliminary PV layout of up to 75 MW and associated infrastructure, are discussed below:

Impacts on wetlands:

Two **wetlands**, both hillside seeps, were recorded in the study area. The wetlands were found to have a **moderate** importance and sensitivity to changes in flow regime and lacked sensitive biota. Potential impacts to be taken into account include:

» Loss and disturbance of wetland habitat and fringe vegetation.
» Introduction and spread of alien invasive vegetation.
» Changes in the amount of sediment entering the system.
» Changes in water quality due to toxic contaminants and increased

nutrient levels entering the system.
» Changes in water flow regime due to the alteration of surface characteristics.

It is preferred from a wetland perspective that the proposed Lethabo Solar Photovoltaic Facility be constructed on site Alternative 1. In order to mitigate the potential impacts on the wetland it is recommended that development within these wetland areas is avoided and that a 30m buffer is set to protect wetland functionality. From the conclusions of the detailed Wetland study undertaken no impacts of high potential significance that cannot be mitigated to a low level were identified within the development footprint. Overall and with the suggested mitigation measures implemented, the **wetland** impacts of the development are likely to be of **moderate to low significance** and no impacts of high significance are likely with mitigation. As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved

Impacts on ecology

The selected property falls within the Central Free State Grassland (GH 6) as defined by Mucina and Rutherford (2006). Three vegetation associations could be identified within the proposed development areas namely:
» Association 1: *Digitaria eriantha* (Transformed Grassland). This grassland has a low sensitivity rating.
» Association 2: *Paspalum urvillei – Verbena bonariensis (*Grassland). This grassland has a low sensitivity rating.
» Association 3: *Cynodon dactylon* - This grassland has a medium sensitivity rating.

115 indigenous plant species could be verified on site, with an additional 22 alien invasive species (excluding planted exotic trees). *Boophane disticha* plants were encountered on the study site and are protected by the Nature Conservation Ordinance 8 of 1969 Schedule 6: Protected Species (Refer to Appendix F of this EMPr).

It is not expected that the development will compromise the survival of or significantly impact any flora or terrestrial vertebrate species on the study area or beyond. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented; and the associated integrity of surrounding wetlands. Overall and with the suggested mitigation measures implemented, the **ecological** impacts of the development are likely to be of **moderate to low significance.** As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

Impacts on Avifauna

Given the presence of existing habitat degradation and disturbance associated with the mining, energy generation and industrial activities that are prevalent in the study area and surrounds, and due to the relatively low importance of the site for many bird species, most impacts are seen as acceptable for avifauna. The overall impact on **Avifauna** is likely to be of a **medium significance prior to mitigation**. This could be reduced to low negative significance following the implementation of mitigation measures, which includes a buffer around the wetlands. . It is anticipated that the proposed Lethabo Solar Photovoltaic Facility can be constructed at either of the two proposed sites with acceptable levels of impact on the resident avifauna.

Impacts on Soils, Land Capability and Agricultural Potential

The overall impact on **Soils and Agricultural Potential** is likely to be of a **medium to low significance** prior to mitigation. This could be reduced to low negative significance following the implementation of mitigation measures. Alternative 1 has a distinct difference in soils between the northern and southern halves. The northern half has largely disturbed, poor quality soils while the southern half has better agriculture potential, especially in the south-west. Alternative 2 has a wetland which should be avoided completely. Based on the soil survey, it is recommended and preferred that the proposed PV facility be developed on Alternative 1 site, if possible avoiding the south-west corner with the Av type soil.

Impacts on Heritage and Paleontological Resources

The overall impact on the **heritage resources** is likely to be of a **low significance** as very sparse heritage traces (of low heritage value) were found during the field survey. Based on the results of the study there are no significant archaeological risks associated with the proposed solar facility at either site considered. However graves can be expected anywhere on the landscape and the low archaeological visibility during the survey could result in graves not identified in the study area.

Impacts on Visual quality of the area

The overall visual impact is likely to be of a low significance. The proposed development will take place within a landscape that is already heavily impacted by large scale industrial development including mining operations and the Lethabo Power Station. The most sensitive landscape areas include the rural landscape to the east of the Vaal River, the urban landscape to the north of the Vaal River and the Vaal River Corridor itself. The proposed development of Alternative Sites 1 and 2 could be visible to residential receptors to the north of the Vaal River. Development of Alternative 2 is likely to be visible to a small number of farmsteads to the east of the Vaal River and the development

of Alternative Site 1 could be visible to a small section of adjacent regional roads to the west. The assessment has shown however that these impacts will be largely screened by existing vegetation and are likely to be negligible given the existing industrial context within which the views will be seen. Areas to the east of the arrays could be affected to a small degree by glare during early mornings in February, March, September and October. The area impacted is not highly developed nor does a major route run through it. The impact is also so minor that it is likely to be un-noticeable and is therefore negligible.

Social and Economic Impacts

The overall social impact is likely to be of a medium significance in terms of positive impacts, and a low medium significance in terms of the negative impacts. From a social perspective it is concluded that the proposed Lethabo Solar Energy Facility Alternative Site 1 or Alternative Site 2 could be developed subject to the implementation of the recommended mitigation measures and management actions contained in the report. The proposed development represents greater positive social potential than negative implications due to the development being located in an industrial area.

From the analysis of alternatives it can be concluded that Alternative Site 1 is the socially preferred alternative as this development would bring more positive socio-economic benefits to the local area for a longer period of time; in terms of job creation, capital expenditure, wage bill expenditure and a higher amount of MWs of renewable energy. Therefore the Alternative site 1 is the socially preferred option based on the greater socio-economic benefits the development will provide to the local area with minimal negative social impacts due to the site being located in an industrial area.

Cumulative effects: Cumulative impacts of this new development to the larger area is likely to have low or no influence on the nature of the areas due to heavy industrial and large mining areas located next to the project site. Existing industrial structures are likely to provide significant screening particularly from middle distance and distance views. From a distance small scale development may also be viewed against a backdrop of larger industry which is also likely to make it less obvious.

Evaluation of the Potential Issues with Associated Infrastructure - Invertors, and Internal Access Roads

In order to connect the Lethabo PV Solar Energy Facility to the power grid, the Eskom intends on building on-site substation and power line for which will connect into the existing substation located on the site.

Potential issues identified to be associated with a proposed overhead power line, substation, access roads and invertors include impacts on

flora, fauna and ecological processes, impacts on avifauna as a result of collisions and electrocutions, heritage and visual impacts. There are no fatal flaws associated with the associated infrastructure of the Lethabo PV Solar Energy Facility site on Farm 1814.

Environmental Sensitivity and Micro-siting

In response to the identified need to adequately manage impacts within sensitive areas identified on the site development footprint, and in order to demonstrate the ability of the project to adhere to recommended mitigation measures, Eskom has developed a best practice mitigation strategy with regards to the facility layout.

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 1-2**.

Overall Conclusion

The technical viability of establishing the Lethabo PV Solar Energy Facility on the Farm 1814 within the Lethabo Coal Fired Power Station boundary has been established by Eskom. The positive implications of establishing the Lethabo PV Solar Energy Facility on the identified site include the following:

» To enable Eskom to diversify their energy mix and reduce their relative carbon footprint at the Lethabo Power Station.
» 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.
» Promotion of clean, renewable energy in South Africa.
» Creation of local employment, business opportunities and skills development for the area.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. These mitigation measures have been taken into account and an optimised layout has been produced (**Figure 8.2**). Environmental specifications for the management of potential impacts are detailed within the Environmental Management Programme (EMPr) for the Lethabo PV Solar Energy Facility

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

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 impacts associated with the development of the Lethabo PV Solar Energy Facility project can be mitigated to an acceptable level. As per the requirements of the NEMA (Act 107 of 1998), this EIA has identified and assessed project alternatives and the potential environmental impacts associated with the proposed PV facility. Alternative Site 1 is anticipated to have the least significant impact on ecological and wetland resources and generate greater positive impacts from a Social perspective (in terms of economic impact and jobs) and is the preferred alternative. In terms of this conclusion, the EIA project team support the decision for environmental authorisation on Alternative site 1. The optimised layout shown in **Figure 8.1 and Figure 8.2** is acceptable and the following conditions would be required to be included within an authorisation issued for the project:

» All mitigation measures detailed within this report and the specialist reports contained within Appendices D to K must be implemented.
» Following the final design of the facility to include the 30 m buffer around the identified wetlands, a final layout must be submitted to DEA for review and approval prior to commencing with construction.
» The Environmental Management Programme (EMPr) as contained within Appendix M of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be the main key in achieving the appropriate environmental management standards as detailed for this project.
» If any protected plant or tree species are required to be removed 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 as the proposed facility is within 500m of a wetland. The viability and sustainability of this

resource should however first be investigated in consultation with DWS.

» 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.

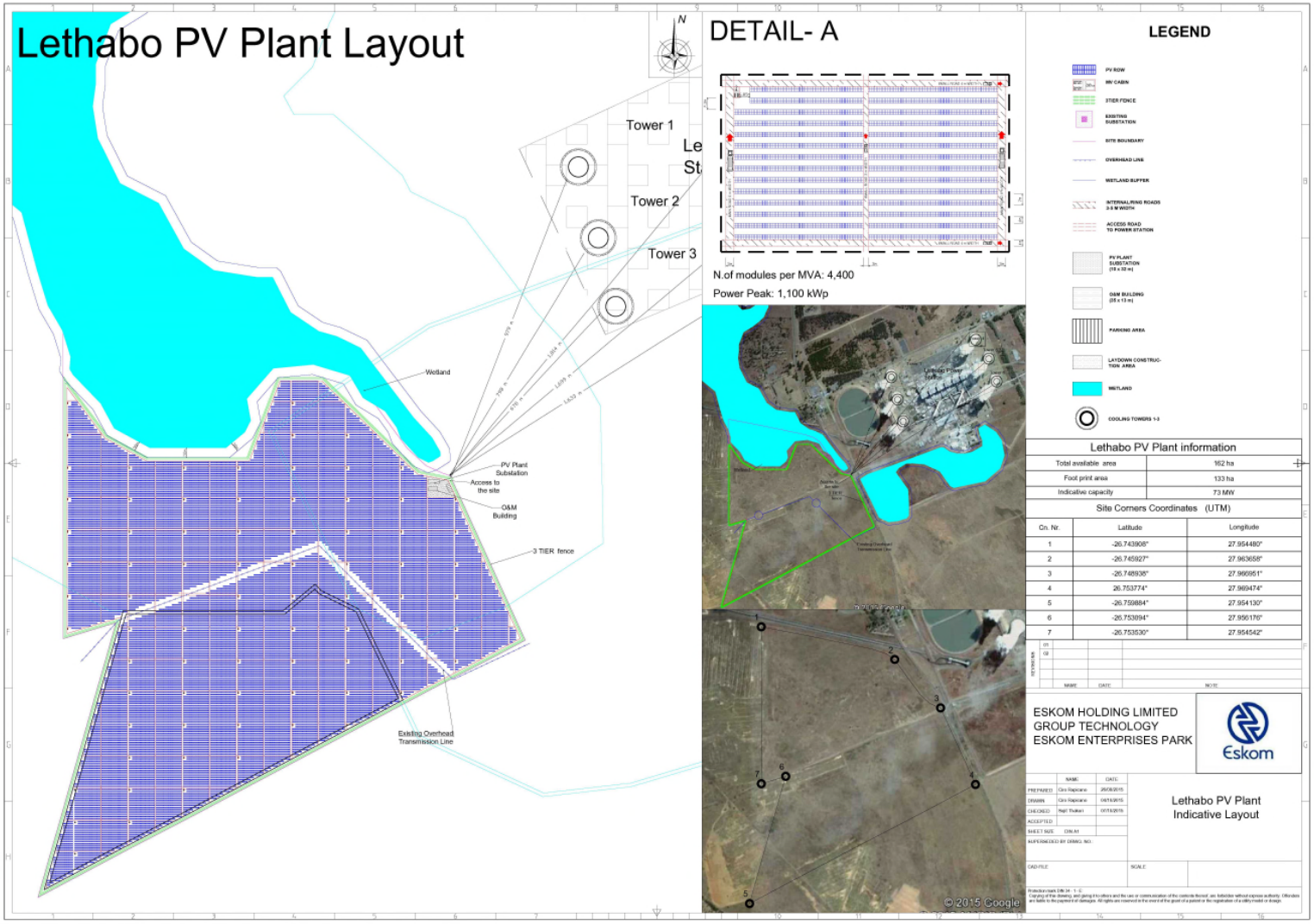
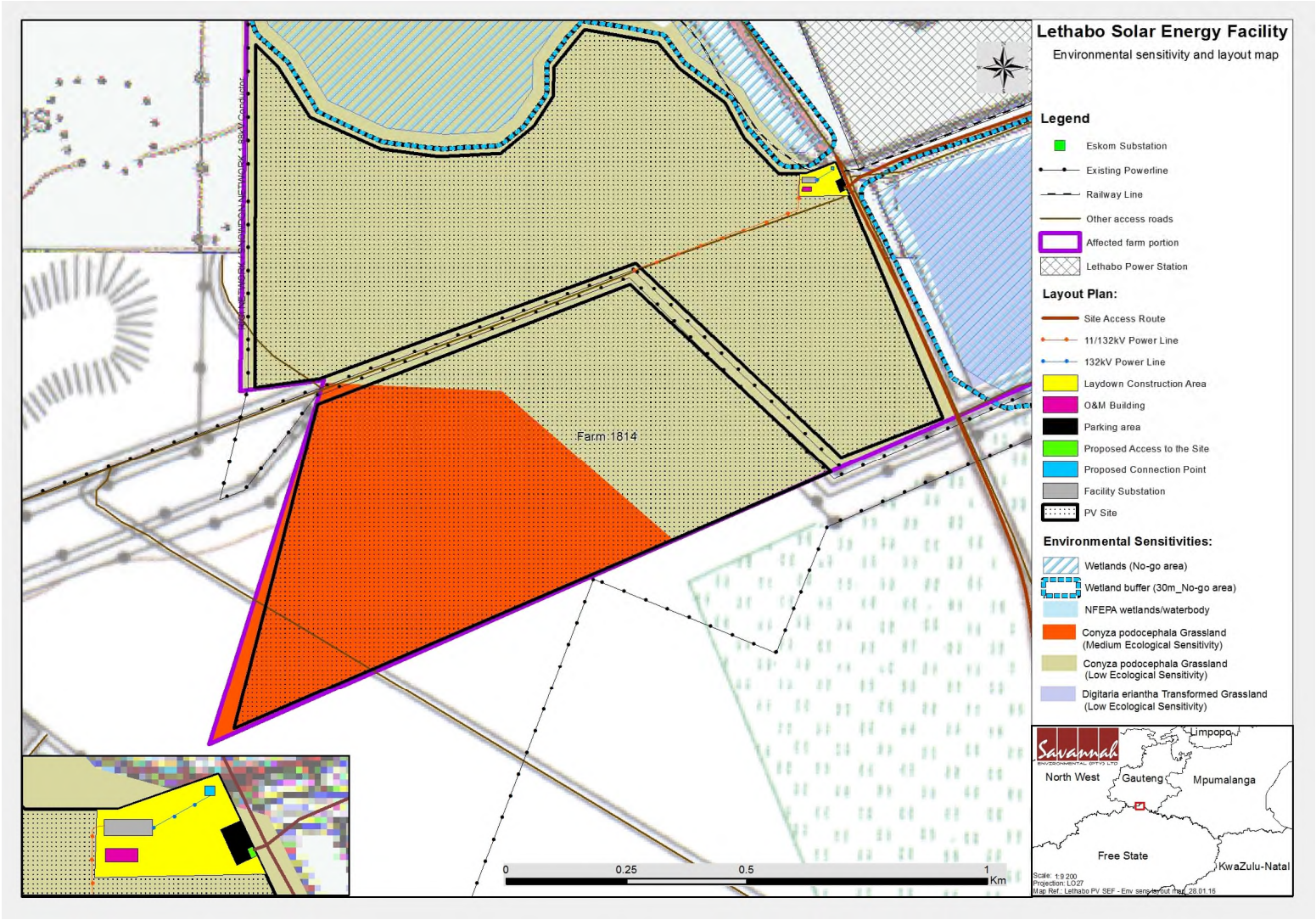


Figure 1: The optimised Layout development footprint of the proposed Lethabo PV Solar Energy Facility



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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.

Article 3.1 (*sensu* Ramsar Convention on Wetlands): "Contracting Parties "shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory"".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

Calcrete: A soft sandy calcium carbonate rock related to limestone which often forms in arid areas.

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

Demand-side Management Programme (DSM): A joint initiative between the DME, the National Electricity Regulator (NER) and Eskom which aims to provide lower cost alternatives to generation system expansion by focusing on the usage of electricity. Consumers are incentivised to use electricity more efficiently and at times of the day outside of Eskom's peak periods.

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

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'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.

Early Stone Age: A very early period of human development dating between 300 000 and 2.6 million years ago.

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.

Late Stone Age (LSA): In South Africa this time period represents fully modern people who were the ancestors of southern African KhoeKhoen and San groups (40 000 – 300 years ago).

Middle Stone Age (MSA): An early period in human history characterised by the development of early human forms into modern humans capable of abstract though process and cognition 300 000 – 40 000 years ago.

Midden: A pile of debris or dump (shellfish, stone artefacts and bone fragments) left by people after they have occupied a place.

Miocene: A geological time period (of 23 million - 5 million years ago).

National Integrated Resource Plan (NIRP): Commissioned by NERSA in response to the National Energy Policy's objective relating to affordable energy services, in order to provide a long-term, cost-effective resource plan for meeting electricity

demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

Natural properties of an ecosystem (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "…physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

Palaeontological: 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.

Pleistocene: A geological time period (of 3 million – 20 000 years ago).

Pliocene: A geological time period (of 5 million – 3 million years ago).

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).

Self-consumption: The possibility for any kind of electricity consumer to connect a photovoltaic system, with a capacity corresponding to his/her consumption, to his/her own system or to the grid, for his/her own or for on-site consumption, while receiving value for the non-consumed electricity which is fed into to the grid.

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.

Sustainable Utilisation (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/).

Structure (historic): Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CO_2	Carbon dioxide
DEA	National Department of Environmental Affairs
DMR	Department of Mineral Resources
DOT	Department of Transport
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
kV	Kilovolt
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
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework
SIA	Social Impact Assessment
ZVI	Zone of visual influence

INTRODUCTION CHAPTER 1

Eskom Holding SOC (state owned company) Ltd (hereafter to be referred to as Eskom) is proposing to establish a **photovoltaic (PV)** solar energy facility of up to 75 MW and associated infrastructure on a site within the Lethabo Coal Fired Power station boundary, approximately 25 km north-east of Sasolburg in the Free State Province (Refer to Figure 1.1). This project is to be known as the Lethabo PV Solar Energy Facility. Based on a pre-feasibility analysis and site identification process undertaken by Eskom a favourable area has been identified for consideration and evaluation through an Environmental Impact Assessment (EIA).

The solar energy facility is proposed to accommodate several arrays of tracking or static **PV panels** and associated infrastructure over the proposed site. From a regional perspective, the greater area is considered favourable for the development of a commercial solar electricity generating facility by virtue of the **climatic conditions** (primarily as the economic viability of a solar energy facility is directly dependent on the annual solar irradiation values for a particular area), relief and aspect, the extent of the site, and the availability of a direct **grid connection** (i.e. point of connection to the National grid). In addition, the project will contribute towards Eskom's target for the reduction of its self-consumption at its sites by introducing a PV Programme at various Eskom-owned properties across the country.

The nature and extent of this facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Environmental Impact Assessment Report.

1.1. Background to the project

The Lethabo PV Solar Energy Facility is proposed on Farm 1814, in the jurisdiction of Fezile Dabi District Municipality and Metsimaholo Local Municipality within the Free State Province (Refer to Table 1.1). The proposed development site is traversed by a number of power lines connecting into the Lethabo Power Station. Access to the site is provided directly from the R716 that runs parallel to the western boundary of the proposed site. Two alternative sites[1] of~162 ha (Alternative 1) and 52 ha (Alternative 2) in extent will be assessed for the Lethabo PV Solar Energy Facility. The proposed Alternative Sites 1 and 2 will accommodate facilities of up to 75 MW and 35 MW respectively. The sites are situated within the broader power station property of approximately 1000 ha on

1 Three alternative sites were assessed at scoping. Based on technical limitation of the one site, it was concluded that only two site alternatives be assessed further at the EIA phase.

Eskom owned land. Therefore, it is anticipated that the PV panels and the associated infrastructure can be appropriately placed within the boundaries of the broader site to avoid any identified environmental sensitivities or constraints identified through the EIA process. These sites were confirmed by Eskom as being potentially suitable for solar energy generation through an internal site selection and feasibility study (Refer to Chapter 2).

Table 1.1: A detailed description of the project site

Province	**Northern Cape Province**
District Municipality	Fezile Dabi District Municipality
Local Municipality	Metsimaholo Local Municipality
Ward number(s)	19
Nearest town(s)	Sasolburg & Vereeniging
Farm name(s) and number(s)	Farm 1814
Portion number(s)	0
SG 21 Digit Code (s)	F01600000000181400000

Lethabo PV Solar Energy Facility will have a net generating capacity of up to 75 MW which will accommodate several arrays of PV panels and associated infrastructure. The project will comprise of the following typical infrastructure which is included in the scope of this EIA:

» Solar panels (fixed/tracking technology).
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, or ground screws to support the PV panels.
» Central inverter/transformer stations to collect all energy generated from the PV panels. The role of the inverter is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
» An on-site substation or switching station.
» A power line to facilitate the connection of the solar energy facility from the on-site substation to Lethabo power station or nearest grid access point.
» Internal access roads.
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity.

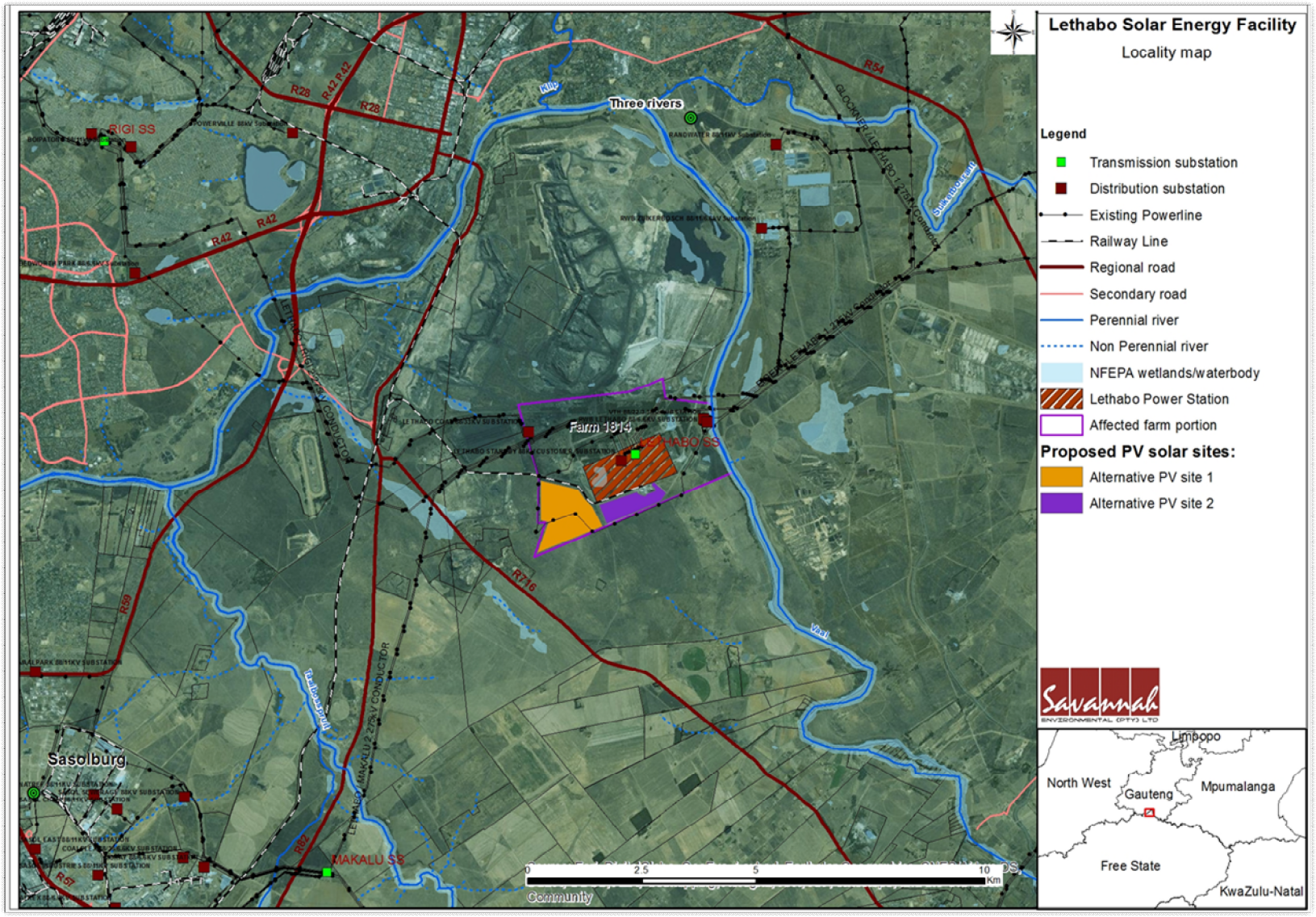

Figure 1.1: Locality map showing the location of Farm 1814 for the proposed Lethabo PV Solar Facility.

The overarching objective for the Lethabo PV Solar Energy Facility is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. Furthermore, the project will contribute towards Eskom's target to reduce self-consumption at their various owned or utilised sites by installing 150 MWp at their various power stations, offices and substations.

The solar PV facility will promote the reduction of Eskom's carbon footprint and support the demand side management energy efficiency programme. In order to assess the environmental feasibility of the proposed project, local level environmental and planning issues will be assessed through the EIA and site-specific studies in order to delineate areas of sensitivity within the broader site. This will serve to inform the design of the facility.

1.2. Conclusions from the Scoping Phase

Specialist input: Several desktop specialist studies were undertaken as part of the Scoping Study for the purposes of identifying potential impacts and potential fatal flaws relating to the proposed Lethabo PV Solar Energy Facility. The impacts identified as potentially resulting from the project broadly included agricultural, ecological, heritage, visual and social impacts and are summarised below:

- Avifauna – Due to the presence of existing habitat degradation and disturbance associated with the mining and energy generation activities in the study area, it is anticipated that the proposed Lethabo PV Solar Facility can be constructed at either of the identified sites with acceptable levels of impact on the resident avifauna. Potential impacts that were identified relating to the PV plant itself are: bird collisions with PV panels; loss of habitat; disturbance; and the nesting of birds on plant infrastructure, of which habitat destruction is likely to be the most significant. Potential impacts of associated infrastructure include the following: collision of large terrestrial birds with overhead power lines; electrocution of birds on pylons; nesting of birds on pylons; habitat destruction and disturbance. Certain levels of habitat destruction and disturbance may also result from the construction of internal access roads, additional on-site substations and operations buildings
- Ecologically sensitive areas on the site – Although most of the study area appears to have been previously disturbed (Refer to Figure 1.2), the actual state of the ecosystem will have to be studied in detail during the peak growing season, before a definite assessment statement can be made as to the ecological impact of the proposed development. The largest concerns identified were:
    - All wetland areas on and adjacent to the study area.

  - The ecological state of the vegetation of the study area and its conservation status.
  - Indigenous and alien invasive weeds and potential invasives within the development.

» Heritage and palaeontology – The desktop study did not identify any paleontological reason to inhibit the development of the Lethabo PV Solar Energy Facility within either the preferred project location or the identified alternative location, subject to the recommended damage mitigation procedures being enacted. This scoping study revealed that a range of heritage sites occur in the larger region and similar sites can be expected within the study area. Every site is relevant to the Heritage Landscape, but it is anticipated that no site in the study area could have conservation value.

» Soils & agricultural potential – The area investigated is comprised of mainly moderately deep to deep soils, with a small percentage of shallow soils. As such, the area can be considered as at least moderate to high potential for agricultural purposes, taking into consideration the annual rainfall.

» Visual / Social Receptors - The brief assessment undertaken for the scoping stage indicated that because the project is proposed against the backdrop of the Lethabo Power Station which includes associated infrastructure such as internal buildings, HV overhead power lines, coal stockpiles, a PFA tip and above ground conveyors, visual impacts of the proposed solar array are generally unlikely to be significant. In terms of possible landscape degradation, the landscape does not appear to have any specific protection, although the Vaal River corridor has obvious local importance as do the residential areas and recreational areas indicated on mapping. Rural areas to the east and the road corridors that pass through them also have some importance in their own right and as approach corridors to the Vaal Dam.

» Cumulative effects - Cumulative impacts of this new development to the larger area is likely to have low or no influence on the nature of the area due to heavy industrial and large mining areas located next to the project site. Existing industrial structures are likely to provide significant screening particularly from middle distance and distance views. From a distance, small scale development may also be viewed against a backdrop of larger industry which is also likely to make it less obvious.

The 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.

Public participation: During the public participation process conducted during Scoping, the proposed project was generally well received from the recipient community, interested and affected parties as well as stakeholders. No

objections to the proposed project were received on any environmental or social basis.

Approval of the Scoping Report: No environmental or social fatal flaws were identified to be associated with the broader site during the Scoping stage of the EIA process, and the Final Scoping Report was accepted by DEA in June 2015.

1.3. Requirement for an Environmental Impact Assessment Process

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

NEMA is national legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. The National Department of Environmental Affairs (DEA[2]) is the competent authority for this project. An application for authorisation for Lethabo PV Solar Energy Facility has been accepted by the DEA (under Application Reference number: 14/12/16/3/3/2/753). Through the decision-making process, the DEA will be supported by the Free State Department of Economic Development, Tourism and Environmental Affairs (DETEA), as the commenting authorities.

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project. Eskom has appointed Savannah Environmental (Pty) Ltd as the independent Environmental Assessment Practitioner (EAP) to undertake the required EIA process for Lethabo PV Solar Energy Facility.

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

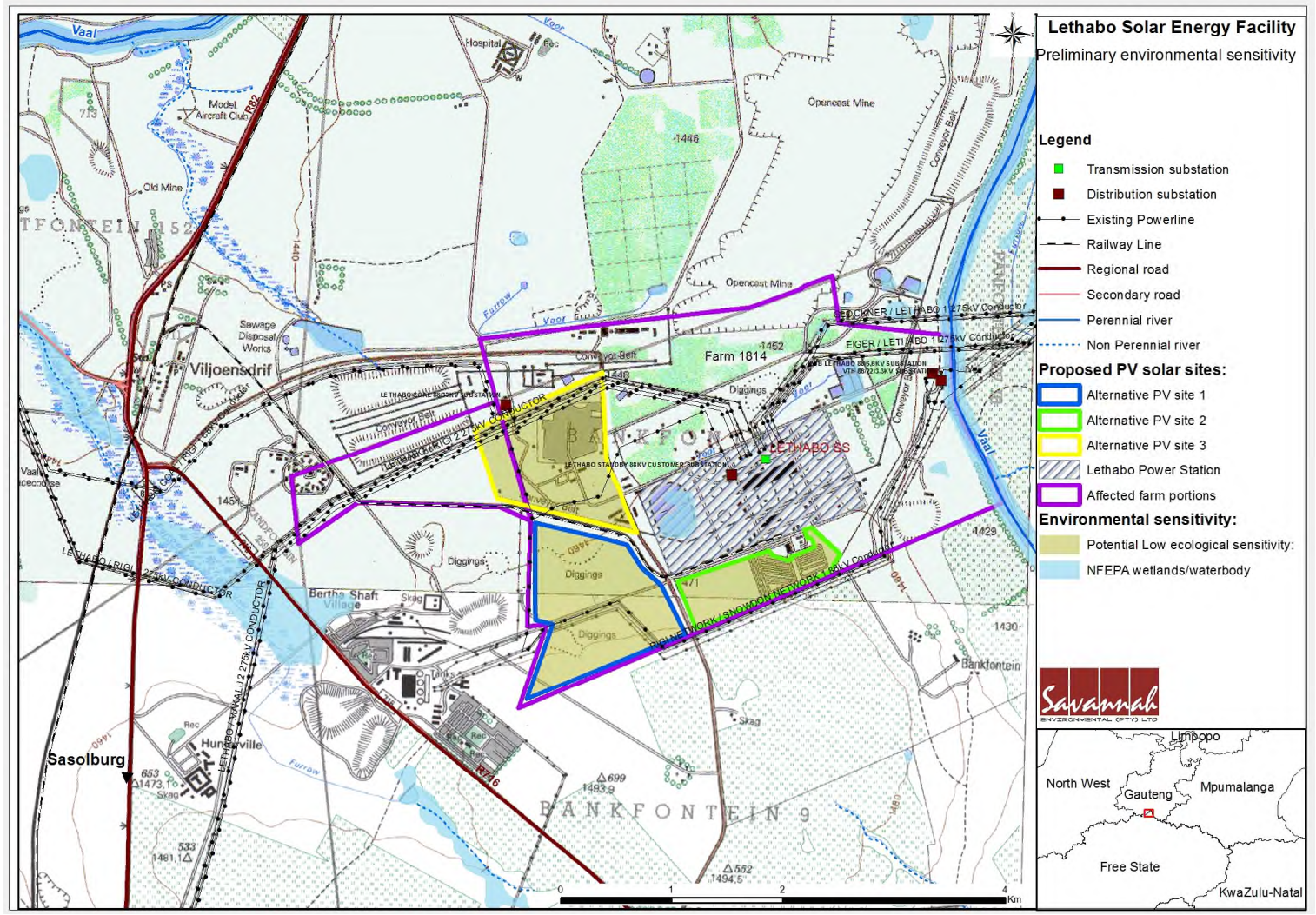

Figure 1.2: Scoping Environmental Sensitivity Map for the proposed Lethabo Solar Energy alternatives sites showing low sensitive ecological areas and potential wetlands.

1.4. Objectives of the EIA Process

The Scoping Phase was completed in **May 2015** with the submission of a Final Scoping Report to the DEA, and the acceptance of scoping was received from DEA in **June 2015**. 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 aimed to address those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with the project including design, construction, operation and decommissioning, and recommend appropriate mitigation measures for potentially significant environmental impacts. The purpose of this EIA report is to assess the impacts associated with the currently proposed layout for the Lethabo PV Solar Energy Facility through detailed specialist studies and public consultation. This EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report for a 30 day period will provide stakeholders with an opportunity to verify that issues they have raised through the EIA Process have been captured and adequately considered. The final EIA Report for submission to DEA will incorporate all issues raised during the public review period of the draft report and responses provided.

1.5. Details of the Environmental Assessment Practitioner and Expertise to conduct the Scoping and EIA Phases

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

Savannah Environmental is a specialist environmental consulting company providing holistic environmental management services, including environmental impact assessments and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental

management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team has considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation.

» *Sheila Muniongo* - the principle author of this report holds an Honours Bachelor degree in Environmental Management and 4 years of 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.
» *Sandhisha Jay Narain* – the co-author for this report holds an Honours degree in Environmental Management. She has 8 years of experience consulting in the environmental field. Her key focus is on on-site Environmental Management; Environmental Compliance Auditing and Monitoring, and has been involved in environmental impact studies and water use licence applications.
» *Jo-Anne Thomas* - the principle Environmental Assessment Practitioner (EAP) for this project, is a registered Professional Natural Scientist and holds a Master of Science degree. She has 18 years of experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy and power line projects across the country.
» *Gabriele Wood* - holds an Honours Degree in Anthropology. She has 6 years consulting experience in public participation and social research. Her experience includes the design and implementation of public participation programmes and stakeholder management strategies for numerous integrated development planning and infrastructure projects. Her work focuses on managing the public participation component of Environmental Impact Assessments and Basic Assessments undertaken by Savannah Environmental

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

» Avifauna – Megan Diamond (Feathers Environmental Services)
» Ecology – Marianne Strohbach (Savannah Environmental) and Michael Cohen (external reviewer)
» Wetlands – Robert Taylor (Limosella Consulting)
» Soils and Agricultural Potential – Garry Paterson (ARC-Institute for Soil, Climate and Water)
» Heritage – Jaco van der Walt (Heritage Contracts and Archaeological Consulting CC (HCAC))
» Palaeontological Assessment – Barry Millstead (BM Geological Services)
» Visual – John Marshall (Afzelia Environmental Consultants and Environmental Planning and Design)
» Social – Candice Hunter (Savannah Environmental) and Dr Bews(external reviewer)

Appendix A includes the curricula vitae for the environmental assessment practitioners from Savannah Environmental and the specialist consultants.

OVERVIEW OF THE PROPOSED PROJECT CHAPTER 2

This chapter provides an overview of the Lethabo PV Solar Energy Facility and details the project scope which includes the planning/design, construction, operation and decommissioning activities. This chapter also explores the need and desirability of the project at the preferred site location, site and technology alternatives as well as the 'do nothing' option. Lastly, it explores the use of solar energy as a means of power generation.

2.1. The Need and Desirability of the Development at the preferred site location

Internationally there is an increase in the deployment of renewable energy technologies for the generation of electricity due to concerns such as climate change and exploitation of non-renewable resources. Through the Integrated Resource Plan (IRP), the South African Government has set a target for renewable energy of 17 GWh renewable energy contributions to final energy consumption by 2030, to be produced mainly from biomass, wind, solar and small-scale hydro. Eskom has already successfully installed PV systems at offices and parking lots within Eskom-owned property to promote renewable energy awareness and to diversify their own energy mix. Furthermore, Eskom is looking at further reducing its self-consumption at its sites by introducing the PV Programme which aims to install up to 150 MWp at its various power stations, which includes the proposed Lethabo PV Solar Energy Facility. The solar PV facilities will promote the reduction of Eskom's carbon footprint and support the demand side management energy efficiency programme.

The approved strategy for PV programme is to install 150 MWp of PV at various power stations. However, the program is exploring the possibility of maximizing the usage of available land at each power station which may result in more than 150 MW being installed. The capacity of 75 MW presented in this report represents the maximum estimated PV capacity at Lethabo Power Station. This far exceeds the capacity allocated for self-consumption (8 – 12 MW) at Lethabo. Currently, Eskom is not permitted to feed electricity from these renewable projects into the national grid. The Program is however exploring to construct maximum available capacity if Eskom receives permission to develop the project and connect into the national grid.

Receptiveness of the site to development of a PV Facility

Eskom considers this area, and specifically the demarcated site on Farm 1814, to be highly preferred for the development of a solar energy facility. The reasons include:

» Extent of site: Availability of level land of sufficient area can be a restraining factor for development of PV facilities. For the development of the Lethabo PV Solar Energy Facility, ~162 ha of land is available for the development footprint within the Eskom-owned property. The larger farm portion owned by Eskom is approximately 1000 ha in extent, which is sufficient for the installation of the facility allowing for avoidance of site sensitivities. The development footprint of the facility would comprise about 15% of the total extent of the farm portion.
» Power transmission considerations: connection to the grid is readily available on site. The electricity generated will be exported to the Lethabo Power Station/distribution network.
» Site access: Access to the site is provided directly from the R716 that runs parallel to the western boundary of the proposed site. As 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 a key factor in determining the viability of the project, particularly taking transportation costs (direct and indirect) into consideration and the impact of this on project economics.
» Loss of current land use: There is no cultivated agricultural land within the farm portions which could be impacted upon by the proposed development. Heavy industrial development includes the adjacent Lethabo Power Station, open cast mining areas to the north and west of the proposed alternative sites, Mittal Steel to the north of Vereeniging and the Sasol refinery in Sasolburg to the south west. These activities include large industrial structures such as cooling towers, overhead conveyors and other industrial buildings that are visible over a wide area. This existing infrastructure has an overwhelming impact on landscape character in the area. Therefore the PV facility will be absorbed in the backdrop of all these industrial infrastructures.
» Topographic conditions: The site conditions are optimum for a development of this nature, with the project area being of a suitable gradient for a PV project.
» Proximity to Towns with a Need for Socio-Economic Upliftment: The Free State Province, like most of South Africa, is marred by unemployment, inequalities and poverty. To this extent the Lethabo PV Facility is situated in close proximity to the towns of Vanderbijlpark to the north of the Vaal and Sasolburg to the south west. These are relatively dense urban areas that are generally inward looking and consequently, local labour would be easy to source, which fits in well with economic development criteria for socio-economic upliftment. The project would present a new opportunity for skilled local labour.

2.2. Strategic Context for Energy Planning: National and Local Policy level

The need for harnessing renewable energy resources (such as wind 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 of17.8 GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This 17,8GW of power from renewable energy amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

Renewable energy technologies are among the supply-side options being considered by Eskom. The organisation has developed a renewable energy strategy which outlines a number of focus areas, including research and development of various technologies. Renewable energy sources which are being evaluated are wind, solar, wave, tidal, ocean current, biomass and hydro. Through the South African Bulk Renewable Energy Generation (SABRE-Gen) programme, a vehicle was established to enable the evaluation of multi-MW, grid connected generation. The initiatives all follow the same functional structure, namely:

a) the identification of feasible options
b) an assessment of the financial and economic viability as well as resource potential in the country
c) the implementation of demonstration projects to conduct operational research
d) the provision of strategies for the uptake and sustainable deployment of the technologies where feasible.

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) 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. This is detailed in the sections which follow.

Free State Provincial Growth and Development Strategy (FSPGDS) - Free State Vision 2030

The draft Provincial Growth and Development Strategy (PGDS) – Free State Vision 2030 was released in May 2012. The PGDS is a critical instrument to shape and coordinate the allocation of national, provincial and local resources, and private sector investment to achieve sustainable development outcomes based on provincial development needs and priorities. The Free State Vision 2030 marks a break with the current five-year planning approach and is a reflective long-term strategic framework envisioned to create an environment to respond to the complexities that characterise the provincial development landscape. Underpinning the vision is the ability of government together with the people to map out the destiny of the province. The Free State 2030 targets include:

» Economic Restructuring, Growth and Employment Creation
» Education, Innovation and Skills Development
» Improved Quality of Life
» Sustainable Rural Development
» Build Social Cohesion

Solar energy, specifically the PV solar energy industry, provides the Free State with an opportunity to diversify its economy in a way that will assist in employment opportunities and contribute towards economic growth and development.

Free State Provincial Spatial Development Framework (FSPSDF)

The vision, the FSGDS and the FSPSDF collectively respond to the need for the province to describe and map its future destiny through long-term development planning, and to forge a common and shared development agenda across a wide spectrum of service delivery mechanisms. This relates to the interconnectedness between development imperatives and the capacity of the various forms of capital vested in the province and to ultimately bring about a better life for all. The PSDF is a spatial and strategic supplement to the Free State Provincial Growth and Development Strategy (FSPGDS, 2012) as it relates to the shaping and coordination of the allocation of national, provincial and local resources, and private sector investment to achieve sustainable development outcomes based on provincial development needs and priorities.

The Free State Vision 2030 envisages that, by 2030 the Free State shall have a resilient, thriving and competitive economy that is inclusive, with immense prospects for human development anchored on the principles of unity, dignity,

diversity, equality and prosperity for all. Impelled by this vision, the Free State of 2030 will be characterised by an economy that encourages the development of new growth sectors with emphasis on the knowledge-based industries and the green economy (FSGDS). The transition towards a resilient, thriving and competitive economy will be pursued within the overarching framework of redistribution of economic resources, ownership and control of the provincial economy, and the creation of opportunities for the marginalised to play a central and meaningful role in the growth and development. The Free State Vision 2030 furthermore envisages that, by 2030, ownership and control patterns of the economy will be transformed, spatial under-development will be addressed, and basic services such as healthcare, education, electricity, water and sanitation will be equitably accessed by the people of the province. In the quest for inclusive economic growth and development, the environment will be protected for future generations. Lasting responses to climate changes will be part of the landscape of the development of the province. Provincial strategic growth and development pillars include:

- Pillar 1: Inclusive economic growth and sustainable growth job creation
- Pillar 2: Education, innovation and skills development
- Pillar 3: Improved quality of life
- Pillar 4: Sustainable rural development
- Pillar 5: Build social cohesion
- Pillar 6: Good Governance

The overarching goal of PSDF is to enable sustainability through sustainable development. In the Free State renewable energy is a key focus area of the Free State Development Corporation. The Free State has significant potential for the harvesting of solar energy. The Free State SDF emphasises the need for economic growth and renewable energy investment. Thus the proposed development is considered to be aligned to the economic and investment priorities of the Free State provincial government.

Fezile Dabi District Growth and Development Strategy (2004-2014)

The Fezile Dabi District Growth and Development Strategy (FDDGDS) aims to provide a framework for sustainable growth and economic development for the District from 2004 to 2014. It seeks to achieve balanced development of economic sectors in accordance with the needs and potentials of the people. It is also aimed at targeted investments in the district with the aim of offering opportunities to the people in skills development, employment and the improved quality of life. The FDDGDS focuses on 6 thrusts considered to be the main economic drivers of the area. The preservation of the productive integrity of agricultural land is identified as of high importance in the Free State province. The SDF also identifies tourism as one of the major growth industries in the region. Minimizing visual impacts, protecting scenic areas and preserving the

integrity of historic settlements are identified as important points to consider with regard to new developments in the area. The proposed development is located within an industrial area and therefore the impacts on the agricultural industry, scenic areas and tourism are expected to be minimal. The project is therefore considered to be in line with the FSDGDS.

Fezile Dabi District Municipality Integrated Development Plan (2012-2017)

Fezile Dabi District Municipality (FDDM) IDP outlines the municipality's plan for 2012-2017. The core mission of the municipality is to improve the lives of citizens and progressively meet their basic, social and economic needs, thereby restoring community confidence and trust in government. Of the 57 key performance areas, the following goals and objectives are of specific relevance to this study:

» To enhance human capacity and productivity within the municipality
» To maintain sound labour relations
» To create skills development opportunities for students & the unemployed in the district
» To create an environment that stimulates the local economic growth

The proposed project is line with these objectives as it will provide opportunities to create skills development for the unemployed in the district and will contribute towards creating an environment that stimulates local economic growth.

Metsimaholo Local Municipality Integrated Development Plan (IDP) (2012/13-2016/17)

The Metsimaholo Local Municipality (MLM) collected and based its strategy on the strategic areas identified by both National and Provincial Government. The five-year plan (2012/13 – 2016/17) is aligned to the local priorities reflected in the election manifesto and is further based on the Medium Term Strategic Framework (MTSF) outcomes and the revised National Key Performance Indicators (NKPIs). Policies that the IDP follow that relates to the proposed development includes the New Growth Path which identifies five other priority areas as part of the programme to create jobs, through a series of partnerships between the State and the private sector. The one priority area in the New Growth path that is in line with the proposed development includes: "Green economy- expansions in construction and the production of technologies for solar, wind and biofuels are supported by the draft Energy on Integrated Resource Plan. Clean manufacturing and environmental services are projected to create 300 000 jobs over the next decade."

The MLM mission is "To promote the sustainable socio-economic development of our communities through effective, efficient and affordable service delivery and sound institutional and financial management." The MLM strategic priorities, key performance areas (KPAs), objectives and programmes include:

Table 2.1: Strategic priorities of the MLM

Strategic Priority	KPA	Programmes
SP1: Build our local economy to create more employment, decent work and sustainable livelihoods	KPA1: Local Economic Development	P8-Local Economic Development P9-Job Creation P10-Sustainable livelihoods
SP2: Broaden access to and improve the quality of municipal services	KPA2: Basic service delivery and infrastructure development	P1-Water P2-Sanitation P3-Electricity P4-Roads and storm water P11-Waste management P12-Community facilities
SP3: Build united, non-racial, integrated and safer communities	KPA3: Community development and social cohesion KPA2: Basic service delivery and infrastructure development	P13-Clean communities P14-Safe communities P15-Healthy communities P16-Arts and culture P17-Disaster management P5-Human settlements P6-Spatial development P7-Public transport
SP4: Promote active community participation	KPA4: Good governance and community participation	P18-Participatory governance
SP5: Ensure more effective, accountable and clean local government that works together with national and provincial government	KPA4: Good governance and community participation KPA5: Financial management and viability KPA6: Municipal transformation and institutional development	P19-Corporate governance P20-Intergovernmental Relations P21-Customer care P22-Revenue and cash flow management P23-SCM and Expenditure management P24-Budgeting and reporting P25-Clean Audit P26-Asset management P27-Facilities management P28-Human capital P29-Institutional excellence

The proposed solar energy facility development will advance the objectives of local economic development and job creation outlined in the strategic priorities of the MLM IDP.

Metsimaholo Local Municipality Economic Development (LED) (2012)

The purpose of the MLM Draft LED Strategy is to develop a framework for economic growth and development. Whilst the development of economic sectors

and industries is the focal point, the objective to ensure skills development, quality employment, SMME and co-operative development becomes part of the outcome during implementation. The economic outcomes of the strategy are not aimed at measuring growth only, but the ability to respond to social needs like education, health, recreation and the general quality of life. The objectives of the MLM strategy include the following:

» To beneficiate the existing manufacturing industry and diversify the local economy (that is, the ability to develop value chain in any industry).
» To develop and position the Metsimaholo economy as the most performing economy in the Free State Province.
» To develop and position the Metsimaholo economy as a leading leisure destination in the Free State Province.
» To develop and position the Metsimaholo economy as a leading retail destination in the Fezile Dabi District.

The intended impacts include the following:
» The development of highly skilled people in the local economy.
» The increase in employment of local people in the local economy.
» The development of SMMEs and Co-operatives in various sectors of the local economy.

The LED lists a number of key considerations that apply to all future planning actions in the MLM area that is relevant to the proposed development, such as increase employment opportunities, development of local human capital and diversifying the local economy. The proposed development will contribute to these key plans by introducing a relatively new industry to the area (diversifying the local economy). It will create new employment opportunities for the local community and introduce skills development and training that will develop the local human capital.

Metsimaholo Local Municipality Spatial Development Framework (SDF) (2012)

The municipality attaches considerable importance to "green" issues within the SDF, including for example energy conservation, the protection of its blue corridors, the retention of the green wedges and other areas of open space and heritage significance.

Key strategic guiding issues of the SDF that are of specific relevance to the proposed development include:

» Sasolburg, Deneysville and Oranjeville are three of the major urban centres in the Municipality at various scales. These areas are also the major areas

within which development opportunities exist and should be concentrated for higher density development.

» The development of these areas is therefore critical for job creation and new housing development. A number of other smaller areas located outside of these urban centres are also identified for new development or redevelopment.
» The development of these areas must be in line with the intention of providing job opportunities and minimising travelling for the poor to benefit from these opportunities.

The SDF identifies a number of priority areas which are regarded as relevant to the proposed development which include: sustainable and less energy intensive forms of development and economic diversification. The proposed development is located in close proximity to Sasolburg within an industrial area. The development also has the intention of providing job opportunities for the local community which is line with the SDF.

Strategic Integrated Projects (SIPs)

The Presidential Infrastructure Coordinating Committee (PICC) are integrating and phasing investment plans across 18 Strategic Infrastructure Projects (SIPs) which have five core functions: to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the integration of African economies. A balanced approach is being fostered through greening of the economy, boosting energy security, promoting integrated municipal infrastructure investment, facilitating integrated urban development, accelerating skills development, investing in rural development and enabling regional integration.

SIP 8 of the energy SIPs supports the development of the Solar Energy Facility which is as follows:

» *SIP 8: Green energy in support of the South African economy:* Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010) and supports bio-fuel production facilities.

In fulfilment of SIP 8 (green energy) and to meet the targets set in the Integrated Resource Plan (IRP 2010), the proposed Lethabo Solar Energy Facility could potentially contribute towards SIP 8 by addition of clean energy to the grid (should the project be constructed and Eskom be permitted to evacuate power from this project to the grid) and the project will create significant socio-economic benefits at a local, regional and national scale.

Solar Energy Technology Roadmap 2013

Diffusion of renewable energy, generally, and solar technology, specifically, in South Africa is meant to address the government's desire to aggressively integrate renewable energy technologies into the national energy mix to reduce the country's carbon emissions levels, to help address its growing electricity generation needs, and its industrial heat needs (DEA draft integrated Energy planning report, 2012). The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions during its operation. The generation of renewable energy will contribute to South Africa's electricity market which has, to date, been heavily dominated by coal-based power generation. The advancement of renewable energy is a priority for South Africa as the government has set a 17GW of electricity by 2030, as part of the IRP 2010. Furthermore, recent policy highlights the desirability of clean, green energy and solar generated energy will play a significant role in reaching these quotas.

The findings of the review of the relevant policies and documents pertaining to the energy sector therefore indicate that solar energy and the establishment of the Proposed Lethabo solar energy facility is supported at a national, provincial, and local level, and that the proposed project will contribute towards the various targets and policy aims at all three levels.

2.3. Project Alternatives

In accordance with the requirements of the EIA Regulations 2010, the consideration of alternatives including site and technology alternatives, as well as the "do-nothing" alternative should be undertaken. The follow sections address this requirement.

2.3.1 Site Alternatives

An internal investigation/screening process was undertaken by Eskom to assess the potential for installing PV facilities at Eskom power stations in Gauteng, Free-State, Mpumalanga and KwaZulu-Natal regions. This study provided an indication of the potential capacity, land availability, environmental constraints and electrical connection options for each of the power stations including Arnot, Duvha, Kendal, Kriel, Lethabo, Majuba, Matimba, Tutuka, Camden, Komati and Ingula. The sites within the Arnot, Duvha, Lethabo, Majuba and Tutuka power stations were selected as the first sites for consideration within EIA processes.

The following factors have been considered in determining a preferred site for PV solar development including:

» Land availability and environmental constraints i.e. ecological sensitive areas; and
» Technical feasibility – taking into account all electrical considerations including point of connection and electrical infrastructure available

At screening level, it was concluded by Eskom that the Lethabo Power Station has land available for a large PV facility. The land profile of the site is predominantly flat with little vegetation and trees and a minimal number of power lines running through some of the preferred site. The point of electrical connection is situated in close proximity to the land area and there are no foreseen risks from an environmental perspective at a high level. The identified alternative Lethabo PV sites are located outside the immediate power station fence but it is still located within the broader power station property on Eskom owned property. Additionally, there was support offered from the power station personnel in accepting to install PV at the power station as well as providing the required information. As a showcase for COP17 a pilot PV project was installed at the power station. In this regard, there is a great support structure available and the personnel at Lethabo already have experience in understanding PV and the operations and maintenance behind it.

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

2.3.2 Layout and Design Alternatives

Two alternative PV sites have been identified through the scoping process. These have been assessed further in this EIA report, and are discussed below as follows:

» **Alternative PV site 1 –** This layout (shown in orange in Figure 2.1) is located in the south west section of the study area. The site is suitable for development.
» **Alternative PV site 2** – This layout is located in southern section of the study area. 80% of this layout (shown in purple in Figure 2.1) is covered by wetlands. This area is therefore not preferred for a PV development.

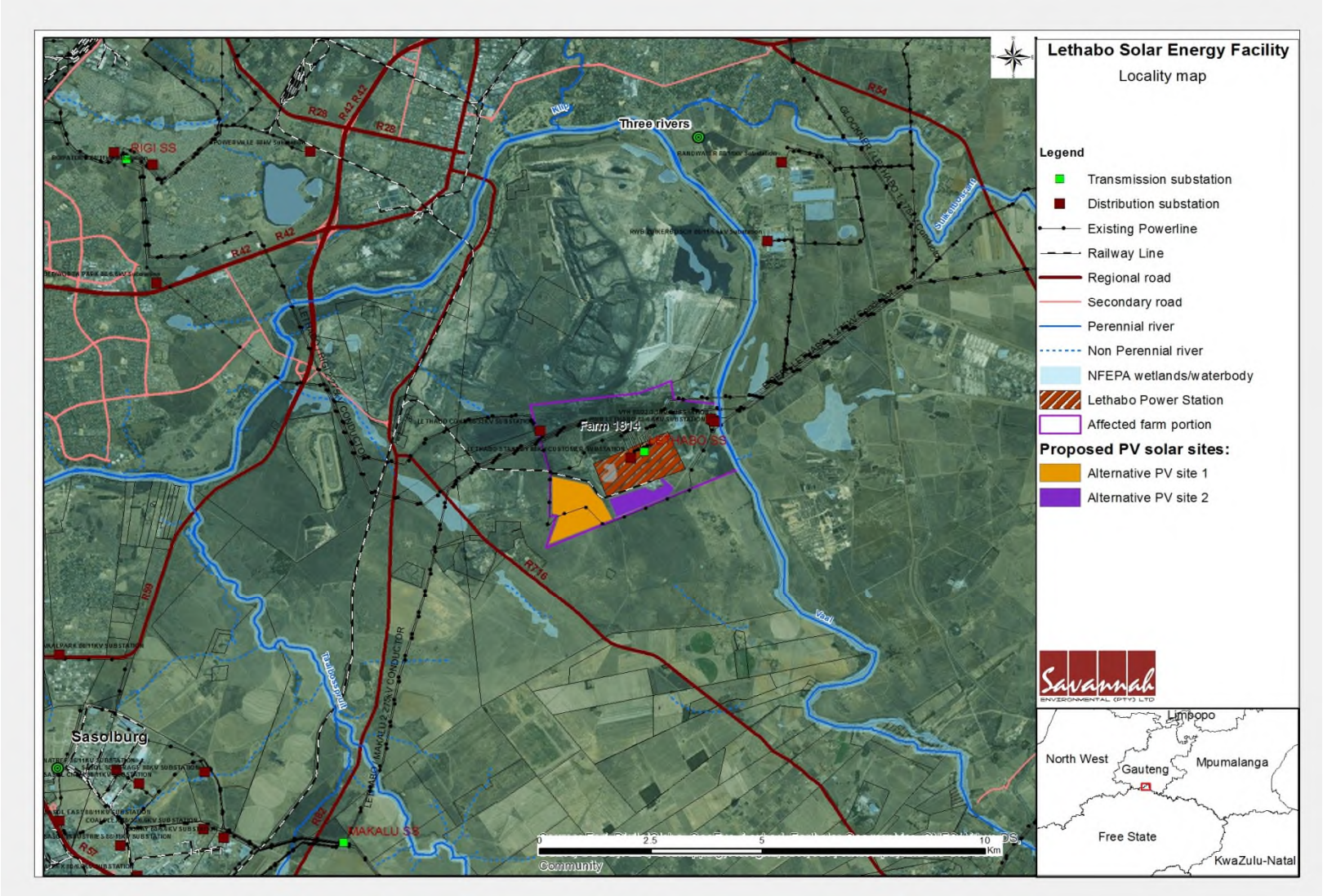

Figure 2.1: Lethabo PV Solar Energy alternative sites: Site 1 (orange) and Site 2 (Purple)

2.3.3 Technology Alternatives

Few technology options are available for PV facilities, and the use of those that are considered are usually differentiated by weather and temperature conditions that prevail on the site, so that optimality is obtained by the final site selection. 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. Solar PV was determined as the most suitable option for the proposed site as large volumes of water are not required for power generation purposes compared to concentrated solar power technology (CSP). PV is also preferred when compared to CSP technology because of the lower visual profile. Two solar energy technology alternatives are being considered for the proposed project and include:

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

The primary differences between technologies available which affect the potential for environmental impacts relate to the extent of the facility, or land-take (disturbance or loss of habitat), fewer megawatts being installed in the same area, as well as the height of the facility (visual impacts). Regardless of the technology, the PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance. The impacts associated with the operation and decommissioning of the facility will be the same irrespective of the technology chosen. The technology to be used will be assessed in within this report.

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 for the same energy output.

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.

2.3.4 The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Lethabo PV 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 PV facility. However, the benefits of this renewable energy facility will not be realised as the generation of electricity from renewable energy resources can offer a range of socio-economic and environmental benefits for South Africa. This alternative is assessed in detail within this EIA Report.

2.4. Description of the Project

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 a net generating capacity of up to 75 MW. An area of approximately ~162 ha in extent will be occupied by the PV panels and associated infrastructure. **Table 2.1 and 2.2** summarise the dimensions of the project components.

The proposed Lethabo PV Solar Energy Project is proposed to include several arrays of photovoltaic (PV) solar panels and will comprise the following:

» Solar panels (fixed/tracking technology) with a net generating capacity of up to 75 MW.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, or ground screws to support the PV panels.
» 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 or switching station.
» A power line to facilitate the connection of the solar energy facility from the on-site substation to Lethabo Power Station or nearest grid access point.
» Internal access roads.
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity.

Table 2.1: The position of the planned infrastructure[3]

Infrastructure	Dimensions/ Details	
Corner points for the Lethabo PV facility site	**Northern Section**	
	26° 44' 47.544" S	27° 57' 17.312" E
	26° 44' 49.085" S	27° 57' 18.997" E
	26° 44' 52.455" S	27° 57' 21.404" E
	26° 44' 54.574" S	27° 57' 26.749" E
	26° 44' 55.055" S	27° 57' 31.130" E
	26° 44' 54.814" S	27° 57' 35.800" E
	26° 44' 52.937" S	27° 57' 38.256" E
	26° 44' 50.914" S	27° 57' 39.700" E
	26° 44' 48.892" S	27° 57' 39.748" E
	26° 44' 46.340" S	27° 57' 42.011" E
	26° 44' 47.159" S	27° 57' 47.548" E
	26° 44' 48.940" S	27° 57' 49.185" E
	26° 44' 51.251" S	27° 57' 52.652" E
	26° 44' 53.611" S	27° 57' 54.096" E
	26° 44' 56.066" S	27° 57' 56.744" E
	26° 44' 56.066" S	27° 57' 58.766" E
	26° 44' 55.296" S	27° 58' 0.981" E
	26° 45' 12.743" S	27° 58' 9.218" E
	26° 45' 15.469" S	27° 58' 1.607" E
	26° 45' 2.277" S	27° 57' 46.007" E
	26° 45' 10.369" S	27° 57' 22.266" E
	26° 45' 10.982" S	27° 57' 17.387" E
	Southern Section	
	26° 45' 12.111" S	27° 57' 22.175" E
	26° 45' 3.729" S	27° 57' 45.577" E
	26° 45' 16.481" S	27° 58' 0.837" E
	26° 45' 34.390" S	27° 57' 16.028" E
Corner points for the Lethabo PV facility substation	26° 44' 56.294" S	27° 57' 58.470" E
	26° 44' 56.294" S	27° 57' 59.539" E
	26° 44' 56.651" S	27° 57' 59.539" E
	26° 44' 56.651" S	27° 57' 58.470" E

[3] Table 2.1 only shows the position of the preferred layout plan ie Alternative 1

Power Line		
132kV Power Line		
0 Starting point (0m) - Connection Point	26° 44' 55.761" S	27° 58' 0.804" E
0 End point (41m) - Substation	26° 44' 56.479" S	27° 57' 59.539" E
11/132kV Power Line		
0 Starting point (0m) - Substation	26° 44' 56.435" S	27° 57' 58.470" E
0 250m	26° 45' 0.622" S	27° 57' 52.064" E
0 End point (434m) - Existing power line	26° 45' 2.766" S	27° 57' 45.829" E

Table 2.2: Details or dimensions of typical structures required for the PV Facility

Component	Description/ Dimensions
Location of the site	Farm 1814, within jurisdiction of Fezile Dabi District Municipality and Metsimaholo Local Municipality, Free State Province
SG Code	F0160000000181400000
Project development footprint	Alternative site 1: ~162 ha Alternative site 2: ~ 52 ha
Proposed technology	Static or tracking photovoltaic
Export capacity	Alternative site 1: up to 75 MW Alternative site 2: 35 MW
Height of installed panels from ground level	Static - up to 3.5 m Tracking – single/double axis up to 6 m
Access road	Access to the site is provided directly from the R716 that runs parallel to the western boundary of the proposed site.
Width and length of internal roads	Main internal road - width: up to 8 m, Secondary internal roads – width: 5 m
Construction laydown area (temporary)	± 200 m x 20 0m
On-site substation	80 m x 120 m
Power line	Servitude width – 32 m Length – Approx. 2.5 km Height of towers – up to 24 m
Workshop area	500 m^2

2.5. Technology considered for the Solar Photovoltaic (PV) Facility and the Generation of Electricity

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 (Refer to Figure 2.2). 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.

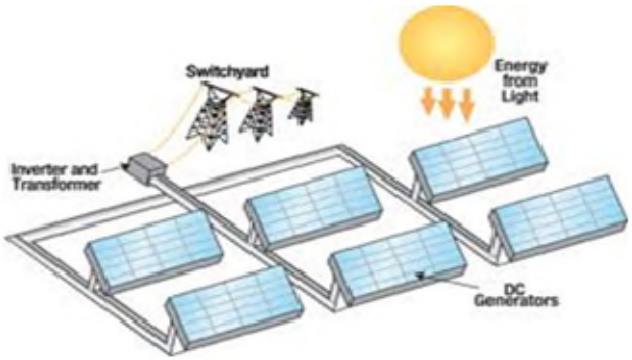

Figure 2.2: Schematic diagram of a PV plant (Sourced from: http://www.solar-green-wind.com/archives/tag/solar-cells)

A solar energy facility typically comprises 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 Modules (75 MW plant in Kalkbutt South-Africa Source: SMA)

Figure 2.4: Picture of the installation of a typical PV array (75 MW plant in Kalkbutt South-Africa Source: PennEnergy)

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 voltage to required transmission voltage level (6.6/11/84/132 kV) for on-site transmission of the power. The inverter and transformer are housed within the power conversion station (PCS) (refer to Figure 2.6). The PV combining switchgear (PVCS), which are dispersed among the arrays, collects the power from the arrays for transmission to the project's substation.

Figure 2.5: Image of a typical inverter

Figure 2.6: Image of a typical power conversion station

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 on a tracking mechanism where at a maximum tilt angle of 45 to 45 degrees. The lowest part of the panel can be 30-50cm from the ground (refer to Figure 2.7).

Figure 2.7: The support structures elevate the PV panels and allow for single axis tracking of the sun for increased efficiency (Source: SAPVIA)

2.6. Services requirements

Water requirements - the proposed Lethabo PV Solar Energy Project will require the use of water during its construction and operation phases. The water requirement for the project is anticipated to be approximately ± 10,000 m^3 over the construction period. Approximately ± 5,000 m^3 per annum for a 20-year operational lifespan of the solar energy facility is required for maintenance (cleaning panels) during the operational phase. Water will be obtained from the Lethabo Power Station adjacent to the proposed project.

Electricity - will be generated from generators for any electrical work on site or electricity will be obtained from an Eskom auxiliary supply, depending on the feasibility during construction.

Sewage and Refuse material disposal - all 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. Office waste generated during operation will be disposed of together with the waste from the Lethabo Power Station.

2.7. 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.

2.7.1 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.

2.7.2 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.

A relatively level and stable surface is required for the safe and effective installation of the PV arrays. Topographic, geotechnical, and hydrologic studies will be used to determine the necessary grading and compaction.

Trenching would occur within each array to accommodate 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 on-site substation.

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

Establishment of Access Roads to the Site

The site can be accessed from the R716 regional road which lies west of the proposed site connecting Vereeniging to Deneysville. Within the site itself, access is already established and is used for the power station. These existing roads will be utilised for construction purposes (and later limited access for maintenance). Internal access roads between the project components will be required. 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.

Installation of PV Panels and Construct Substation & Inverters

The PV panels will be arranged in arrays, the mounting structure will be preferably fixed onto the ground with the use of rammed or screw anchor foundations (see typical example Figure 2.8). Where the soil conditions do not lend themselves to these technologies, concrete or chemical anchors will be deployed. This approach reduces installation time, will make the installation of the plant less invasive for the territory and facilitate the decommissioning at the end of its production cycle. The height of the PV panel structure will be up to 3.5m for fix mounted structures. In case of single/dual axis structures, the height of Panel Structure, can reach up to 6 meters.

Figure 2.8: Frame, structural details (Lesedi Solar PV Project, Kimberly, South Africa. Source: Power Technology.com)

Inverters will be installed to facilitate the connection between the solar energy facility and the Eskom electricity grid via a new 11 kV (for connection at station board) or 132 kV (for connection at HV yard) power line. The position of the inverters within the footprint of the broader site will be informed by the final positioning of the PV components.

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

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.

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 to its pre-construction state. 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.

2.7.3 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.

An Operation and Maintenance plan will be compiled for the facility by Eskom. 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 will create ~10 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. 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. A volume of approximately 5000 m^3 per annum would be required during the operational phase. This will be acquired from the Lethabo Power Station adjacent to the proposed project.

2.7.4 Decommissioning Phase

Depending on the continued economic viability of the facility following the initial 20 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 dissembled and replaced with new, more efficient technology/infrastructure available at that time. However, if the decision is made to decommission the facility, the following activities will form part of the project scope.

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

When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, 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

Depending on the continued economic viability of the facility following the initial 20-25 year operation period, the solar energy facility will either be decommissioned or the operation phase will be extended. If it is deemed financially viable to extend the operation phase, existing components would either continue to operate or be dissembled and replaced with new, more efficient technology/infrastructure available

at that time. However, if the decision is made to decommission the facility, the following activities will form part of the project scope:

- Site Preparation: Site preparation activities will include confirming the integrity of the site access to accommodate the required decommissioning equipment.
- Disassemble and Remove Existing Components: When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, all above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will be, 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.

Rehabilitation: The site will be rehabilitated and can be returned to its' pre-construction condition or another beneficial land-use.

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3.1. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and is 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 PV facilities is illustrated in Figure 3.1. These policies are discussed in more detail in the following sections.

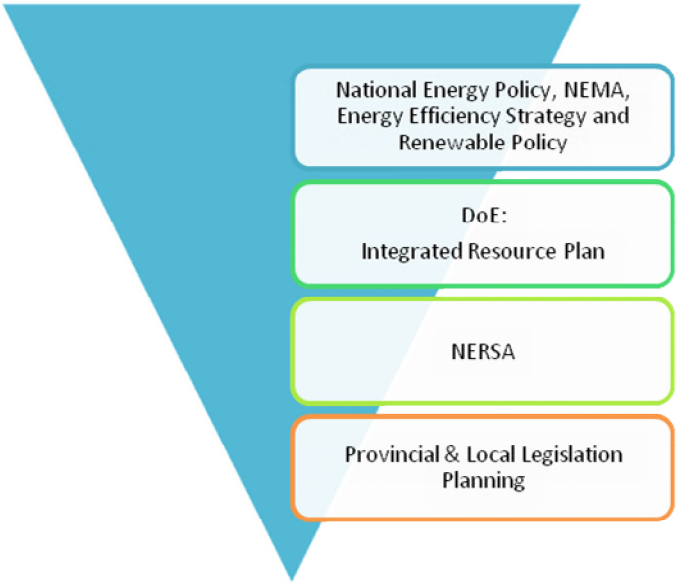

Figure 3.1: Hierarchy of electricity policy and planning documents

3.2.1 The Kyoto Protocol, 1997

South Africa's electricity is mainly generated from coal-based technologies. South Africa accounts for ~38 % of Africa's CO_2 (a greenhouse gas contributing to climate change) from burning of fossil fuels and industrial processes. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. South Africa ratified the Kyoto Protocol in 2002. The Kyoto Protocol requires developing countries to reduce its greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. Therefore certain guidelines and policies (discussed further in the sections below) were put in place for the Government's plans to reduce greenhouse gas emissions. The development of renewable energy projects (such as the proposed PV energy facility) is therefore in line with South Africa's international obligations in terms of the Kyoto Protocol. A second commitment period commenced from 1 January 2013, and extends to 31 December 2020.

3.2.2 White Paper on the Renewable Energy Policy of the Republic of South Africa (1998)

The White Paper on Renewable Energy Policy(1998) supplements the Government's overarching policy on energy as set out in its White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The White Paper on Renewable Energy Policy recognises the significance of the medium and long-term potential of renewable energy. The main aim of the policy is to create the conditions for the development and commercial implementation of renewable technologies. The position of the White Paper on Renewable Energy is based on the integrated resource planning criterion of:

> *"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."*

The White Paper on Renewable Energy 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.

South Africa relies heavily on coal to meet its energy needs because it is well-endowed with coal resources in particular. However South Africa is endowed with renewable energy resources that can be sustainable alternatives to fossil fuels, but which have so far remained largely untapped. This White Paper fosters the uptake of renewable energy in the economy and has a number of objectives that include:

» ensuring that equitable resources are invested in renewable technologies;
» directing public resources for implementation of renewable energy technologies;
» introducing suitable fiscal incentives for renewable energy and;
» creating an investment climate for the development of renewable energy sector.

The objectives of the White Paper are considered in six focal areas, namely: financial instruments, legal instruments, technology development, awareness raising, capacity building and education, and market based instruments and regulatory instruments. The policy supports the investment in renewable energy facilities as they contribute towards ensuring energy security through the diversification of energy supply, reducing GHG emissions and the promotion of renewable energy sources.

The White Paper set a target of 10 000GWh to be generated from renewable energy by 2013. The target was reviewed during the renewable energy summit of 2009 held in Pretoria. The summit raised the issue over the slow implementation of renewable energy projects and the risks to the South African economy of committing national

investments in the energy infrastructure to coal technologies. Other matters that were raised include potential large scale roll out of solar water heaters and enlistment of Independent Power Producers to contribute to the diversification of the energy mix.

3.2.3 The National Energy Act (2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar thermal energy:

"*To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements (…); to provide for (…) increased generation and consumption of renewable energies*…(Preamble)."

The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The Act provides the legal framework which supports the development of renewable energy facilities for the greater environmental and social good.

3.2.4 The Electricity Regulation Act, 2006 (Act No. 4 of 2006), as amended

The Electricity Regulation Act, 2006, replaced the Electricity Act, 1987 (Act No. 41 of 1987), as amended, with the exception of Section 5B, which provides for the funds for the energy regulator for the purpose of regulating the electricity industry. The Act establishes a national regulatory framework for the electricity supply industry & introduces the National Energy Regulator as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licences & registration as the manner in which generation, transmission, distribution, trading & the import & export of electricity are regulated.

3.2.5 Renewable Energy Policy in South Africa

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

August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed Ilanga Tower 1 Project, 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 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.

3.2.6 National Development Plan

The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030. The NDP identifies 9 key challenges and associated remedial plans. Managing the transition towards a low carbon national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

The proposed project will support many of the objectives of the National Development Plan (NDP). Some of these objectives are listed below:

» Create 11 million jobs by 2030; and
» Procuring about 20 000MW of renewable electricity by 2030.

Infrastructure is a key priority of the NDP, which identifies the need for South Africa to invest in a strong network of economic infrastructure to support the country's medium- and long-term economic and social objectives. The NDP has been approved and adopted by government and has received strong endorsement from broader society. The plan sets out steps that aim to ensure that, in 20 years, South Africa's energy system looks very different to the current situation: coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources – especially wind, solar and imported hydroelectricity – will play a much larger role.

3.2.7 Integrated Energy Plan

The development of a national Integrated Energy Plan (IEP) was envisaged in the White Paper on Energy Policy of 1998 and the Minister of Energy, as entrenched in the National Energy Act of 2008, is mandated to develop and publish the IEP on an annual basis. The IEP takes existing policy into consideration and provides a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development.

The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include:

» To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector.
» To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels).
» To guide investment in and the development of energy infrastructure in South Africa.
» To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

Eight key objectives for energy planning were identified:

» Objective 1: Ensure the security of supply
» Objective 2: Minimise the cost of energy
» Objective 3: Increase access to energy
» Objective 4: Diversify supply sources and primary sources of energy
» Objective 5: Minimise emissions from the energy sector
» Objective 6: Promote energy efficiency in the economy

» Objective 7: Promote localisation and technology transfer and the creation of jobs
» Objective 8: Promote the conservation of water

The IEP recognises the potential of renewable energy for power generation.

3.2.8 Final Integrated Resource Plan 2010 - 2030

The Integrated Resource Plan (IRP) 2010-30 was promulgated in March 2011. The primary objective of the IRP 2010 is to determine the long term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. However, the IRP 2010 also serves as input to other planning functions, *inter alia* economic development, and funding, environmental and social policy formulation. The accuracy of the IRP 2010 is to be improved by regular reviews and updates, and a draft revised Plan is currently available for public comment. The IRP 2010 projected that an additional capacity of up to 56 539MW of generation capacity will be required to support the country's economic development and ensure adequate reserves over the next twenty years. The required expansion is more than two times the size of the existing capacity of the system.

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; **17.8 GW of renewables** (including wind and solar); and 8.9 GW of other generation sources. This means that 75% of new generation capacity by 2030 will be derived from energy sources other than coal.

3.2. 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 formulating 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 power generation facilities 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 declared as protected 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.
» *Department of Water and Sanitation (DWS):* This Department is responsible for water resource protection, water use licensing and permits.
» *Department of Mineral Resources (DMR):* Approval from the 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.

At **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 provincial roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Provincial Department of Water and Sanitation:* This Department is responsible for water resource protection, water use licensing and permits.
» *Free State Heritage Authority (FSHRA):* is responsible for the identification and management of heritage resources in the Free State.
» *Free State Department of Agriculture:* This Department is responsible for all matters which affect agricultural land within the province.

At **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 Metsimaholo Local Municipality which forms part of the Fezile Dabi District Municipality. There are also numerous non-statutory bodies such as environmental non-governmental organisations (NGOs) and community based organisations (CBO) working groups that play a role in various aspects of planning and environmental monitoring that will have some influence on proposed solar energy development in the area.

3.3. Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this Final Scoping 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)
- Metsimaholo Municipality Integrated Development Plan
- 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 evaluated in the scoping report, and to be addressed in the EIA. A listing of relevant legislation is provided in Table 3.1.

Table 3.1: Relevant legislative permitting requirements applicable to the proposed Lethabo PV Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GN R543, R544, R545 and R546 of December 2010, a Scoping and EIA Process is required to be undertaken for the proposed project.	National Department of Environmental Affairs – lead authority. Provincial Free State – Department of Economic Development, Tourism and Environmental Affairs (DETEA)	The listed activities triggered by the proposed Project have been identified and assessed in the EIA process being undertaken. This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	Department of Environmental Affairs (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992)	Department of Environmental Affairs Free State – Department of Economic Development, Tourism and Environmental Affairs (DETEA) Local Authorities	Noise impacts are expected to be associated with the construction phase of the project and are not likely to present a significant intrusion to the local community. There is no requirement for a noise permit in terms of the legislation.
National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required). Consumptive water uses may include the taking of water from a water resource 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 watercourse - Section 21i.	Department of Water Affairs & Sanitation (DWS)	A water use license (WUL) is required to be obtained if water resources (such as wetlands or drainage lines) are impacted on, or if infrastructure lies within 500m of wetland features or the regulated area of a watercourse (being the riparian zone or the 1:100yr floodline whichever is greatest). 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) of the National Water Act.
Minerals and Petroleum Resources Development Act	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	Department of Mineral Resources	As no borrow pits are expected to be required for the construction of the facility, no mining permit or

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
(Act No 28 of 2002)	the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act. S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.		right is required to be obtained. Approval in terms of S53 will be required to be obtained..
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as "priority areas" in terms of air quality. Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. Section 32 makes provision for measures in respect of dust control. Section 34 makes provision for: (1) the Minister to prescribe essential national noise	National Department of Environmental Affairs – air quality Local Municipality - Noise	No permitting or licensing requirements applicable for air quality aspects. The section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities. An atmospheric emission licence issued in terms of Section 22 may

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	standards - (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or (b) for determining – (i) a definition of noise (ii) the maximum levels of noise (2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.		contain conditions in respect of noise. This will however, not be relevant to the facility, as no atmospheric emissions will take place. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which will change the character of a site exceeding 5 000 m2 in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent.	» National Department of Environmental Affairs where heritage assessment is a component of the EIA » South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains. » Free State Heritage Resources Authority - Issue	A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.	of permits for removal or destruction of heritage resources in the Free State Province	
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on	National Department of Environmental Affairs Free State – Department of Economic Development, Tourism and Environmental Affairs (DETEA)	A specialist flora and fauna assessment has been undertaken for the proposed project. A permit may be required should any listed plant species (such as ***Boophane disticha***) are disturbed or destroyed as a result of the proposed development. NB: All list of protected vertebrate species (reptiles, birds, and mammals) that could occur in the study area according to the ADU and SANBI databases, as well as Apps (2000) is presented in

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	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). » The Department of Environmental Affairs (DEA) published Regulations on Alien and Invasive Species (AIS) in terms of the National Environmental Management: Biodiversity Act, on Friday 1st August 2014. A total of 559 alien species are now listed as invasive, in four different categories. A further 560 species are listed as prohibited, and may not be introduced into the country		Appendix C of the ecology report.
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: » Category 1 plants: are prohibited and must be controlled. » Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent	Department of Agriculture	» While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	their spread. » Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. » These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.		addition, a weed control and management plan must be implemented. » The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas. However, none of these activities are expected to be undertaken on site.
National Forests Act (Act No. 84 of 1998)	» Protected trees: 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'. » Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence.	Department of Environmental Affairs	A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest. No protected tree species were observed within or near the study area and it is highly unlikely that any protected tree species would be impacted by the development.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S12 the landowner 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.	Department of Water Affairs	While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	In terms of S17, the landowner must have such equipment, protective clothing, and trained personnel for extinguishing fires.		must be ensured that the landowner and developer proactively manage risks associated with veld fires and provide cooperation to the local Fire Protection Agency.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance or storage of any hazardous	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
	substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 921), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away.	Hazardous Waste – National DEA General Waste –FS DETEA	As no waste disposal facility is proposed, no waste license is required to be obtained. Should waste be stored on site, this will be required to be in terms of the Norms and Standards for Waste Storage (GN 926 of November 2013).

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

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
The Nature Conservation Ordinance (NCO) 8 of 1969 and subsequent amendments	The Act provides for the conservation of fauna and flora and the hunting of animals causing damage and for matters incidental thereto	Free State Department of Economic Development, Tourism and Environmental Affairs (DETEA)	A permit may be required for flora and fauna removal, therefore this provincial legislation has been incorporated in this report and will remain applicable through the life cycle of the proposed project.

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 4

An Environmental Impact Assessment (EIA) process refers to that process (in line with the EIA Regulations) which involves the identification of and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project/ activity. The EIA process comprises two main phases: i.e. **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including an Environmental Management Programme (EMPr) to the competent authority for decision-making. The EIA process is illustrated below:

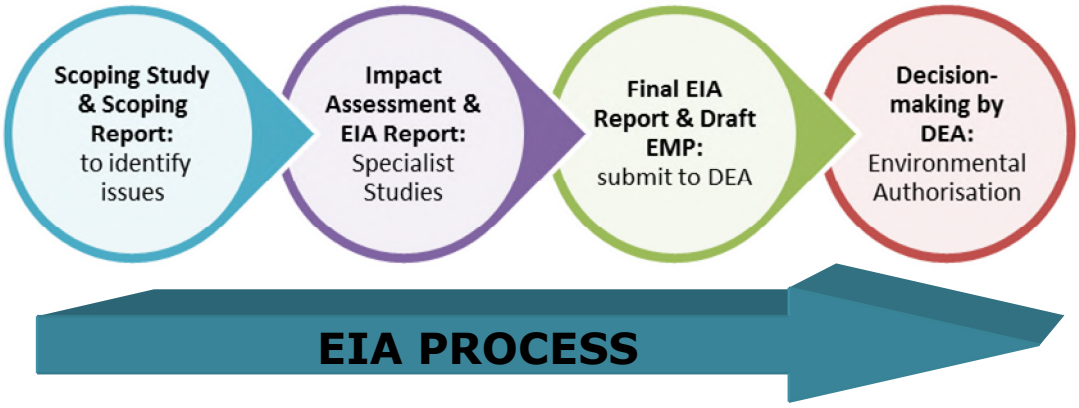

Figure 4.1: The Phases of an EIA Process

The EIA process for the proposed Lethabo PV Facility is being undertaken in accordance with the sections 24 (5) of the National Environmental Management Act (No 107 of 1998). In terms of the EIA Regulations of June 2010 (GNR 543), a Scoping and EIA Study are required to be undertaken for this proposed project. The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

4.1 Relevant Listed Activities

The EIA Regulations were revised in December 2014 as promulgated in GNR 982 – 985. In terms of Sub-Regulations 53(2) and 53(3) of these Regulations) Transitional Arrangements):

"If a situation arises where an activity or activities, identified under the previous NEMA Notices, no longer requires environmental authorisation in terms of the current activities and competent authorities identified in terms of section 24(2) and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), and where a decision on an application submitted under the previous NEMA regulations is still pending, the competent authority will consider such application to be withdrawn".

And "where an application submitted in terms of the previous NEMA regulations, is pending in relation to an activity of which a component of the same activity was not identified under the previous NEMA notices, but is now identified in terms of section 24(2) of the Act, the competent authority must dispense of such application in terms of the previous NEMA regulations and may authorise the activity identified in terms of section 24(2) as if it was applied for, on condition that all impacts of the newly identified activity and requirements of these Regulations have also been considered and adequately assessed."

Therefore, similarly listed and additional activities relevant to the current application have been identified and are listed in Table 4.1.

Table 4.1: Listed activities triggered by the proposed Lethabo PV Facility

Listed activity as described in GN R.544, 545 and 546	**Listed activity as described in GN R 983, 984 and 985**	**Relevance to the project**
GNR 544 item 10 (i): The construction of facilities or infrastructure for the transmission and distribution of electricity – (i)Outside urban areas with a capacity of more than 33 but less than 275 kilovolts	GN R 983 Activity 11: The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts	The facility will require the construction of an on-site substation and an overhead distribution power line outside an urban area, with a capacity of less than 275kV.
GNR 544 item 11(x)(xi) The construction of (x) the construction of buildings exceeding 50 square metres in size or; (xi) infrastructure or structures covering 50 square metres or more, where such construction occurs within a watercourse or within 32 metres of a watercourse measured from the edge of the watercourse.	GN R 983 Activity 12: The development of (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse, or (c) within 32m of a watercourse	The PV facility will include the development of infrastructure exceeding 50 square metres in size (workshop area, site office and underground cabling, panels) within 32 metres of a watercourse.

GNR 544 item 18(i) The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation , removal, or moving of soil, sand, shells, shell grit, pebbles, or rock of more than 5 cubic metres from (i) a watercourse	GN R 983 Activity 19: The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse	Construction of the PV facility requires the infilling or excavation and removal of soil of more than 5 cubic metres from a watercourse.
GNR 544 item 22 (ii) The construction of a road outside urban areas (ii) where no road reserve exists where the road is wider than 8 metres	GN R983 Activity 24: The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres	The facility will require the construction of new internal access roads within the site which will be wider than 8m in width (up to 13m in width), to be constructed outside urban areas.
GN544 Item 47 (ii): The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre – (ii) where no reserve exists, where the existing road is wider than 8 metres	GN R 983 Activity 56: The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (ii) where the existing reserve is wider than 13,5 meters	The facility will require the widening/lengthening of existing access roads to the site by more than 6 metres where no reserve exists, and where the existing road is wider than 8 metres.
GN545 Item 1: The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	GN R 984 Activity 1: The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more	The PV facility will generate an electricity output of more than 20MW. The proposed facility will consists on of arrays of photovoltaic (PV) panels with an electricity output of up to 75MW.
GN545 Item 15: Physical alteration of undeveloped, vacant or derelict land for residential, retail,	GN R983 Activity 28: Residential, mixed, retail, commercial, industrial or institutional developments where such land was used	The development area of the solar energy facility would be in excess of 20ha. The area required for the development is ~162 ha

commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.	for agriculture or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare	
GN546 Item 14 (a) i: The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation (a) In Free State: i. All areas outside urban areas	GN R 984 Activity 12: The clearance of an area of 20 hectares or more of indigenous vegetation	The solar energy facility will be located outside urban areas and will require the clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation cover. The area required for the development is ~162 ha.

4.2 Scoping Phase

The Scoping Phase was completed in **May 2015** with the submission of a Final Scoping Report to the DEA, and acceptance thereof received from DEA in **June 2015**. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

The Scoping Study provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern. The Scoping Report aimed at detailing the nature and extent of the proposed Lethabo PV Facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. 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).

4.3. Environmental Impact Assessment Phase

The EIA Phase for the proposed Lethabo PV Facility aims to achieve the following:

» Provide a comprehensive assessment of the social and biophysical environments affected by the proposed project.

» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility.
» Comparatively assess feasible alternatives put forward as part of the projects.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public participation process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA Report addresses potential direct, indirect, and cumulative[5] impacts (both positive and negative) associated with all phases of the project including design, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

4.3.1. Tasks completed during the EIA Phase

The EIA Phase for the proposed Lethabo PV Facility 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 an 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.

These tasks are discussed in detail below.

[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).

4.3.2 Authority Consultation

The National DEA is the competent authority for this application. Consultation with the regulating authorities (i.e. DEA and DETEA) has continued throughout the EIA process. The following will also be undertaken as part of this EIA process:

» Submission of a final EIA Report following the 30-day public review period of the draft EIA Report and an additional 21 days public review period of the final EIA Report.
» If required, an opportunity for DEA and DETEA representatives to visit and inspect the proposed project site.
» Notification and Consultation with Organs of State (refer to Table 4.1) that may have jurisdiction over the project, including:
  * Provincial and local government departments (including South African Heritage Resources Agency, Department of Water and Sanitation , South African National Roads Agency Limited, Department of Agriculture, Department of Public Works, Roads and Transport, etc.).
  * Parastatals and Non-Governmental Organisations (South African Civil Aviation Authority (SACAA), and Square Kilometre Array (SKA))
  * Metsimaholo Local Municipality and Fezile Dabi District Municipality

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

4.3.3 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 have been provided, as follows:

» 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 22 March 2016 – 25 April 2016. The comments received from I&APs is captured within a Comments and Response Report, which is included within the final EIA Report, for submission to the authorities for review and decision-making.

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

» Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of—
    (i) the site where the activity to which the application relates is or is to be undertaken; and
    (ii) any alternative site mentioned in the application;
» Giving written notice to:
    (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
    (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    (iii) Owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
    (v) the municipality which has jurisdiction in the area;
    (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
    (vii) any other party as required by the competent authority.
» Placing an advertisement in:
    (i) one local newspaper; and
    (ii) in at least one provincial newspaper.
» Open and maintain a register/ database of interested and affected parties and organs of state.
» Release of a Draft EIA Report for Public Review
» 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 for the project to date.

» **Placement of Site Notices**
Site notices have been placed on-site and at relevant public places Proof of this is included in **Appendix C**.

» **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).

Table 4.1: Key stakeholder groups identified during the EIA Process

Organs of State
National Government Departments
Department of Agriculture, Forestry and Fisheries (DAFF)
Department of Communications
Department of Energy (DoE)
Department of Mineral Resources (DMR)
Department of Public Works (DPW)
Department of Rural Development and Land Reform (DRDLR)
Department of Water and Sanitation (DWS)
Government Bodies and State Owned Companies
National Energy Regulator of South Africa (NERSA)
Sentech
South African Civil Aviation Authority (CAA)
South African Heritage Resources Agency (SAHRA)
South African National Roads Agency Limited (SANRAL)
Square Kilometre Array: Southern Africa
Telkom SA Ltd
Provincial Government Departments
Free State Heritage Resources Authority (FSHRA)
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
Local Government Departments
Metsimaholo Local Municipality
Fezile Dabi District Municipality
Conservation Authorities

BirdLife South Africa
Wildlife and Environment Society of South Africa (WESSA)
Endangered Wildlife Trust (EWT)
Landowners
Affected landowners and tenants
Neighbouring landowners and tenants

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:

* Sasolburg Ster (13 January 2015)
* Vaal weekblad (14 January 2015)

A second advert was placed announcing the date and venue of the public meeting and the availability of the draft scoping report. This advert appeared in the following newspapers:

* Sasolburg Ster (17 March 2015)
* Vaal weekblad (18 March2015)

During the EIA phase, a further 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:

* Vaal weekblad: (1 April 2016)
* Vanderbijlpark ster (4 April 2016)

» **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 4.2 below:

Table 4.2: Consultation undertaken with I&APs for the Lethabo PV Facility

Scoping Phase	Activity	Date
	Distribution of the background information document and letters announcing the EIA process to I&APs. These letters were distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups.	10 December 2014
	Placement of site notices on-site.	12 December 2014
	Placement of the newspaper advertisements announcing the EIA process and inviting members of the public to register as I&APs on the project's database. The advertisements were placed in the following newspapers: * Sasolburg Ster * Vaal Weekly	 13 January 2015 14 January 2015
	Distribution of written notices announcing the availability of the Draft Scoping Report and details of the public meeting. These letters were distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups. In addition, hard copy and CD copies of the Draft Scoping Report were sent to Organs of State departments via courier.	18 March 2015
	The availability of the Draft Scoping Report for public review and public meeting details were advertised as follows: * Sasolburg Ster * Vaal Weekblad	 17 March 2015 18 March 2015
	30-day review period for the Draft Scoping Report	18 March 2015 - 21 April 2015
	Focus Group Meeting with Metsimaholo Local Municipality	18 February 2015
	Focus Group Meeting with impacted and adjacent landowners	18 February 2015
	Public meeting	16 April 2015
EIA Phase	Distribution of letters announcing the availability of the Draft EIA Report for review for a 30-day comment period and the details of the public meeting. These letters were distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups. In addition, hard copy and CD copies of the Draft Scoping Report were sent to Organs of State departments via courier.	22 March 2016

	The availability of the EIA Report and the date of the Public Meeting advertised as follows: * Vaal Weekblad * Vanderbijlpark Ster	1 April 2016 4 April 2016
	30-day review period of the EIA Report	22 March 2016 – 25 April 2016
	Public Meeting	12 April 2016

Records of all consultation undertaken are included in **Appendix C**

4.3.4 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. This is included in **Appendix C**.

4.3.5 Assessment of Issues Identified through the Scoping Process

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

Table 4.2: Specialist consultants appointed to evaluate the potential impacts associated with the Lethabo PV Facility

Specialist	Area of Expertise	Appendix
Megan Diamond (Feathers Environmental Services)	Avifauna	Appendix D
Marianne Strohbach (Savannah Environmental) and Michael Cohen (External Reviewer)	Ecology	Appendix E
Jaco van der Walt (Heritage Contracts and Archaeological Consulting CC (HCAC))	Heritage and Archaeology	Appendix F
Barry Millstead (BM Geological Services)	Palaeontology	Appendix G
John Marshall (Afzelia Environmental Consultants and Environmental Planning and Design)	Visual	Appendix H
Candice Hunter (Savannah Environmental) and Neville Bews (external reviewer)	Social	Appendix I
Garry Paterson (ARC-Institute for Soil, Climate and Water)	Soils and Agricultural Potential	Appendix J
Rob Taylor (Limosella Consulting)	Wetlands	Appendix K

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the proposed Lethabo PV Facility Issues were assessed in terms of the following criteria:

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

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

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

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

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

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

As Eskom 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 EMPr is included as **Appendix L**.

4.3.6 Assumptions and Limitations

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

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

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

DESCRIPTION OF THE RECEIVING ENVIRONMENT CHAPTER 5

This section of the Draft EIA Report provides a description of the environment of the greater farm portion as well as the specific site within the greater farm portion that may be affected by the proposed Lethabo PV Facility project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as site investigations, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices D – K**.

5.1 Regional Setting: Location of the Study Area

The proposed Lethabo Solar Photovoltaic (PV) Facility is located between Sasolburg and Vereeniging, approximately 10 and 25 km from the major towns in the Vaal Triangle in the Free State. The site falls within the Metsimaholo Local Municipality which falls within the Fezile Dabi District Municipality. The identified alternative sites fall within the Lethabo coal fired power station property boundary (refer to Figure 5.1.). The sites can be accessed directly from the R716.

5.2 Biophysical Characteristics of the Study Area

5.2.1 Climatic Conditions

The climate of the area can be regarded as warm to hot, with rain in summer and dry winters. The long-term average annual rainfall in this region is 638 mm, of which 530.8 mm, or 83%, falls from November to April. The total annual evaporation is 2 187 mm per year, peaking at 7.8 mm per day in November and December. Temperatures vary from an average monthly maximum and minimum of 28.0ºC and 18.2ºC for January to 13.9ºC and -2.2ºC for July respectively. The extreme high temperature that has been recorded is 38.1ºC and the extreme low –12.8ºC. Frost occurs most years on around 50 days on average between mid-May and early September.

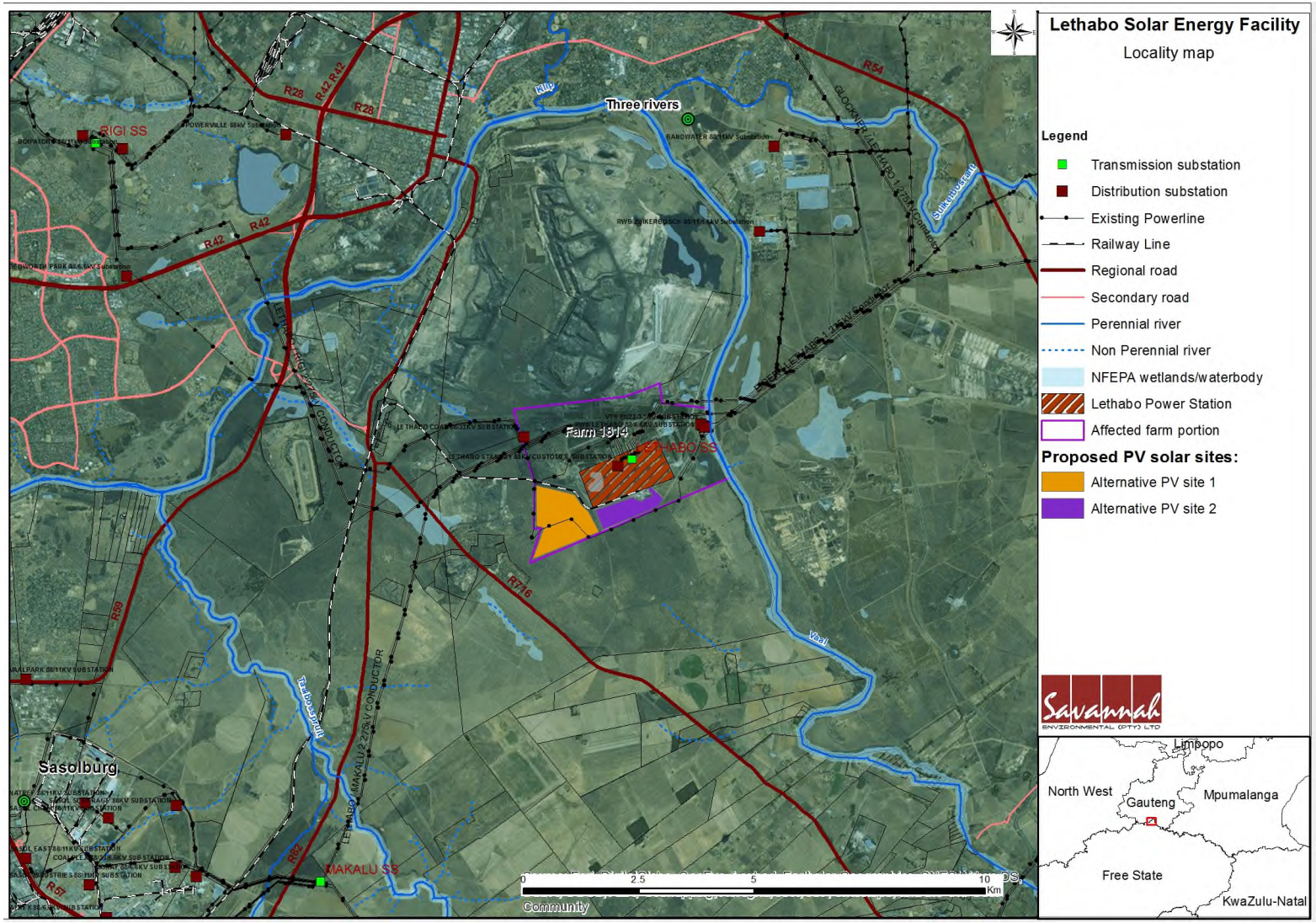

Figure 5.1: Lethabo PV Solar Energy Facility project site showing the site location as well as existing infrastructure in the area

5.2.2 Topography and Geology

The proposed sites are located in a bowl that has been formed by a major meander in the Vaal River. The base of the bowl is set at around 1445m amsl. Land rises gently to north, south, east and the west to between 1495 to 1510m amsl. The proposed sites are located close to the slopes of the southern edge of the bowl. This adjacent landform is likely to have a significant influence on the extent of visibility to the south.

The two alternative development areas are completely underlain by rocks of the Early Permian Vryheid Formation. In the Main Karoo Basin of South Africa the Vryheid Formation is a sandstone and coal-rich stratigraphic unit that inter-fingers with (i.e., is transitional with and partially time equivalent to) the overlying Volkrust and underlying Pietermaritzburg Formations; both of which are both are predominantly argillaceous. Genetically the formation can be divided into lower fluvial-dominated deltaic interval, a middle fluvial interval (the coal-bearing zone) and an upper fluvial-dominated deltaic interval. The thickness and frequency of the sandstone units increases from the base of the formation, reaching their maximum in the middle fluvial interval and then decrease again towards the overlying Volksrust Formation. To the south and south-east the Vryheid Formation grades laterally into undifferentiated, deep-water argillites of the Ecca Group. The Vryheid Formation is one of sixteen (16) recognised stratigraphic units that constitute the Permian Ecca Group. During the deposition of the Ecca Group the basin was dominated by a large sea (the salinity levels of this water body remain unresolved). The exception to this model was the deposition of the coal-bearing strata of the Vryheid Formation along the northern margin during an episode of deltaic progradation into the basin.

5.2.3 Soils, Land Types and Agricultural Potential

Soils

Much of the areas consist of grey or yellow-brown, sandy or loamy apedal soils on soft (or occasionally hard) plinthite. The depths vary somewhat, with zones of shallow, disturbed soils or wetter clay soils also occurring (as can be seen from the information contained in Table 5.1).

Land Types

A summary of the dominant land type characteristics is given in Table 5.1.

Agricultural Potential

The moderately high rainfall in the area (as described in Section 5.2.1) means that rain-fed cultivation can be successfully practiced on suitable soils. However, the low clay content in the subsoil means that water infiltration in these soils will be rapid and that the soils will tend to dry out quickly in any period without rainfall. The broad agricultural potential is summarised in Table 5.2. It can be seen that areas with moderate agricultural potential occupy less than 30% of the study area.

5.2.4 Surface Water

Regional Hydrology

The Vaal River bows to the east, north and west of the sites at a distance of 1.48km at its closest point. Several open water bodies are located within the arc of the river, the closest being 830 m north of the Alternative Site 2. Artificial furrows are installed around the power station draining water eastwards and away from the study sites. One concrete reservoir is the only NFEPA wetland that has been demarcated within the study site and its 500m buffer (Nel et al., 2011). Inspection of aerial photos from 2012, provided by the office of the surveyor general, showed no obvious rivers or channelled waterways on or within 500m of the sites. However, two wetlands, both hillside seeps, were found in the study site, these are discussed further in the sections that follow. The slope on the study sites varies from ~0.5% to ~1.8% in a north easterly direction, with the altitude ranging from ~1460-1450 m.a.s.l.

Quaternary Catchments

The study site falls within the quaternary catchment C22F. In this catchment the mean annual precipitation is lower than the potential evapotranspiration and as such any wetlands in this catchment would rely largely on regional hydrology for their source of water (water supplied by rainfall is unlikely to be enough to support these wetlands). These wetlands are sensitive to any changes in the volume and duration of the water supplied by regional hydrology.

Wetlands on site

Two wetlands were delineated on the study site, both being hillslope seeps. Figure 5.2 and Figure 5.3 shows the delineated wetlands together with the 30m wetland buffers. 15.6 ha of wetland are located on the Alternative Site 1 while 37 ha and 56 ha of wetland are located on the Alternative Sites 2 respectively. Several small depressions a few meters in diameter are located on the Alternative Site 1. These small depressions did show signs of wetness but due to their size they have been excluded as wetlands.

Table 5.1: Land types of Lethabo Solar Facility

Map Unit	Dominant soils	Sub-dominant soils	Depth (mm)	Characteristics	Area (ha)
Av	Avalon 2100	Longlands 2000, Pinedene 2100	700-1200+	Brown to grey-brown, structureless to weakly structured, loamy sand to sandy loam topsoil on yellow-brown, structureless to weakly structured, loamy sand to sandy loam subsoil on grey, mottled, weakly structured sandy clay loam soft plinthic.	Alt 1: 51.73 Alt 2: 31.66 **Tot: 83.39**
Lo	Longlands 2000	Kroonstad 1000, Wasbank 1000	600-1200+	Brown to grey-brown, structureless to weakly structured, loamy sand to sandy loam topsoil on grey, structureless, sand to loamy sand subsoil on grey, mottled, weakly structured sandy clay loam soft plinthic (occasionally with hard, cemented nodules).	Alt 1: 23.56 Alt 2: None **Tot: 23.56**
Kd	Kroonstad 1000	Longlands 2000, Pinedene 2100	450-1000	Brown to grey-brown, structureless to weakly structured, loamy sand to sandy loam topsoil on grey, structureless, sand to loamy sand subsoil on grey, mottled, moderately structured, sandy clay loam to clay loam subsoil.	Alt 1: 32.68 Alt 2: 20.29 **Tot: 53.97**
Ka	Katspruit 1000	Kroonstad 1000	100-350	Brown to grey-brown, weakly structured, loamy sand to sandy loam topsoil on grey, mottled, moderately structured, sandy clay loam to clay loam subsoil. Occurs in lower-lying areas (wetlands).	Alt 1: None Alt 2: 14.03 **Tot: 14.03**
Wb	Witbank 1000	Katspruit 1000, Glenrosa 1121	200-600	Brown to grey-brown, weakly structured, loamy sand to sandy loam topsoil on hard, mottled, gravelly material. Occasionally, patches of shallow gleyed soils (**Ka** unit) also occur. Apparently***** resulting from previous human disturbance (including dumping and excavation).	Alt 1: 75.83 Alt 2: None **Tot: 75.83**
				Totals	Alt 1: 183.8 Alt 2: 65.98 **Tot: 279.78**

Table 5.2: Agricultural potential of the proposed Lethabo PV sites

Agric. Potential Class	Map Unit(s)	Limitations	Area (ha)
Moderate	Av	Loamy sand (occasionally sandy) nature of subsoil means water infiltration will be rapid, leading to potential drought of crops under rain-fed conditions	Alt 1: 51.73 Alt 2: 31.66 **Tot: 83.39**
Low	Lo, Kd	Sandy to extremely sandy subsoil, coupled with reduced natural fertility, means crop yields will often be less than optimal, coupled with drought hazard	Alt 1: 56.24 Alt 2: 20.29 **Tot: 76.53**
Very Low	Wb	Widespread shallow depth to underlying hard layer, coupled with gleyed patches and uneven surface means arable agriculture will be very problematic.	Alt 1: 75.83 Alt 2: None **Tot: 75.83**
Wetland	Ka	Restricted depth to gleyed clay, coupled with wetness hazard in rainy season, means this area should be avoided for all agriculture	Alt 1: None Alt 2: 14.03 **Tot: 14.03**
		Totals	Alt 1: 183.8 Alt 2: 65.98 **Tot: 279.78**

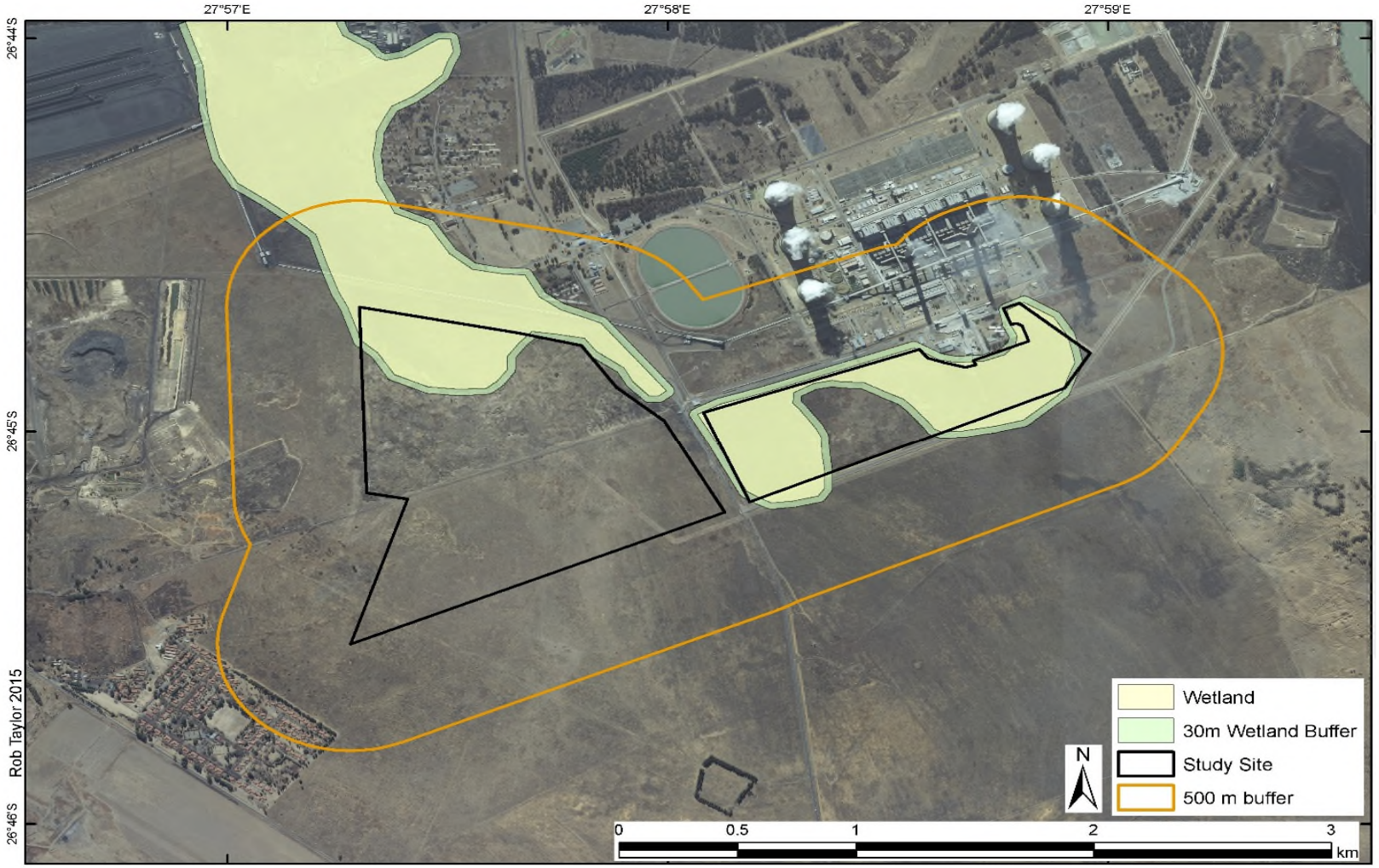

Figure 5.2: The wetlands and wetland buffers on the study site.

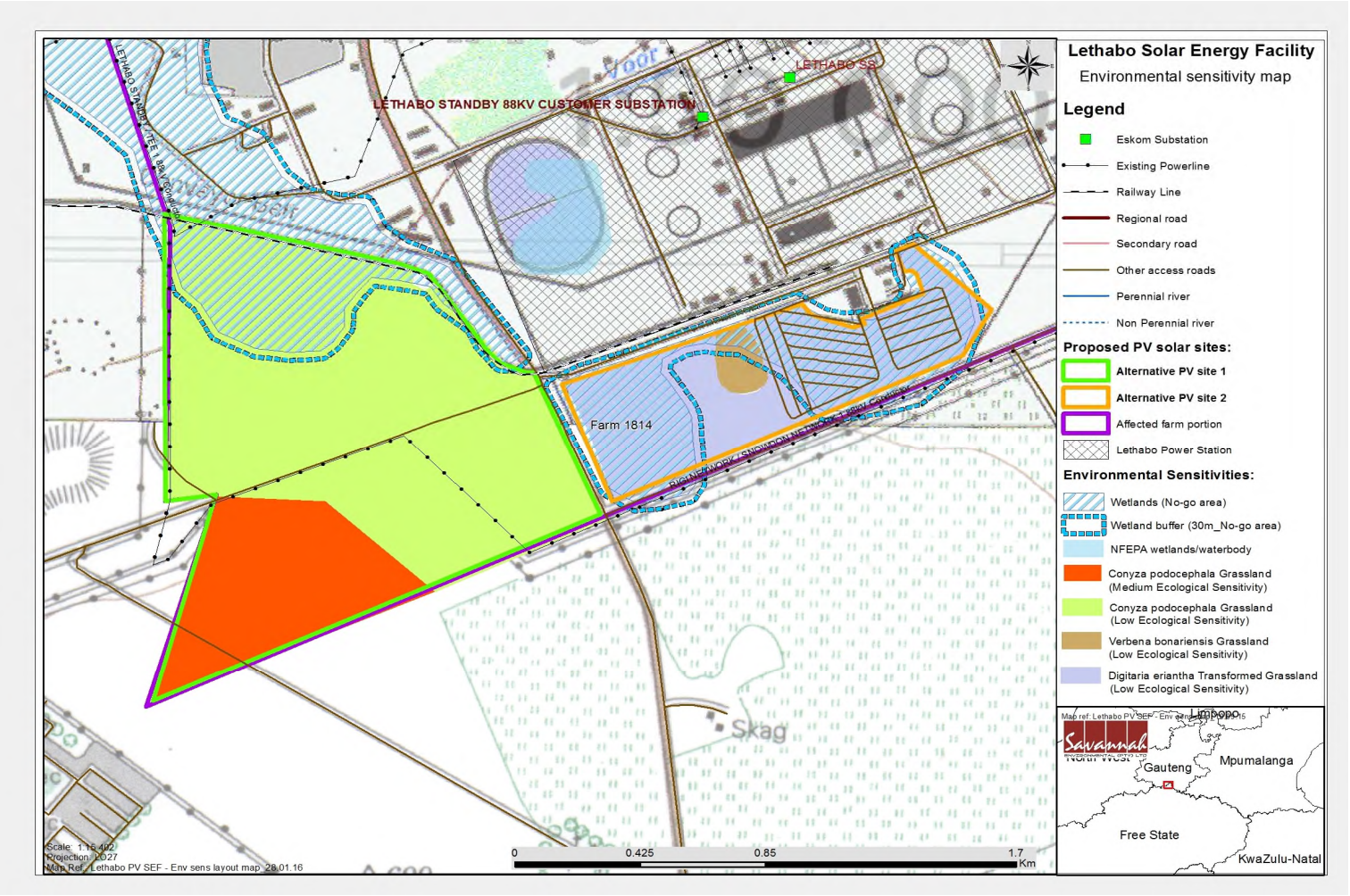

Figure 5.3: Environmental Sensitivity map for the project study area illustrating sensitive areas in relation to the Lethabo PV Solar Energy facility

5.3 Ecological Profile

5.3.1 Flora

Vegetation overview

The study area falls within the original extent of the Central Free State Grassland (Unit Gh 6) as defined by Mucina and Rutherford (2006). The Central Free State Grassland (Unit Gh 6) is a relatively short grassland on undulating plains. Where in a pristine condition, it is dominated by *Themeda triandra,* whilst *Eragrostis curvula* and *E. chloromelas* become more dominant in degraded habitats. Severely degraded clayey bottomlands are often dominated by dwarf karroid shrubs, whilst riverine areas and severely overgrazed/trampled low-lying areas are prone to encroachment by *Acacia karroo* (Mucina and Rutherford 2006).

This vegetation type is not officially listed as a threatened ecosystem, but it is regarded as vulnerable (Mucina and Rutherford 2006) due to large portions of it being transformed either for cultivation or by dams, with only small portions that are protected such as in the Rustfontein Dam Nature Reserve.

Fine-Scale Vegetation Patterns

During a detailed vegetation survey of the study area, three vegetation associations could be identified as follows (Refer to figure 5.3):

» Association 1: *Digitaria eriantha* (Transformed Grassland), this vegetation consists of a relatively dense herbaceous layer, and covers most of site alternative 2. Past rehabilitation efforts have included over seeding by *Digitaria eriantha* and *Eragrostis curvula*. A large presence of alien invasives, most notable *Tagetes minuta* (Khaki Weed) is still indicative of the disturbed nature of this vegetation. This grassland has a low sensitivity rating.

» Association 2: *Paspalum urvillei – Verbena bonariensis (*Grassland), a small central section of site alternative 2 has moist soil conditions, which has led to the establishment of some facultative wetland species. The dense grass layer is heavily invaded by the Category 1b alien invasive *Verbena bonariensis*, which has the capacity to gradually displace more of the natural vegetation. This grassland has a low sensitivity rating.

» Association 3(green): *Cynodon dactylon - Conyza podocephala* Grassland
This vegetation covers site alternative 1 and beyond. The area was largely transformed by past mining activities, and then rehabilitated. The resultant grassland has then been subjected to uncontrolled grazing, which has been

resolved in the meantime. Diversity of the grassland is already relatively high, but the dominance of *Cynodon dactylon* and abundance of ruderal forbs shows that the vegetation community is still developing and not yet in a stable climax state. Nevertheless, the presence of several geophytes, including the slow-growing *Boophane disticha*, show a positive trajectory of change of these grasslands. This grassland has a medium sensitivity rating due to the high diversity sections.

Invasive Plants

The following listed alien invasive species (all category 1b) have been recorded on the study area:

» *Cirsium vulgare*
» *Datura stramonium*
» *Gleditsia triacanthos*
» *Verbena bonariensis*

Additional alien invasive species do occur in the surrounding area along major transport routes, which could be accidentally introduced to the project site during construction. Regular monitoring and early eradication should enable a cost-effective control of invasives.

Plant species of Conservation Concern

The following red data species have been recorded from the area (2827) according to the red data species list of SANBI and the ADU database (Refer Table 5.3):

Table 5.3: Red data plant species list of SANBI and the ADU database (2827)

Species	RD Status	Possibility of being present	Threat
Trachyandra erythrorrhiza	NT	Not expected	Habitat destruction
Stenostelma umbelluliferum	NT	Not expected	Habitat destruction
Miraglossum laeve	VU	Unlikely	Habitat destruction
Kniphofia typhoides	NT	Unlikely	Habitat destruction
Khadia beswickii	VU	Unlikely	Illegal trade
Hypoxis hemerocallidea	Declining	Slight	Medicinal Trade
Habenaria barbertoni	NT	Not expected	Habitat destruction

Species	RD Status	Possibility of being present	Threat
Gunnera perpensa	Declining	Unlikely	Habitat destruction
Drimia elata	DDT	Slight	Medicinal Trade
Crinum bulbispermum	Declining	Slight	Habitat destruction
Cineraria austrotransvaalensis	NT	Unlikely	Habitat destruction
Boophone disticha	**Declining**	**Observed**	**Medicinal Trade**
Acalypha caperonioides var. *caperonioides*	DDT	Slight	Habitat destruction
Adromischus umbraticola subsp*. umbraticola*	NT	Unlikely	Habitat destruction
Alepidea attenuata	NT	Unlikely	Habitat destruction
Brachycorythis conica subsp*. transvaalensis*	EN	Unlikely	Habitat destruction
Brachystelma incanum	VU	Unlikely	Habitat destruction
Callilepis leptophylla	Declining	Unlikely	Medicinal trade
Cineraria longipes	VU	Unlikely	Habitat destruction
Drimia sanguinea	NT	Slight	Medicinal trade
Gnaphalium nelsonii	Rare	Slight	Habitat destruction
Lepidium mossii	DDD	Slight	Habitat destruction
Lessertia mossii	DDT	Unlikely	Habitat destruction
Lithops lesliei subsp*. lesliei*	NT	Unlikely	Illegal trade
Myrothamnus flabellifolius	DDT	Unlikely	Medicinal trade
Pearsonia bracteata	NT	Unlikely	Habitat destruction
Stapelia paniculata subsp. paniculata	NT	Unlikely	Illegal trade

Boophane disticha plants were encountered on the study site and are protected by the Nature Conservation Ordinance 8 of 1969 Schedule 6: Protected Species.

5.3.2 Fauna

There are a number of amphibians, reptiles 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, Reptiles and Mammals

A list of protected vertebrate species (reptiles, birds, and mammals) that could occur in the study area according to the ADU and SANBI databases, as well as Apps (2000) is presented in Appendix C of the ecology report

At the time of the survey, small burrows of Yellow Mongoose (*Cynictis penicillata*) was observed on Site Alternative 1. In addition, the following terrestrial vertebrates are commonly observed on the site.

» Duiker *(Sylvicapra grimmia)*
» Steenbok *(Raphicerus campestris)*
» Aardwolf *(Proteles cristata)*
» Hares *(Lepus saxatilis and L. capensis)*

Species of conservation concern

The following red data species, presented in Table 5.4, have been recorded from the area (2827) according to the red data species list of SANBI and the ADU database:

Table 5.4: Red data faunal species list of SANBI and the ADU database (2827)

Species	RD Status	Possibility of being present	Threat
Giant Girdled Lizard *Smaug (Cordylus) giganteus*	VU	Slight	Habitat destruction
Giant Bull Frog *Pyxicephalus adspersus*	NT	Slight	Habitat destruction
Coppery Grass Lizard *Chamaesaura aenea*	NT	Slight	Habitat destruction

5.3.3 Avifauna

Avifaunal Habitats within the study area

Whilst much of the distribution and abundance of bird species can be attributed to the broad vegetation types present in an area, it is the smaller spatial scale habitats (micro habitats) that support the requirements of a particular bird species that need to be examined in greater detail. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food availability and various anthropogenic factors, all of which will either attract or deter birds and are critically important in mapping the site in terms of avifaunal sensitivity and ultimately informing the mitigation requirements. Investigation of the two alternative development sites revealed the presence of grassland habitat (degraded and disturbed to a large extent) and small wetland areas (Figure 5.4). In addition, commercial dryland cultivation, irrigated agricultural lands, the Vaal river system, eucalyptus plantations as well as mines, quarries, industrial and residential areas feature prominently within the immediate surrounds of the two proposed development sites.

Figure 5.4: Examples of the microhabitat (degraded grassland and small wetlands) observed, at each of the two proposed sites during the site visit

Relevant Bird Populations

» Southern African Bird Atlas Project (SABAP) 1 and 2: A combined total of at least 333 bird species has been recorded within the relevant SABAP quarter degree squares and pentads (refer to Avifaunal report - Appendix D). The presence of these species in the broader area provides an indication of the diversity of species that could potentially occur at the two alternative sites. Of the 333 species, 27 are Red List species, 11 near-endemics, two endemics and five regional endemic species. Although Red List endemics (Black Harrier, Blue Korhaan, Agulhas Long-billed Lark and Melodious Lark) have been recorded in the broader study area. The report rates for each of these are low which suggests that these species may not in fact occur frequently within the quarter degree squares or pentads and are therefore unlikely to occur at either of the two identified sites. The Red List bird species as well as those with a level of endemism, recorded in the study area by SABAP 1 and 2 are presented in Table 1 of the Avifaunal report (Appendix D).

» Coordinated Avifaunal Roadcount (CAR) Data: The Co-ordinated Avifaunal Roadcounts (CAR) project monitors the populations of 21 species of large 'terrestrial' birds in agricultural habitats (Young *et.al.* 2003). Although CAR road counts do not give an absolute count of the all the individuals in a population, they do provide a measure of relative abundance in a particular area. The closest CAR routes are situated approximately 5km east and 13km south west of the proposed development sites. Data emanating from this project indicates that this in an area that has been largely ruined for large terrestrial birds, probably as a result of the intensive agricultural practices that have dominated this region over the years. The absence of Kori Bustard, Blue Crane, Grey Crowned Crane, Blue Korhaan and Secretary bird is testament to this. Given, the scarcity of large terrestrial birds in the general area and the current level of existing disturbance, it is unlikely that large terrestrial species of conservation concern will be present at either of the two identified sites. Northern Black Korhaan, Spur-winged Goose, Black-headed Heron and Helmeted Guineafowl were the only large terrestrial species observed at the proposed development sites and within their immediate surrounds during the data collection period.

5.4 Land-Uses

Heavy industrial development dominates the land use in the study area, and includes the adjacent Lethabo Power Station, open cast mining areas to the north and west of the proposed alternative sites, Mittal Steel to the north of Vereeniging and the Sasol refinery in Sasolburg to the south west. These activities include large industrial structures such as cooling towers, overhead conveyors and other industrial buildings that are visible over a wide area. They have an overwhelming impact on landscape character from immediately adjacent areas but also influence landscape character over a wider area.

Urban development includes Vereeniging and Vanderbijlpark to the north of the Vaal and Sasolburg to the south west. These are relatively dense urban areas that are generally inward looking. Views of the broader landscape are generally only possible from the edges of the developed areas. Agricultural development includes small-holdings to the south of the proposed alternative sites and closer to the urban areas and larger farming units that are generally located to the south and east. Farms are generally a mixture of arable and pasture.

5.5 Access and Transport Routes in the Region

The site can be accessed from the R716 regional road which lies west of the proposed site connecting Vereeniging to Deneysville. Within the site itself, access is already established. This is used for the power station and will be utilised for construction purposes (and later for limited access for maintenance).

5.6 Visual Quality of the Area

The different characteristics that contribute to the overall visual quality surrounding the proposed Lethabo PV solar facility is shown in Figure 5.5 and explained below:

The **Industrial Landscape Character Area**, in which the proposed development is located, is a functional area first and foremost. Its only importance is related to ensuring that the industry including power production and mining, functions efficiently. The main visual elements include power station and mine buildings and dumps. The natural landscape is highly degraded. There are blocks of alien trees close to the northern and western edges of the power station that do screen many of the lower elements within the complex particularly from the north, east and west.

The **Urban Landscape Character Areas** are possibly the most cohesive character areas, as once inside settlement areas, existing buildings and street / garden trees block the majority of views of surrounding areas. Consequently, views towards the site are only possible from the urban edge and from elevated areas particularly overlooking undeveloped or open areas within the urban structure. Whilst the urban area has a diverse range of uses, the use that could possibly be most sensitive to infrastructure development such as that proposed is the residential component. It is likely however that the distance between the urban edge and the proposed development, the extent of exiting industrial development that is already obvious and the screening effect of existing vegetation will mean that the degree of sensitivity to the development will be low.

Rural Landscape Character Areas cover two areas that have some key differences and might be considered separate character areas:

- The rural area to the south and west of the Vaal River are highly impacted by industrial infrastructure and urban fringe elements such as substations and old mine dumps. This area also has a number of small-holdings. This means that the rural area is generally more degraded and land units are more divided and generally smaller scale when compared to the rural area to the east of the Vaal River. The main agricultural activity within this area appears to be livestock grazing.
- The rural area to the east of the Vaal River appears to include larger scale agricultural units and a more diverse agricultural mix including both arable and livestock grazing. The area is also less impacted by infrastructure than the area to the west of the River.

The rural area to the east of the Vaal River is used as a corridor for people travelling to the Vaal Dam which has regional and possibly national importance for water based recreation. Any development that changes the character of this approach corridor might be considered to have negative connotations for these users. Given the power station context within which the proposed development will take place and the distance, it is unlikely that there will be any change of character due to the proposal. However, this needs to be addressed during the assessment.

The Riverine Landscape Character Area is an important local recreational resource. It has also been used by recreational, tourism and residential development as a setting for these activities and so has obvious aesthetic importance within the area. The river channel is generally depressed below the adjacent landscape character areas. It is also mainly lined with tall riverine vegetation which generally includes alien tree species such as *Salix babylonica* (weeping willow). This level difference and surrounding vegetation result in views from the corridor being largely blocked. In most cases, it is only the larger industrial elements such as chimney stacks and cooling towers of the power station that may be visible.

URBAN LANDSCAPE CHARACTER OF THE AREA

RURAL LANDSCAPE CHARACTER AREA


RIVERINE LANDSCAPE CHARACTER AREA


INDUSTRIAL LANDSCAPE CHARACTER AREA


Figure 5.5: Views of the different land characteristics within the project site

5.7 Social Characteristics of the Study Area and Surrounds

The purpose of the section is to provide an overview of the current socio-economic baseline environment and context in which the proposed project will take place within the Metsimaholo Local Municipality (MLM) and Fezile Dabi District Municipality (FDDM) in the Free State Province. This section of the report will provide a strategic understanding of the socio-economic profile of the study area, in order to develop a better understanding of the socio-economic dynamics as a background to the development of the project. The data presented in this section has been largely derived from the Free State Census 2011 Municipal Report, FDDM IDP 2012-2017, MLM IDP 2014/2015, the Census Survey 2011 (Stats SA), as well as the local government handbook 2012.

5.7.1 Population

The population trends in a geographical area affect the rate of economic growth through the provision of labour and entrepreneurialism and the demand for goods and services. These trends also indicate the number of people who are likely to be impacted by the proposed project. The proposed development will be constructed in the FDDM within the MLM. The population of the FDDM in 2011 was approximately 488 036 people, of which 149 108 people reside in the MLM. The average annual population growth rate in the study area is estimated by comparing data from 2001 to 2011.

5.7.2 Employment profile

The MLM is largely populated by potentially economically active population. In the MLM the unemployment rate is 32% and there are approximately 20 528 people who are unemployed. This implies that there is a lot of human capital available for any kind of work, but also that there is space for training and developing economically active population in the relevant fields needed. This could increase the employment level and decrease the poverty level in the local area. Local workers should be utilised as much as possible for the proposed development in order to alleviate local unemployment.

5.7.3 Household income levels

The MLM has the lowest percentage of low income households and the highest percentage of middle and high income households in the district. The average household incomes of the MLM are as follows:

» 59.1% of households are classified as low income earners.
» 33.1% of households are classified as middle income earners;
» 7.8% of households are classified as high income earners.

The high percentage of low income households indicates that that there is a high demand for employment opportunities which will help decrease the dependence on forms of assistance either from government and or non-government organisations. The high poverty level of 59.1% has social consequences such as not being able to pay for basic needs and services. The lower average income levels indicate a higher demand for employment opportunities in the economy. However skill levels are less likely to improve unless education levels improve which will lead to more skilled people which will in turn lead to the opportunity to earn higher income levels. This means that there should be less focus on the quantity of job creations and more focus on the quality of jobs created.

5.7.4 Education levels

Education plays a critical role in the development of communities and impacts greatly on economies. The type of education and training received by individuals equally determines the occupation or career they would eventually pursue. It provides a set of basic skills for development, creativity and innovative abilities. The level of education influences growth and economic productivity of a region. There is a positive correlation between a higher level of education and the level of development and standard of living. Education levels in any given population will influence economic and human development. It is clear that low education levels lead to low skills base in an area, while high education levels have the opposite effect, producing a skilled or highly skilled population. Household and personal income levels are also either positively or adversely affected by education levels.
The skills available indicate whether it is possible to employ local residents in the construction and operation phase of a project. Table 5.5 demonstrates the level of education/skills availability in the study area.

Table 5.5: Education levels of population aged 20 years and older (Source: Census 2011 & Free State Municipal Report)

	No schooling	Some primary	Completed primary	Some secondary	Grade 12/Matric	Higher Education
Free State Province	7.1%	16.2%	5.4%	34.7%	26.8%	9.8%
Fezile Dabi DM	7.3%	15.9%	4.9%	35.2%	27.6%	9.1%
Metsimaholo LM	5.7%	11.9%	4.2%	35.8%	29.9%	12.5%
Moqhaka LM	5.4%	16.7%	5.5%	35.9%	27.9%	8.6%
Ngwathe LM	8.5%	19.2%	5.3%	34.7%	25.9%	6.4%
Mafube LM	14.2%	18.1%	5.2%	31.9%	24.4%	6.2%

The education levels in the area are generally low. More than half of the population aged 20 years and older in all the municipalities have only some secondary education or less (in the MLM this being 57.6% of the population); this indicates that the more than half of the local population are semi- skilled or unskilled. This reflects the rural nature of the region and relatively poor access to education. Only 29.9% of the MLM have a matric and 9.1% have higher education; indicating that a relatively small proportion of the population are skilled or highly skilled.

The skills profile of the area indicates that the availability of local labour for the proposed project is largely limited to low-skilled construction workers and a small number of skilled workers.

5.7.5 Access to services

Access to basic services is generally greater in the MLM than at a provincial level demonstrating that service delivery is generally more accessible. This is attributed to high population density in the MLM which decreases the cost of infrastructure development and service delivery compared to less dense areas.

5.7.6 Economic trends

Fezile Dabi DM is the second largest contributor to the Provincial GGP (31%) and Motheo District Municipality being the largest (35%) contributor. The economy of Fezile Dabi DM (4%) has been the largest growing economy in the province (FDDM IDP 2012-2017). The economy of the Free State Province has been restructuring from a primary sector economy to a tertiary economy. This shift has been happening also on the economy of Metsimaholo LM. The shift of the economy from a primary to a tertiary economy is resulting in a large number of jobs losses and the mining sector is identified as suffering the largest loses.

5.8 Heritage features of the region

5.8.1 Heritage and archaeology

Very little research has been done in this area and the following studies were consulted during the scoping phase: archaeological impact assessment (vd Walt et al, 2005) and a Heritage Impact study (Bruwer 2006). Du Piesanie also completed a NID for proposed sand mine close to the study area. Heritage features identified in these studies include mostly Stone Age components and historical features. Du Piesanie indicated that the area was used for extensive plantations and this would have destroyed and disturbed any surface evidence of heritage features.

The study area is characterised by typical Highveld grass veld and some portions, was extensively ploughed in the past. Infrastructure like roads and sand mining etc. also

impacted on the study area and these activities would have destroyed surface indicators of heritage sites. The study area is slightly undulating with no major landscape features like pans or hills that would have been focal points in antiquity and lack raw material suitable for the manufacture of stone artefacts or for the construction of late Iron Age Stone walled settlements.

In terms of the built environment of the area (as defined in Section 34 of the NHRA), no standing buildings older than 60 years occur in the areas surveyed. No burial grounds or graves were recorded and no significant cultural landscapes or viewscapes were noted during the fieldwork. The environmental manager of Lethabo Power station, Ms Sylvanna Wilson, did however point out several known grave sites. All of these sites are located outside of the assessed areas and will not be impacted on by the proposed development. As graves can be expected anywhere on the landscape and due to poor visibility at the time of the survey due to vegetation cover (long grass) and the fact that the area has been disturbed it is recommended that a chance find procedure is incorporated for this project.

5.8.2 Paleontology (Fossils)

'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 study area is completely underlain by potentially fossiliferous sedimentary rocks of the Early Permian Vryheid Formation The most conspicuous and common components of the palaeontological record of the Ecca Group in general are the plant macrofossils of the *Glossopteris* flora. Two large and conspicuous leaf form taxa dominate the *Glossopteris* flora; these being *Glossopteris* and *Gangamopteris*. Within the upper Ecca (containing the Vryheid Formation) *Gangamopteris* has ceased to occur with only *Glossopteris* present (Anderson and McLauchlan, 1976). In that summary it is indicated that the Vryheid Formation can be expected to contain the plant macrofossils *Buthelezia*, *Sphenophyllum*, *Rangia*, *Phyllotheca*, *Schizoneura*, *Sphenopteris*, *Noeggerathiopsis*, *Taeniopteris*, *Pagiophyllum* and *Benlightfootia* and the wood taxa *Australoxylon* and *Prototaxoxylon*. In addition to the above records can be added the observations of Tavener-Smith *et al*., (1988) where it was noted that both *Glossopteris* and *Vertebraria* occur within the palaeontological record of the formation.

Animal body fossils are rare within the Ecca Group in general (excepting the time equivalent faunas of the Whitehill Formation). However, no reptile fossils have been identified within the Vryheid Formation. Hobday and Tavener-Smith (1975) reviewed trace fossil assemblages identified within the Vryheid Formation. Within that fossil assemblage they identified two forms (*Helminthiopsis* and *Taphrelminthopsis* within

horizontally laminated siltstones and mudstones that represent part of the deep water *Nerites* community.

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 Lethabo PV Solar Energy Facility and associated infrastructure. 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 75 MW.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, or ground screws to support the PV panels.
» 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 or switching station.
» A power line to facilitate the connection of the solar energy facility from the on-site substation to Lethabo Power Station or nearest grid access point.
» Internal access roads.
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity.

The proposed Lethabo PV Solar Energy Facility will have a development footprint of approximately ~162 ha. The development of the 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 including implementation of a storm water management plan. The construction phase for the Lethabo PV Solar Energy Facility is expected to take approximately 15-18 months.
» *Operation* – will include operation of the facility and the generation of electricity for Eskom's own consumption at the Lethabo Coal Fired Power station which will be fed via the on-site substation and an overhead power line. The operational phase of the Lethabo PV Solar Energy Facility is expected to extend in excess of 20 - 25 years.
» *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with

decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

6.1 Alternatives Assessment

Alternative PV site:

» Alternative PV site 1 – This layout (shown in green in Figure 6.1) is located in the south west section of the study area. The site is suitable for development, with the implementation of the proposed mitigation measures.
» Alternative PV site 2 – This layout is located in southern section of the study area. 80% of this layout (shown in orange in Figure 6.1) is covered by wetlands. This area is therefore not preferred for a PV development.

Potential impacts pertaining to the alternative PV sites assessed in the sections below, and a comparative assessment of these alternatives is provided.

Technology Alternatives

Impacts on the environment associated with the project can be influenced by the type of PV panel array to be used. Two solar energy technology alternatives are being considered for the proposed project and include:

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

The primary differences between technologies available 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). However, the two alternative PV technologies do not differ in any significant way as far as ecology, visual, and avifaunal impacts are 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 sections that follow. The PV panels are designed to operate for 20-25 years, unattended and with low maintenance. The impacts associated with the operation and decommissioning of the facility will be the same irrespective of the technology chosen

6.2 Potential Impacts on Ecology (Flora, Fauna and Ecosystems)

Solar energy facilities require relatively large areas of land for placement of infrastructure. The proposed Lethabo PV Solar Energy Facility and associated infrastructure requires ~162 ha for the establishment of the proposed panels and associated infrastructure. The main expected negative impact from an ecological perspective will be 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).

6.2.1 Results of the Ecological Study

The selected property falls within the Central Free State Grassland (GH 6) as defined by Mucina and Rutherford (2006). A total of 1432 plant species have been recorded in the Sasolburg/Vereeniging area according to the SANBI database. This high number is largely attributable to the many diverse habitats within the grid, but will not all be found within any one habitat type. Only 115 indigenous plant species could be verified on site, with an additional 22 alien invasive species (excluding planted exotic trees).

Vegetation units identified during this study are based on the overall similarity in species composition, vegetation structure and biophysical attributes that are part of an ecosystem, but smaller phytosociological differences within each vegetation unit are present. The ecological sensitivity of the site is mapped in Figure 6.1.

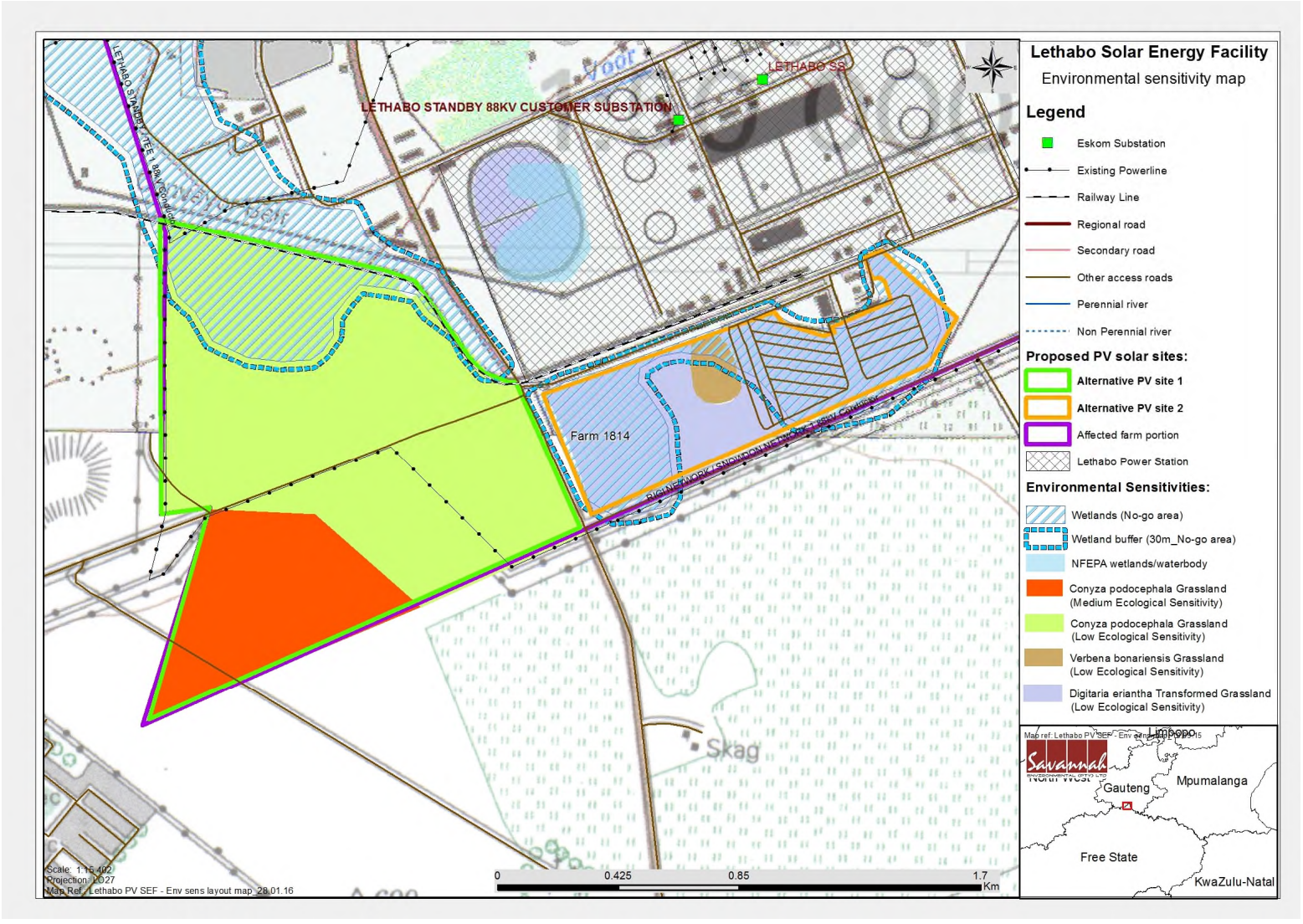

Figure 6.1: Sensitivity map indicating sensitive ecological areas within the proposed Lethabo PV Facility

6.2.2 Impact table summarising the significance of impacts on ecology during the construction and operation phases (with and without mitigation)

***Nature of impact*:** Loss of indigenous (-ve) and alien invasive (+ve) vegetation, increase in runoff and erosion, possible increased distribution of alien invasive species, possible disturbance and reduction of habitat or injury to/loss of burrowing vertebrates, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of re-vegetation potential of soil surface

Activity**:** Upgrading and/or creation of site access road and internal maintenance tracks

Note: The study area is surrounded by gravel and tar roads, and on-site access will thus be limited to service and construction tracks

Relevant Listed activities:
GN 544, activity 11(ii), 18(i), 22 (i) & 47 (ii)
GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**
Extent	Site specific (1)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (15)**
Status	Negative	*Positive* where aliens invasive species will be cleared *Neutral* where roads exist or on transformed areas
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably well	

***Mitigation*:**

» Implement a 30 m buffer around wetlands to protect wetland functionality.
» Conduct search, rescue and relocation of protected species on higher diversity grasslands
» After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows:
  - Protected plant species: must be relocated or a permit obtained to destroy them;
  - Animal burrows: must be monitored by the EO 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 grasslands to a minimum.
» If filling material is to be used, this should be sourced from areas free of invasive species.
  - It is recommended that sealed surfaces from site alternatives 2 be crushed and used as filling material where and if possible.
» Topsoil (the upper 25 cm of soil) is an important natural resource; it must be stripped, where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for

rehabilitation of disturbed or exposed areas caused by construction activities and not as full material. 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 (storm water and erosion management plan required).
» Prevent leakage of oil or other chemicals or any other form of pollution.
» Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed.
» After decommissioning, if access roads or portions thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable re-vegetation program.

***Cumulative impacts*:**

» Possible erosion of areas lower than the access road.
» Possible contamination of lower-lying wetlands due to oil or other spillage.
» Possible spread and establishment of alien invasive species.

***Residual impacts*:**

» Altered vegetation composition and structure.
» Altered topsoil conditions.
» Potential barren areas.
» Potential for erosion and invasion by weed or alien species.

***Nature of impact*:** Temporary disturbance of burrowing animals, possible reduction of habitat and forage availability to terrestrial vertebrates by exclusion, Loss of indigenous (-ve) and alien invasive (+ve) vegetation, window of opportunity for the establishment of alien invasive speciesaltered topsoil characteristics prone to capping which occurs when the surface soil particles bind together creating an impermeable layer. This reduces the ability of soils to absorb water, leading to surface waterlogging and increasing the risk of run-off and erosion, even on very gentle slopes. The impermeable layer can also deprive seed of moisture and oxygen and can impede germinating shoots.,

Activity**:** Fencing area – may also serve as maintenance track to PV panels

Environmental Aspect: Removal of vegetation, compaction of soils, creation of runoff zone, impact on protected species, impact on terrestrial vertebrates

Note: Secure fencing already exists around the entire site alternative 2 area, hence this assessment applies to currently unfenced sections of the proposed alternative 1 only

Relevant Listed activities:

GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**
Extent	Site specific (1)	Site specific (1)
Duration	Long-term (4)	Long term (4)
Magnitude	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (15)**
Status	Negative	*Positive* where alien invasive

		species will be cleared *Neutral* where on transformed or highly degraded areas *Minimal new negative impacts expected*
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	Reasonably well	

Mitigation:

» Implement a 30 m buffer around wetlands to protect wetland functionality.
» After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows:
  o Protected plant species: must be relocated or a permit obtained to destroy them;
  o Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated to a similar habitat as determined by a qualified professional/contractor.
» As part of the design phase, it must be made clear what vegetation will be permissible within the development area and how this will be kept in a state that is suitable for the development, e.g. regular mowing:
  o It will be important to maintain a fairly dense, low vegetation layer to protect erodible soils preventing further wetland degradation.
» 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 development footprint areas.
» Prevent leakage of oil or other chemicals; strictly prohibit littering of any kind.
» Monitor the establishment of alien and indigenous invasive species and remove as soon as detected, whenever possible *before* regenerative material can be formed.

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 fragmentation of rangelands.

Residual impacts:

» Altered vegetation composition (temporary).
» Possibility for erosion and invasion by alien invasive species.

Nature of impact : Significant decrease of weeds and alien invasive vegetation (+ve, if properly mitigated), loss of indigenous vegetation, site-specific altered distribution of rainfall and resultant runoff patterns, general increase in runoff from PV and/or bare areas and associated accelerated erosion, reduction of habitat for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased severe erosion or dust due to lower buffering capacity *if* vegetation remains sparse.

Activity: Construction and operation of PV panels on previously transformed and/or highly degraded areas – site alternative 2 and eastern section of site alternative 1.
Environmental Aspect: Removal of vegetation, compaction of topsoil, creation of new or altered runoff zone, redistribution and concentration of runoff from panel surfaces, artificial shading of vegetation, continued displacement of terrestrial vertebrates, reduced buffering capacities of the landscapes during extreme weather events, reduction of alien invasive species (+ve).

Note: tracking panels may occupy more land, but will have smaller sealed surfaces leading to smaller concentrated runoff volumes, which will cause less soil erosion. Also, smaller panels spaced wider allow a denser vegetation layer to re-establish to stabilise the soils and suppress weeds and invasives.

Relevant Listed activities:
GN 545 activity 1 & 15
GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**
Extent	Site specific (1)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Medium (35)**
Status	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Unlikely
Can impacts be mitigated?	Reasonably	

Mitigation:

» After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and active animal burrows:
  - Protected plant species: must be relocated or a permit obtained to destroy them;
  - Animal burrows: must be monitored by the EO 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.

» Weeds and alien invasive species must be eradicated or significantly reduced:
  - This is not only to stop the high reproduction and spreading of alien invasives, but also to reduce maintenance costs of the proposed development;
  - Continue monitoring and removing all invasive vegetation after construction up to decommissioning.

» After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr:
  - Use species that were part of the original indigenous species composition similar to the remaining intact natural vegetation as listed in the specialist report, or sow with *Eragrostis curvula*. It is expected that *Cynodon dactylon* will re-establish by itself.
  - A strong grass layer will also suppress the re-emergence of weed species from existing seed banks.

» 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; it must be stripped,

where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as full material. Excess removed topsoil can be used for the rehabilitation of areas where sealed surfaces have been removed.

» Temporarily stored topsoil, as indicated above, must be re-applied within 6 months; topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan and must as minimum be free of weeds and alien invasive species.
» 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 re-vegetation efforts accordingly.
» Prevent leakage of oil or other chemicals; strictly prohibit littering of any kind.

Cumulative impacts:

» If mitigation measures are not strictly followed the following could occur:
  - erosion of areas around the panels and continued erosion of the development area with associated siltation and/or degradation of lower-lying wetlands and adjacent natural endangered vegetation.
  - contamination of drainage lines, lower-lying rivers or wetlands.
  - spread and establishment of invasive species.

Residual impacts:

» altered topsoil characteristics.
» altered vegetation composition (which will in this case be positive if indigenous grassland vegetation can be re-established).

Nature of impact: Loss and further fragmentation of species of conservation concern, altered vegetation cover, window of opportunity for the establishment of alien invasive species, 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 detrimental effects during periods of extreme weather events, e.g. severe erosion or dust due to lower buffering capacity of sparser vegetation.

Activity**:** Construction and operation of any development component(s) on higher diversity grasslands – south western section of site alternative 1.
Environmental Aspect**:** Removal of or excessive damage to vegetation, compaction of soils, creation of runoff zone, redistribution and concentration of runoff from panel surfaces, artificial shading and resulting decimation of vegetation, displacement of terrestrial vertebrates, reduced buffering capacities of the landscapes during extreme weather events

Note: tracking panels may occupy more land, but will have smaller sealed surfaces leading to smaller concentrated runoff volumes, which will cause less soil erosion. Also, smaller panels spaced wider allow a denser vegetation layer to re-establish to stabilise the soils and suppress weeds and invasives.

Relevant Listed activities:

GN 544, activity 11(ii), 18(i), 22 (i) & 47 (ii)
GN 545 activity 1 & 15
GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**
Extent	Site and surroundings (2)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**High (65)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:

» After the final layout of permissible development components has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and active animal burrows:
  - Protected plant species: must be relocated or a permit obtained to destroy them;
  - Animal burrows: must be monitored by the EO 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 grassland 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.
  - use only species that were part of the original indigenous species composition as listed in the specialist report.

» As part of the design phase, it must be made clear what vegetation will be permissible within the development area and how this will be kept in a state that is suitable for the development, e.g. regular mowing.
  - It will be important to maintain a fairly dense, low vegetation layer to protect erodible soils and prevent further wetland degradation.

» Remove all rubble and other foreign materials currently on the site. Prevent any further pollution.

» Weeds and alien invasive species must be eradicated or significantly reduced:
  - This is not only to stop the high reproduction and spreading of alien invasive species, but also to reduce maintenance costs of the proposed development.
  - Continue monitoring and removing all invasive vegetation after construction up to decommissioning.

» After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr.
  - Use species that were part of the original indigenous species composition similar to the remaining intact natural vegetation as listed in the specialist report, or sow with *Eragrostis curvula*. It is expected that several indigenous species will naturally re-establish due to existing seed banks.
  - A strong grass layer will suppress the re-emergence of weed species from existing seed banks.

- » If filling material is to be used, this should be sourced from areas free of invasive species.
  - o Topsoil (the upper 25 cm of soil) is an important natural resource; it must be stripped, where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as full material. Excess removed topsoil's can be used for the rehabilitation of areas where sealed surfaces have been removed.
- » Temporarily stored topsoil must be re-applied within 6 months, topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan.
- » 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.
- » Prevent leakage of oil or other chemicals; strictly prohibit littering of any kind.
- » Remove all alien invasive vegetation prior to construction.
- » Monitor the establishment of all invasive species and remove as soon as detected, whenever possible before regenerative material can be formed.

Cumulative impacts:

- » If mitigation measures are not strictly adhered to the following could occur:
  - o Loss of and further fragmentation of remaining portions of natural grassland and associated ecosystem services such as pollination.
  - o Alteration of occupancy by terrestrial fauna, possible reduction of available habitat and food availability to terrestrial fauna.
  - o Spread and establishment of invasive species and further associated degradation of remaining endangered vegetation.

Residual impacts:

- » altered topsoil characteristics.
- » altered vegetation composition.
- » fragmentation and loss of diversity of endangered vegetation.

***Nature of impact*:** Loss of vegetation, increase in runoff and erosion, disturbance of burrowing animals

Activity: Construction of a short power line as part of the grid connection

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

Relevant Listed activities:

GN 544, activity 10 (i),11(ii), 18(i)
GN 545 activity 15
GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**
Extent	Site and surroundings (2)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)

Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (15)**
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» During the design phase, aim to have connection routes coinciding with existing tracks or fence lines to reduce the disturbance to vegetation and avoid creating new tracks and areas of compaction by construction and maintenance machinery.
» Avoid crossing wetland areas as far as possible.
» After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows:
  - Protected plant species: must be relocated where affected by pylons, maintenance tracks or construction, or a permit obtained to destroy them;
  - Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor to a suitable habitat.
» During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas.
» Limit clearing of indigenous vegetation to pylon positions only.
» Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution
» Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed.

Cumulative impacts:

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

Residual impacts:

» Very localised alteration of soil surface characteristics
» Very localised alteration of species composition

***Nature of impact*:** Loss of vegetation and/or species of conservation concern, significant decrease and possible eradication of weeds and alien invasive plants (+ve), loss of microhabitats, altered and 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

Activity: Construction of substation and other associated buildings, workshops, offices, etc. on *transformed areas*
Environmental Aspect: Removal of vegetation, compaction and alteration of topsoil, creation of runoff zone, redistribution and concentration of runoff from sealed surfaces, displacement of terrestrial vertebrates

Relevant Listed activities:

GN 544, activity 10 (i),11(ii), 18(i)
GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**

Extent	Site specific (2)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Low (25)**
Status	Negative	Neutral on transformed or degraded grassland areas *(Negative on high diversity grassland areas.*
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» During the design phase, ensure that none of these development components are situated outside transformed areas.
» Implement a 30 m buffer around wetlands to protect wetland functionality.
» Conduct search, rescue and relocation of protected species on higher diversity grasslands
» After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows:
  - Protected plant species: must be relocated or a permit obtained to destroy them;
  - Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor to a suitable habitat.
» Weeds and alien invasive species must be eradicated or significantly reduced:
  - Continue monitoring and removing all invasive vegetation after construction up to decommissioning.
» 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; it must be stripped, where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as full material. Temporarily stored topsoil must be re-applied within 6 months, topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan.
» If filling material is to be used, this should be sourced from areas free of invasive species.
» Rehabilitate and revegetate all areas outside the 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 non-weed indigenous species listed for the natural remaining grasslands as described in the specialist, taking the observed original cover percentages of intact grasslands 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 erosion of areas around sealed surfaces and continued erosion or degradation of the development area with associated degradation of lower-lying wetlands;
  - o contamination of wetlands;
  - o spread and establishment of invasive species.

Residual impacts:

» Altered topsoil characteristics.
» Possible removal of existing foreign materials from the environment (which would be desirable and positive).
» Altered vegetation composition (which can be positive if invasive species are replaced by indigenous species).

***Nature of impact*:** Loss of vegetation and/or species of conservation concern, 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

Activity: Temporary construction camps and sites where materials, machinery and temporary staff facilities are kept during construction
Environmental Aspect: Removal of vegetation, compaction of soils, creation of runoff zone, displacement of terrestrial vertebrates, possible contamination of topsoil and groundwater by chemicals or oils

Note: within the power plant area there are already transformed areas that could possibly be utilised for storage of construction equipment

Relevant Listed activities:
GN 544, Activity 18(i);
GN 546, Activity 14(i).

	Without mitigation	**With mitigation**
Extent	Site specific (1)	Site specific (1)
Duration	Moderate-term (3)	Short-term (2)
Magnitude	Low (4)	Small (0)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (32)**	**Low (9)**
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» Implement a 30 m buffer around wetlands to protect wetland functionality.
» Conduct search, rescue and relocation of protected species on higher diversity grasslands
» After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows:
  - o Protected plant species: must be relocated or a permit obtained to destroy them;
  - o Animal burrows: must be monitored by the EO prior to construction for activity/presence

of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.

» 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 on site for cooking or any other purposes.
» Facilities may not be used as staff accommodation.
» Topsoil (the upper 25 cm of soil) is an important natural resource; it must be stripped, where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as full material. Temporarily stored topsoil must be re-applied within 6 months, topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan.
» After construction is completed 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 of intact grasslands 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:
  - erosion of the development area with associated siltation and/or erosion of lower-lying wetlands;
  - contamination of drainage lines, lower-lying rivers, wetlands and ground water;
  - spread and establishment of invasive species.

Residual impacts:

» Altered topsoil characteristics.
» Altered vegetation composition.

***Nature of impact*:** 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.

Activity: topsoil stockpiles that might be required during construction
Environmental Aspect: Removal of vegetation, compaction of soils, creation of runoff zone, displacement of terrestrial vertebrates

Note: remaining sealed surfaces on the site alternatives 2 (and previously alternative 3 site at scoping) could be crushed and used as filling material, as this will also greatly benefit the ongoing rehabilitation efforts on that area

Relevant Listed activities:
GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (2)

Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (15)**
Status	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» Implement a 30 m buffer around wetlands to protect wetland functionality.
» Conduct search, rescue and relocation of protected species on higher diversity grasslands
» After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows:
  - Protected plant species: must be relocated a permit must be obtained for relocation;
  - Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
» 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 or as determined by the Engineer surveying the site) is an important natural resource; it must be stripped, where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as fill material. Temporarily stored topsoil must be re-applied within 6 months, topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan.
» Monitor erosion of areas and control where necessary.
» After construction is completed remove all foreign material prior to starting the rehabilitation.
» Backfill borrow pits that may be created first with overburden or subsoil's, with an overlay of topsoil , following to 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:
  - continued erosion of the altered surfaces with associated siltation and/or erosion of lower-lying wetlands;
  - contamination of drainage lines, lower-lying rivers or wetlands;
  - spread and establishment of invasive species.

Residual impacts:

» Altered topsoil characteristics.
» Altered vegetation composition.

***Nature of impact*:** localised increase in runoff and accelerated erosion, possible contamination of soil and groundwater, possible contamination and damage to terrestrial fauna.

Activity**:** PV array *components* and their continued maintenance and eventual decommissioning: regular washing and possible breakage of panels.

Environmental Aspect**:** altered runoff and associated vegetation and erosion patterns.

Relevant Listed activities:
GN 545 activity 1 & 15
GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**
Extent	Site and surroundings (2)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Probable (3)
Significance	**Medium (50)**	**Low (15)**
Status	Negative	Neutral
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» Where panels need to be washed, this must be undertaken using water only. The use of water should be minimal.
» Where water is used for washing, monitor areas around the PV arrays for signs of accelerated erosion and establishment of weeds or alien invasive species and manage according to the erosion- and invasive species management plan.
» Prior to construction and up to decommissioning, clear instructions must be drafted and at all times available on site on how any breakages of PV panels will be dealt with, including:
    o Correct salvage, disposal and preferably also recycling methods (or possibilities) for any broken materials.

Cumulative impacts:

» Possible pollution of surrounding areas if no mitigation is implemented.
» Possible increase in and spread of alien invasive species beyond the site if no mitigation is implemented.

Residual impacts:

» None expected if mitigation measures are implemented.

6.2.3 Comparative Assessment of the PV site alternatives

Each site alternative had a very different past land use history, which greatly influenced the current vegetation composition. It is not expected that the development will compromise the survival of or significantly impact any flora or terrestrial vertebrate species on the study area or beyond. The most significant impacts are expected to be

on ecosystem health and functionality, which should remain relatively intact if, all mitigation recommendations are implemented; and the associated integrity of surrounding wetlands. Alternative site 1 and 2 is suitable for development with the implementation of the proposed mitigation measures.

The two alternative PV technologies do not differ in any significant way as far as the impacts on the ecological sensitivities are concerned. There is **no significant difference** in the potential impacts associated with the technology alternatives. Therefore, there is **no preference** between the alternative technologies, and both are considered to be viable for use at the site.

Aspect	Site Alternative 1	Site Alternative 2
Ecology	Acceptable » Infringes on a portion of the mapped gravel hill area » The south-western portion of this site has a medium ecological sensitivity rating. It is not expected that the development will compromise the survival of or significantly impact any flora or terrestrial vertebrate species on the study area or beyond. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if, all mitigation recommendations are implemented; and the associated integrity of surrounding wetlands. » Avoids the major sensitive features of the site, i.e. ephemeral drainage lines, large rocky hill, rock pans and large wooded area	Acceptable » The abundance of species of concern within the development area is low » No highly sensitive ecological features within the development footprint. Majority of the site is covered by wetlands.

6.2.4 Implications for Project Implementation

» The proposed PV facility development on the site will not have significant impacts on the above-ground ecology of the site if all mitigation measures are followed, especially if listed alien invasive species within the site can be reduced. If such currently present disturbances can be sufficiently mitigated, the impact may be to some extent beneficial for more sensitive surrounding areas. The low ecological

sensitivity of the larger portion of the study area is due to the past land-use history, during which these areas were transformed or degraded.

» Potentially high negative impacts on the ecological environment will occur if portions of high diversity grassland vegetation will be further disturbed.

» The impact on fauna is expected to be small to negligent. Presence of indigenous terrestrial vertebrates within the study area is low due to current land use. 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 recommended buffers around wetland and seepage areas.

6.3 Potential Impacts on Avifauna

6.3.1 Results of the avifauna assessment

The site visit produced a combined list of 41 bird species (refer to appendix of the avifauna report contained in Appendix D covering both the project development area and to a limited extent, the surrounding area. Species that featured prominently include Cape Turtle-Dove Helmeted Guinea fowl, Southern Red Bishop and Crowned Lapwing. These are species that are often associated with urban, peri-urban and farmland environments, and therefore their relatively high reporting rate in the study area is not unexpected. No Red List species or species of conservation concern were recorded using the data collection methods. In addition no raptor nests were noted during the site survey and the only indication of a possible breeding site was Helmeted Guinea fowl egg shells observed along Walked Transect 2. No distinct flights paths across either of the proposed sites were recorded. The only two flights that were noted were of Egyptian Goose (two individuals) flying in an area outside of the impact zone and another single flight involving Spur-winged Goose (nine individuals) flying in a northerly direction across Alternative Site 1.

Although Amur Falcon and Lesser Kestrel (both summer migrants to South Africa) were not recorded during the surveys owing to the timing of the site visit, these species have been previously observed foraging at Alternative Site 1 and the broader study area (pers. comms Pieter Muller – Eskom Land Development representative). Similarly Barn Swallows are also likely to feature prominently during the summer months.

Other species recorded in relative abundance include: African Stonechat, Southern Masked-Weaver, Northern Black Korhaan, Blacksmith Lapwing, Laughing Dove and Common Fiscal. All of these species have the potential to be displaced by the solar development as a result of habitat transformation and disturbance. However sufficient similar habitat is available within the broader study area, and therefore it is highly

unlikely that the displacement impact will be of regional or national significance. In addition, the majority of these species may also be susceptible to collisions with the solar PV panels.

6.3.2 Sensitivity Assessment

At both a landscape and site specific level, the avifaunal sensitivity of the two sites is considered to be low. The only sensitive feature present at each of the proposed development sites are the wetland areas. The wetlands have been assigned a medium sensitivity rating. Ordinarily, wetland systems would be assigned a higher sensitivity rating given their importance in terms of avifauna. However, owing to the fact that the wetland system present at Alternative Site 1 is modified, subject to existing disturbances of medium intensity, but still has some degree of connectivity with other ecosystems with intermediate levels of species diversity, a medium sensitivity has been allocated. The remainder of Alternative Site 1 is fairly uniform and comprised of disturbed grassland with no topographical features, resulting in low species richness with no identifiable avifaunal flight paths and is therefore considered to be of low sensitivity. Despite the presence of a wetland at Site Alternative 2, the entire area is considered to be of low sensitivity, since the wetland is subject to disturbance of high intensity, is highly transformed and very poor in species diversity. A map delineating these areas is been provided below (Refer to Figure 6.2).

While renewable energy sources, such as solar energy, hold great potential to alleviate dependence on fossil fuels they are not without their environmental risks and negative impacts. Poorly sited or designed solar energy facilities can have negative impacts on not only vulnerable species and habitats but also entire ecological processes. These impacts are extremely variable and are dependent on a number of contributing factors which include the design and specifications of the development, topography, habitats capable of supporting various bird species as well as the number and diversity of birds present at the development site. Solar energy facilities may impact birds and bird populations in the following key ways. These can be grouped as either lethal, direct mortality impacts (i.e. collisions with the PV panels and associated infrastructure) that affect individual birds; or the non-lethal, less direct impacts (i.e. displacement) as a result of habitat transformation and disturbance that are common to most forms of development (Drewitt & Langston, 2008). The potential impacts of solar facilities and associated infrastructure on avifauna are listed below:

<u>The potential impacts of solar facilities on avifauna include:</u>

» Displacement as a result of habitat loss or transformation
» Displacement as a result of disturbance

<u>The potential impacts of the associated infrastructure on avifauna include:</u>

» Collisions with power line infrastructure
» Electrocutions on power line and other electrical infrastructure

» Habitat destruction and disturbance associated with the construction and maintenance of power line and other infrastructure

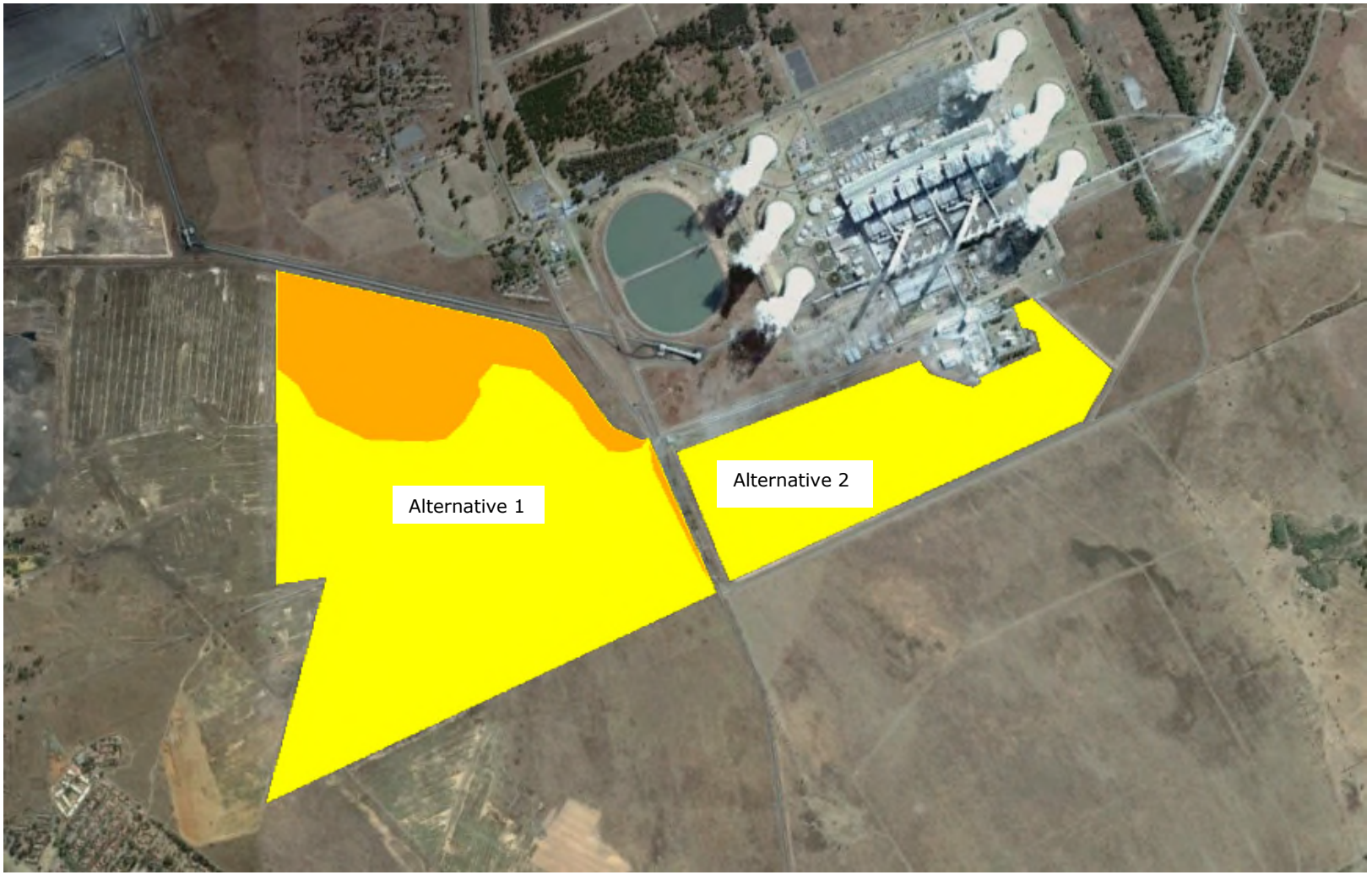

Figure 6.2: Avifaunal sensitivity map - medium avifaunal sensitivity areas are represented by the orange polygons and low avifaunal sensitivity areas are represented by the yellow polygons.

6.3.3 Impact tables summarising the significance of impacts on avifauna (with and without mitigation)

Nature: Displacement as a result of habitat transformation associated with the construction of the facility (PV arrays and associated infrastructure) resulting in a negative direct impact on the resident avifauna, particularly Northern Black Korhaan and smaller passerine species.		
Relevant Listed activities: GN 544, activity 10 (i),11(ii), 18(i) GN 545 activity 1 & 15 GN 546, activity 14(a) (i).		
	Without mitigation	**With mitigation**
Extent	Site (1)	Site (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	low (4)	Minor (2)
Probability	highly probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (24)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes through the selection of the alternative site that presents the least environmental impact.	
Mitigation: Restricting the construction footprint to a bare minimum - this can be achieved by selecting Alternative Site 2 as the preferred alternative. This site has a smaller footprint size, lower avifaunal species richness and is subject to significant existing habitat degradation and disturbance. Recommendations (i.e. the avoidance of key vegetation types and wetlands) emanating from the botanical and wetland specialist studies must be strictly adhered to and implemented.		
Cumulative impacts: The surrounding area is already heavily transformed as a result of mining, energy generation, urban, agricultural and pastoral activities. However the areas that have been earmarked for development are not particularly sensitive and therefore the cumulative impact is deemed not to be significant		
Residual Impacts: Smaller passerine species may return once the construction activity is completed and the site rehabilitated, but it is unlikely that the numbers will recover to those recorded prior to the development due to the significant habitat transformation that will take place. It is unlikely that the large terrestrial birds (i.e. Northern Black Korhaan) will continue to use the habitat amongst the solar arrays.		

***Nature*:** Displacement as a result of disturbance associated with noise and movement of construction and operational equipment and personnel, resulting in a negative direct impact on the resident avifauna, particularly Northern Black Korhaan and smaller passerine species.

Relevant Listed activities: GN 544, activity 10 (i),11(ii), 18(i) GN 545 activity 1 & 15 GN 546, activity 14(a) (i)		
	Without mitigation	**With mitigation**
Extent	Site (1)	Site (1)
Duration	Short (2)	Short (2)
Magnitude	moderate (6)	Low(4)
Probability	highly probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (21)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Partially	
Mitigation: Based on the medium to low sensitivity of the site it is only recommended that a one year post construction monitoring programme be established to monitor the impact of disturbance and barrier effects on the resident avifauna. If required, mitigation measures will be proposed after analysis of the post construction monitoring data. Construction activities must be confined to the site footprint to avoid any additional impacts on bird species residing in the broader area.		
Cumulative impacts: In addition to the proposed Lethabo PV Solar Energy Facility, there are several activities (i.e. mining, energy generation, industrial, urban, agricultural and pastoral) that feature prominently both within the impact zone and the broader study area and are a significant source of existing disturbance. These activities, coupled with the limited habitat diversity and degradation within the proposed development sites, are a likely cause of the absence of Red List species within the impact zone. Those species that have persisted have undoubtedly developed a tolerance for the current levels of disturbance and are likely to persist within the broader area despite the development of the solar facility.		
Residual Impacts: The majority of species observed in the development area may return once the construction activity is completed.		

Nature: Collisions of priority avifauna (water birds, doves, weavers, canaries, larks) with the solar panels, resulting in a negative direct mortality impact.		
Relevant Listed activities: GN 545 activity 1		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	long term (4)	long term(4)
Magnitude	low (4)	minor (2)
Probability	probable (3)	probable (3)
Significance	**Medium (30)**	**Low (24)**
Status	Negative	Negative

Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated	Yes	

Mitigation measures:

» Strict control must be maintained over all activities during construction, in line with an approved Construction EMPr.

- During Construction, if any of the Red Data species identified in this report are observed to be roosting and/or breeding in the vicinity, the ECO must be notified and to report these as part of their tasks.

» The construction camps must be as close to the site as possible.

» Contractors and working staff should stay within the development footprint and movement outside these areas including avian micro-habitats must be restricted.

» Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads running through the study area during all phases.

Cumulative impacts:

Development of multiple solar energy facilities in this region near Upington may have cumulative impacts on birds, however limited due to the species which occur in the area. Each plant will have to be individually assessed in terms of whether mitigation measures are required to protect avifauna.

Residual impacts:

Localised loss or displacement of avifauna species.

Nature: Collisions of priority avifauna with overhead power lines, resulting in a negative direct mortality impact, particularly large terrestrial species (Northern Black Korhaan) and water dependent species (storks, ducks, geese, ibis)

Relevant Listed activities:
GN 544, activity 10 (i)

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	low (4)	minor (2)
Probability	probable (3)	improbable (2)
Significance	**Medium (30)**	**Low (14)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	

Mitigation measures:

Every effort must be made to select a route that poses the least risk to birds, preferably routing the proposed power line alongside existing power line infrastructure in an effort to increase conductor visibility. High risk sections of power line must be identified by a qualified avifaunal specialist during the walk through phase of the project, once the alignment has been finalized. If power line marking is required, bird flight diverters must be installed on the full span length on each of the conductors (according to Eskom guidelines). Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.

Cumulative impacts:
An extensive power line network features prominently both on the proposed sites and within the broader study area. Any additional power lines will undoubtedly increase the collision risk to power line sensitive species (i.e. Northern Black Korhaan, Spur-winged Goose, Egyptian Goose, Black-headed Heron and various waterfowl species) that may be present in the broader study area and therefore collisions with the proposed grid connection will potentially have a medium to high cumulative impact. However given the proximity of the proposed sites to the existing power line and substation infrastructure, the proposed grid connection is likely to be relatively short in length and installation of anti-collision devices on the conductors/earthwires will further reduce this impact.

Residual Impacts:
Mitigation will reduce but not entirely eliminate collision mortality.

***Nature*:** Electrocutions of priority avifauna on distribution (<132kV) power line tower/pole structures, resulting in a negative direct mortality impact, particularly large eagle species, herons and storks.

Relevant Listed activities:
GN 544, activity 10 (i)

	Without mitigation	**With mitigation**
Extent	Low (2)	Low (1)
Duration	Long term (4)	Long term (4)
Magnitude	low 4	minor 2
Probability	probable 3	improbable 2
Significance	**Medium (30)**	**Low (14)**
Status	Negative	Negative
Reversibility	Low	Medium
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	

Mitigation measures:
Only Eskom approved bird friendly tower/pole structures must be used for the entire length of the power line

***Cumulative impacts*:**
An extensive power line network features prominently both on the proposed sites and within the broader study area. Any additional power lines will undoubtedly increase the electrocution risk to power line sensitive species (i.e. large eagles, storks and herons) that may be present in the broader study area and therefore electrocutions on the towers of the proposed grid connections will have a medium to high cumulative impact. However given the low reporting rates of these species in the area, the proximity of the proposed sites to the existing power line and substation infrastructure resulting in a shorter grid connection with fewer towers and construction of Eskom approved bird friendly tower/pole structures will further reduce this impact.

Residual impacts:
Mitigation will reduce electrocution mortality to negligible levels.

Nature: Electrocutions of priority avifauna at substations and switching stations, resulting in a negative direct mortality impact, particularly crows, small raptors and owls.

Relevant Listed activities: GN 544, activity 10 (i)		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (1)
Duration	Long term (4)	Long term (4)
Magnitude	Long term (4)	Long term (4)
Probability	Low (4)	Minor (2)
Significance	Probable (3)	Improbable (2)
Status	**Medium (30)**	**Low (14)**
Reversibility	Negative	Negative
Irreplaceable loss of resources	Low	Medium
Can impacts be mitigated	Yes	
Mitigation measures: Substation hardware is often too complex to warrant any mitigation for electrocution at this stage. It is rather recommended that if on-going impacts are recorded once operational, site specific mitigation be applied reactively. This is an acceptable approach since Red List bird species are unlikely to frequent the substation and be electrocuted.		
Cumulative impact: An extensive electricity network features prominently within the broader study area. Any electrical infrastructure in the form of substations and switching stations will undoubtedly increase the electrocution risk to those species (i.e. owls, crows, weavers, swallows) that are attracted to these structures and installations as a result of the roosting and nesting opportunities that they provide. Additional substations and switching stations will have a medium to high cumulative impact. Reactive mitigation as discussed above will reduce this impact.		
Residual impacts: Mitigation will reduce electrocution mortality to negligible levels.		

Nature: Nest building by birds on PV infrastructure (i.e. electrical boxes associated with each array) would result in a negative direct impact on maintenance activities.		
Relevant Listed activities: GNR 545 Activity 1		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (20)**
Status	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources	Yes – bird fatalities	Yes- Bird fatalities
Can impacts be mitigated	Yes	Yes
Mitigation measures: Similarly to the impacts associated with substations, it is recommended that if ongoing impacts are recorded once operational, that these are assessed by a suitably qualified avifaunal specialist and site specific mitigation (e.g. commercial bird deterrent options) is applied reactively. Assessment of this impact should be included in the monitoring and maintenance schedules of the EMPr.		

Cumulative impacts: None
Residual impacts: None

6.3.4 Comparative Assessment of the PV alternatives

In general, the site has been determined to have medium to low sensitivity in terms of avifauna, based on the micro-habitats available to avifauna within the confines of the proposed sites and the species these habitats are likely to support. Given the presence of existing habitat degradation and disturbance associated with the mining, energy generation and industrial activities that are prevalent in the study area, it is anticipated that the proposed Lethabo Solar PV Energy Facility can be constructed at either of the two proposed sites with acceptable levels of impact on the resident 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. There, is **no significant difference** in the potential impacts on avifauna associated with the alternative technologies. Therefore, there is **no preference** between the alternative technologies, and both are considered to be viable for use at the site.

Aspect	Site Alternative 1	Site Alternative 2
Avifauna	Acceptable – » avoids the identified high avifaunal sensitive areas » .	Acceptable –avoids the identified high avifaunal sensitive areas » Smaller footprint size and proximity to the power station

6.3.5 Implications for Project Implementation

There will undoubtedly be some impact on avifauna but it is the specialist's professional opinion that the impact will be acceptable provided the following conditions are met:

» Adherence to the site specific EMPr. Of particular concern is the layout of the power line infrastructure. Ideally an avifaunal walk down should be conducted once the power line towers have been surveyed and marked. Input must be given into micro siting as well as which sections of power line require marking with bird flight diverters. This walk down should also ground truth all other project component final layouts.

6.4 Assessment of Impacts on Surface Water Resources

6.4.1 Results of the Surface Water Resources Assessment

Soil Indicators:

Soils were used extensively for delineating the wetlands on site. Wetland soil types found on site included: Katspruit (Orthic A /G horizon), Westleigh (Orthic A / soft plinthic B), Witbank (Orthic A / Man-made soil deposit). Signs of wetness that were used to delineate the wetland boundary included red and yellow mottles, gleys, and soft plinthic nodules.

Vegetation Indicators

Wetland plants were an important indicator for the delineation process. *Typha capensis* (Bulrush) and *Phragmites australis* were found in ponding water, while a community of wetland species indicated the extent of the permanent, seasonal and temporary zones. Some common obligate and facultative wetland species used to delineate the wetlands were: *Paspalum urvilli*, *Imperata cylindrica, Kyllinga erecta*, *Cyperus longus, Persicaria limbata, Oenothera stricta* and *Verbena bonariensis.*

6.4.2 Sensitivity Assessment

Two wetlands were delineated on the study site, both being hill slope seeps. Figure 6.3 shows the delineated wetlands together with the 30 m wetland buffers. 15.6 ha of wetland was located on the Alternative Site 1 while 37 ha of wetland was located on the Alternative Site 2. Several small depressions a few meters in diameter were located on Alternative Site 1. These small depressions did show signs of wetness but due to their size they have been excluded as wetlands. The two wetlands in the study site are very similar in their function, type and ecology. They merge shortly downstream of the study area and as such they will be treated as one wetland for the purpose of these assessments.

Present Ecological Status (PES)

Large areas of the eastern wetland were covered in gravel and rubble. This wetland had also been drained with a herring-bone drain system. The dominant vegetation was invasive alien species. The PES score for this wetland is a D↓, a large change in ecosystem processes and loss of natural habitat and biota has occurred. The northern wetland was largely natural with the upper (southern) parts of the seep being completely unmodified with the lower reaches being impacted on by old roads, a railway and demolished buildings. The PES score for this wetland is an A (Refer to Table 6.1), near natural conditions.

Table 6.1: Summary of hydrology, geomorphology and vegetation health assessment for the wetlands on the study site (Macfarlane *et al,* 2009).

Wetland Unit	Extent (%)	Hydrology		Geomorphology		Vegetation		Overall health score	PES Score
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score		
Seep (East)	27	6.50	0.00	0.70	0.00	5.40	-1.00	4.53	D↓
Seep (North)	73	0.00	0.00	0.00	0.00	1.00	0.00	0.29	A→
Total	**100**	**1.76**	**0.00**	**0.19**	**0.00**	**2.19**	**-0.27**		

Ecological Importance and Sensitivity (EIS)

A combined EIS score of 1.6 was calculated for both the seep wetlands, placing them in the moderate importance and sensitivity category. Wetlands in this category are considered to be ecologically important and sensitive on a provincial or local scale (DWAF, 1999). No important or sensitive biota was found.

The solar PV facility will have several impacts on the surrounding environment and wetlands. The earth works, construction and operation of the facility will change habitats and the ecological environment, infiltration rates, amount of runoff and runoff intensity of storm-water, and therefore the hydrological regime of the site. Potential impacts to be taken into account include:

» Loss and disturbance of wetland habitat and fringe vegetation.
» Introduction and spread of alien invasive vegetation.
» Changes in the amount of sediment entering the system.
» Changes in water quality due to toxic contaminants and increased nutrient levels entering the system.
» Changes in water flow regime due to the alteration of surface characteristics.

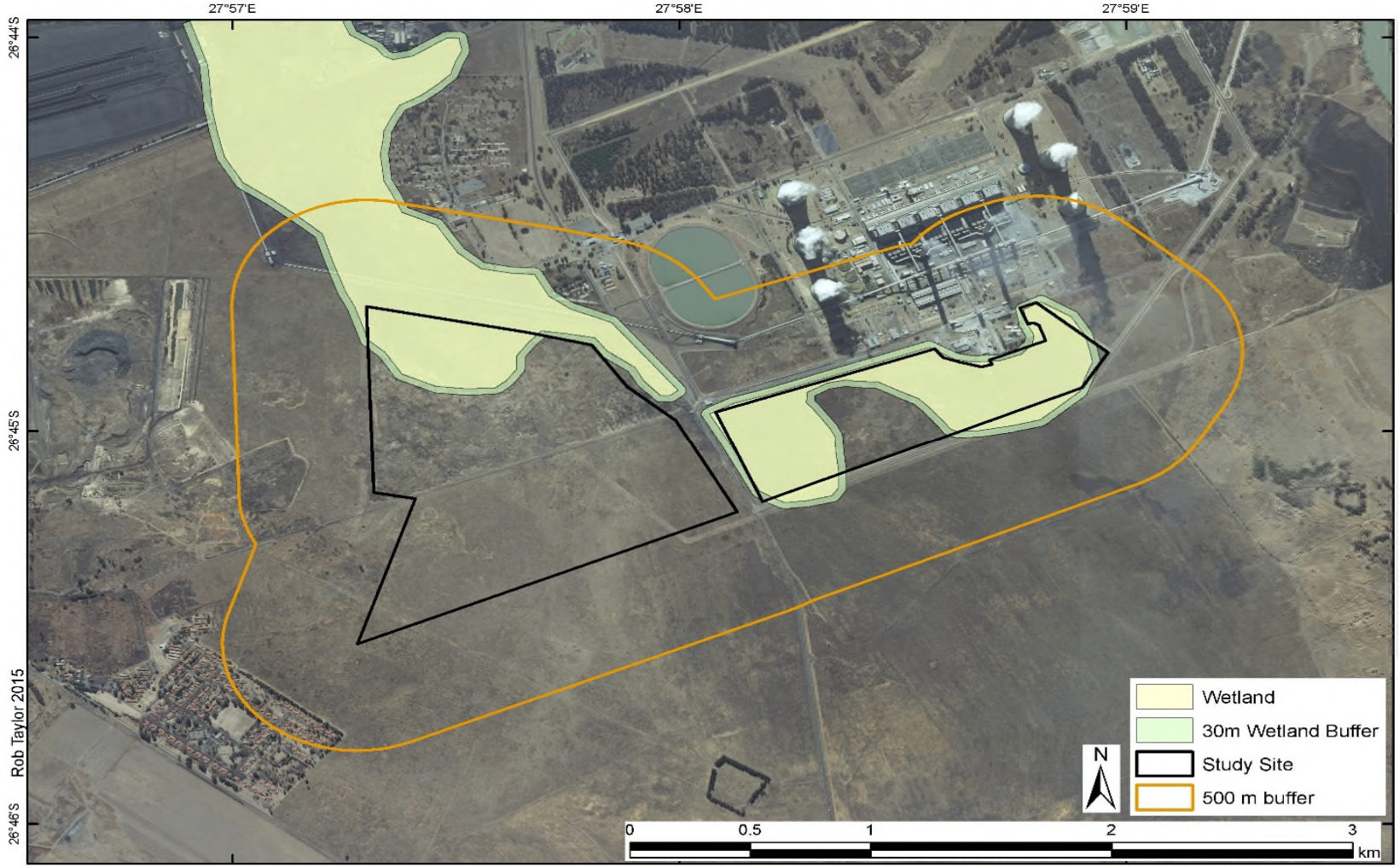

Figure 6.3: Lethabo PV Solar Energy Facility in relation to wetlands and wetland buffers on the study site

6.4.3 Impact tables summarising the significance of impacts on Surface Water Resources (with and without mitigation)

Nature: Loss and disturbance of wetland habitat and fringe vegetation due to direct development on the wetland as well as changes in management, fire regime and habitat fragmentation.		
Relevant Listed activities: GN 544, activity 10 (i),11(ii), 18(i) GN 545 activity 1,15 GN 546, activity 14(a) (i).		
	Without mitigation	***With mitigation***
Extent	Moderate (3)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (10)	Slight (4)
Probability	Highly probable (4)	Improbable (2)
Significance	**High (72)**	**Low (20)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: » The development footprint should be designed around current wetland and wetland buffers. » Where wetlands will be lost to the development footprint, those wetlands that are least disturbed and show near natural conditions and functionality should be given priority for conservation. » Where wetlands are lost, compensation should be made to protect the remaining wetlands and their catchments, increase their buffers and rehabilitate their condition and functionality.		
Cumulative impacts: Any loss of wetlands will add to the overall loss of wetlands in the region.		
Residual impacts: Once lost it is unlikely that a wetland can be rehabilitated to its original state and functionality.		

Nature: Introduction and spread of alien invasive vegetation due to both opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien invasive species can impact on hydrology, by reducing the quantity of water entering a wetland, and out compete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment.		
Relevant Listed activities: GN 544, activity 10 (i),11(ii), 18(i) GN 545 activity 1,15 GN 546, activity 14(a) (i).		
	Without mitigation	***With mitigation***
Extent	Medium (3)	Low (1)
Duration	Permanent (5)	Medium-term (3)

Magnitude	Moderate (6)	Small (0)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (56)**	**Low (8)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

***Mitigation*:**

» Implement appropriate weed control throughout project development.
» Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area and returning it where possible afterwards.
» Rehabilitate or revegetate disturbed areas as soon as possible after construction is completed.
» Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish.

Cumulative impacts:

If allowed to seed before control measures are implemented alien plans can easily colonise and impact on downstream users. Alien plants can form dense thickets which replace indigenous wetland habitats and their natural flow regime. This will result in a loss of wetland species and wetland functioning.

Residual impacts:

After clearing of invasive plants their seeds may remain dormant in the soil for many years and will require extensive follow-up control measures.

Nature: Changes in the amount of sediment entering the system due to earthworks and soil disturbance as well as the removal of natural vegetation. This could result in sedimentation of the wetland and increase the turbidity of the water.

Relevant Listed activities:

GN 544, activity 10 (i),11(ii), 18(i)
GN 545 activity 1,15
GN 546, activity 14(a) (i).

	Without mitigation	***With mitigation***
Extent	Moderate (3)	Low (1)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Moderate (6)	Slight (4)
Probability	Very probable (4)	Improbable (2)
Significance	**Medium (56)**	**Low (16)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.

» Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area.
» A vegetation rehabilitation plan should be implemented. As a recommendation, grassland can be removed as sods and stored within transformed vegetation. The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other or within sensitive environs. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks.
» Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.
» Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access.
» Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.
» Runoff from roads must be managed to avoid erosion and pollution problems.
» Maintain buffer zones around wetlands to trap sediments.

Cumulative impacts:
Additional sediments would lead to increase turbidity downstream which will put additional stress on aquatic life and loss of sensitive biota. Downstream dams and weirs will face a reduction in capacity due to sedimentation.

Residual impacts:
Once sensitive biota is lost from a system it can take many years to re-colonize.

Nature: Changes in water quality due to toxic contaminants and changes in nutrients are largely caused by discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage. This could result in the loss of sensitive biota in the wetlands and a reduction in wetland function.

Relevant Listed activities:
GN 544, activity 10 (i)
GN 545 activity 1

	Without mitigation	***With mitigation***
Extent	Moderate (3)	Low (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (48)**	**Low (12)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:
» After construction, the land must be cleared of waste, surplus materials, and equipment, and all parts of the land should be left in a condition as close as possible to that prior to use.

» Ensure that maintenance work does not take place haphazardly, but, according to a fixed plan, from one area to the other.
» Maintenance of construction vehicles must be undertaken to avoid hydraulic or diesel spills.
» Control of waste discharges.
» Maintenance of buffer zones around wetlands to trap sediments with associated toxins.
» All potentially polluting and hazardous substances used and stored on site should be stored in clearly demarcated areas away from storm water.

Cumulative impacts:

The addition of toxic contaminants will impact on downstream ecosystems resulting in the loss of sensitive biota. Bioaccumulation of toxins in the food chain can be harmful especially to predators higher up in the food chain. Nitrification can lead to algal blooms that reduce the oxygen levels in the water causing anaerobic conditions.

Residual impacts:

Once sensitive biota is lost from a system it can take many years to re-colonize. Once in the system it may take many years for some toxins to be eradicated.

Nature:

Changes in water flow regime due to the alteration of surface characteristics (the compaction of soil, the removal of vegetation, surface water redirection and infrastructure) is likely to increased peak flows and decrease flood attenuation. Increased storm water discharge could result in soil erosion.

Relevant Listed activities:

GN 544, activity 10 (i),11(ii), 18(i)
GN 545 activity 1,15
GN 546, activity 14(a) (i)

	Without mitigation	***With mitigation***
Extent	Moderate (3)	Low (1)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Moderate (6)	Slight (4)
Probability	Very probable (4)	Improbable (2)
Significance	**Medium (56)**	**Low (16)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» Maintain buffer zones around wetlands
» Stormwater should be managed and stormwater discharge points must be suitably protected against erosion.

Cumulative impacts:

Increase stormwater will affect downstream users who are dependent on their topsoil and grass cover for agriculture. A reduced infiltration of water into the soil may reduce low flows that sustain wetlands during dry periods.

Residual impacts:

Once topsoil is lost it is hard to replace and re-vegetate. The disturbance caused by erosion will

create a window of opportunity for alien invasive plants to colonise.

6.4.4 Comparative Assessment of the PV site alternatives

The less disturbed section of the wetland encroaches onto a portion of the north of site Alternative 1. The more impacted section of the wetland covers a large portion of site Alternative 2. Site **Alternative 1** is considered the most **favourable** for development since less wetland habitat will be lost if development occurs here.

There, is **no significant difference** in the potential impacts on wetlands associated with the alternative technologies. Therefore, there is **no preference** between the alternative technologies, and both are considered to be viable for use at the site.

Aspect	Site Alternative 1: preferred alternative	Site Alternative 2
Avifauna	» Less wetland habitat will be lost	» The more impacted section of the wetland covers a large portion of site Alternative 2.

6.4.5 Implications for Project Implementation

It is important that the following mitigation measures be carefully implemented in order to prevent impacts to regional hydrology:

» The footprint of the development should not encroach onto wetland areas or their associated buffer zones. Boundaries of these sensitive areas should be clearly marked and access prevented.
» A stormwater management system must ensure that the quality and quantity of stormwater resulting from the development (construction and operational phase) is the same as the stormwater characteristics prior to development.

Further general potential impacts of the construction and operational phase of the proposed solar PV facility include:

» Clearing/removal of natural vegetation. Even though development does not encroach onto the wetland areas or their buffer zones, clearing vegetation upland from wetlands may result in increased energy of surface flows resulting in erosion and sedimentation. Plants hold soils in place and trap sediments and attenuate water flow, functions that are lost when vegetation clearing occurs.

» Mobilization of sediments. Soil erosion could lead to increased sedimentation and turbidity downstream of the activity, which in turn reduces the water storage capacity thereof, smothers vegetation, and decreases oxygen concentration. If sedimentation is allowed to continue, wetlands will lose their function and likely become invaded by alien invasive plant species.

Exposure to erosion, removal of wetland vegetation, vegetation against slopes and compaction of soils, expose the resulting bare soils to erosion during rainfall events. Erosion removes the top soil layer, thereby preventing the successful establishment of indigenous vegetation on eroded soils. Eroded areas are likely to be colonised by alien invasive and pioneer plants, or in severe cases, no vegetation will establish causing high velocity runoff during rainfall events and continuous erosion. The occurrence of erosion resulting from the proposed activities should be closely monitored and addressed.

6.5 Assessment of Potential Impacts on Heritage Sites and Palaeontology

6.5.1 Results of the Heritage Survey

The study area is characterised by typical Highveld grass veld. Some portions were ploughed in the past and infrastructure such as roads and sand mining have also impacted on the study area. These activities would have destroyed surface indicators of heritage sites. The study area is slightly undulating with no major landscape features like pans or hills that would have been focal points in antiquity, and lack raw material suitable for the manufacture of stone artefacts or for the construction of late Iron Age Stone walled settlements. The study area was assessed in terms of the archaeological component of Section 35 of the NHRA and no surface indicators of archaeological (Stone or Iron Age) material was identified in the study area. In terms of the built environment of the area (Section 34), no standing buildings older than 60 years occur in the study area. No burial grounds or graves were recorded and no significant cultural landscapes or viewscapes were noted during the fieldwork.

Based on the results of the study it was concluded that there are no significant archaeological risks associated with the proposed solar facility. However graves can be expected anywhere in the landscape and the low archaeological visibility during the survey could result in graves not having been identified in the study area. Therefore it is recommended that a chance find procedure is incorporated into the EMPr for this project as detailed below.

6.5.2 Paleontological impacts

The effects of the required construction operations to the geological strata underlying the project area will be restricted to the Early Permian Vryheid Formation; this geological unit is known to be fossiliferous. The probability of the project resulting in a negative

impact on the paleontological heritage of the Vryheid Formation has been assessed as moderate. Any negative impact on the fossil materials will potentially be significant due to the scientific and cultural importance of many of the fossils that may be expected to be present.

6.5.3 Impact table summarising the significance of impacts on heritage resources (with and without mitigation)

Nature: Pre Construction and Construction activities can have a negative impact on heritage resources.

Activities result in disturbance of surfaces and/or sub-surfaces containing heritage / paleontological artefacts resulting in the destruction, damage, excavation, alteration, removal or collection from its original position, of any archaeological material or object.

Relevant Listed activities:
GN 544, activity 10 (1), 22 (i) & 47 (ii)
GN545, activity 1 & 15
GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (2)
Probability	Not Probable (1)	Not Probable (1)
Significance	**Low (10)**	**Low (9)**
Status	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation::
Mitigation measures are not considered necessary. However, chance find procedures and management actions will be required for inclusion in the EMPr including:

» If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any grave site, artefact of cultural significance, fossil or rock engraving on the site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
» It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area.
» The senior on-site Manager will inform the ECO/EO of the chance find and its immediate impact on operations. The ECO/EO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.

Cumulative impacts:
Where any archaeological contexts occur the impacts are once-off permanent destructive events. Multiple projects in an area can contribute to a cumulative impact on heritage resources.

Residual Impacts:
Where any archaeological contexts occur the impacts are once-off permanent destructive events.

6.5.4 Impact table summarising the significance of impacts on Paleontological resources (with and without mitigation)

Nature: Pre Construction and Construction activities can have a negative impact on paleontological resources.

Activities resulting in disturbance of surfaces and/or sub-surfaces containing fossil materials resulting in the destruction, damage, excavation, alteration, removal or collection from its original position, of any fossil material or object.

Relevant Listed activities:
GN 544, activity 10 (1), 22 (i) & 47 (ii)
GN545, activity 1 & 15
GN 546, activity 14(a) (i).

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium(36)**	**Low (24)**
Status	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation::
Mitigation measures are not considered necessary as the study area has been extensively modified by human activity. Accordingly there appears to be little chance of undamaged or in situ fossil materials existing at the surface. However, the following damage mitigation protocols are, recommended:

» The EO should be trained to identify the types of fossils that may be expected to occur within the Vryheid Formation.
» If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any fossil material this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
» It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area.
» The senior on-site Manager will inform the ECO/EO of the chance find and its immediate impact on operations. The ECO/EO will then contact a professional palaeontologist for an assessment of the finds who will notify the SAHRA.

Cumulative impacts:
Where any palaeontological contexts occur the impacts are once-off permanent destructive events. Multiple projects in an area can contribute to a cumulative impact on fossil materials.

Residual Impacts:

Where any paleontological resources occur the impacts are once-off permanent destructive events.

6.5.5 Comparative Assessment of the PV site alternatives

The scattered/isolated finds during the field survey are not noted to be of major heritage significance. In terms of impacts arising from disturbance and loss as a result of the proposed PV facility, there is **no significant** difference in the potential impacts on the alternative sites or technologies. Therefore, there is **no preference** between the alternatives from a heritage as well as a paleontological perspective.

6.5.6 Implications for Project Implementation

From a heritage and paleontological perspective the proposed project area is considered to acceptable. If the above recommendations are adhered to and based on approval from SAHRA, it is concluded that the development can continue as the impact of the development on heritage and paleontological will not impact negatively on the archaeological record of the Free -State. If during the pre-construction phase or during construction, any archaeological or paleontological finds are made (e.g. graves, stone tools, fossils and skeletal material), the operations must be stopped, and the archaeologist or palaeontologist (depending on the find) must be contacted for an assessment of the finds. Due to the subsurface nature of archaeological and palaeontological material and graves the possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded, but can be easily mitigated by preserving the sites *in-situ* within the development.

6.6 Impacts on Soils, Land-Use and Agricultural Potential

6.6.1 Results of the Soils Survey

The analysis results show the sandy nature of the soils, with consequent low cation values. P levels are reasonable in the topsoil, but very low in the subsoils, showing that there has probably been some sort of fertilization or soil amendment in the past. The soils are slightly acidic, with low organic carbon content, especially in the subsoils. These results confirm that the soils are not naturally fertile, due to the sandy texture and leaching of bases that has occurred.

6.6.2 Impacts on Soils

The major impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. With the lack of high

potential soils in the vicinity (*note*: the Av class soil as show in Figure 6.4 is of medium agricultural sensitivity), this impact would in all probability have a limited significance. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state following rehabilitation, with little impact. In addition, due to the sandy nature of many of the soils occurring, the danger of increased susceptibility to wind erosion must also be addressed.

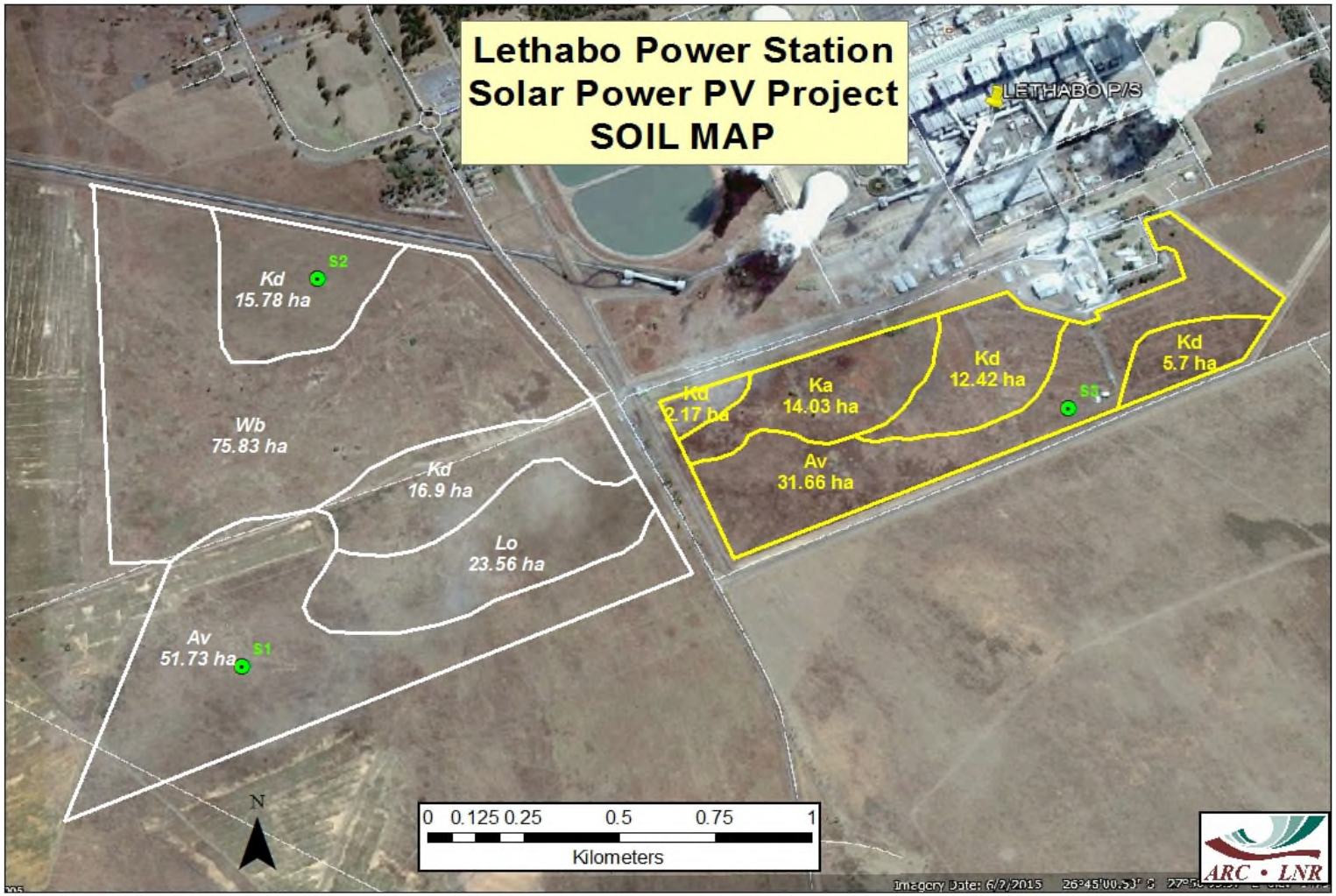

Figure 6.4: Lethabo PV Solar Energy Facility in relation to soil types found in the study area.

6.6.3 Impact tables summarising the significance of impacts on soils and land use (with and without mitigation)

Nature: Loss of agricultural potential		
Relevant Listed activities: GN 544, activity 10 (1) & 47 (ii) GN545, activity 1 & 15 GN 546, activity 14(a) (i).		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Slight (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (24)**	**Low (16)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: The main mitigation measure will be to develop the facility on low to medium potential soils, wherever possible		
Cumulative impacts: Little or none foreseen at this time		
Residual Risks: Little or none, as long as proper rehabilitation measures are carried out.		

Nature: Increased wind erosion hazard		
Relevant Listed activities: GN 544, activity 10 (1) & 47 (ii) GN545, activity 1 & 15 GN 546, activity 14(a) (i).		
	Without mitigation	**With mitigation**
Extent	Medium (3)	Low (2)
Duration	Long-term (4)	Short-term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (39)**	**Low (12)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: This will involve ensuring that a vegetation cover (probably locally adapted grass mixture) remains on the soil surface as far as possible. In addition, dust suppression measures (watering,		

gravel cover of roads/tracks etc.) should be implemented.
Cumulative impacts: Removal of topsoil by wind would mean that the removed dust would be deposited on neighbouring properties.
Residual Risks: Loss of topsoil would cause a drop in the natural fertility of the area, even in the ability to provide for grazing of livestock.

6.6.4 Comparative Assessment of the PV site alternatives

Alternative Site 1 has a distinct difference in soils between the northern and southern sections. The northern half of the site has largely disturbed, poor quality soils while the southern half of the site has better agriculture potential, especially in the south-west. Alternative 2 has a wetland which should be avoided completely. Based on the soil survey, it is recommended and **preferred** that the proposed PV facility be developed on **Alternative 1** site, if possible avoiding the south—west corner with the Av type soil.

The two alternative PV technologies do not differ in any significant way as far as the impact on soils and agricultural potential is concerned. Therefore, there is **no preference** between the alternative technologies, and both are considered to be viable for use at the site.

Aspect	Site Alternative 1: preferred alternative	Site Alternative 2
Soils and Agricultural potential	» Northern half of the site has largely disturbed, poor quality. » Soils while the southern half of the site has better agriculture potential. » It is preferred that the proposed PV facility be developed on Alternative 1 site, with the implementation of mitigation measures to conserve the Av type soil	» The wetland covers a large portion of site Alternative 2 and should be avoided completely.

6.6.5 Implications for Project Implementation

There are no fatal flaws associated with the soils and agricultural potential on the site and the project can be developed on Site Alternative 1, with the use of good soil management measures during all phases of development of the project.

6.7 Assessment of Potential Visual Impacts

6.7.1 Visual Character of the landscape

The affected landscape can be divided into the following general character areas that are largely defined by development.

» **Industrial Landscape Character Areas** located around heavy industrial and large mining areas. The structures associated with these uses dominate the landscape surrounding the development site. Existing industrial structures are likely to provide significant screening particularly from middle distance and distance views. From a distance small scale development may also be viewed against a backdrop of larger industry which is also likely to make it less obvious. In terms of sensitivity to possible landscape change due to the proposed development these areas are not likely to be sensitive. The relatively low elements that are proposed are likely to have little or no influence on the nature of the areas.

» **Urban Landscape Character Areas** that are generally inward looking residential and commercial areas, adjacent to industrial areas have minimal influence. Minor development close to the edge or within these areas might influence their character, however small-scale development away from the edge is highly unlikely to have any influence on the way that these areas are used or perceived.

» **Rural Landscape Character Areas.** This is a mainly productive landscape. These areas are interspersed with smaller extractive industry and because they are relatively open, larger industrial operations influence character particularly from northern sections that are closer to the Power Station and Sasolburg Refinery. This character area cannot therefore be considered as a pristine agricultural landscape although the further to the south and east one travels towards the Vaal Dam, the smaller the influence of industry and mining becomes and the greater the perception there is of it being a cohesive agricultural landscape. The vegetation pattern results in a high degree of screening of low level development such as that proposed. This is likely to mean that occasional glimpses of the development may be possible from these areas particularly from adjacent areas, however as the viewer moves to the south and east, existing vegetation is likely to screen views.

» **Riverine Corridor Landscape Character Areas**. This is far from a pristine landscape mainly due to adjacent development and the extent of alien vegetation; however, it does have local significance as it is a relatively natural corridor within a densely developed area. Due to elevation and the extent of riverine vegetation, views out of this corridor are limited. This is likely to mean that the proposed development is unlikely to be obvious.

6.7.2 Visual Assessment

It is possible that an area might be sensitive due to an existing use. The nature of an outlook is generally more critical to areas that are associated with recreation, tourism and in areas where outlook is critical to land values. This section is intended to highlight

Sensitive Receptors or places within the landscape which, due to use, could be sensitive to landscape change. They include:

» Area Receptors which include:
  * Urban areas on the fringes of Sasolburg, Vereeniging and Vanderbijlpark. Should there be a significant impact on these areas, it is possible that there could be significant objection from residents. However, the landscape analysis and field investigation has indicated that, due to the distance between the site and receptors and due to the extent of existing vegetation whilst sections of the proposed development may be visible, it is unlikely that it will be obvious to these areas.
  * Two small residential areas close to and to the south of the proposed sites. These areas include housing associated with the adjacent mine as well as a school and social club. At the time of the site visit, the housing area had been abandoned and sections were under demolition. Due to the extent of vegetation within the housing area and the aspect of the development, views over the proposed sites were only possible from small eastern-most sections of this receptor. The existing school and social club overlook the proposed sites; however the sites are only visible from the northern extremity of this area receptor.
  * Areas that are important for tourism and recreational use such as local golf courses, Emerald Resort, the Vaal River Corridor and the Vaal Racecourse. As with the urban landscape areas, the landscape analysis and field investigation has indicated that, due to the distance between the site and receptors and due to the extent of existing vegetation it is unlikely that the proposed development will be visible from any of these areas.
» Linear Receptors which include main routes through the area. The most sensitive of these is likely to be the R54 as this is the main route to the Vaal Dam which is a major local recreation and tourism destination. The landscape analysis and field investigation has indicated that, due to the distance between the site and receptors and due to the extent of existing vegetation the proposed development is unlikely to be visible from the R54. It is possible that it could be visible over a short section of the R716 and R82 roads, however due to the extent of existing vegetation the full extent of development is not likely to be obvious and it will only be visible over a short section of road.
» Point Receptors that include isolated and small groups of homesteads which are generally located within the Rural Landscape to the south and east of the project area. The landscape analysis and field investigation has indicated that, due largely to landform, the proposed development will not be visible to any of the identified point receptors to the south of the alternative sites and due to distance and existing vegetation, parts of the proposed development may be visible but are unlikely to be obvious from point receptors to the east of the alternative sites.

Possible visual receptors that may be sensitive to landscape change are indicated on Figures 6.5 and 6.6 (Zones of Theoretical Visibility). These figures indicate that:

i. The Lethabo Power Station structures play a major role in limiting views of the proposed development to the north. Alternative Site 1 particularly is well screened by these structures as it is surrounded to the north and west by conveyors and to the east by the main power station structures.
ii. Alternative Site 1 is largely visible to the north and east whereas Alternative Site 2 is largely visible to the east.
iii. A minor ridgeline to the east of the Vaal River will screen views of Alternative Site 2 from the R54.
iv. A series of minor ridgelines to the north of the alternative sites will screen views of all alternative sites from areas to the north.

Key viewpoints that are adjudged to afford the best view of or towards the alternative sites from the identified visual receptors / LCAs are also indicated on Figures 6.5 and 6.6 inclusive. Photographs from these viewpoints are included as Plates 2 to 10 inclusive in the VIA report (**Appendix H**) and summarised as follows:

» Viewpoint 1 (Vanderbijlpark), site alternative 2
» Viewpoint 1 (Vanderbijlpark), site alternative 1
» Viewpoint 2 (Emerald Resort), site alternatives 1 & 2
» Viewpoint 3 (east edge of derelict mine housing), site alternative 1
» Viewpoint 3 (east edge of derelict mine housing), site alternative 2
» Viewpoint 4 (east side of Vaal River), site alternative 2
» Viewpoint 5 (east side of Vaal River), site alternative 2

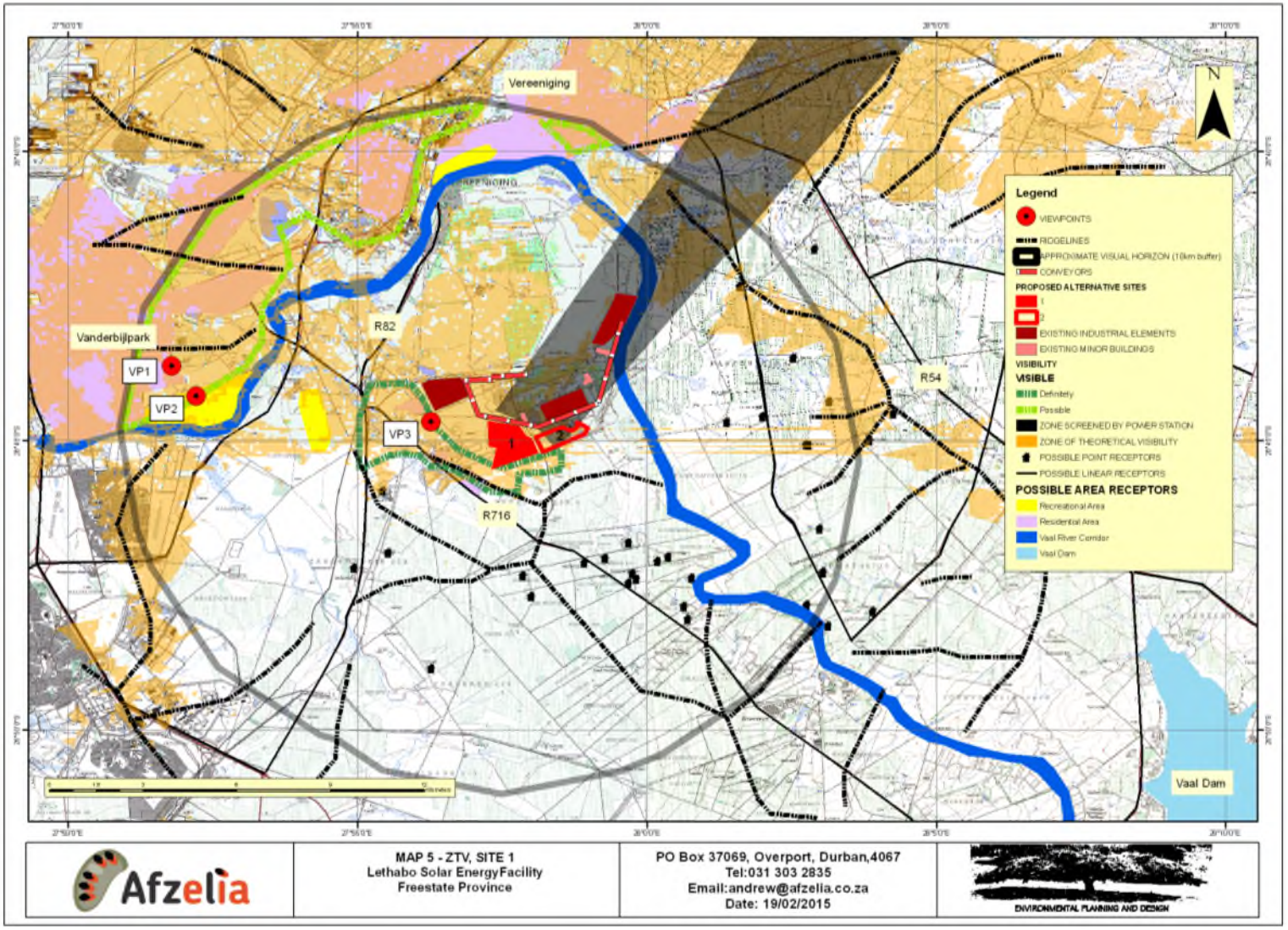

Figure 6.5: Zones of Theoretical Visibility – PV Site Alternative 1

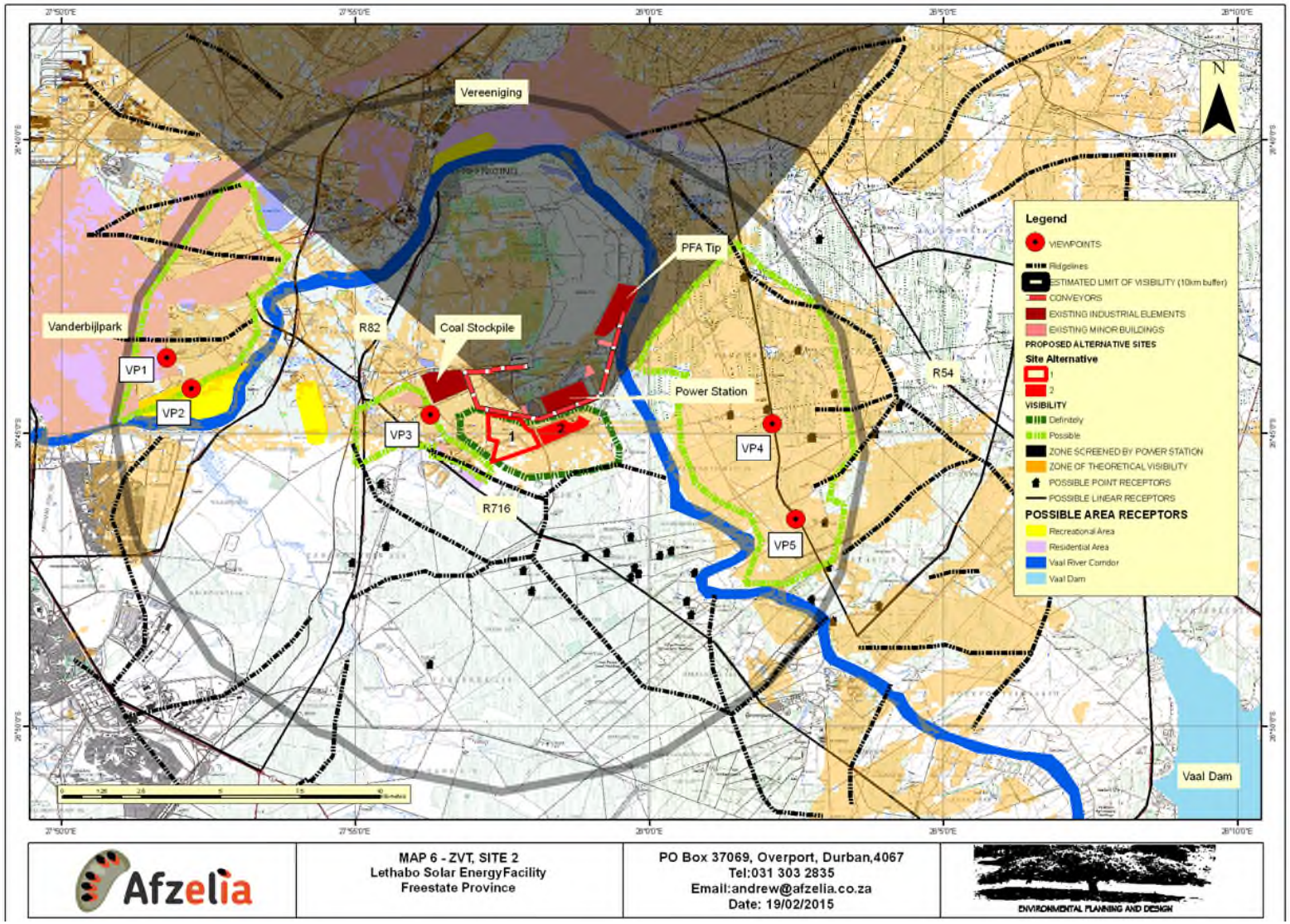

Figure 6.6: Zones of Theoretical Visibility – PV Site Alternative 2.

6.7.3 Impact table summarising the significance of visual impacts (with and without mitigation)

Impacts associated with development alternatives fall into three categories including;

1. Landscape degradation,
2. Change of view for visual receptors,
3. Ocular impacts associated with glare.

Landscape degradation

Nature of impact: Further industrial influence at the edges of the Landscape Character Area (LCA)		
Relevant Listed activities: GN 544, activity 10(i), 22 (i) & 47 (ii) GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**Alternatives 1 and 2** Site and immediate surroundings **(2)**	n/a
Duration	**Alternatives 1 and 2** Long term **(4)**	n/a
Magnitude	**Alternatives 1** The proposed development is unlikely to be highly obvious from urban areas. **(2)** **Alternatives 2** The proposed development is unlikely to be visible from urban areas. **(0)**	n/a
Probability	**Alternatives 1** Significant impact is improbable **(2)** **Alternatives 2** Significant impact is very improbable **(1)**	n/a
Significance	**Alternatives 1** Low **(16)** **Alternatives 2** Very low **(6)**	n/a
Status	**Alternatives 1** Negative **Alternatives 2** Neutral.	n/a
Irreplaceable loss	The project can be dismantled at decommissioning. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	Mitigation is not possible.	
Mitigation / Management:		

Mitigation is not possible. Development of Alternative Sites 1 and 2 are likely to be visible from higher urban areas to the north of the Vaal Dam and particularly in higher areas of Vanderbijl Park. However, views of the alternative developments will be at least partly screened by existing vegetation and distance will also help to significantly reduce the influence of this development. Alternative 2 is also largely screened by the existing power station and is further from urban areas than Alternative 1. It is therefore not expected that the development of Alternative 1 or 2 would have any significant impact on existing urban LCA the edges of which are already impacted by industry. No mitigation measures are necessary as existing vegetation will significantly break views of both alternatives.
Cumulative impact Both alternative 1 and 2 will increase the extent of industrial development and reduce the extent of green space obvious in the views from the selected viewpoints. However, Alternative 2 will largely be viewed with the plant as a backdrop whereas Alternative 1 will visually extend industrial development into a green space. Cumulative impacts associated with Alternative 1 are therefore unlikely to be noticeable whereas the cumulative impact associated with Alternative 2 is likely to be un-noticeable.
Residual impacts None as infrastructure can be removed after decommissioning thereby removing the impact.

Nature of impact**:** Degradation of the Rural LCA particularly the corridor leading to the Vaal Dam.		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**Alternatives 1 and 2** Site and immediate surroundings **(2)**	n/a
Duration	**Alternatives 1 and 2** Long term **(4)**	n/a
Magnitude	**Alternatives 1** The proposed development is unlikely to be visible from key rural areas. **(0)** **Alternatives 2** The proposed development is unlikely to be highly obvious from rural areas. **(2)**	**Alternatives 2** The proposed development is unlikely to be highly obvious from rural areas. **(1)**
Probability	**Alternatives 1** Significant impact is very improbable **(1)** **Alternatives 2** Significant impact is improbable **(2)**	**Alternatives 2** Significant impact is improbable **(1)**
Significance	**Alternatives 1** Very low **(6)** **Alternatives 2**	**Alternatives 2** Very Low (7)

	Low **(16)**	
Status	**Alternatives 1** Neutral. **Alternatives 2** Negative.	n/a
Irreplaceable loss	The project can be dismantled. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	Yes	
Mitigation / Management: There is slight concern regarding the extent of visibility of Alternative 2 to areas to the east of the Vaal Dam. There currently is a stand of alien trees within Eskom land that will help to screen this view. Mitigation measures might include, ensuring that this stand of vegetation is retained and augmented / extended. It would be possible to completely screen this Alternative from areas to the east within three to five years if screen planting is undertaken around the south eastern and eastern sections of the proposed site. ***Explanatory note:*** a) Landform to the south and west of the alternative development sites significantly limits visibility from those directions. Existing vegetation also helps in this regard. Impacts on the Rural LCA to the west of the Vaal River resulting from all development alternatives are therefore negligible. b) Development of Alternative Site 1 will not be visible to the Rural LCA to the east of the Vaal River. Development on Alternative Site 2 is likely to be visible to the Rural LCA to the east of the Vaal River. It will however be largely screened by both landform and existing vegetation. Distance will also play an important role in minimising this impact as the array will be viewed in profile meaning that at most a 4m high band will be visible.		
Cumulative impacts » Alternative 1 will not increase the extent of industrial development as seen from rural areas. Hence there is no cumulative impact. » Alternative 2 could marginally increase the extent of industrial development that is seen from rural areas and hence the impact indicated above is cumulative.		
Residual impacts None as infrastructure can be removed after decommissioning thereby removing the impact.		

Change of view for visual receptors

The assessment indicates that the following Visual Receptors could be impacted:

1. Residential areas particularly those on the edges of the Urban LCA and in close proximity to alternative development sites.
2. Recreational facilities including the Emerald Resort, the Riviera Country Club and other facilities within the Riverine LCA.
3. Main routes (linear receptors) through the area particularly the R54, R716 and R82.
4. Adjacent Farmsteads particularly the closest properties to the south and east of the alternative development sites.

Nature of impact: Further Industrialisation and reduction in rural character of the view.		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**<u>Alternatives 1 and 2</u>** Site and immediate surroundings **(2)**	n/a
Duration	**<u>Alternatives 1 and 2</u>** Long term **(4)**	n/a
Magnitude	**<u>Alternatives 1</u>** The proposed development is unlikely to be highly obvious from urban areas. **(2)** **<u>Alternatives 2</u>** The proposed development is unlikely to be visible from urban areas. **(0)**	n/a
Probability	**<u>Alternatives 1</u>** Significant impact is improbable **(2)** **<u>Alternatives 2</u>** Significant impact is very improbable **(1)**	n/a
Significance	**<u>Alternatives 1</u>** Low **(16)** **<u>Alternatives 2</u>** Very low **(6)**	n/a
Status	**<u>Alternatives 1</u>** Negative. **<u>Alternatives 2</u>** Neutral.	n/a
Irreplaceable loss	The project can be dismantled after decommissioning. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	Mitigation is not really possible due to relative levels nor is it necessary.	
Mitigation / Management: No mitigation measures are necessary as existing vegetation will significantly break views. ***Explanatory note:*** a) The one residential area that is associated with the adjacent coal mine that overlooks Alternative 1 was under demolition at the time of the site visit. Even though the residential area is in close proximity to the alternative sites, the orientation of the houses and existing vegetation result in it being very difficult to gain a clear view over the proposed alternative sites. Therefore even if this site is to be redeveloped for residential use, it is unlikely to affect		

the assessment.

Development of Alternative Sites 1 and 2 will be visible to higher areas of residential areas to the north of the Vaal River. However, the development will be seen at a distance and will be largely screened by existing vegetation. From the majority of areas it is unlikely that whilst the development may be visible, its nature will not be discernible.

Cumulative impacts:

Alternative 1 could add slightly to the extent of industrial development visible from residential areas, hence this is a cumulative impact.

Residual impacts

None as infrastructure can be removed after decommissioning thereby removing the impact.

***Nature of impact*:** Further Industrialisation and reduction in rural character of the view.

Relevant Listed activities:

GN 544, activity 10(i)
GN 545, activity 1

	Without mitigation	**With mitigation**
Extent	**Alternatives 1 and 2** Site and immediate surroundings **(2)**	n/a
Duration	**Alternatives 1 and 2** Long term **(4)**	n/a
Magnitude	**Alternatives 1 and 2** The proposed development is unlikely to be visible from recreational areas. **(0)**	n/a
Probability	**Alternatives 1 and 2** Significant impact is very improbable **(1)**	n/a
Significance	**Alternatives 1 and 2** Very low **(6)**	n/a
Status	**Alternatives 1 and 2** Neutral.	n/a
Irreplaceable loss	The project can be dismantled. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	Mitigation is not necessary.	

Mitigation / Management:

No mitigation measures are necessary as existing vegetation will significantly break views of the Alternative Sites 1 and 2.

Explanatory note:

a) It is highly unlikely that development of Alternative Site 1 and 2 will be visible to any of the recreational areas within the Riverine LCA.

No mitigation is necessary as none of the alternative development areas would negatively impact on these receptors.

Cumulative impacts:

If a small impact occurs it would add slightly to existing impacts associated with industry, it is therefore cumulative.

Residual impacts
None as infrastructure can be removed after decommissioning thereby removing the impact.

Nature of impact: Impacts on main routes (linear receptors) through the area particularly the R54, R716 and R82.		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**<u>Alternatives 1 and 2</u>** Site and immediate surroundings **(2)**	n/a
Duration	**<u>Alternatives 1 and 2</u>** Long term **(4)**	n/a
Magnitude	**<u>Alternatives 1</u>** The proposed development could be visible to small sections of main routes particularly to the west. **(2)** **<u>Alternative 2</u>** The proposed development is unlikely to be visible from main routes. **(0)**	n/a
Probability	**<u>Alternatives 1 and 2</u>** Significant impact is very improbable **(1)**	n/a
Significance	**<u>Alternatives 1</u>** Very low **(8)** **<u>Alternatives 2</u>** Very low **(6)**	n/a
Status	**<u>Alternatives 1 and 2</u>** Neutral.	n/a
Irreplaceable loss	The project can be dismantled after decommissioning. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	Mitigation is not necessary.	
Mitigation / Management: No mitigation measures are necessary as existing vegetation will significantly break views of the alternatives 1 and 2. ***Explanatory note:*** a) Development of Alternative Site 1 could be visible to small sections of the R82 and the R716, however, existing vegetation largely screens these views. Development of Alternative Site 2 is unlikely to be visible to the R54 as existing landform screens this view.		
Cumulative impacts:		

If a small impact occurs it would add slightly to existing impacts associated with industry, it is therefore cumulative.
Residual impacts None as infrastructure can be removed after decommissioning thereby removing the impact.

Nature of impact: Impacts on farmsteads particularly those to the east of the Vaal River.		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**<u>Alternatives 1 and 2</u>** Site and immediate surroundings **(2)**	n/a
Duration	**<u>Alternatives 1 and 2</u>** Long term **(4)**	n/a
Magnitude	**<u>Alternative 1</u>** The proposed development is unlikely to be visible **(0)** **<u>Alternative 2</u>** The proposed development is unlikely to be highly obvious from urban areas. **(2)**	n/a
Probability	**<u>Alternatives 1 and 2</u>** Significant impact is very improbable **(1)**	n/a
Significance	**<u>Alternative 1</u>** Very low **(6)** **<u>Alternative 2</u>** Very low **(8)**	n/a
Status	**<u>Alternative 1</u>** Neutral. **<u>Alternative 2</u>** Negative.	n/a
Irreplaceable loss	The project can be dismantled after decommissioning. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	Yes	
Mitigation / Management: There is slight concern regarding the extent of visibility of alternative 2 to areas to the east of the Vaal Dam. There currently is a stand of alien trees within Eskom land that will help to screen this view. Mitigation measures might include, ensuring that this stand of vegetation is retained and augmented / extended. It would be possible to completely screen this alternative from areas to the east within three to five years if screen planting is undertaken around the south eastern and eastern sections of the proposed site.		

Explanatory note: a) Development of Alternative Site 1 and 2 will be screened from all farmsteads to the south by landform. b) Development of Alternative Site 2 will be visible to a small number of farmsteads to the east of the Vaal River. However views of the development will be largely screened by existing vegetation.
Cumulative impacts: If a small impact occurs with the development of Alternative 2, it will add slightly to existing impacts associated with industry, it is therefore cumulative.
Residual impacts None as infrastructure can be removed after decommissioning thereby removing the impact.

Ocular impacts associated with glare

***Nature of impact*:** Glare impacting on adjacent roads and residential areas		
Relevant Listed activities: GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**Alternatives 1 and 2** Site and immediate surroundings **(2)**	n/a
Duration	**Alternatives 1 and 2** Long term **(4)**	n/a
Magnitude	**Alternatives 1 and 2** The proposed development is unlikely to result in any significant impact associated with glare. **(0)**	n/a
Probability	**Alternatives 1 and 2** Significant impact is very improbable **(1)**	n/a
Significance	**Alternatives 1 and 2** Very low **(6)**	n/a
Status	**Alternatives 1 and 2** Neutral to negative.	n/a
Irreplaceable loss	The project can be dismantled after decommissioning. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	Yes	
Mitigation / Management: The impact is so low that it probably will not be noticed. Mitigation is not necessary		
Cumulative impacts: There are no major sources of glare currently noticeable. This impact is therefore not cumulative.		
Residual impacts None as infrastructure can be removed after decommissioning thereby removing the impact.		

6.7.4 Comparative Assessment of the PV site alternatives

Alternative Sites 1 and 2 are located on high areas and because of this they will be exposed to viewers within the urban area to the north and rural area to the east of the Vaal River. However, these impacts are not likely to be significant and given the industrial context in which the proposed development will be set are unlikely to degrade the landscape to any noticeable degree. Therefore on visual grounds **both site alternatives are acceptable**. In terms of visual impacts arising there is **no significance** difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

6.7.5 Implications for Project Implementation

The proposed development of Alternative Sites 1 and 2 could be visible to residential receptors to the north of the Vaal River. Development of Alternative 2 is likely to be visible to a small number of farmsteads to the east of the Vaal River and the development of Alternative Site 1 could be visible to a small section of adjacent regional roads to the west.

The assessment has shown however that these impacts will be largely screened by existing vegetation and are likely to be negligible given the existing industrial context within which the views will be seen.

6.8 Assessment of Potential Social Impacts

The key social issues associated with the **construction phase** include the following **potential positive impacts:**

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

The key social issues associated with the **construction phase** include the following **potential negative impacts:**

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

The key social issues affecting the **operational phase** include the following potential **positive** impacts:

» Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training.
» The establishment of renewable energy infrastructure.

The key social issues affecting the **operational phase** include the following potential **negative** impacts:

» The visual impacts and associated impact on sense of place.

6.8.1 Impact tables summarising the significance of social impacts associated with the construction phase (with and without mitigation measures)

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 social environment if not managed appropriately. The Alternative Site 1, 75MW component, is expected to extend over a period of 18-24 months. The construction period for the Alternative Site 2 for the 35 MW solar energy facility will be approximately 8-12months.

Direct employment and skills development

The construction of the proposed project will require a workforce and therefore direct employment will be generated. The proposed development will create employment opportunities for the local community. This is therefore a positive social impact. Although the exact number of employment opportunities has not been determined at this stage, it is estimated that during the construction phase approximately the 75MW solar energy facility on the Alternative Site 1 is likely to create approximately 250-300 employment opportunities, for approximately 15-18 months. The Alternative Site 2, with a generating capacity of 35 MW, solar energy facility will generate approximately 150-200 employment opportunities, for approximately 8-12months. However this number is likely to vary depending on the final designs of the proposed project. In terms of skills requirements, it is common that approximately 45% of the opportunities will be available to low-skilled workers (construction labourers, security staff etc.), 22% will be available to semi-skilled workers (drivers, equipment operators etc.), and 33% will be available to skilled personnel (engineers, land surveyors, project managers etc.). The total wage bill for the construction for the 75 MW facility on the Alternative Site 1 is estimated to be in the region of R13 million. The wage bill for the Alternative Site 2 will be less, in the region of R7 million for the 35 MW facility.

The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area.

Nature: The creation of employment opportunities and skills development opportunities during the construction phase for the country and local economy				
Relevant Listed activities: GN 544, activity 10(i), 22 (i) & 47 (ii) GN 545, activity 1				
	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without enhancement	**With enhancement**	**Without enhancement**	**With enhancement**
Extent	Local- Regional (2)	Local- Regional (2)	Local- Regional (2)	Local- Regional (2)
Duration	Short term (2)	Short term (2)	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Moderate (6)	Minor(2)	Low (4)
Probability	Probable (3)	Highly probable (4)	Probable (3)	Highly probable (4)
Significance	**Low (24)**	**Medium (40)**	**Low (15)**	**Low (28)**
Status	Positive	Positive	Positive	Positive
Reversibility	N/A			
Irreplaceable loss of resources	N/A			
Can impacts be enhanced	Yes			
Enhancement measures: In order to enhance the local employment, skills development and business opportunities associated with the construction phase the following measures should be implemented: » It is recommended that local employment policy is adopted to maximise the opportunities made available to the local labour force. Eskom should make it a requirement for contractors to implement a 'locals first' policy, especially for semi and low skilled job categories. Enhance employment opportunities for the immediate local area, Ward 19, if this is not possible, then the broader focus areas should be considered for sourcing employees such as the Metsimaholo Local Municipality. » Employ local contractors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. » In the recruitment selection process; consideration must be given to women during recruitment process. » It is recommended to set realistic local recruitment targets for the construction phase. » Training and skills development programmes should be initiated prior to the commencement of the construction phase.				
Cumulative impacts Opportunity to upgrade and improve skills levels in the area				
Residual impacts Improved pool of skills and experience in the local area				

Economic multiplier effects

There are likely to be opportunities for local businesses to provide services and materials for the construction phase of the development. The local service sector will also benefit from the proposed development. The site is located approximately 15km north east of Sasolburg. Given the relative proximity of the site to town, no on-site accommodation construction camp is envisaged. Off-site accommodation in the nearest town would be required for contract workers and certain employees. The economic multiplier effects from the use of local goods and services opportunities will include, but is not limited to, construction materials and equipment and workforce essentials such as services, safety equipment, ablution, accommodation, transportation and other goods.

Also the injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area. Through the stimulation of employment and income is the creation of new demand within the local and regional economies. With increased income comes additional income for expenditure on goods and services supplied. The intention is to maximise local labour employment opportunities, this is likely to have a positive impact on local communities and have downstream impacts on household income, education and other social aspects. The implementation of the enhancement measures below can enhance the opportunities for local area.

***Nature*:** Significance of the impact from the economic multiplier effects from the use of local goods and services				
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1				
	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without enhancement	**With enhancement**	**Without enhancement**	**With enhancement**
Extent	Local- regional (2)	Local- Regional (2)	Local- regional (2)	Local- Regional (2)
Duration	Short term (2)	Short term (2)	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Moderate (6)	Minor (2)	Low (4)
Probability	Probable (3)	Highly probable (4)	Probable (3)	Highly probable (4)
Significance	**Low (24)**	**Medium (40)**	**Low (15)**	**Low (28)**
Status	Positive	Positive	Positive	Positive
Reversibility	N/A			
Irreplaceable loss of resources	N/A			
Can impacts be	Yes			

enhanced	
Enhancement	
» It is recommended that a local procurement policy is adopted by the developer to maximise the benefit to the local economy, where feasible. » Eskom should develop a database of local companies, specifically Historically Disadvantaged (HD) 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 where applicable. » Eskom should source as much goods and services as possible from the local area; engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers where feasible.	
Cumulative impacts	
Opportunity for local capital expenditure, potential for the local service sector	
Residual impacts	
Improved local service sector, growth in local business	

Safety and security impacts

An increase in crime is often associated with construction activities. The perceived loss of security during the construction phase of the proposed project due to the influx of workers and/or outsiders to the area (as influxes of construction workers, newcomers or jobseekers are usually associated with an increase in crime) may have indirect effects, such as increased safety and security issues for neighbouring properties and damage to property, such as the risk of veld fire, stock theft, crime and so forth. The perception exists that construction related activities (influx of jobseekers, and construction workers and so forth) is a contributor to increased criminal activities in an area. The Alternative Site 1 is likely to create approximately 250-300 employment opportunities (approximately 15-18 months). The Alternative Site 2 will generate approximately 150-200 employment opportunities (approximately 8-12 months). An influx of construction workers will be significantly more and for a longer period of time for the Alternative Site 1, therefore increasing the perceived safety and security risks in comparison to Alternative Site 2.

Apart from the construction crew that poses a potential increased risk there may also be an influx of people looking for economic opportunities (job seekers). Safety and security impacts are a reality in South Africa which needs to be addressed through appropriate mitigation measures. The adjacent landowners were interviewed and safety and security concerns were discussed; it was concluded that the adjacent landowners / tenants do not have concerns with safety and security in terms of possible crime, damage to property or stock theft for either of the proposed sites. Therefore the impact is assessed to be of low significance. Nevertheless, precautions will still need to put in place to limit any possible negative impacts associated with safety and security.

Nature: Temporary increase in safety and security concerns associated with the influx of people during the construction phase

Relevant Listed activities:
GN 544, activity 10(i)
GN 545, activity 1

	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Low(24)**	**Low (16)**	**Low (15)**	**Low (10)**
Status	Negative	Negative	Negative	Negative
Reversibility	Yes			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Yes			

Mitigation

» Access in and out of the construction area should be strictly controlled by a security company.
» The appointed EPC contractor must appoint a security company and appropriate security procedures are to be implemented.
» The contractor must ensure that open fires on the site for heating, smoking or cooking are not allowed except in designated areas.
» Contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff.
» A comprehensive employee induction programme would cover land access protocols, fire management and road safety. This must be addressed in the construction EMPr as the best practice.
» A Community Liaison Officer should be appointed as a grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.

Cumulative impacts
Possible increase in crime levels (with influx of people) with subsequent possible economic losses, however limited considering the nature of the area (industrialised area)

Residual impacts
None anticipated

Impacts on daily living and movement patterns

An increase in traffic due to heavy vehicles could create short-term disruptions and safety hazards for current road users. Transportation of project components and

equipment to the proposed site will be transported using vehicular / trucking transport. The existing secondary access road is off the R716, the same access road that is utilized to access the Lethabo Power Station and the Anglo Vaal Colliery. This secondary road will be the primary access road to the proposed site. The primary roads that will be used for transportation of project components and equipment will be the R716 and the secondary road off the R716. There are regular daily movement patterns on the R716 and secondary road off the R716 from employees of Eskom that work at the Lethabo Power Station and adjacent landowners (local farmers) and employees at Anglo Vaal Colliery that utilize these roads to access their place of work. The R716 is a tarred road and the secondary road off the R716 is tarred and is currently being upgraded. The roads to the proposed site are currently in good condition and are utilised on a daily basis by a large number of trucks going to and from the Lethabo Power Station and Anglo Vaal Colliery. Increased traffic due to heavy vehicles could cause disruptions to the local community and increase safety hazards. The use of local roads and transport systems may cause road deterioration and congestion.

An increase of traffic from the rise in construction vehicles is a safety concern for other road users and local communities in the area. The movement of construction related activities crossing over the R716 does have the potential to increase the risk for road users. Also with wear and tear on roads that is not maintained / repaired; the safety risk also increases. The R716 and the access road would mainly be affected and the use of un-roadworthy vehicles, drivers disobeying traffic rules and the obstruction of motorist's views will contribute to this potentially negative impact.

***Nature*:** Temporary increase in traffic disruptions and movement patterns during the construction phase				
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1				
	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short term (2)	Short term (2)	Very short term (1)	Very short term (1)
Magnitude	Moderate (6)	Moderate (6)	Low (4)	Low (4)
Probability	Highly Probable (4)	Probable (3)	Highly Probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (27)**	**Low (24)**	**Low (18)**
Status	Negative	Negative	Negative	Negative
Reversibility	Yes			
Irreplaceable loss of resources	No			
Can impacts be	Yes			

mitigated	
Mitigation	
» All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. » Heavy vehicles should be inspected regularly to ensure their road safety worthiness. » Implement penalties for reckless driving for the drivers of heavy vehicles as a way to enforce compliance to traffic rules. » Avoid heavy vehicle activity during 'peak' hours (when people are driving to and from work). » The developer and engineering, procurement and construction (EPC) contractor's must ensure that any damage / wear and tear caused by construction related traffic to the roads is repaired » Provision of adequate and strategically placed traffic warning signs and control measures along the R716 and secondary roads to warn road users of the construction activities taking place, displaying road safety messages and speed limits for the duration of the construction phase. » A comprehensive employee induction programme to cover land access protocols and road safety. This must be addressed in the construction EMPr as the best practice. » A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.	
Cumulative impacts	
Possible increased traffic and traffic disruptions impacting local communities movement patterns and increased risks for road users	
Residual impacts	
Non anticipated	

Pressure on economic and social infrastructure impacts from an in-migration of people

The in-migration of people to the area as either non-local workforce of construction workers and/or jobseekers could result in pressure on economic and social infrastructure due to in migration of construction workers and jobseekers and pressure on local population (rise in social conflicts and social dynamics). Influx of people into the area, especially by job seekers, could further lead to a temporary increase in the level of crime, cause social disruption and put pressure on basic services. Adverse impacts could occur if a large in-migrant workforce, culturally different from the local indigenous group, is brought in during construction. This influx of non-local work force could also strain the existing community infrastructure and social services. The local municipalities already have a large indigence population that relies on free basic services from the municipality, which has constrained the municipalities' bulk infrastructure due to a lack of funding. The proposed development will create a range of employment possibilities and thus it will attract jobseekers. The Alternative Site 1 (75MW PV facility) will create more job opportunities than the smaller proposed facility on Alternative Site 2 (35MW PV facility).

Sasolburg is the closest town to the proposed site and is seen as sensitive social receptor and in-migrants (either bringing in an outside workforce or jobseekers) coming into the area could put pressure on social infrastructure; create social problems, tensions and conflicts. The impact associated with in-migration of

jobseeker and/or an outside workforce includes pressure on local municipal services and infrastructure such as sanitation, electricity, water, waste management, health facilities, transportation and availability of housing. Squatter settlements may develop near towns to accommodate jobseekers. It is very difficult to control the influx of people into an area, especially in a country where there's high levels of unemployment. An influx of jobseekers to an area often results in an increase in prostitution activities and temporary sexual relations with locals; this could result increase in the spreading of HIV/Aids and STD's and unwanted pregnancies. The disruption of the local area as a result of the proposed PV facility development largely depends on the level of local employment achievable and clearly stipulating a local employment regime to limit outsiders coming into the area. Employment opportunities can be sourced from the surrounding local area first, Ward 19, and if availability of labour is limited then the search can be extended to the local municipality. The local municipality's population could fulfil the majority of the lower and semi-skilled employment opportunities that emerge.

***Nature*:** Added pressure on economic and social infrastructure during construction as a result of in-migration of people				
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1				
	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local-regional (2)	Local- regional (2)	Local-regional (2)	Local- regional (2)
Duration	Short-term (2)	Short-term (2)	Very short-term (1)	Very short-term (1)
Magnitude	Moderate (6)	Low (4)	Low (6)	Minor (4)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**	**Low (27)**	**Low (14)**
Status	Negative	Negative	Negative	Negative
Reversibility	No			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Yes			
Mitigation » A 'locals first' policy should be advertised for construction employment opportunities, especially for semi and low-skilled job categories. Enhance employment opportunities for the immediate local area, Ward 19, if this is not possible, then the broader focus areas should be considered for sourcing employees such as the Metsimaholo Local Municipality. » It is recommended that local employment policy is adopted to maximize the opportunities made available to the local labour force. » Recruitment of temporary workers at the gates of the development site should not be allowed. A recruitment office located in town with a Community Liaison officer should be established to				

deal with jobseekers. » Have clear rules and regulations for access to the proposed site to control loitering. » A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.
Cumulative impacts » Additional pressure on infrastructure due to additional people in the area. » Possible increase in criminal activities and economic losses in area for property owners.
Residual impacts Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure.

Nuisance Impacts (noise & dust)

Impacts associated with construction related activities include noise, dust and disruption to adjacent properties is a potential issue. Experience from other solar energy facilities projects and other developments indicate that site clearing does increase the risk of dust being generated, which can in turn impact on adjacent properties. The potential impacts can be addressed by implementing effective mitigation measures. The movement of heavy construction vehicles during the construction phase also has the potential to create noise, damage to roads and dust. The primary sources of noise during construction would be from the construction equipment and other sources of noise include vehicle traffic. Generation of dust would come from construction activities. Short-term increases in the use of local roads would occur during the construction period. Heavy equipment would most likely remain at the site for the construction period. The proposed site is located within the boundary of the Lethabo Power Station area, so the impact will be less significant as it's located within an industrial area. The adjacent landowners/ tenants that were interviewed also indicated that these nuisance impacts would not be of concern during the construction phase. The noise, dust and increased use of the local roads are expected to be negative but short term impact. Social impacts for Alternative Site 1 and Alternative Site 2 will be similar. The only significant differences of the alternative sites is that the construction phase will be longer for Alternative Site 1 as the size of the solar energy facility is larger (75MW, 18-24 months of construction), therefore the negative construction impacts such as disruption from nuisance impacts (traffic, noise and dust during construction) and would be experienced for a longer period of time in comparison to Alternative Site 2 (35MW, 8-12 months of construction). However, the proposed development is located in an industrial area and the surrounding landowners do not have any concerns in terms of nuisance impacts and safety and security impacts, therefore these impacts are neutral and have low significance.

***Nature*:** Nuisance impacts in terms of temporary increase in noise and dust, and the wear and tear on private farm roads for access to the site

Relevant Listed activities: GN 544, activity 10(i), 22 (i) & 47 (ii) GN 545, activity 1				
	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)	Very short-term (1)	Very short-term (1)
Magnitude	Minor (2)	Minor (2)	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Low (15)**	**Low (10)**	**Low (12)**	**Low (8)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Yes			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Yes			
Mitigation: The potential impacts associated with construction and heavy vehicles can be effectively mitigated. The mitigation measures include: » 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. » Ensure that drivers adhere to speed limits. » Ensure all vehicles are road worthy; drivers are qualified and are made aware of the potential noise and dust issues. » A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.				
Cumulative impacts » Other construction activities in area will heighten the nuisance impacts, such as noise, dust and wear and tear on roads.				
Residual impacts None anticipated				

6.8.2 Impact tables summarising the significance of social impacts associated with the decommissioning phase (with and without mitigation measures)

The solar energy facility will be operational for approximately 20-25 years. The potential positive and negative impacts which could arise as a result of the operation of the Project include the following:

Direct employment and skills development

The operation phase (20-25 years) of the proposed development will require a workforce and therefore direct employment will be generated. Although the exact number of construction workers is not confirmed at this stage, it is estimated that approximately ~50 jobs will be generated during the operation phase for the 75 MW facility and approximately ~25 jobs created for the 35 MW facility. Given that solar energy facilities are relatively new in South Africa, a number of highly skilled personnel may need to be recruited from outside the Local Municipal area. The employees would include skilled engineers (specialised in both electrical and mechanical engineering) as well as less skilled services such as safety and security and engineering assistants. Routine activities would include operation of the solar facility to produce power, and regular monitoring and maintenance activities to ensure safe and consistent operation. Maintenance will be carried out throughout the lifetime of the solar energy facility. Typical activities during maintenance include washing solar panels routinely (in the evening) and vegetation control and maintenance. Employment opportunities will be created during the operation phase and is rated as positive impact although limited.

***Nature*:** The creation of employment opportunities and skills development opportunities during the operation phase for the country and local economy				
Relevant Listed activities: GN 544, activity 10(i), 22 (i) & 47 (ii) GN 545, activity 1				
	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without enhancement	**With enhancement**	**Without enhancement**	**With enhancement**
Extent	Local- Regional (3)	Local- Regional (3)	Local- regional (3)	Local- Regional (3)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Low (4)	Low(4)	Minor (2)	Minor (2)
Probability	Probable (3)	Highly Probable (4)	Probable (3)	Highly Probable (4)
Significance	**Low (30)**	**Medium (40)**	**Low (27)**	**Medium (36)**
Status	Positive	Positive	Positive	Positive
Reversibility	N/A			
Irreplaceable loss of resources	N/A			
Can impacts be enhanced	Yes			
Enhancement » It is recommended that a local employment policy is adopted by the developer to maximise the project opportunities being made available to the local community. Enhance employment opportunities for the immediate local area, Ward 19, if this is not possible, then the broader focus areas should be considered for sourcing employees such as the Metsimaholo Local				

Municipality. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible » The developer should establish vocational training programs for the local employees to promote the development of skills
Cumulative impacts Opportunity to upgrade and improve skills levels in the area
Residual impacts Improved pool of skills and experience in the local area

Development of clean, renewable energy infrastructure

Energy production has been and still is one of the main pivots of the social and economic development of South Africa. South Africa currently relies on coal-generated energy to meet its energy needs. Almost 72% of South Africa's primary energy is from coal, over half used to generate electricity and a quarter used for synfuels production. South Africa's carbon emissions are higher than those of most developed countries partly because of the energy-intensive sectors which rely heavily on low quality coal. Use of low quality coals is the main contributor of GHG emission (ERC, 2004). The energy-intensive sectors of the economy emit carbon emissions that are higher than those of most developed economies. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions. The generation of renewable energy will contribute to South Africa's electricity market. The advancement of renewable energy is a priority for South Africa. The government considers the use of renewable energy as a contribution to sustainable development (White Paper on Renewable Energy, 1998). As most of the sources are indigenous and naturally available, its use will strengthen energy security as it will not be subjected to disruption by international crisis. Furthermore, recent policy highlights the desirability of clean; green energy and solar generated energy will play a significant role in reaching these quotas (ERC, 2004). Given South Africa's reliance on Eskom as a power utility, the benefits associated with an Independent Power Producer based on renewable energy are regarded as an important contribution.

Bringing in the renewable energy sector to the Metsimaholo economy may contribute to the diversification of the local economy and provide greater economic stability. The growth in the renewable energy sector could introduce skills and development into the area. The development of the solar energy facility could therefore add to the stability of the economy, and even though this proposed development is small scale in comparison to the overall potential of the sector, it could contribute to the local economy. The proposed 75MW facility or 35MW facility will help contribute to offset the total carbon emissions associated with energy generation in South Africa. Internationally there is an increase in the deployment of renewable energy technologies for the generation of electricity due to concerns such as climate change

and exploitation of non-renewable resources. Through the Integrated Resource Plan (IRP), the South African Government has set a target for renewable energy of 17 GWh renewable energy contributions to final energy consumption by 2030, to be produced mainly from biomass, wind, solar and small-scale hydro. Eskom has already successfully installed PV systems at offices and parking lots within Eskom-owned property to promote renewable energy awareness and to diversify their own energy mix. Furthermore, Eskom is looking at further reducing their self-consumption at their various owned or utilised sites by introducing Eskom's Ilanga PV Project Portfolio which aims to install 150MWp at their various power stations, offices and substations, which includes the proposed Lethabo PV Facility. The solar PV facility will promote the reduction of Eskom's carbon footprint and support the demand side management energy efficiency programme.

Nature: Development of clean, renewable energy infrastructure				
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1				
	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without enhancement	**With enhancement**	**Without enhancement**	**With enhancement**
Extent	Local- Regional- National (4)	Local- Regional- National (4)	Local- Regional- National (4)	Local- Regional- National (4)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)	Highly probable (4)	Highly probable (4)
Significance	**Medium (48)**	**Medium (48)**	**Medium (40)**	**Medium (40)**
Status	Positive	Positive	Positive	Positive
Reversibility	Yes			
Irreplaceable loss of resources	Yes (impact of climate change)			
Can impacts be enhanced	No			
Enhancement None anticipated				
Cumulative impacts Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming				
Residual impacts Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming				

Visual impact and sense of place impacts

The sense of place is developed over time as the community embraces the surrounding environment, becomes familiar with its physical properties, and creates its own history. The sense of place is created through the interaction of various characteristics of the environment, including atmosphere, visual resources, aesthetics, climate, lifestyle, culture and heritage. Importantly though it is a subjective matter and is dependent on the demographics of the population that resides in the area and their perceptions regarding trade-offs. An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. The social impacts associated with the impact on sense of place relate to the change in the landscape character and visual impact of the proposed solar energy facility.

The proposed development is located within an industrial area, within the boundary of the Lethabo Power Station area and is located adjacent to the Anglo Vaal Colliery (open cast mining). The adjacent landowner is Anglo American. The environmental officer from Anglo and the tenant who leases some of the adjacent land for livestock farming indicated that there will not be any anticipated visual issues from their side as the project is located in an industrial area. The Lethabo Power Station located next to the site, the power and transmission lines and the open cast mining are infrastructural and disrupting elements that currently affect visual resources in the immediate local area. Therefore the anticipated impact on the areas visual quality and sense of place is expected to be of very low significance. Additionally, the visual impact assessment as presented in section 6.7.2 of this report has shown the visual impacts will be largely screened by existing vegetation and are likely to be negligible given the existing industrial context within which the views will be seen.

Nature**:** Visual impacts and sense of place impacts associated with the operation phase of the project				
Relevant Listed activities: GN 544, activity 10(i), 22 (i) & 47 (ii) GN 545, activity 1				
	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)
Significance	**Low (18)**	**Low (18)**	**Low (14)**	**Low (14)**
Status	Negative	Negative	Negative	Negative
Reversibility	Yes			
Irreplaceable loss of resources	No			

Can impacts be mitigated	Yes
Mitigation » No mitigation measures are necessary as existing vegetation will significantly break views.	
Cumulative impacts None anticipated	
Residual impacts None anticipated if the visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status.	

6.8.3 Impact tables summarising the significance of social impacts associated with the decommissioning phase (with and without mitigation measures)

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 adjacent landowners who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the proposed facility the 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 20-25 years post commissioning. The decommissioning phase is therefore likely to create additional, construction type jobs, as opposed to the job losses typically associated with decommissioning however for a limited period of time.

Given the relatively small number of people employed during the operation phase for the Alternative Site 1 75MW solar energy facility (approximately ~50) and even less for the Alternative Site 2 35MW solar energy facility (approximately ~25), the social impacts at a community level associated with decommissioning are likely to be low. In addition, potential impacts associated with the decommissioning phase can be effectively managed with the implementation of a retrenchment and downscaling programme. Based on the current situation of the local area the impacts are assessed to be Low with mitigation measures.

Nature**:** Social impacts associated with retrenchment including loss of jobs and source of income				
	Alternative site 1 (75MW)		**Alternative site 2 (35MW)**	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Extent	Local- district (2)	Local- district (2)	Local- district (2)	Local- district (2)
Duration	Short term (1)	Short Term (1)	Short term (1)	Short Term (1)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Highly Probable	Probable (3)	Highly Probable	Probable (3)

	(4)		(4)	
Significance	**Low (28)**	**Low (21)**	**Low (20)**	**Low (15)**
Status	Negative	Negative	Negative	Negative
Reversibility	Yes, assumes retrenchment packages are paid to all affected employees			
Irreplaceable loss of resources?	No			
Can impact be mitigated?	Yes			
Mitigation » Eskom 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; » There should be a decommissioning/ rehabilitation fund established as part of the environmental management programme, allocated to rehabilitate disturbed areas.				
Cumulative impacts Loss of jobs and associated loss of income etc. can impact on the local economy and other businesses.				
Re*sidual impacts* Loss of jobs and associated loss of income, can impact on local economy and other businesses.				

6.8.4 Comparative Assessment of the PV site alternatives

Social impacts for Alternative Site 1 and Alternative Site 2 will be similar. The only significant differences is that the construction phase will be longer for Alternative Site 1 as the size of the solar energy facility is larger (75 MW), and therefore the negative construction impacts such as disruption from nuisance impacts (traffic, noise and dust during construction) and safety and security impacts would be experienced for a longer period of time. However, the proposed development is located in an industrial area and the surrounding landowners have not raised any concerns in terms of nuisance impacts and safety and security impacts. Therefore these impacts are considered to be neutral and have low significance. With the Alternative Site 1 having a longer construction phase (18-24 months for a 75MW facility) in comparison to the Alternative Site 2 (8-12 months for a 35MW facility) more economic benefits will be experienced for a longer period of time such as; more employment opportunities, wages for a longer period, capital expenditure, skills development and economic multiplier benefits. Therefore these impacts are positive and consequently the **Alternative Site 1** would represent more socio-economic opportunities for the local area and therefore **preferred**.

Aspect	**Site Alternative 1: preferred alternative**	**Site Alternative 2**
Socio-Economic Impacts	» The negative construction impacts would be experienced for a longer	» The negative construction impacts would be

	period of time. » Impacts are considered to be neutral and have low significance due to the industrial nature of the environment. » More economic benefits will be experienced for a longer period of time such as; more employment opportunities, wages for a longer period, capital expenditure, skills development and economic multiplier benefits.	experienced for a shorter period of time. » Less economic benefits will be experienced for a shorter period of time.

6.8.5 Implications for Project Implementation

» The findings of the SIA undertaken for the proposed Lethabo PV Facility indicates that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The development of renewable energy has also been identified as key growth sector by the local municipality 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.
» 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.
» A skills development and training programme to be developed for the construction and operational phases.
» Any negative social impacts during construction and operational of the plant can be managed to acceptable levels.
» It is therefore recommended that the Lethabo PV Facility can be developed, subject to the implementation of the recommended enhancement and mitigation measures contained in the EMPr.

6.9 Assessment of the Do Nothing Alternative

The 'Do-Nothing' alternative is the option of not constructing the proposed Lethabo PV 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.

a) Socio-economic impact

Social: The impacts of pursuing the No-go Alternative are both positive and negative as follows:

» The benefits would be that there is no disruption from, nuisance impacts (noise and dust during construction), visual impacts and safety and security impacts. The impact is therefore neutral.
» There would also be an opportunity loss in terms of job creation, skills development and associated economic business opportunities for the local economy.

Foregoing the proposed development would not necessarily compromise the development of renewable energy facilities in South Africa. However, the socio-economic benefits for local communities would be forfeited.

New Business: The total wage bill for the construction for the 75M W facility on the Alternative Site 1 is estimated to be in the region of R13 million. The wage bill for the Alternative Site 2 will be less, in the region of R7 million for the 35 MW facility. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area. Some of the positive spin off effects that are to ensue from the project expenditure will be localised in the communities located near the site. The local services sector and specifically the trade, transportation, catering and accommodation, renting services, personal services and business services are expected to benefit the most because of project activities during the construction phase. These new business sales that will be stimulated as a result of the establishment of the project, albeit for a temporary period, will be lost if the no go alternative is pursued.

Employment: About 250-300 employment opportunities, for approximately 15-18 months will be created during construction. At least a third of these jobs will become available for the local communities.

Skills development: The establishment of the project will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. In terms of skills requirements, it is common that approximately 45% of the opportunities will be available to low-skilled workers (construction labourers, security staff etc.), 22% will be available to semi-skilled workers (drivers, equipment operators etc.), and 33% will be available to skilled personnel (engineers, land surveyors, project managers etc.).

The no-go alternative will therefore result in the above economic benefits **not being realised** and a subsequent loss of income and opportunities to local people. From this perspective the no-go alternative is not preferred.

b) Regional scale impact

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation.

» **Exploitation of South Africa's 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.

» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows Eskom to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for ~1 % of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 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 a renewable energy facility have significant potential for job creation skills development and associated economic multipliers for the local economy.

» **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.

At a project-specific scale, the pursuit of the no go alternative will eliminate the benefits of the proposed PV Facility at Eskom's Lethabo Power Station in enabling Eskom to diversify their energy mix and reduce their relative carbon footprint. Given South Africa's reliance on Eskom as a power utility, and on Eskom non-renewable energy sources, the benefits associated with Eskom also producing renewable energy is regarded as an important contribution to meeting national renewable energy, and climate change targets as well as enable Eskom to support the demand side management energy efficiency programme.

The "Do Nothing" alternative is therefore not preferred as Eskom and South Africa needs to diversify electricity generation sources, to which this project will contribute.

ASSESSMENT OF CUMULATIVE IMPACTS CHAPTER 7

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (GN 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". For cumulative effects analysis to assist the decision-maker and inform interested parties, it must be limited to effects that can be evaluated meaningfully (DEAT, 2004). Boundaries must be set so analysts are not attempting to measure effects on everything. Therefore, the cumulative impacts associated with the proposed Lethabo PV Solar Energy Facility have been viewed from two perspectives within this report:

» Cumulative impacts associated with the scale of the project.
» Cumulative impacts associated with other generation facilities within 30 km radius of the proposed facility.

Most development impacts are indirect, subtle, and cumulative or unfold over several years following construction or commencement of the operation of the development. While a possible mechanism for an impact to occur can usually be identified, the actual likelihood of occurrence and its severity are much harder to describe (Hill and Arnold, 2012).

The alignment of renewable energy developments with South Africa's Integrated Resource 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.

Due to the growth 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 minimised where required and possible. This chapter considers whether the proposed project's potential impacts become more significant when considered in combination with the other impacts associated with other generation / industrial development within the area.

7.1 Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing

and potential impacts eventuating from similar or diverse undertaking in the area[6]. The proposed Lethabo PV Solar Energy Facility is located directly within a 30 km radius of one renewable project development site, the CSP Demonstration Plant project. This project is situated south west of the proposed Lethabo PV Solar Energy Facility in Sasolburg. Details of the project are presented in **Table 7.1.**

Table 7.1: Evaluation of potential Cumulative Impacts associated with the Lethabo PV Solar Energy Facility and other renewable energy projects in the area.

Project Name	Location	Approximate distance from the site (measured from the centre)	Project Status
CSP Demonstration Plant Project	ChemCity ECO industrial Park (Sasolburg) Extention 69	~13km to the south west of the site	In process

In addition to these renewable developments, other industrial developments within close proximity of the development site include the following and are illustrated in **Figure 7.1**.

- Lethabo Coal Fired Power Station and
- Sasolburg Refinery

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

» Loss of vegetation and impacts on ecology;
» Impacts on avifauna;
» Impacts on soils and agricultural potential;
» Impacts on heritage resources;
» Visual impacts; and
» Social impacts.

In the sections below the potential impacts associated with other generation facilities within the vicinity of the facility/development 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.

[6] Definition as provided by DEA in the EIA Regulations.

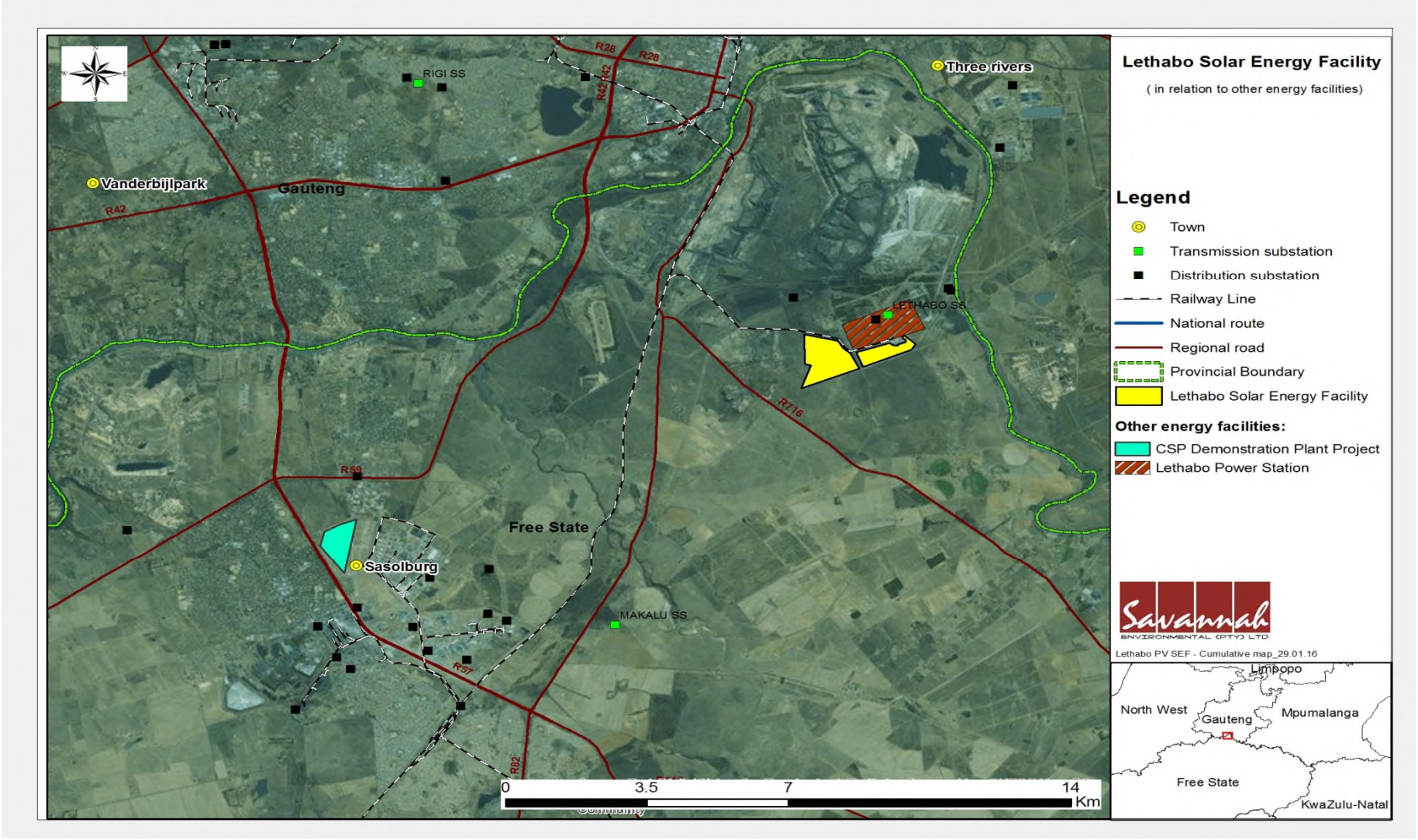

Figure 7.1: The Lethabo PV Solar Energy Facility in relation to other renewable developments within 30 km of the site

7.1.1 Ecological Processes (flora and fauna)

The study area exhibits relatively flat topography and relatively homogenous vegetation which are factors that reduce the overall cumulative impact on the area to a relatively low level in terms of the potential of the high local development intensity to disrupt broad scale ecological processes. The cumulative loss of habitat resulting from the current and other developments in the area are not likely to impact the country's ability to meet conservation targets and objectives as the affected vegetation types are widespread and have been impacted little by transformation to date.

Cumulative negative impacts on ecology related to transformation of land, disturbance and habitat loss may occur during construction as well as impacts on fauna and flora. This will result in the negative impacts on ecosystems site being managed to acceptable levels, with acceptable loss, and therefore in keeping with the principles of sustainable development. With the implementation of good environmental management practise during the life cycle of the project, cumulative impacts on ecology as a result of the establishment of similar industrial development will be to an acceptable level. Cumulative impacts on Ecology are summarised in **Table 7.2** and discussed below:

» Excessive clearing of currently declining species in the area, especially *Boophane disticha* could significantly impact local and regional population dynamics, as well as microhabitats and resources associated with these species available to other fauna and flora species. For the development, protected species should be relocated as far as possible.

» Excessive clearing of vegetation and landscaping will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of areas around sealed surfaces and continued erosion or degradation of the development area with associated degradation of lower-lying wetlands, contamination of wetlands and spread and establishment of invasive species.

» Rehabilitation and re-vegetation of all surfaces disturbed or altered during construction is desirable. Runoff from sealed surfaces or surfaces that need to be kept clear of vegetation to facilitate operation of a development needs to be monitored regularly to ensure that erosion control and stormwater management measures are adequate to prevent the degradation of the surrounding environment.

» Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent rangelands.

Table 7.2: Cumulative impacts on Ecology

Nature: Transformation of land, disturbance and habitat loss may occur during construction as well as impacts on fauna and flora		
	Without mitigation	**With mitigation**
Extent	Local- regional (3)	Local- Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (52)**	**Low-Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impacts be enhanced	Yes	
Enhancement: With the implementation of the environmental management practise in the EMPr throughout the life cycle of the project, as described in chapter 6 of this report, cumulative impacts on ecology as a result of the establishment of similar industrial development will be to an acceptable level.		
Residual impacts » N/A		

7.1.1 Cumulative impacts on Avifauna

In addition to the proposed Lethabo PV Solar Energy Facility, there are several activities (i.e. mining, energy generation, industrial, urban, agricultural and pastoral) that feature prominently both within the impact zone and the broader study area and are a significant source of existing disturbance to avifauna. These activities, coupled with the limited habitat diversity and degradation within the proposed development sites, are a likely cause of the absence of Red List species within the impact zone. Those species that have persisted have undoubtedly developed a tolerance for the current levels of disturbance and are likely to persist within the broader area despite the development of the solar facility.

The surrounding area is already heavily transformed as a result of mining, energy generation, and urban, agricultural and pastoral activities. However the areas that have been earmarked for development are not particularly sensitive and therefore the cumulative impact is deemed not to be significant. Cumulative impacts on Avifauna are summarised in **Table 7.3.**

Table 7.3: Cumulative impacts on Avifauna (with and without mitigation)

NATURE: Cumulative impact of the proposed Solar Photovoltaic (PV) project (i.e. PV panels and associated electrical infrastructure) and the existing developments and operations (i.e. mining, energy generation, industrial activities and residential developments) within the study area.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Site bound (1)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (18)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated? Yes		
Enhancement: It is important to note that very little empirical evidence exists that quantifies the current level of impact within the study area and the effect that mitigation (if any) has had on reducing these impacts. It is therefore speculated that the significance of the cumulative impact, as a result of the addition of the solar PV facility, may either be reduced if the mitigation measures, as discussed in Chapter 6, for each impact associated with the solar facility are implemented.		

7.1.2 Cumulative impacts on Surface water resources

Any loss of wetlands will add to the overall loss of wetlands in the region. If allowed to seed before control measures are implemented alien plants can easily colonise and impact on downstream users. Alien plants can form dense thickets which replace indigenous wetland habitats and their natural flow regime. This will result in a loss of wetland species and wetland functioning. Additional sediments would lead to increased turbidity downstream which will put additional stress on aquatic life and loss of sensitive biota. Downstream dams and weirs will face a reduction in capacity due to sedimentation. Cumulative impacts on Surface Water Resources are summarised in **Table 7.4.**

Table 7.4: Cumulative impacts on Surface Water Resources (with and without mitigation)

Nature: Loss of Habitat, establishment of alien vegetation, changes to sediment and stormwater regimes, downstream erosion, deterioration of water quality		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Permanent (5)	Short term (2)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (64)**	**Medium (30)**
Status (positive or negative)	Negative	Positive
Reversibility	No	
Irreplaceable loss of resources	Yes	
Can impacts be enhanced	Yes	
Enhancement: Ensure that the development footprint is as small as possible and does not encroach onto wetland boundaries or buffers. Ensure that stormwater management is in place so that no net change to stormwater energy enters the wetland. Monitoring for erosion on site and downstream should form part of an EMP. If erosion is recorded it should be rehabilitated. An alien vegetation management plan should form part of the EMP		
Residual impacts : Loss of wetland habitat, stream straitening and loss of temporary wetland zones downstream from the development		

7.1.3 Cumulative impacts on Soils and Agricultural Potential

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.

7.1.4 Cumulative Heritage Impacts

Archaeological and palaeontological sites are non-renewable and impact on any archaeological/palaeontological context or material will be permanent and destructive. Very sparse heritage and fossil traces were found on the site and from archaeological heritage perspective the observed resources may be regarded as being of generally low significance. Therefore, any impact in this regard is unlikely to add significantly to the cumulative impact of other developments in the area. It still remains important for each development to observe mitigation measures and to incorporate any sensitive heritage features into the layout plans where possible.

7.1.5 Visual impacts

The proposed development will take place within a landscape that is already heavily impacted by large-scale industrial development including mining operations and the

Lethabo Power Station. Therefore, the proportion of rural or riverine character in the area when compared with heavy industrial character will remain the same. Cumulative impacts of this new development to the larger area is likely to have low or no influence on the nature of the area due to existing heavy industrial and large mining areas located next to the project site. Existing industrial structures are likely to provide significant screening of the PV facility particularly from middle distance and distance views. From a distance small-scale development may also be viewed against a backdrop of larger industry which is also likely to make it less obvious. Visual Cumulative impacts on are summarised in **Table 7.5.**

Table 7.5: Impact table summarising the Visual cumulative impacts (with and without mitigation)

Nature: Impacts associated with development include Landscape degradation, Change of view for visual receptors and ocular impacts associated with glare.		
	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	No mitigation possible
Duration	Long term (4)	No mitigation possible
Magnitude	Small (0)	No mitigation possible
Probability	Very improbable (1)	No mitigation possible
Significance	**Low (6)**	No mitigation possible
Status (positive or negative)	Neutral	
Reversibility	Yes	
Irreplaceable loss of resources	The project can be dismantled. Therefore there will be no irreplaceable loss.	
Can impacts be enhanced	No mitigation measures are necessary	
Enhancement: No mitigation measures are necessary as existing vegetation will significantly break views of the alternatives 1 and 2		
Residual impacts » N/A		

7.1.6 Socio-economic impacts

Cumulative impacts have been considered as part of the social impact assessment (refer to Appendix H) and identified where relevant. The proposed Lethabo PV Solar Energy Facility has the potential to result in significant positive cumulative impacts; specifically with the establishment of a number of solar energy facilities and other industrial developments in the vicinity of Metsimaholo Local Municipality which will create a number of socio-economic opportunities for the area, and which, in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. Benefits to the local, regional and national economy through

employment and procurement of services could be substantial should many 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 incentivize operation and maintenance companies to centralize and expand their activities towards education and training.

Table 7.6.: Impact table summarising the Socio-Economic cumulative impacts (with and without mitigation)

Nature: An increase in employment opportunities, skills development and business opportunities with the establishment of more than one solar energy facility		
	Without mitigation	**With mitigation**
Extent	Local- regional (3)	Local- Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (33)**	**Medium (52)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement: The establishment of a number of solar energy facilities in the area does have the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities. The positive benefits will be enhanced if local employment policies are adopted and local services providers are utilised by the developers to maximise the project opportunities available to the local community.		
Residual impacts » Improved pool of skills and experience in the local area » Economic growth for small-scale entrepreneurs		

7.2 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.

Cumulative impacts of this new development to the larger area is likely to have low or no influence on the nature of the area due to heavy industrial and large mining areas located next to the project site and the general low sensitivity of the proposed development area. Existing industrial structures are likely to provide significant screening particularly from middle distance and distance views.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 8

Eskom is proposing to establish the Lethabo PV Solar Energy Facility of up to 75 MW and associated infrastructure on the Farm 1814 within the Lethabo Coal Fired Power Station boundary, approximately 25 km north-east of Sasolburg in the jurisdiction of Fezile Dabi District Municipality and Metsimaholo Local Municipality within the Free State Province.

The proposed facility will require a development footprint area of approximately ~162 ha (within a bigger farm portion which is 1000ha in extent), and will be comprised of the following primary elements:

» Solar panels (fixed/tracking technology) with an export capacity of up to 75 MW.
» 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 invertor/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 and overhead power line to facilitate the connection between the solar energy facility and the existing Lethabo Power Station
» Internal access roads
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity

The purpose of the proposed facility is to contribute towards Eskom's target to reduce self-consumption at their various owned or utilised sites by installing 150 MWp at their various power stations, offices and substations. The project is proposed as part of Eskom's plans to further reduce its self-consumption. The solar PV facilities will promote the reduction of Eskom's carbon footprint and support the demand side management energy efficiency programme.

Need and desirability: Solar PV is one of the most cost-effective, reliable and proven approaches for generating solar power. These systems emit no emissions and create no waste. PV facilities are considered to be a sustainable power solution for both the short and long-term. Solar power has numerous advantages over fossil-fuelled power generation and other renewable technologies, including the fuel source, sunlight, is delivered to the site for free; there is no waste, and therefore there is no need to contain or store waste products; and solar PV has the benefit of not requiring large amount water during the power production cycle.

Selection of the Project Area and development site: An internal investigation/screening process was undertaken by Eskom to assess the potential for installing PV facilities at Eskom power stations in Gauteng, Free-State, Mpumalanga and KwaZulu-Natal regions. This study provided an indication of the potential capacity, land availability, environmental constraints and electrical connection options for each of the power stations including Arnot, Duvha, Kendal, Kriel, Lethabo, Majuba, Matimba, Tutuka, Camden, Komati and Ingula. The sites within the Arnot, Duvha, Lethabo, Majuba and Tutuka power stations were selected as the first sites for consideration within EIA processes.

The following factors have been considered in determining a preferred site for PV solar development including:

» Land availability and environmental constraints i.e. ecological sensitive areas; and
» Technical feasibility – taking into account all electrical considerations including point of connection and electrical infrastructure available

At screening level, it was concluded by Eskom that the Lethabo Power Station has land available for a large PV facility. The land profile of the site is predominantly flat with little vegetation and trees and a minimal number of power lines running through some of the preferred site. The point of electrical connection is situated in close proximity to the land area and there are no foreseen risks from an environmental perspective at a high level.

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), Eskom 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 Lethabo PV 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 process 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 as well as the extent of studies required within the EIA Phase were defined.
» *EIA Phase* – potentially significant biophysical and social impacts[7] 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 an Environmental Management Programme (EMPr) (refer to **Appendix M**).

The Conclusions and Recommendations of this EIA for Lethabo PV Solar Energy Facility 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 Lethabo PV Solar Energy Facility are provided in this Chapter.

8.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within **Appendices D-K** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Lethabo PV 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. Potential impacts which could occur as a result of the proposed project are summarised in the sections which follow.

The environmental impacts identified and assessed to be associated with the proposed PV facility include:

» Impacts on wetlands.
» Impacts on ecology and habitats occurring on the site.
» Impacts on heritage and paleontological resources.
» Impact on avifauna.
» Visual impacts
» Social and economic impacts.

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

The sections which follow provide a summary of the environmental impacts associated with the proposed project, as identified through the EIA, as well as a mitigation strategy in order to reduce the impacts.

8.2 Summary of All Impacts

A summary of the potential impacts identified and assessed through the EIA process in terms of the preliminary PV layout of up to 75 MW and associated infrastructure, are discussed below:

Impacts on wetlands:
Two **wetlands**, both hillside seeps, were recorded in the study area. The wetlands were found to have a **moderate** importance and sensitivity to changes in flow regime and lacked sensitive biota. Potential impacts to be taken into account include:

» Loss and disturbance of wetland habitat and fringe vegetation.
» Introduction and spread of alien invasive vegetation.
» Changes in the amount of sediment entering the system.
» Changes in water quality due to toxic contaminants and increased nutrient levels entering the system.
» Changes in water flow regime due to the alteration of surface characteristics.

It is preferred from a wetland perspective that the proposed Lethabo Solar Photovoltaic Facility be constructed on site Alternative 1. In order to mitigate the potential impacts on the wetland it is recommended that development within these wetland areas is avoided and that a 30m buffer is set to protect wetland functionality. From the conclusions of the detailed Wetland study undertaken no impacts of high potential significance that cannot be mitigated to a low level were identified within the development footprint. Overall and with the suggested mitigation measures implemented, the **wetland** impacts of the development are likely to be of **moderate to low significance** and no impacts of high significance are likely with mitigation. As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

Impacts on ecology
The selected property falls within the Central Free State Grassland (GH 6) as defined by Mucina and Rutherford (2006). Three vegetation associations could be identified within the proposed development areas namely:

» Association 1: *Digitaria eriantha* (Transformed Grassland). This grassland has a low sensitivity rating.
» Association 2: *Paspalum urvillei – Verbena bonariensis (*Grassland). This grassland has a low sensitivity rating.
» Association 3: *Cynodon dactylon* - This grassland has a medium sensitivity rating.

115 indigenous plant species could be verified on site, with an additional 22 alien invasive species (excluding planted exotic trees). *Boophane disticha* plants were encountered on the study site and are protected by the Nature Conservation Ordinance 8 of 1969 Schedule 6: Protected Species (Refer to Appendix F of this EMPr).

It is not expected that the development will compromise the survival of or significantly impact any flora or terrestrial vertebrate species on the study area or beyond. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented; and the associated integrity of surrounding wetlands. Overall and with the suggested mitigation measures implemented, the **ecological** impacts of the development are likely to be of **moderate to low significance.** As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

Impacts on Avifauna

Given the presence of existing habitat degradation and disturbance associated with the mining, energy generation and industrial activities that are prevalent in the study area and surrounds, and due to the relatively low importance of the site for many bird species, most impacts are seen as acceptable for avifauna. The overall impact on **Avifauna** is likely to be of a **medium significance prior to mitigation**. This could be reduced to low negative significance following the implementation of mitigation measures, which includes a buffer around the wetlands. . It is anticipated that the proposed Lethabo Solar Photovoltaic Facility can be constructed at either of the two proposed sites with acceptable levels of impact on the resident avifauna.

Impacts on Soils, Land Capability and Agricultural Potential

The overall impact on **Soils and Agricultural Potential** is likely to be of a **medium to low significance** prior to mitigation. This could be reduced to low negative significance following the implementation of mitigation measures. Alternative 1 has a distinct difference in soils between the northern and southern halves. The northern half has largely disturbed, poor quality soils while the southern half has better agriculture potential, especially in the south-west. Alternative 2 has a wetland which should be avoided completely. Based on the soil survey, it is recommended and preferred that the proposed PV facility be developed on Alternative 1 site, if possible avoiding the south-west corner with the Av type soil.

Impacts on Heritage and Paleontological Resources

The overall impact on the **heritage resources** is likely to be of a **low significance** as very sparse heritage traces (of low heritage value) were found during the field survey. Based on the results of the study there are no significant archaeological risks associated with the proposed solar facility at either site considered. However graves can be expected anywhere on the landscape and the low archaeological visibility during the survey could result in graves not identified in the study area.

Impacts on Visual quality of the area

The overall visual impact is likely to be of a low significance. The proposed development will take place within a landscape that is already heavily impacted by large scale industrial development including mining operations and the Lethabo Power Station. The most sensitive landscape areas include the rural landscape to the east of the Vaal River, the urban landscape to the north of the Vaal River and the Vaal River Corridor itself. The proposed development of Alternative Sites 1 and 2 could be visible to residential receptors to the north of the Vaal River. Development of Alternative 2 is likely to be visible to a small number of farmsteads to the east of the Vaal River and the development of Alternative Site 1 could be visible to a small section of adjacent regional roads to the west. The assessment has shown however that these impacts will be largely screened by existing vegetation and are likely to be negligible given the existing industrial context within which the views will be seen. Areas to the east of the arrays could be affected to a small degree by glare during early mornings in February, March, September and October. The area impacted is not highly developed nor does a major route run through it. The impact is also so minor that it is likely to be un-noticeable and is therefore negligible.

Social and Economic Impacts

The overall social impact is likely to be of a medium significance in terms of positive impacts, and a low medium significance in terms of the negative impacts. From a social perspective it is concluded that the proposed Lethabo Solar Energy Facility Alternative Site 1 or Alternative Site 2 could be developed subject to the implementation of the recommended mitigation measures and management actions contained in the report. The proposed development represents greater positive social potential than negative implications due to the development being located in an industrial area.

From the analysis of alternatives it can be concluded that Alternative Site 1 is the socially preferred alternative as this development would bring more positive socio-economic benefits to the local area for a longer period of time; in terms of job creation, capital expenditure, wage bill expenditure and a higher amount of MWs of renewable energy. Therefore the Alternative site 1 is the socially preferred option based on the greater socio-economic benefits the development will provide to the local area with minimal negative social impacts due to the site being located in an industrial area.

Evaluation of the Potential Issues with Associated Infrastructure - Invertors, and Internal Access Roads

In order to connect the Lethabo PV Solar Energy Facility to the power grid, the Eskom intends on building on-site substation and power line for which will connect into the existing substation located on the site.

Potential issues identified to be associated with a proposed overhead power line, substation, access roads and invertors include impacts on flora, fauna and ecological processes, impacts on avifauna as a result of collisions and electrocutions, heritage and visual impacts. There are no fatal flaws associated with the associated infrastructure of the Lethabo PV Solar Energy Facility site on Farm 1814.

8.3. Recommendation regarding Preferred Alternative

From the conclusions of the studies undertaken as part of the EIA process, Alternative 1 is nominated as the preferred alternative for implementation. This recommendation is based on the following:

» Impacts on wetlands will be reduced with the implementation of this alternative and;
» Development would bring more positive socio-economic benefits to the local area for a longer period of time; in terms of job creation, capital expenditure, wage bill expenditure and a higher amount of 75 MWs of renewable energy.

8.4. 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 proposed Lethabo PV Solar Energy Facility is located directly within a 30km radius of two renewable project development sites, one being a CSP Project. Cumulative impacts of this new development to the larger area is likely to have **low** or no influence on the nature of the areas due to heavy industrial and large mining areas located next to the project site. Existing industrial structures are likely to provide significant screening particularly from middle distance and distance views. From a distance small scale development may also be viewed against a backdrop of larger industry which is also likely to make it less obvious.

8.5. Environmental Sensitivity and Micro-siting

In response to the identified need to adequately manage impacts within sensitive areas identified on the site development footprint, and in order to demonstrate the ability of the project to adhere to recommended mitigation measures, Eskom has developed a best practice mitigation strategy with regards to the facility layout.

The EIA recommendations have been taken into account by Eskom and the PV facility layout has been optimised to avoid the encroachment of wetlands on Site Alternative 1, in order to maintain optimal wetland functionality in the study area. The refinement of the layout results in a decrease in the net generating capacity of the PV facility, from 75 MW to 73 MW. This refined layout will still be able to meet the main objective of supplementing Eskom's self consumption at the Lethabo Power station. The required mitigation measures are illustrated in Figure 8.1 and Figure 8.2 and represent a positive outcome in terms of impact reduction and mitigation and the optimal layout for the facility.

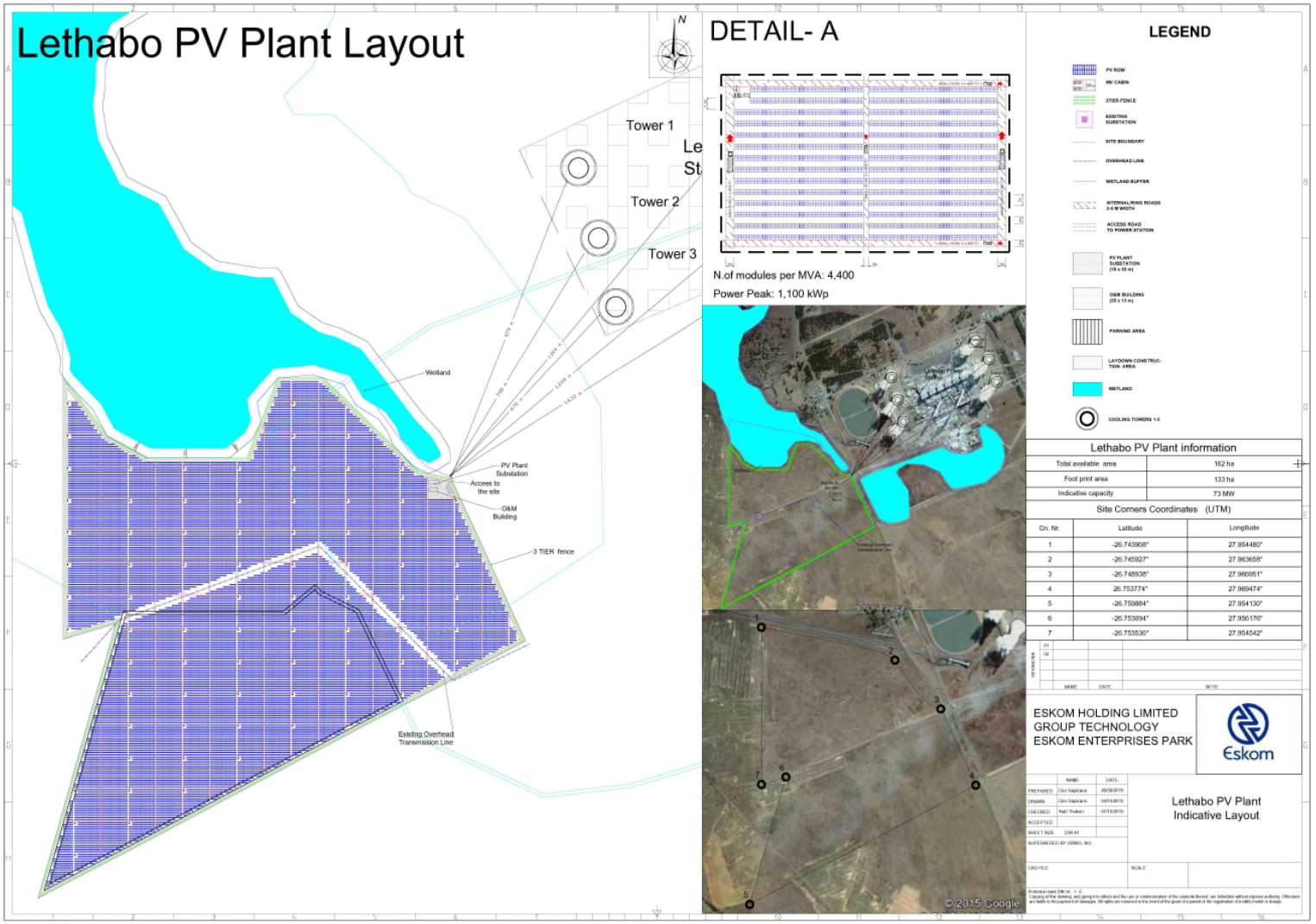

Figure 8.1: The optimised Layout development footprint of the proposed Lethabo PV Solar Energy Facility

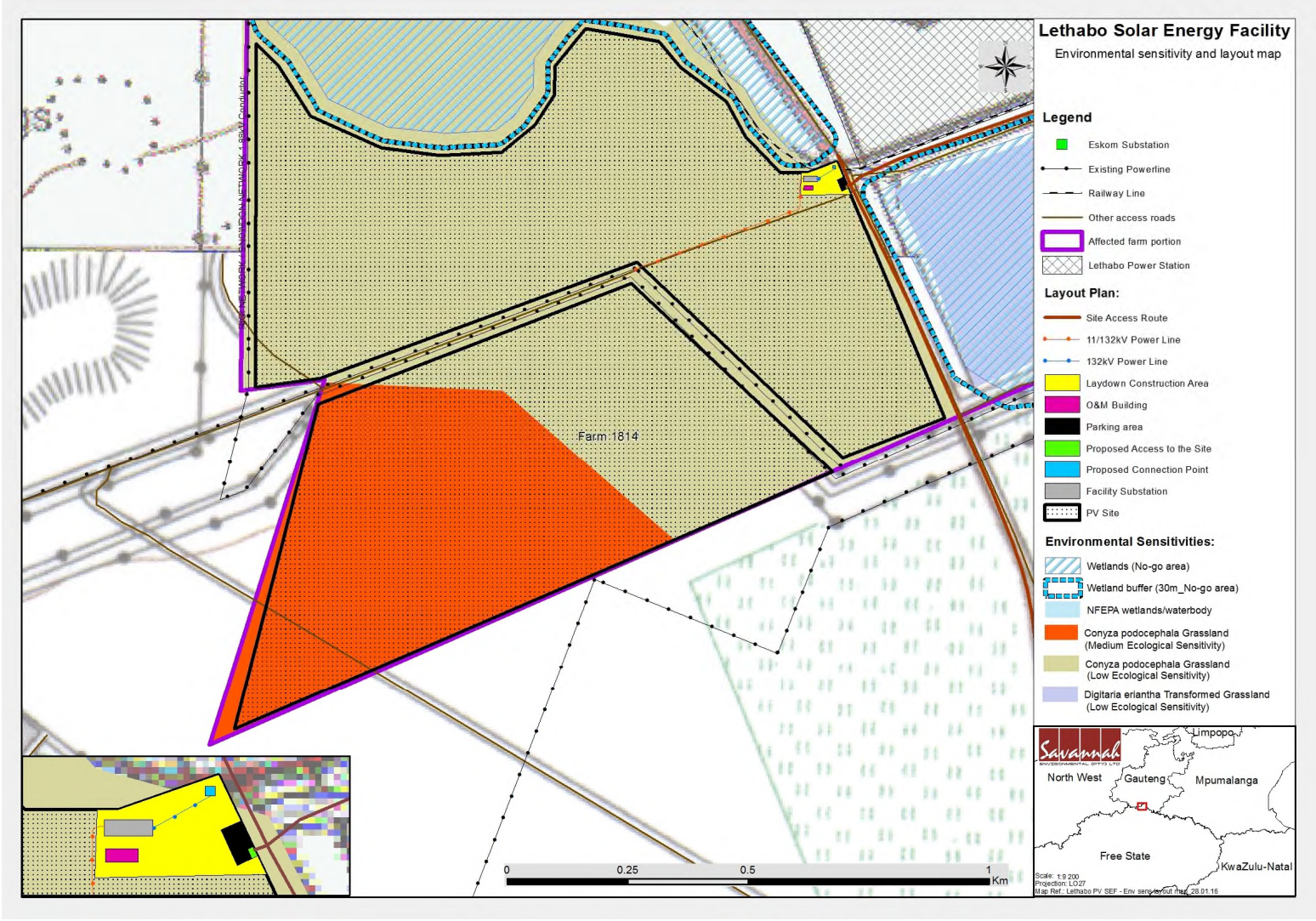

Figure 8.2: The final/optimised layout map superimposed (overlain) on the environmental sensitivity for the Lethabo PV Solar Energy Facility

8.6 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. The cost of loss of biodiversity must be minimised on the Lethabo PV site through the careful location of the development to avoid key areas supporting biodiversity of conservation importance.
» Direct loss of wetland habitat due to the construction and utilisation of land for the PV project. The cost of loss of wetland habitat must be minimised on the Lethabo PV site through the implementation of 30 m buffers around the wetland and careful location of the development to avoid key areas supporting 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 Lethabo Power Station, 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 EMPr are adhered to.

Benefits of the project include the following:
» The main benefit of the proposed PV facility at Eskom's Lethabo Power Station is to enable Eskom to diversify their energy mix and reduce their relative carbon footprint.
» 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.
» 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.

8.7. Overall Conclusion (Impact Statement)

The technical viability of establishing the Lethabo PV Solar Energy Facility on the Farm 1814 within the Lethabo Coal Fired Power Station boundary has been established by

Eskom. The positive implications of establishing the Lethabo PV Solar Energy Facility on the identified site include the following:

» To enable Eskom to diversify their energy mix and reduce their relative carbon footprint at the Lethabo Power Station.
» 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.
» Promotion of clean, renewable energy in South Africa.
» Creation of local employment, business opportunities and skills development for the area.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. These mitigation measures have been taken into account and an optimised layout has been produced (**Figure 8.1 and Figure 8.2**). Environmental specifications for the management of potential impacts are detailed within the Environmental Management Programme (EMPr) for the Lethabo PV Solar Energy Facility included within **Appendix M**. With reference to the information available at this planning approval stage in the project cycle, the confidence in the environmental assessment undertaken is regarded as high.

8.8. 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 Lethabo PV Solar Energy Facility project can be mitigated to an acceptable level. As per the requirements of the NEMA (Act 107 of 1998), this EIA has identified and assessed project alternatives and the potential environmental impacts associated with the proposed PV facility. Alternative Site 1 is anticipated to have the least significant impact on ecological and wetland resources and generate greater positive impacts from a Social perspective (in terms of economic impact and jobs) and is the preferred alternative. In terms of this conclusion, the EIA project team support the decision for environmental authorisation on Alternative site 1. The optimised layout shown in **Figure 8.1 and Figure 8.2** is acceptable and the following conditions would be required to be included within an authorisation issued for the project:

- All mitigation measures detailed within this report and the specialist reports contained within Appendices D to K must be implemented.
- Following the final design of the facility to include the 30 m buffer around the identified wetlands, a final layout must be submitted to DEA for review and approval prior to commencing with construction.
- The Environmental Management Programme (EMPr) as contained within Appendix M of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be the main key in achieving the appropriate environmental management standards as detailed for this project.
- If any protected plant or tree species are required to be removed 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 as the proposed facility is within 500m of a wetland. The viability and sustainability of this resource should however first be investigated in consultation with DWS.
- 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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