ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
ENVIRONMENTAL IMPACT REPORT

WOODHOUSE SOLAR 1 PV FACILITY, NORTH WEST PROVINCE

DEA REF NO.: 14/12/16/3/3/2/863

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

MAY 2016

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/863
Title	:	Environmental Impact Assessment Report: Woodhouse Solar 1 PV Facility, Northern Cape
Authors	:	Savannah Environmental (Pty) Ltd Lisa Opperman Karen Jodas Gabriele Wood
Sub-consultants	:	Savannah Environmental Eco-Care Consultancy Simon Todd Consulting Heritage Contracts and Archaeological Consulting CC (HCAC) National Museum of Bloemfontein Afzelia Environmental Consultants Neville Bews and Associates
Client	:	Genesis Woodhouse Solar 1 (Pty) Ltd
Report Status	:	Environmental Impact Assessment Report for review
Review Period	:	03 May 2016 – 02 June 2016

When used as a reference this report should be cited as: Savannah Environmental (2016) Environmental Impact Assessment Report: Proposed Woodhouse Solar 1 PV Facility, North West Province.

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Genesis Woodhouse Solar 1 (Pty) Ltd is proposing the development of the Woodhouse Solar 1 PV Facility as well as all associated infrastructure on a site to be located within the Remaining Extent of the Farm Woodhouse 729. The proposed project site is located approximately 10km south east of the town of Vryburg in the Naledi Local Municipality and within the greater Dr Ruth Segomotsi Mompati District Municipality, North West Province. A second PV facility is also proposed to be developed on the project site which will be known as the Woodhouse Solar 2 PV Facility (DEA Ref.: 14/12/16/3/3/2/865). This development is to be assessed through a separate EIA process.

The project site is considered suitable and favourable by the developer for the construction of the Woodhouse Solar 1 PV Facility from a technical perspective due to the following site characteristics:

» **Climatic conditions:** Climatic conditions determine the economic viability of a solar energy facility as it is directly dependent on the annual direct solar irradiation values for a particular area.
» **Topographic conditions:** The local site conditions are optimum for a development of this nature. A level surface area (i.e. with a minimal gradient) is preferred for the installation of a PV facilities. The slope of the proposed development area is predominantly flat.
» **Extent of the site:** Significant land area (~240ha) is required for the proposed Woodhouse Solar 1 PV Facility. The project site (i.e. the Remaining Extent of the farm Woodhouse 729, with an extent 2264ha) is larger than the area required for development which allows for the avoidance of any identified environmental and/or technical constraints.
» **Proximity:** This site is located in close proximity to feasible grid connections, which minimises the need for a long power line connection. This is preferred from an environmental and technical perspective.

The nature and extent of the Woodhouse Solar 1 PV Facility, as well as the potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this EIA report. The EIA Report consists of nine chapters, which include:

» **Chapter 1** provides background to the project and the environmental impact assessment, and an introduction to the rationale behind the selected project site, development area and technology proposed.
» **Chapter 2** provides the project description, need and desirability, project site and development area selection information and identified project alternatives.
» **Chapter 3** outlines the strategic regulatory and legal context for energy planning in South Africa and specifically for 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 site and 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 the potential for 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.

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

The release of a EIA Report for a 30-day review period provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report will incorporate all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project

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DEA REQUIMENT FOR THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Savannah Environmental has compiled a table (refer to Table 1 below) which outlines the DEA requirements as outlined in the acceptance of the scoping report dated 16 February 2016, and where in the final EIR the requirements have been addressed within this report for ease of reference. The acceptance of the scoping report is included in **Appendix B.**

TABLE 1: INFORMATION REQUESTED BY DEA

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
General		
a)	All comments and recommendations made by all stakeholders and Interested and Affected Parties (I&APs) in the draft SR and submitted as part of the final SR must be taken into consideration when preparing an Environmental Impact Assessment report (EIAr) in respect of the proposed development. Please ensure that all mitigation measures and recommendations in the specialist studies are addressed and included in the final EIAr and Environmental Management Programme (EMPr).	i. All comment received from I&APs are included in Appendix C ii. All mitigation measure and recommendations in specialist reports forms part of the EIAr report chapter 6 and 8, and the EMPr (**Appendix J**)
b)	Please ensure that comments from all relevant stakeholders are submitted to the Department with the final EIAr. This includes but is not limited to the North West Department of Rural, Environmental and Agricultural Development, the Department of Agriculture, Forestry and Fisheries (DAFF), the provincial Department of Agriculture, the South African Civil Aviation Authority (SACAA), the Department of Transport, the Naledi Local Municipality, the Dr Ruth Segomotsi Mompati District Municipality, the Department of Water and Sanitation (DWS), the South African National Roads Agency Limited (SANRAL), the South African Heritage Resources Agency (SAHRA), the Endangered Wildlife Trust (EWT), BirdLife SA, the Department of Mineral Resources, the Department of Rural Development and Land Reform, the Department of Environmental Affairs: Directorate Biodiversity and Conservation, and the Square Kilometre Array (SKA).	All comments received from the relevant Departments will form part of the Final EIA report.
c)	You are also required to address all issues raised by Organs of State and I&APs prior to the submission of the EIAr to the Department.	Issues raised by Organs of State and I&APs will form part of the Final EIA report prior to the submission to the Department.
d)	Proof of correspondence with the various stakeholders must be included in the EIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	Proof of correspondence with the various stakeholder associated with the project is included in **Appendix C.**
e)	In addition, the following additional information is required for the EIAr: i. Following a review of the SR and the application form received in Junauary 2016, this Department advises the application form must be amended and resubmitted to	i. Noted. However, this activity no longer applies to the project as the development will not be located within a watercourse or within 32m of a watercourse.

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	include the correct listed activities. As such the Department advises that the following listed activity and the relevant issue be addressed: <u>GR R. 985: Item 14:</u> "The development of (xii) infrastructure or structures with a physical footprint of 10 square meter or more where such development occurs (a) within a watercourse or (b) within 32meters of a watercourse measured from the edge of the watercourse (e) in North West (i) outside urban areas in (ee) Critical Biodiversity Areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans". Please note that GN R. 985: Activity 14 (ee) does not refer to "Critical Biodiversity Areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans". This must be amended and form part of the EIAr. ii. The EIAr must include the following: GN R.983 Item 19: With regards to infilling or excavation of watercourses for the construction of the PV Solar Energy Facility, this Department requires the applicant to provide an indication of the preferred and alternative locations from which the material used for infilling will be sourced and where the excavated material will be stored and/or disposed of. In addition, the impacts associated with this activity must be adequately assessed in the EIAr. iii. The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for. iv. The listed activities represented in the EIAr and the application form must be the same and correct. v. It is imperative that the relevant authorities are continuously involved throughout the EIA process as the development property possibly falls within geographically designated areas in terms of all activities under GN R. 985. Written comments form the relevant authorities must be obtained and submitted to this Department. In addition, a graphical representation of the proposed development within the respective geographical areas must be provided. vi. The EIAr must provide the technical details of the proposed facility in a table format as well as their description andor dimensions. A sample for minimum information required is listed under point 2 of the EIA information require for solar energy facilities. vii. 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. viii. The EIAr must provide the following:	ii. This listed activity is not considered as relevant for the development of the project as all distrurbance to watercources will be avoided by the development and the infrastructure of the facility. iii. Each listed activity applied for is assessed in Chapter 6. iv. The listed activities in the EIAr and the amended application form are the same and correct v. Relevant authorities have been provided with opportunities to provide comment on the geographically designated areas, and will continue to be provided with the opportunity to provide input. A graphical representation of the proposed development within the respective geographical areas is included in Chapter 5. vi. The technical information of the Woodhouse Solar 1 PV Facility is included in Chapter 2. vii. The corner coordinated of the development site and the start, middle and end points of the linear activities is included in **Appendix K**. viii. The layout for the development including all infrastructure is included in **Appendix K**. A description of all the associated infrastructure is included in Chapter 2. ix. A comments and response report in accordance with Appendix 2 h(iii) of the EIA Regulations, 2014, is included in **Appendix C**. x. Detail regarding the PPP is included in Chapter 4. xi. Detail of the future plans of the site after decommissioning is included in Chapter 2. xii. Information on the services required for the development is included in Chapter 2. Proof of agreement for these services will be provided to the Department. xiii. The need and desirability of the development of the Woodhouse

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	- 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; and; ➢ 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. ix. The EIAr must also include a comments and response report in accordance with Appendix 2 h (iii) of the EIA Regulations, 2014. x. The EIAr must include the detail inclusive of the PPP in accordance with Regulation 41 of the EIA Regulations. xi. 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. xii. 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 theses agreements must be provided. xiii. 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. xiv. 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 e.g. roads. The layout map must indicate the following: • PV positions and its associated infrastructure; • Permanent laydown area footprint; • Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible); • Wetlands, drainage lines, rivers, stream and water crossing of roads and cables indicating the type of bridging structures that will be used; • The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its	Solar 1 PV Facility within the greater Vryburg area, as well as the proposed site is included in Chapter 2. xiv. A copy of the final site layout map and alternatives is included in Chapter 8 and **Appendix K**. xv. An environmental sensitivity map is included in **Appendix K.** xvi. A final layout map overlain with the environmental sensitivities is included in **Appendix K**. xvii. A shapefile of the preferred development layout/footprint will be provided ti the Department with the submission of the final EIA report.

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	associated infrastructure; • Substation(s) andlor transformer(s) sites including their entire footprint; • Connection routes (including pylon positions) to the distribution/transmission network; • All existing infrastructure on the site, especially roads; • Buffer areas; • Buildings, including accommodation; and • All "no-go" areas. xv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process. xvi. A map combining the final layout superimposed (overlain) on the environmental sensitivity map. xvii. A shapefile of the preferred development layout/footprint must be submitted to this Department. The shapefile must be created using the Hartebeesthoek 94 Datum and the data should be in Decimal Degree Format using the WGS 84 Spheroid. The shapefile must include at a minimum the following extensions i.e .. shp; .shx; .dbf; .prj; and, .xml (Metadata file). If specific symbology was assigned to the file, then the .avl and/or the .Iyr file must also be included. Data must be mapped at a scale of 1: 10 000 (please specify if an alternative scale was used). The metadata must include a description of the base data used for digitizing. The shapefile must be submitted in a zip file using the EIA application reference number as the title.	
ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)		
f)	The Environmental Management Programme (EMPr) to be submitted as part of the EIAr must include the following: i. All recommendations and mitigation measures recorded in the EIAr and the specialist studies conducted. ii. The final site layout map. iii. Measures as dictated by the final site layout map and micro-siting. iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process. v. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map. vi. An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken. vii. A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed.	i. All recommendations and mitigation measures recorded in the EIAr and the specialist studies conducted are included in the EMPr document – refer to **Appendix J**. ii. Included in EMPr **– Appendix J** iii. Included in EMPr - **Appendix J** iv. Included in EMPr – **Appendix J** v. Included in EMPr – **Appendix J** vi. An alien invasive management plan is included in the EMPr as **Appendix E**. vii. Refer to **Appendix G** of the EMPr. viii. Refer to **Appendix F** of the EMPr ix. Refer to EMPr – **Appendix E** x. Refer to **Appendix H** of the EMPr xi. Refer to **Appendix H** of the EMPr xii. Refer to **Appendix I** of the EMPr xiii. Refer to **Appendix J** of the EMPr xiv. An erosion management plan for monitoring and rehabilitating erosion is included in the EMPr as

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.	**Appendix J.**
	viii. A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.	xv. Refer to the EMPr – Objective 18.
	ix. An open space management plan to be implemented during the construction and operation of the facility.	xvi. Refer to the EMPr .
	x. A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.	
	xi. A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment.	
	xii. A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	
	xiii. A fire management plan to be implemented during the construction and operation of the facility.	
	xiv. An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.	
	xv. An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary	

NO.	INFORMATION REQUIREMENTS	CROSS REFERENCE IN THIS EIA REPORT
	measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems. xvi. Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	
g)	The EAP must provide detailed motivation if any of the above requirements is not required by the proposed development and not included in the EMPr.	All the above requirements are met within this EIAr and EMPr document.
h)	It is noted by this Department that Savannah Environmental (Pty) Ltd has been appointed by Genesis Woodhouse Solar 1 to undertake the Ecological Impact Assessment. Please note that the internal data, information or internal study can be used, attached and referred to in the SR, provided that it is not referred to as a specialist study. Furthermore, the applicant can appoint an external independent specialist to conduct such studies, or alternatively, internal specialists can be appointed to conduct specialist investigations, however, the reports must be sent for independent review by external independent specialists.	The Ecological Impact Assessment was undertaken by Eco-Care Consultancy and not Savannah Environmental.
i)	The EIAr must include a cumulative impact assessment of the facility since there are other facilities in the region. The specialist studies as outline in the PoSEIA which is incorporated as part of the SR must also asses the facility in terms of potential cumulative impacts.	A cumulative Impact Assessment is included as Chapter 7 as a whole.

INVITATION TO COMMENT ON THE EIA REPORT

Members of the public, local communities and stakeholders are invited to comment on the EIA Report for the Woodhouse Solar 1 PV Facility which has been made available for 30-day review and comment period at the following locations from **03 May 2016 – 02 June 2016**:

» Vryburg Public Library
» www.savannahSA.com

Please submit your comments to
Gabriele Wood of Savannah Environmental (Pty) Ltd PO Box 148, Sunninghill,2157, Gauteng Tel: 011 656 3237 Fax: 086 684 0547 E-mail: gabriele@savannahsa.com
The due date for comments on the Draft EIA Report is **02 June 2016**

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

EXECUTIVE SUMMARY

Genesis Woodhouse Solar 1 (Pty) Ltd propose the development of a commercial photovoltaic (PV) solar energy facility (known as the Woodhouse Solar 1 PV Facility) on the Remaining Extent of the farm Woodhouse 729. The proposed project site is located approximately 10km south east of the town of Vryburg and falls under the jurisdiction of the Naledi Local Municipality and within the greater Dr Ruth Segomotsi Mompati District Municipality in the North West Province (refer to **Figure 1**). The proposed facility and associated infrastructure (i.e. the development footprint) would occupy an area of approximately 240ha.

The Solar Facility will have a contracted capacity of 100MW which will accommodate several arrays of photovoltaic (PV) panels and associated infrastructure. The project will comprise of the following typical infrastructure:

» Arrays of single axis PV tracking or fixed tilt PV panels with a generating capacity of up to 100MW.
» Mounting structures to support the PV panels.
» On-site inverters to convert the power from a direct current to an alternating current the power and a substation to facilitate the connection between the solar energy PV facility and the Eskom electricity grid.
» A new 132kV power line between the on-site substation and the Eskom grid connection point. Four alternatives are being considered for the grid connection:
  * *Alternative 1*: A direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property (i.e. on the Remaining Extent of the farm Woodhouse 729);
  * *Alternative 2*: A direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property;
  * *Alternative 3:* A turn-in turn-out connection to the existing Delareyville Munic / Vryburg 1 88kV Feeder located along the northern boundary of the affected property; and
  * *Alternative 4:* A turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line, to be constructed by Eskom.
» Cabling between the project components, to be laid underground where practical.
» Offices and workshop areas for maintenance and storage.
» Temporary laydown areas.
» Internal access roads and fencing around the development area.

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

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

OVERALL CONCLUSION (IMPACT STATEMENT)

The technical viability of establishing a solar energy facility with a net generating capacity of 100MW on a site located on the Remaining Extent of the farm Woodhouse 729 has been established by Genesis Woodhouse Solar 1 (Pty) Ltd. The positive implications of establishing the Solar Facility on the identified site include the following:

» The potential to harness and utilise solar energy resources within the North West Province
» The project will assist the South African government in reaching their set targets for renewable energy.
» The project will assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project will assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business
» The National electricity grid in the North West Province will benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed PV facility from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts have been reduced by implementing the mitigation measures recommended by the specialist team during the EIA process, and this specifically included the consideration of the facility layout in relation to sensitivities identified. The avoidance of areas of sensitivity is illustrated by the facility layout drawing included as **Figure 8.2**. The project has considered constraints, and is considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) for the PV facility (included within **Appendix J**).

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

OVERALL RECOMMENDATION

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

The optimised development footprint, and the preferred grid connection (power line) alternative, i.e. Alternative 1 is presented in **Figure 8.2** and avoids the high sensitivities identified on the site, and are nominated as the preferred alternatives following the full assessment through this EIA process. The reasons for this are below:

- The optimised development footprint/layout avoids all the high sensitive areas, and their associated buffers, located within the development area. The location of the development footprint within the broader project site is optimal for grid connection as the grid connection alternatives, and the preferred grid connection alternative, are located in close proximity.
- Preferred grid connection alternative: a direct connection to the Eskom Bophirima substation located within the project site. This connection is considered as acceptable in all the specialist studies undertaken for the development and is also considered as the most technically suitable.

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

- Disturbed areas should be rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
- During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
- All mitigation measures detailed within this report as well as the specialist reports contained within **Appendices D to I** are to be implemented.
- The draft Environmental Management Programme (EMPr) as contained within **Appendix J** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed PV facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental management standards as detailed for this project.
- A comprehensive stormwater management plan should be compiled for the developmental footprint prior to construction.
- An ecological walk through survey for the PV plant and associated infrastructure (including the grid connection power line route) must be undertaken prior to construction.
- A permit to be obtained for removal of protected trees and provincially protected flora that are affected.
- A post construction (once operational) site walk over the facility footprint be conducted by an avifaunal specialist to determine whether a long-term avifaunal mortality monitoring programme is required for the site.
- The relevant Water Use License for water uses to be obtained from DWS.
- Applications for all other relevant and required permits required to be obtained by Genesis Woodhouse Solar 1 (Pty) Ltd must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to any heritage sites, disturbance of protected vegetation and protected trees, and water uses.

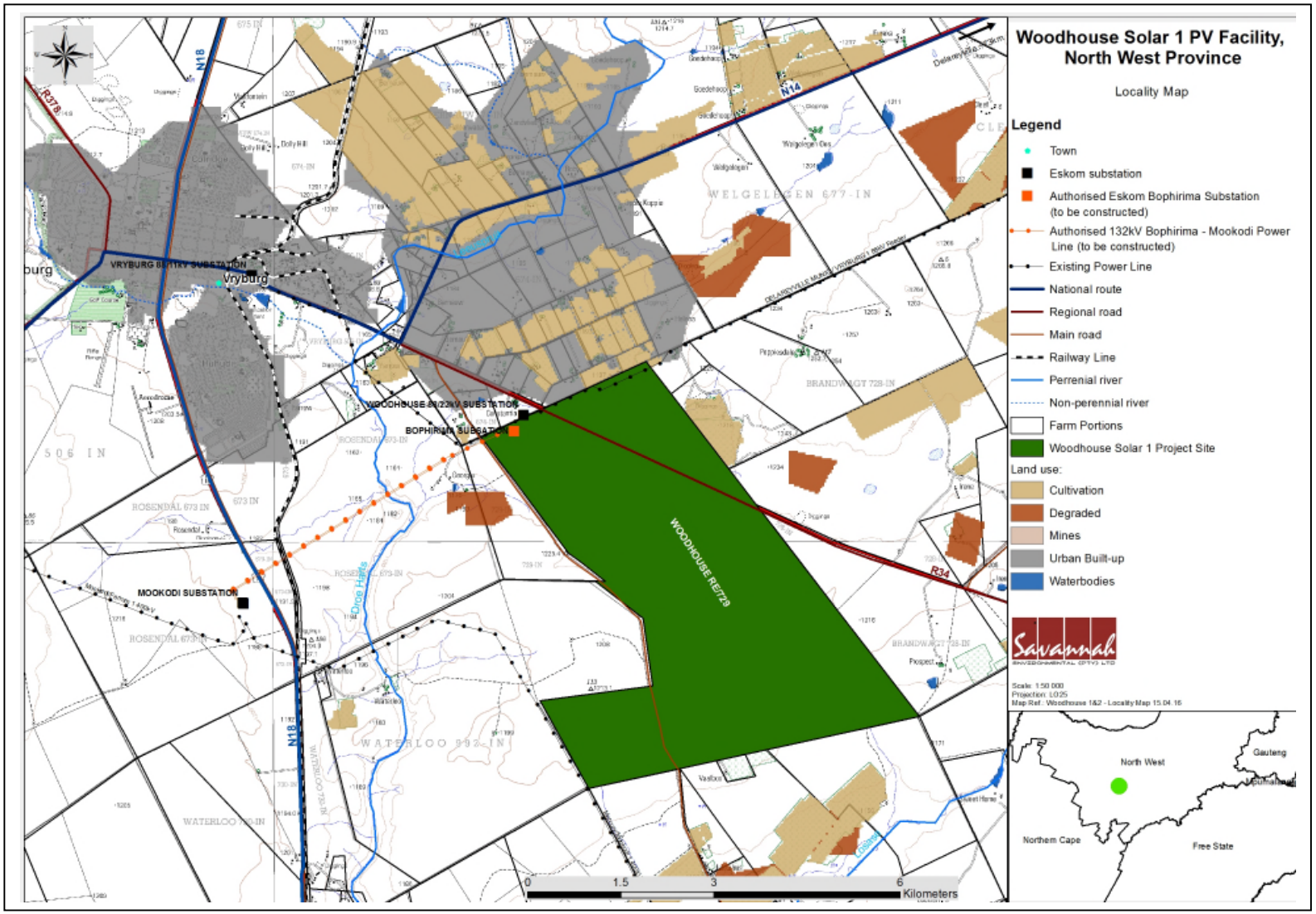

Figure 1: Locality map showing the location of the Remaining Extent of the farm Woodhouse 729 within which the Woodhouse Solar 1 Facility is proposed.

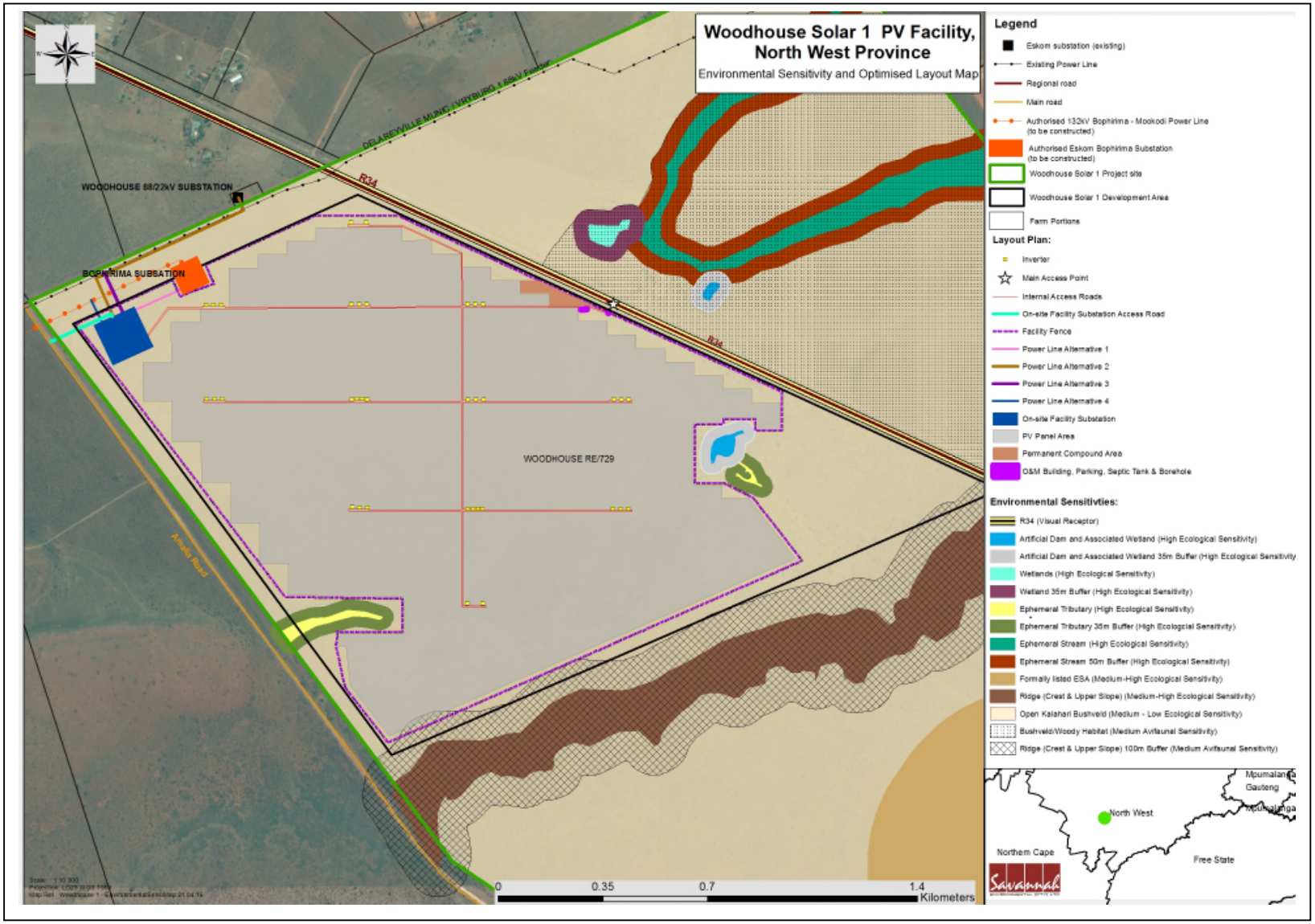

Figure 2: Environmental Sensitivity Map for the proposed Woodhouse Solar 1 PV Facility.

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APPENDICES

DEFINITIONS AND TERMINOLOGY

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

Archaeological material: Remains resulting from human activities which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

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

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

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

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

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

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

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

i. The land, water and atmosphere of the earth;

ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

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

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

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

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

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

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

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

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

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

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

Project development property: The project development area considered through the EIA process in defining the area for the Woodhouse Solar 1 PV Facility include, and are defined as follows:

» Project site: The site of the proposed project, situated on the Remaining Extent of the farm Woodhouse 729.
» Development Area: (287ha in extent) is a smaller focus area within the project site which has been selected as the best practicable option for the facility, considering technical preference and environmental constraints identified in Scoping. The development area has been subject to detailed assessment in the EIA Phase, and provides the boundary within which the development footprint (240ha) of the PV facility will be located, so as to be able to avoid the sensitive areas identified
» Project development footprint: The total development footprint in the development area for the PV facility, including associated infrastructure is ~ 240ha in extent

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

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

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

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

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

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

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

ABBREVIATIONS AND ACRONYMS

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

INTRODUCTION CHAPTER 1

Genesis Woodhouse Solar 1 (Pty) Ltd propose the development of a commercial photovoltaic (PV) solar energy facility (known as the Woodhouse Solar 1 PV Facility) on the Remaining Extent of the farm Woodhouse 729 (refer to **Figure 1.1**). The proposed project site[1] is located approximately 10km south east of the town of Vryburg and falls under the jurisdiction of the Naledi Local Municipality and within the greater Dr Ruth Segomotsi Mompati District Municipality in the North West Province. A second PV facility is also proposed to be developed on the project site which will be known as the Woodhouse Solar 2 PV Facility (DEA Ref.: 14/12/16/3/3/2/865). This development is to be assessed through a separate EIA process.

From a regional perspective, the greater Vryburg area is considered favourable for the development of commercial solar electricity generating facilities by virtue of the prevailing 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 Eskom national grid). The proposed project site is also situated within a Renewable Energy Development Zone (Vryburg REDZ[2]) which has been earmarked for the development of renewable energy facilities within South Africa.

The Woodhouse Solar 1 PV Facility is planned to be bid into the Department of Energy's Renewable Energy Independent Power Producers Procurement (REIPPP) Programme with the aim of evacuating the generated power into the Eskom national electricity grid and aiding in the diversification and stabilisation of the country's electricity supply.

The nature and extent of this PV facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases of a development of this nature are explored in more detail in this Environmental Impact Assessment report (hereafter referred to as the EIA report). Site specific environmental issues associated with the location of the development area and the development footprint (i.e. PV facility layout situated within the development area) located within the broader project site are considered within various specialist assessments in order to establish the environmental suitability for the development,

[1] Project site is defined as the Remaining Extent of the farm Woodhouse 729.

[2] In the Statement on Cabinet Meeting of 17 February 2016 the cabinet approved the gazetting of Renewable Energy Development Zones (REDZ). The aim of the zones are to streamline the regulatory process, identifying geographical areas where wind and solar Photovoltaic technologies can be incentivised and where intense grid expansion can be directed. These REDZ will ensure a transition to a low carbon economy, accelerating infrastructure development and contributing to a more coherent and predictable regulatory framework.

delineate areas of sensitivity within the development area and ultimately inform the most appropriate location for the PV facility and the associated infrastructure. The following sections have been included in this EIA report:

» **Chapter 1** provides background to the project and the environmental impact assessment, and an introduction to the rationale behind the selected project site, development area and technology proposed.
» **Chapter 2** provides the project description, need and desirability, project site and development area selection information and identified project alternatives.
» **Chapter 3** outlines the strategic regulatory and legal context for energy planning in South Africa and specifically for 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 site and 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 the potential for 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.

1.1. Requirement for an Environmental Impact Assessment Process

The development (i.e. construction and operation) of the proposed Woodhouse Solar 1 PV Facility is subject to the requirements of the EIA Regulations of 2014 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 proposed development.

NEMA is the 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[3]) is the competent authority for this project. An application for authorisation for the Woodhouse Solar 1 PV Facility has been accepted by the DEA (under the application reference number: 14/12/16/3/3/2/863). Through the decision-making process, the

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

DEA will be supported by the North West Department of Rural, Environmental and Agricultural Development (READ), as the commenting authority.

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 proposed project.

Genesis Woodhouse Solar 1 (Pty) Ltd has appointed Savannah Environmental (Pty) Ltd as the independent Environmental Assessment consultant to undertake the environmental impact assessment and prepare the EIA report for the Woodhouse Solar 1 PV Facility.

1.2. Legal Requirements as per the EIA Regulations for the undertaking of an Environmental Impact Assessment Report, 2014

This EIA report has been prepared in accordance with the requirements of the EIA Regulations published on 08 December 2014 promulgated in terms of Chapter 5 of the National Environmental Management Act (Act No 107 of 1998). This chapter of the EIA report includes the following information required in terms of Appendix 3: Content of Environmental Impact Assessment Reports.

Requirement	Relevant Section
3(a) the details of the EAP who prepared the report and (ii) the expertise of the EAP, including a curriculum vitae.	The details and expertise of the EAP who prepared the report has been included in section 1.6 and Appendix A of this EIA report.
3(b) the location of the activity including (i) the 21 digit Surveyor General code of each cadastral land parcel, (ii) where available the physical address and farm name and (iii) where the required information in items (i) and (ii) is not available, the co-ordinates of the boundary of the property or properties.	The location of the proposed Woodhouse Solar 1 PV facility is included in section 1.2 and Table 1.1. The information provided includes the 21-digit Surveyor General code of the affected property and the farm name (i.e. Remaining Extent of the farm Woodhouse 729). Additional information is also provided regarding the location of the development which includes the relevant province, local and district municipalities, ward and current land zoning.

1.3. Background to the project

The proposed PV facility entails the development (i.e. construction and operation) of the Woodhouse Solar 1 PV Facility. The PV facility will have a development area[4] of approximately 287ha in extent and will be developed within an area of 2264ha in extent (i.e. the Remaining Extent of the farm Woodhouse 729), and together with all associated infrastructure will constitute less than 15% of the property.

The Remaining Extent of the farm Woodhouse 729 has been identified by the developer as a suitable project site which has the potential to house the development of a solar energy PV facility (refer to **Table 1.1** and **Figure 1.1** below). The broader project site of 2264ha has been considered through a technical feasibility level assessment by the developer and the Scoping Phase of the EIA process, within which the development area (approximately 287ha in extent) and development footprint of the PV facility has been appropriately located in order to avoid environmental sensitivities.

Technical considerations: Within the project site a preferred development area, of approximately 287ha in extent, was identified by the developer within which the development footprint will be located (refer to **Figure 1.2**). This preferred development area was identified on the basis of a) the accessibility of the development area from the existing regional road (R34), b) the proximity of the development area to the proposed grid connection options, as well as c) the consent of the landowner to establish the PV facility in that particular portion of the affected property/project site. The preferred location for the development area of the PV facility was demarcated by the developer (based on a technical preference) and approved by the landowner, and is situated in the northern portion of the project site and is located to the west of the regional road (R34).

Environmental considerations: The broader project site of 2264ha has been considered through the Scoping Phase of the EIA process. The preferred development area of the PV facility (up to 287ha in extent) has been appropriately located in order to avoid environmental sensitivities.

Therefore, the project infrastructure (PV panels and the associated infrastructure) has, through the EIA process, been assessed and appropriately placed within the boundaries of the broader project site to avoid the environmental sensitivities or constraints identified through the EIA process.

[4] The development area is the identified location within the project site within which the Woodhouse Solar 1 PV Facility will be sited. The development area will include the PV panels and other associated infrastructure to be constructed for the PV facility, although the extent of the new 132kV power line and access roads are only partially included. The development area is approximately 287ha in extent.

Table 1.1: A detailed description of the farm Woodhouse 729

Province	North West Province
District Municipality	Dr Ruth Segomotsi Mompati District Municipality
Local Municipality	Naledi Local Municipality
Ward number(s)	5
Nearest town(s)	Vryburg, Huhudi, Delareyville, Stella and Schweizer-Reneke
Farm name(s) and number(s)	Woodhouse 729
Portion number(s)	Remaining Extent
SG 21 Digit Code (s)	T0IN00000000072900000
Current zoning	Agricultural

The scope of the EIA applies to the development area and the development footprint for the Woodhouse Solar 1 PV Facility and associated infrastructure, including access roads, grid connection power lines, substation, cables, offices etc. The PV facility will have a contracted capacity of up to 100MW, which will accommodate several arrays of tracking or static PV panels.

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

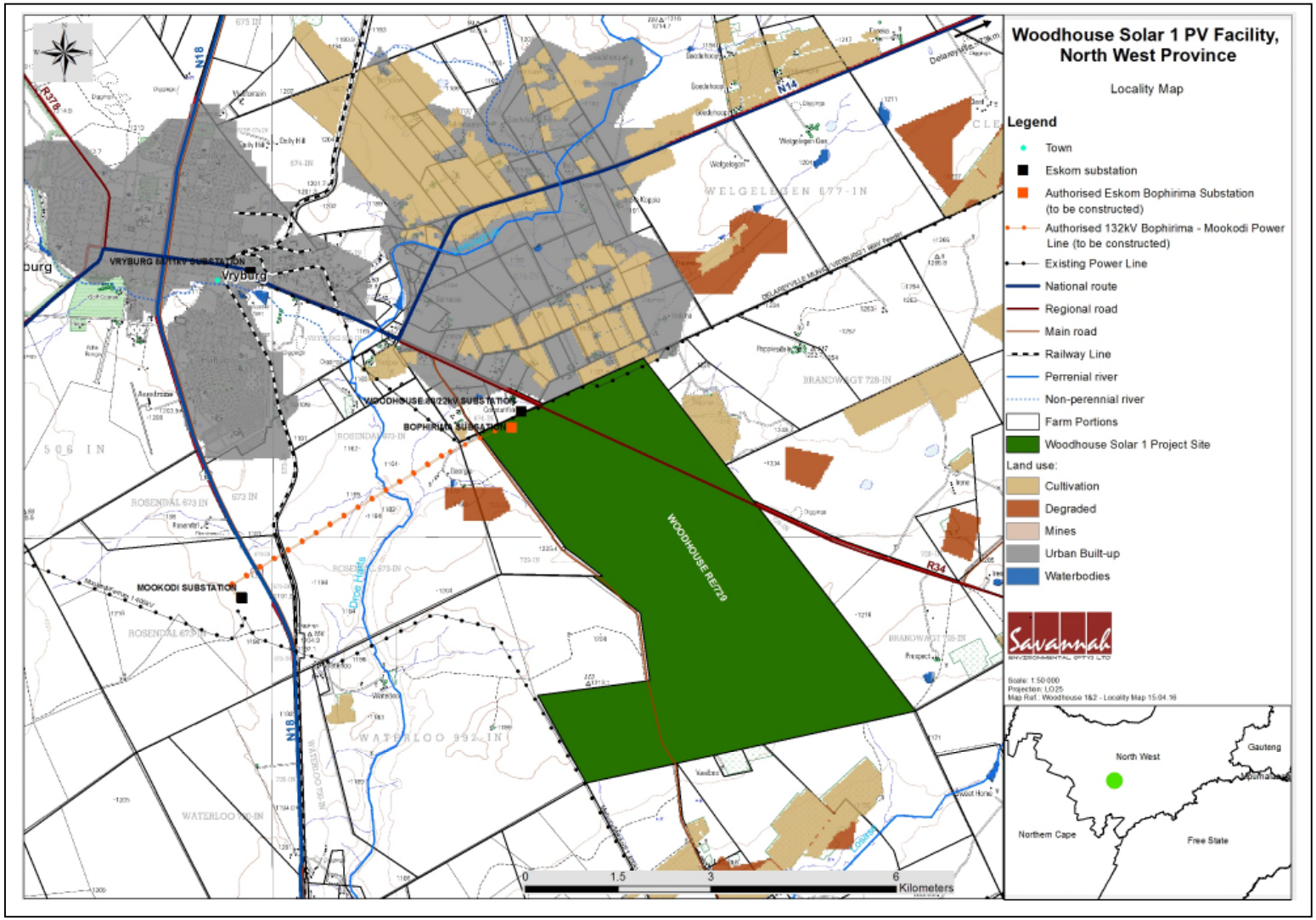


Figure 1.1: Locality map illustrating the location of the project site (i.e. the Remaining Extent of the farm Woodhouse 729) south east of the town of Vryburg.

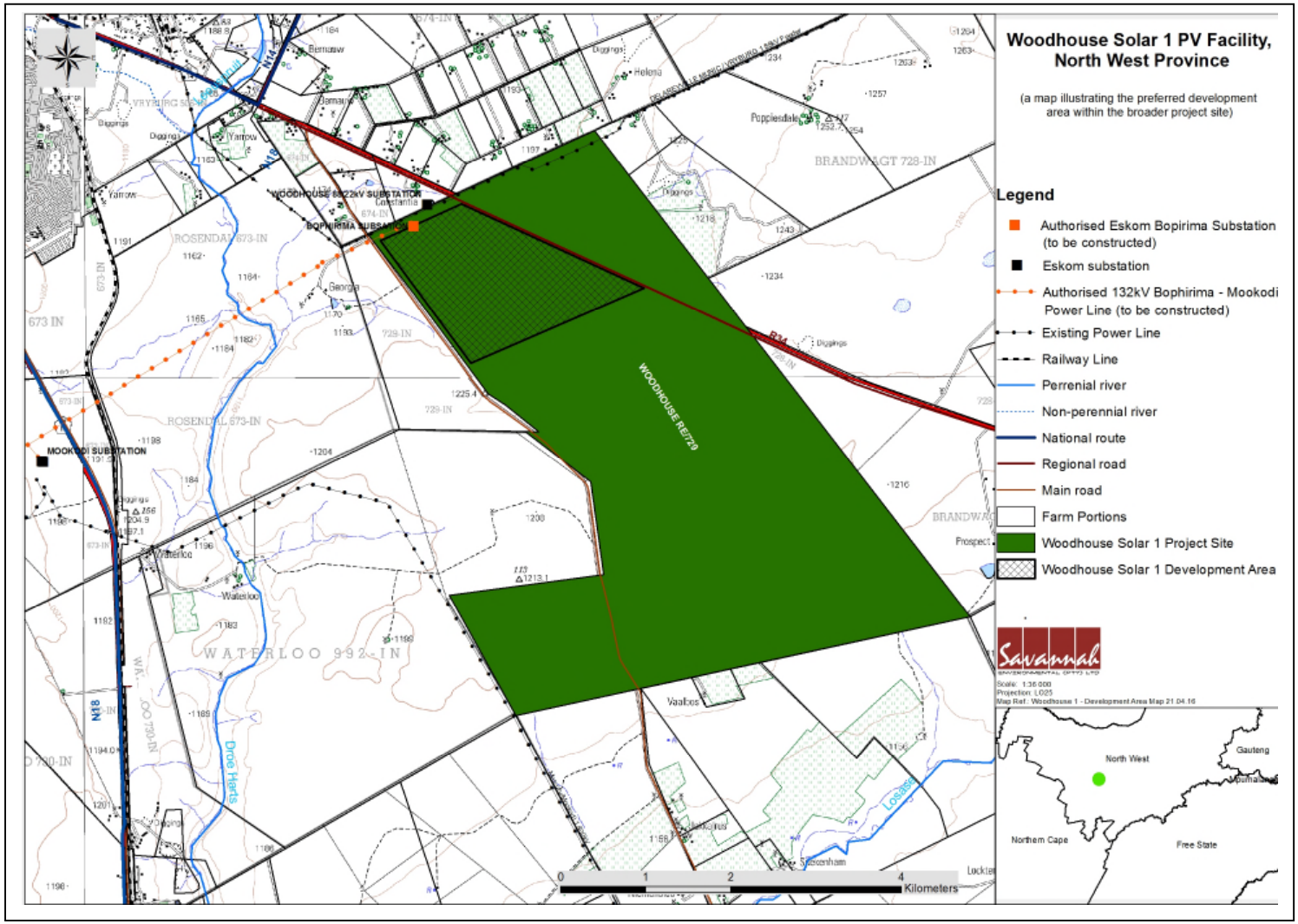


Figure 1.2: A map illustrating the preferred development area (hatched area) within the project site for the Woodhouse Solar 1 PV Facility**.**

The project will comprise the following typical infrastructure, which is included in the scope of this EIA:

- Arrays of single axis PV tracking or fixed tilt PV panels with a generating capacity of up to 100MW.
- Mounting structures to support the PV panels.
- On-site inverters to convert the power from a direct current to an alternating current the power and a substation to facilitate the connection between the solar energy PV facility and the Eskom electricity grid.
- A new 132kV power line between the on-site substation and the Eskom grid connection point. Four alternatives are being considered for the grid connection:
  - *Alternative 1*: A direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property (i.e. on the Remaining Extent of the farm Woodhouse 729);
  - *Alternative 2*: A direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property; and
  - *Alternative 3:* A turn-in turn-out connection to the existing Delareyville Munic / Vryburg 1 88kV Feeder located along the northern boundary of the affected property; and
  - *Alternative 4:* A turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line, to be constructed by Eskom[5].
- Cabling between the project components, to be laid underground where practical.
- Offices and workshop areas for maintenance and storage.
- Temporary laydown areas.
- Internal access roads and fencing around the development area.

Within the Scoping Phase of the project three grid connection alternatives were considered for the development of the PV facility including i) a direct connection to the authorised Eskom Bophirima Substation to be constructed in the northern portion of the Remaining Extent of the farm Woodhouse 729, ii) a direct connection to the existing Woodhouse 88/22KV Substation located on the northern boundary of the site and iii) a direct connection to the existing Mookodi 400/132kV Substation located to the west of the site . After further considerations regarding the grid connection options and negotiations with Eskom, the developer opted to amend the grid connection alternatives considered for the Woodhouse Solar 1 PV Facility. Therefore, four grid connection options considered in this EIA report and for the development of the PV facility (as included in the abovementioned section) is i) a direct connection to the authorised Eskom Bophirima Substation, ii) a direct connection to the existing

[5]In the event that Eskom is unable to complete the construction of the proposed 132kV Eskom Bopirima-Mookodi overhead line, Genesis Eco-Energy Developments would consider undertaking the construction of the authorised power line within the authorised corridor (DEA Ref.: 12/12/20/1929) to connect the PV facility, via a turn-in turn-out connection to the completed 132kV power line, to the existing Mookodi 400/132KV Substation located to the west of the project site.

Woodhouse 88/22kV Substation, iii) a turn-in turn-out connection to the existing Delareyville Munic / Vryburg 1 88kV Feeder and iv) a turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line.

In the event that Eskom is unable to complete the construction of the authorised 132kV Eskom Bopirima-Mookodi overhead line, Genesis Eco-Energy Developments would consider undertaking the construction of the already authorised power line (on Eskom's behalf) within the authorised corridor (DEA Ref.: 12/12/20/1929) in order to be able to connect the PV facility to the existing Mookodi 400/132kV Substation located to the west of the project site. This authorised corridor to Mookodi Substation is not required to be reassessed and for that reason is not assessed as an alternative in this EIA.

1.4. Conclusions from the Scoping Phase

Several desktop specialist studies, including limited field-surveys, were undertaken for the purpose of identifying potential environmental and social impacts and the potential for fatal flaws relating to the development of the proposed PV facility on the site. The sensitive areas within the project site identified within the Scoping Phase have been mapped in order to inform the developer of areas to avoid through the placement of infrastructure on the project site. The scope of the scoping evaluation included ecological, heritage (i.e. archaeology and palaeontology), visual, and social impacts, and the findings are summarised below. To provide a better understanding of the state of the ecological sensitive areas, specifically relating to Critical Biodiversity Areas which occur within the project site, a Scoping Phase site inspection was undertaken. This inspection was aimed at determining the status, condition and capabilities of these areas to fulfil their irrespective ecological functions and to determine whether the development of the PV facility will have a potential detrimental impact on these areas and their functions.

- Ecologically sensitive areas on the site: The project site is situated in the Savanna biome and Eastern Kalahari Bushveld Bioregion. The vegetation in and surrounding the project site is the Ghaap Plateau Vaalbosveld. The conservation status of this unit is classified as Least Threatened and is not listed under the National List of Ecosystems that are Threatened and in need of protection. Therefore the bulk of the project site is not considered sensitive to development. There are, however, localised ecologically sensitive features identified within the project site which define the areas most suited for development, which include the following:
  - Water resources: A desktop delineation identified depression wetlands located within the project site, one valley bottom wetland which has been transformed by the presence of a small dam, one flat/depression wetland which has also been dammed and one other artificially constructed dam. Drainage lines also occur within the project site and are considered as a

medium-high ecological sensitivity. These areas are considered to be ecologically sensitive to development and should be avoided.

- Critical Biodiversity Areas: Terrestrial Critical Biodiversity Areas and Aquatic Critical Biodiversity Areas, as identified in the bioregional plans, and occupy a portion of the project site.
  - The following CBA areas are located within the project site but are considered as a low-medium ecological sensitivity to development as a result of previous disturbance, current grazing practices and infrastructure development within these areas. These areas include a CBA 1 Link, dams, an ESA 2 Wetland, an ESA Dolomite area, a CBA 2 Corridor and a CBA 2 SQ4.
  - Three hill features have been classified as CBA 2 (Hills). These areas are of medium-high ecological sensitivity to development.
  - The wetland body located within the center of the project site is regarded as an Aquatic 1 CBA wetland feature and is of very high ecological sensitivity, and smaller wetland bodies occurring in and around the project site is regarded as Aquatic 2 CBA wetland features (high ecological sensitivity). These wetland features should be avoided by development.

- Visual/Social Receptors: The Woodhouse Solar 1 PV Facility is likely to have a visual impact on a relatively limited area of 2–3km from the project site and impacts are unlikely to extend outside of 5km. Potentially sensitive visual receptors that occur in the areas surrounding the project site include the town of Vryburg located to the north west, the surrounding roads including the R34, N18 and N14, small holdings located to the north of the project site and potential farmsteads located within the surrounding areas.
- Heritage: Heritage impacts include impacts on archaeological and palaeontological resources.
  - *Impacts on archaeological resources:* As a result of the previous and historical land-use of the project site, which has been inhabited from the 1800's onwards, the possibility exists that structures/features older than 60 years may occur. Previous work done in the broader study area of the project site indicated that pans, drainage lines and ridges are sensitive from a heritage perspective. A drainage line located within the south eastern portion and three pans (located in the northern portion, centre of the site, and on the eastern boundary) are highlighted as areas of potential sensitivity from a heritage perspective. Therefore, the bulk of the project site is not considered sensitive to development.
  - *Impacts on palaeontological resources*: The project site is underlain by the Ghaap Group (Schmidtsdrif Subgroup, and Vryburg Formation), as well as the Dwyka Group of the Karoo Supergroup. Small outcrops of Permo-Carboniferous Dwyka Group, Vryburg Formation, (north-western and south-eastern borders) and Schmidtsdrif Subgroup (south-western margin) is present. Although trace fossils and plants could be present in the Dwyka the

likelihood of significant fossil heritage in the Vryburg area is considered to be low, and the site is not considered to be sensitive to development.

» Social Impacts: Social impacts can either be of a positive (direct employment opportunities, skills development, economic multiplier effects, Socio-Economic Development (SED), Enterprise Development (ED), share ownership in the project company with local communities and the development of clean, renewable energy infrastructure) or negative (nuisance impacts associated with the generation of noise and dust, safety and security, pressure on economic and social infrastructure from an in-migration of people and an impact on the sense of place) nature during both the construction and operation phases of the PV facility. The location of the site is not considered to be highly sensitive to development.

» Soils, agricultural potential and land capability: The entire project site is classified as Land Class V, which is associated with little or no erosion hazard but has other limitations which are impractical that limit its use mainly to grazing and habitat for wildlife. These limitations restrict the type of plants that can be grown and prevent normal tillage of cultivated crops. The climatic conditions of the project site are associated with a moisture availability of class 4 which equates to moderate to severe limitations accompanied by low and unreliable rainfall. Temperature and rainfall variations are high and restrict regular crop production. Various factors have constraints that prohibit crop production and lead to insignificant agricultural activities except that of grazing. The agricultural potential of the project site is described as low, and does not warrant further assessment. Therefore, the project site is not considered sensitive to development.

Figure 1.3 provides an illustration of all environmental sensitivities identified during the Scoping Phase as well as the areas which are considered as appropriate for the development, i.e. medium-low sensitive areas.

These medium-low sensitive areas represents the portions of the affected property/project site with the greatest potential for the development of a PV facility after taking into consideration the sensitivities identified. Subsequently, the sensitive environmental features that were identified during the Scoping Phase have been taken into consideration by the developer in designing the layout of the Woodhouse 1 Solar PV facility. The proposed layout of the infrastructure for the PV facility is discussed further in Chapter 2 of this EIA report.

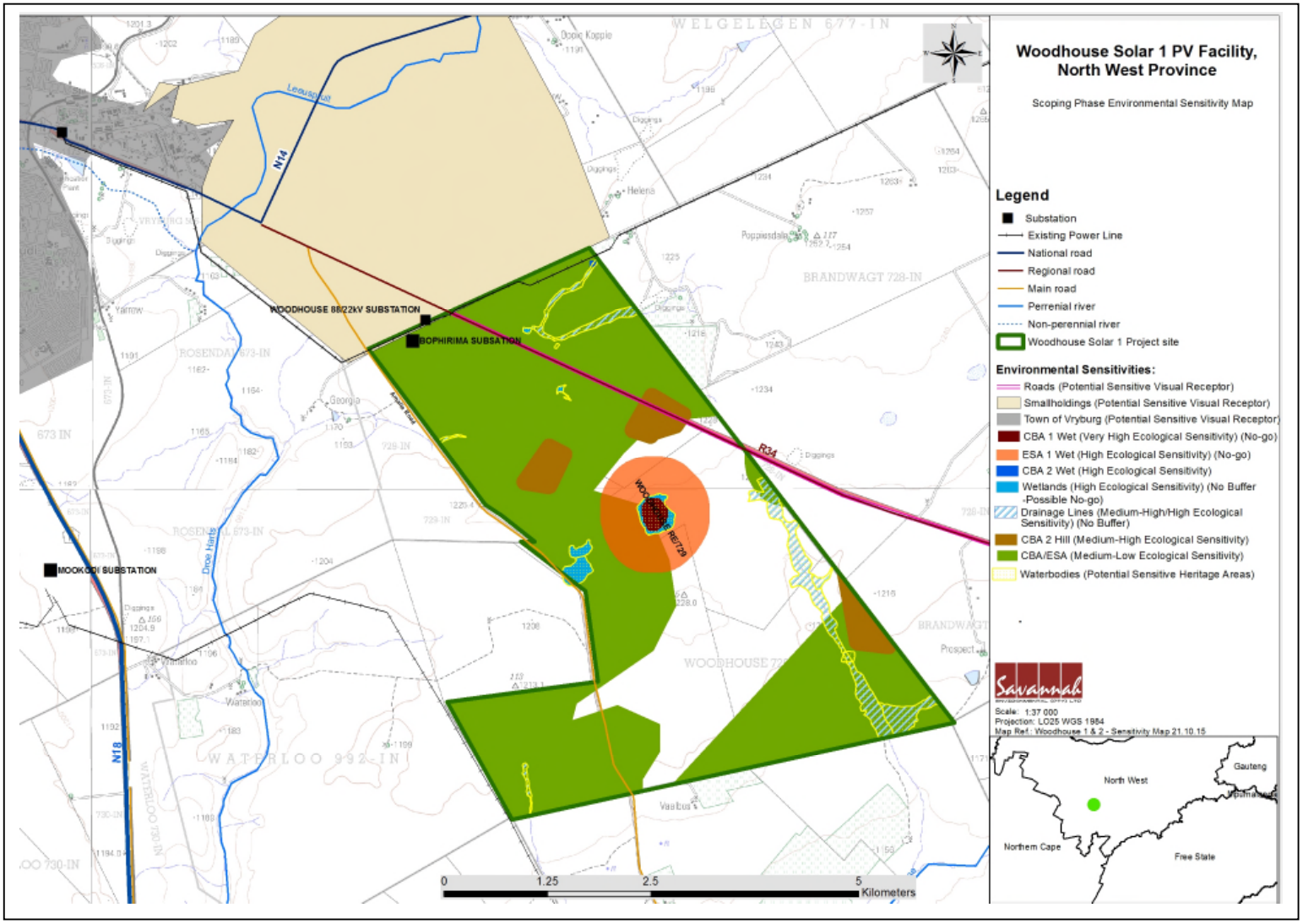


Figure 1.3: Map illustrating the environmental sensitivities identified in the Scoping Phase at a desktop level within the Remaining Extent of the farm Woodhouse 729.

Public participation Process: During the public participation process conducted in the Scoping Phase, the proposed PV facility was generally well received by the interested and affected parties and stakeholders in the greater Vryburg area. No objections to the Woodhouse Solar 1 PV Facility development were received on any environmental or social basis. All concerns and issues raised with the EIA team during the Scoping Phase public participation process are considered and assessed in this EIA report.

Approval of the Scoping report: No environmental or social impacts of high significance which could not be avoided or mitigated were identified to be associated with the broader project site during the Scoping Phase of the EIA process. The Final Scoping report was accepted by DEA on 16 February 2016.

1.5. Objectives of the Environmental Impact Assessment Process

The Scoping Phase was completed in **January 2016** with the submission of a Final Scoping Report to the DEA, and the acceptance of scoping received from DEA on **16 February 2016**. The Scoping Phase included desk-top studies and limited field-survey and served to identify potential impacts associated with the proposed development and to define the extent of studies required within the EIA Phase. Input from the project developer, specialists with experience in the broader study area and in EIAs for similar projects, as well as a public consultation process with key stakeholders, which included both government authorities and interested and affected parties (I&APs), was included in the evaluation of impacts.

Appendix 3 of the Environmental Impact Assessment Process of the EIA Regulations, 2014, contains the objectives to be achieved through the undertaking of an EIA process. The following objectives have been considered and undertaken through a consultative process within this EIA report for the Woodhouse Solar 1 PV Facility:

- The policies and legislative context associated with the location of the PV facility and the manner in which the proposed development complies with and responds to the relevant policies and legislative context.
- The need and desirability of the proposed Woodhouse Solar 1 PV Facility in the context of the preferred location.
- The location of the preferred development footprint within the site based on an impact and risk assessment process including cumulative impacts and a ranking process of the development footprint focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment in order to determine the nature, significance, consequence, extent, duration, and probability of the impacts occurring to inform identified preferred alternatives and the degree to which these impacts can be reversed, may cause irreplaceable loss of resources, and can be avoided, managed or mitigated.

» Identify the most ideal location for the Woodhouse Solar 1 PV Facility within the preferred site based on the lowest level of environmental sensitivity identified during the assessment.
» Identify, assess and rank the impacts that the PV Facility will have on the preferred location through the life of the development.
» Identify suitable and appropriate measures to avoid, manage or mitigate identified impacts and identify residual risks which need to be managed and monitored.

The release of the EIA report for a 30 day review period will provide stakeholders with an opportunity to review and provide input in terms of potential issues and concerns that may be associated with the development of the PV facility. The final EIA report for submission to the DEA will consider and incorporate all issues, concerns and responses raised during the review period of the EIA report. The DEA will also consider these issues, concerns and responses in their decision-making of the application for Environmental Authorisation.

1.6. Details of the Environmental Assessment Practitioner and Expertise to conduct the Scoping and EIA phases

Savannah Environmental was contracted by Genesis Woodhouse Solar 1 (Pty) Ltd as the independent Environmental consultant to undertake the Scoping and EIA processes for the proposed Woodhouse Solar 1 PV Facility. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to Genesis Woodhouse Solar 1 (Pty) Ltd. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise from 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.

» *Lisa Opperman* - the principle author of this report holds a Bachelor degree with Honours in Environmental Management and has one year of experience in the environmental field. Her key focus is on environmental impact assessments, public participation, environmental management plans and programmes, as well as

mapping using ArcGIS for a variety of environmental projects. She is currently involved in several EIAs for renewable energy projects across the country.

» *Karen Jodas* - is a registered Professional Natural Scientist and holds a Master of Science degree and is the registered EAP on the proposed project. She has 20 years of experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy projects across the country.

» *Gabriele Wood* - has 9 years of 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.

» *Candice Hunter* – is a social specialist with a Master's degree in Environmental Management and an advanced certificate in Social Impact Assessments (SIA). She has over 2 years of experience as a social consultant. Specific experience lies in field social research; the management and analysis of socio-economic baseline data; policy and programme analysis, undertaking stakeholder engagement; and conducting general social research for a variety of projects. Expertise lie in field of social impact assessments within the renewable energy field, with significant experience in social consulting and report writing.

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

» Ecology - Gerhard Botha (Eco-Care Consultancy)
» Avifauna – Blair Zoghby and Simon Todd (Simon Todd Consulting)
» Archaeology - Jaco van der Walt (Heritage Contracts and Archaeological Consulting cc (HCAC))
» Palaeontology – Elize Butler (Bloemfontein National Museum)
» Visual – Jon Marshall (Afzelia Environmental Consultants)
» Social and land use - Neville Bews (Neville Bews and Associates)

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

OVERVIEW OF THE PROPOSED PROJECT CHAPTER 2

This chapter provides an overview of the Woodhouse Solar 1 PV 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.

The Woodhouse Solar 1 PV Facility is planned to be developed on the Remaining The Woodhouse Solar 1 PV Facility is planned to be developed on the Remaining Extent of the farm Woodhouse 729, located approximately 10km south east of the town of Vryburg in the North West Province.

2.1. Legal Requirements as per the EIA Regulations for the undertaking of an Environmental Impact Assessment Report, 2014

This chapter of the EIA report includes the following information required in terms of Appendix 3: Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken	The layout for the development of the Woodhouse Solar 1 PV Facility is included as Figures 2.4 and section 2.4.1.
3(d)(ii) a description of the proposed activity, including a description of the associated structures and infrastructure related to the development.	A description of the proposed development of the Woodhouse Solar 1 PV Facility and the associated infrastructure is included in section 2.3.
3(f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.	The need and desirability for the development of the Woodhouse Solar 1 PV Facility in the proposed location is included in section 2.2.
3(g) a motivation for the preferred development footprint within the approved site.	A motivation for the location of the identified development area and the development footprint within the project site (i.e. Remaining Extent of the farm Woodhouse 729) is included in section 2.4.1.
3(h)(i) details of the development footprint considered.	The details of the development footprint considered for the Woodhouse Solar 1 PV Facility is included in section 2.3 and Table 2.1.
3(h)(vii) positive and negative impacts that the	The positive and negative impacts of the

proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	proposed Woodhouse Solar 1 PV Facility is included in section 2.2.
3(h)(ix) if no alternative development locations for the activity were investigated, the motivation for not considering such.	A motivation for not considering any alternative development locations is included in section 2.4.1.
3(h)(x) a concluding statement indicating the preferred alternative development location within the approved site.	No alternative development locations within the preferred project site have been identified for the Woodhouse Solar 1 PV Facility. The motivation for not considering alternative development locations within the project site is included in section 2.4.1.

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

The overarching objective for the development of the Woodhouse Solar 1 PV Facility is to maximise electricity production through exposure to the South African renewable solar resource and to diversify and stabilise the electricity mix of the country. It also aims to minimise infrastructure, operational and maintenance costs, as well as minimising detrimental social and environmental impacts. The project site[6] proposed for the development of the PV facility is located approximately 10km south east of the town of Vryburg and is situated outside of the urban edge of Vryburg. The affected property identified for the development (i.e. the Remaining Extent of the farm Woodhouse 729) is currently used by the landowner for grazing activities and has not been considered for an alternative land use such as urban development.

The North West Province has been identified as an area with the potential for the development of solar renewable energy generation, with suitable solar radiation levels and available tracts of land. The greater Vryburg area has been identified by the Council for Scientific and Industrial Research (CSIR), on behalf of the National Department of Environmental Affairs, as one of the areas best suited for the roll-out of solar photovoltaic (PV) and wind energy projects in South Africa, known as the Renewable Energy Development Zones. The zones were approved by Cabinet for gazetting and public comment on 17 February 2016. The project site is therefore situated within an area which is considered as a preferred location where renewable energy developments can take place and has therefore become a node for the development of renewable energy projects. These focus areas for the development of renewable energy are known as Renewable Energy Development Zones (REDZ), with the Vryburg area classified as REDZ zone 6.

[6] The site of the proposed project, situated on the Remaining Extent of the farm Woodhouse 729.

From an environmental perspective the suitability of the project site for the development of the PV facility is also measured in terms of other solar energy facilities in the surrounding areas. Within a 10km radius from the site there are at least 5 other proposed facilities located, none of which have been constructed, and only one of which is a preferred bidder project. These facilities include:

» The Carocraft Solar Park
» Sediba Solar Energy Facility
» Waterloo Solar Park (Preferred Bidder Round 4.5)
» Tiger Kloof Solar Energy Facility
» Woodhouse Solar 2 PV Facility.

Given the competitive nature of the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, a high annual solar irradiation value and grid connectivity suitability are some of the most important factors of success for the development of a solar energy facility. The selection of the abovementioned Waterloo Solar Park as a Preferred Bidder project, which is located directly adjacent to the west of the Remaining Extent of the farm Woodhouse 729, is a confirmed indicator that the Woodhouse Solar 1 PV Facility project site is located where the required solar resources and grid connectivity characteristics are competitive and suitable for the selection process by the Department of Energy for future bidding rounds of the REIPPP Programme.

2.2.1 Site Selection and Pre-Feasibility Analysis

Due to the nature of the development (i.e. a renewable energy facility), the location of the project is largely dependent on technical factors such as the availability of the solar resource (i.e. the fuel source), extent and topography of the site and available grid connection.

The broader study area (i.e. the greater Vryburg area) was identified as having the potential for the installation of PV panels on the basis of key technical criteria being met, including the solar resource, accessibility of the site, accessibility to the Eskom grid, and local site topography. The project site was identified by the project developer as being technically viable and given its attributes is also considered to be commercially feasible and competitive i.e. able to offer electricity to the national grid of South Africa at a highly competitive tariff in order to stabilise and diversify the energy mix of the country and therefore, ensuring the availability of electricity to the South African citizens.

Pre-feasibility investigations were undertaken during the early-stages of project development. Genesis-Eco Energy Developments (Pty) Ltd implemented a site selection study in order to find potential sites that met both technical and environmental guidelines for the development of a solar energy facility. This process included using Geographical Information System (GIS) Data to identify the properties within the Vryburg Renewable Energy Development Zone (REDZ 6) and the proximity to Eskom's

newly upgraded Mookodi Substation. Individual land parcels were identified within the area for further pre-feasibility investigation. These included the Remaining Extent of the farm Woodhouse 729, as well as additional properties located west of this land parcel. From the initial pre-feasibility analysis, the applicant excluded those properties from the feasible project sites where a) agreement could not be reached with the landowner (i.e. availability constrained), b) were considered to present greater environmental constraints which would have a higher environmental impact if selected for the development and reduce the chances of success for the project (i.e. environmentally constrained) and c) greater technical constraints on other sites which would influence the cost effectiveness and therefore influence the South African Economy.

After the consideration of the various land parcels for the development of a solar energy facility, the preferred project site identified by the developer is a 2264ha property known as the Remaining Extent of the farm Woodhouse 729. It is within this project site where the development of the PV facility will take place with the consent of the landowner.

2.2.2 Receptiveness of the project site to development of a PV Facility

The use of solar power for electricity generation is essentially a non-consumptive use of a natural resource. The project site (i.e. Remaining Extent of the farm Woodhouse 729) displays characteristics which, in the opinion of the Genesis Woodhouse Solar 1 (Pty) Ltd experienced solar development team, make the location of the development and the development footprint desirable and preferred. The detail regarding site-specific characteristics, and how these provide further motivation for the selection of the specific site chosen for this project is provided below:

Project site extent, conditions and land availability: Availability of level land of sufficient area can be a restraining factor for the development of a solar energy facility. The Woodhouse Solar 1 PV Facility will have a generating capacity of up to 100MW which requires an area of ~287ha in extent for the construction of the facility. The farm portion/project site, owned by a single landowner, is 2264ha in extent and is therefore almost 10 times larger than what is required for the installation of the PV facility, and allows for avoidance of environmental sensitivities located within the project site. The landowner is willing to allow the development of the PV facility to take place on his property and will allow the developer to lease the portion proposed for the development area of the PV facility. The following are key considerations:

- The project site conditions are optimal for a development of this nature, with the site being of a suitable gradient for the development of a PV facility.
- The region within which the site is located can be described as a flat plateau. The area is consistent with the land type and classifies the landscape with an average slope of between 0% and 2% which is suitable for a development of this nature.

» The development area (inclusive of the development footprint) of the facility would comprise less than 15% of the total extent of the affected farm portion.

This project site is therefore considered suitable for the construction and operation of the Woodhouse Solar 1 PV Facility, allowing for avoidance of sensitivities within the greater project site.

Site access: Access to the project site is considered as an important characteristic as easy access is required for the transportation of project related infrastructure and heavy machinery. The proximity of the project site to viable access routes decreases the impact on secondary roads in terms of traffic during the construction and operation phases. The project site can be readily accessed via the regional road (R34) which traverses the northern portion of the project site. Alternatively, access can be gained via an unsurfaced main road, known as the Amalia Road, which is located along the western boundary of the project site.

Grid connection considerations: Ease of access into the Eskom national electricity grid is vital to the viability of a solar energy facility. PV facilities which are in *close proximity* to a grid connection point and/or demand centre are favourable and reduce the losses associated with power transmission. Four alternatives options for the grid connection exist between the on-site substation and the national grid, all located within 1 km of the site or closer. These alternative options include:
i) a direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property (i.e. the Remaining Extent of the farm Woodhouse 729);
ii) a direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property;
iii) a turn-in turn-out connection to the existing Delareyville Munic-Vryburg 1 88kV Feeder located along the northern boundary of the affected property; and
iv) A turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line to be constructed by Eskom.

In the event that Eskom is unable to complete the construction of the proposed 132kV Eskom Bopirima-Mookodi overhead power line, Genesis Eco-Energy Developments would consider undertaking the construction of the authorised power line within the authorised corridor (DEA Ref.: 12/12/20/1929) to connect the PV facility via the completed 132kV power line to the existing Mookodi 400/132KV Substation located to the west of the project site.

In addition, Eskom's '2040 Transmission Network Study' has drawn on various scenarios to determine the grid's development requirements, as well as to identify critical power corridors for future strategic development or strengthening of the power/grid backbone. The national power corridors have been refined and consolidated into five transmission power corridors of 100 km in width, which are being used by the Department of

Environmental Affairs for a strategic environmental assessment (SEA) which will seek to identify environmentally acceptable routes over which long-term environmental impact assessment (EIA) approvals can be secured. The Woodhouse Solar 1 PV Facility project site is located approximately 5km south of the Northern corridor (refer to **Figure 2.1**), which provides assurance of the viability of a grid connection solution in the long-term.

Agricultural considerations: The entire project site is classified as Land Class V, which is associated with little or no erosion hazard but has other limitations which are impractical that limit its use mainly to grazing and habitat for wildlife. These limitations restrict the type of plants that can be grown and prevent normal tillage of cultivated crops. The climatic conditions of the site are associated with a moisture availability of class 4 which equates to moderate to severe limitations accompanied by low and unreliable rainfall. Temperature and rainfall variations are high and restrict regular crop production. Various factors have constraints that prohibit crop production and lead to insignificant agricultural activities except that of grazing. The agricultural potential of the project site can therefore be described as low.

Loss of current land use: There is no cultivated agricultural land within the affected property (as a result of low agricultural potential) which could be impacted upon by the proposed PV facility. The site is used for low density livestock grazing, and the potential loss of less than 15% of the site to the current land use would not have a detrimental impact on the current land use.

Climatic conditions and available solar resource: Climatic conditions determine the economic viability of a solar energy facility as it is directly dependent on the annual direct solar irradiation values for a particular area. The North West Province receives a high average daily direct normal and global horizontal irradiation (GHI)[7] (2120-2240 kWh/m^2/annum)) which indicates that the regional location is appropriate for the solar energy facility in terms of the available solar resource. Factors contributing to the location of the PV facility include the relatively high number of daylight hours and the low number of rainy days experienced in this region.

Local labour and poverty alleviation: The project site is located ~10km from the town of Vryburg, which will act as the source of local labour during the construction and operation of the proposed PV facility. This will lead to social upliftment in an area where unemployment and poverty are considered as significant social issues. The current unemployment rate of the Naledi Local Municipality is at 26.4%.

Socio-economic and enterprise development: The establishment of the proposed Woodhouse Solar 1 PV Facility with a generating capacity of up to 100MW (and other

[7] GHI is the total amount of shortwave radiation received from above by a surface horizontal to the ground. The value of particular interest to CSP installations is the Direct Normal Irradiance (DNI) as mirrors track the suns movements throughout the day.

renewable energy facilities in the area) has the potential to result in significant socio-economic opportunities for the region, which, in turn, will result in a positive social benefit. This was also one of the primary considerations in the determination of the REDZ (the site is located in the Vryburg priority area). The positive impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The Community Trust associated with the project will also create significant socio-economic benefits for the surrounding communities. These benefits should also be viewed within the context of the limited socio-economic opportunities in the area. All areas within a 50km radius of the proposed solar energy facility will benefit from the socio-economic and enterprise development initiatives committed to by the Woodhouse Solar 1 PV Facility as prescribed by the Department of Energy in their Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. These commitments will allow the local community to own a share in the Woodhouse Solar 1 PV Facility, therefore benefitting from dividends, and will also see a percentage of turnover being deployed back into the local community.

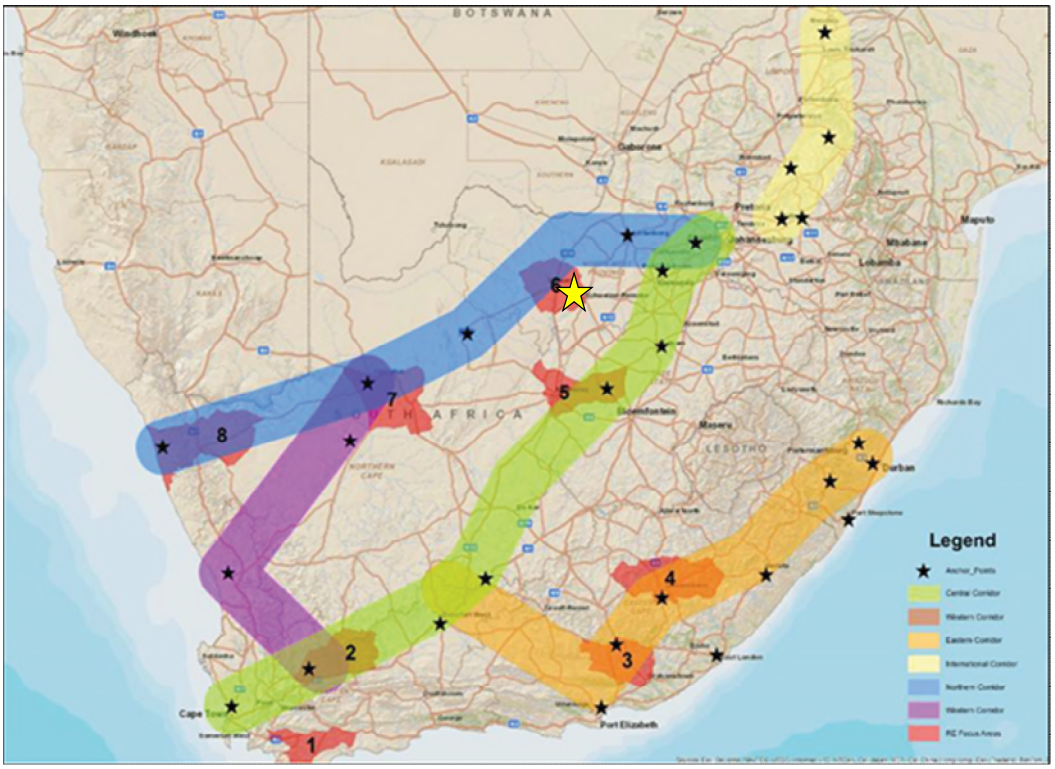


Figure 2.1: Map indicating the Eskom "Critical Power" Corridors and Renewable Energy Development Zones (REDZ). The proposed Woodhouse Solar 1 PV facility position is shown by the yellow star on the map in close proximity to the Northern power corridor and within the Vryburg focus area (REDZ 6) (Source: CSIR, 2014).

2.2.3 Renewable Energy Development Zones (REDZ)

The Department of Environmental Affairs (DEA) has committed to contribute to the implementation of the National Development Plan and National Infrastructure Plan by investigating the undertaking of Strategic Environmental Assessments (SEAs) to identify adaptive processes that streamline the regulatory environmental requirements for Strategic Integrated Projects (SIPs) while safeguarding the environment.

The solar photovoltaic (PV) and wind SEA was accordingly commissioned by DEA in support of SIP 8 (Strategic Infrastructure Projects), which aims to facilitate the implementation of sustainable green energy initiatives. This SEA identifies areas where large scale solar PV and wind energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZ)[8].

The REDZ also priority areas for investment into the electricity grid. Currently one of the greatest challenges to renewable energy development in South Africa is the saturation of existing grid infrastructure and the difficulties in expanding the grid. Proactive investment in grid infrastructure is therefore likely to be an important factor in determining the success of REDZ.

As shown in **Figure 2.2** below, the proposed Woodhouse Solar 1 PV Facility falls within the REDZ Vryburg Focus Area (Zone 6) which was selected by the Department of Environmental Affairs as an area highly suitable for solar energy facilities given a range of factors considered. This provides further motivation for the selection of the specific site chosen for this project.

[8] In the Statement on Cabinet Meeting of 17 February 2016 the cabinet approved the gazetting of Renewable Energy Development Zones (REDZ). The aim of the zones are to streamline the regulatory process, identifying geographical areas where wind and solar Photovoltaic technologies can be incentivised and where intense grid expansion can be directed. These REDZ will ensure a transition to a low carbon economy, accelerating infrastructure development and contributing to a more coherent and predictable regulatory framework.

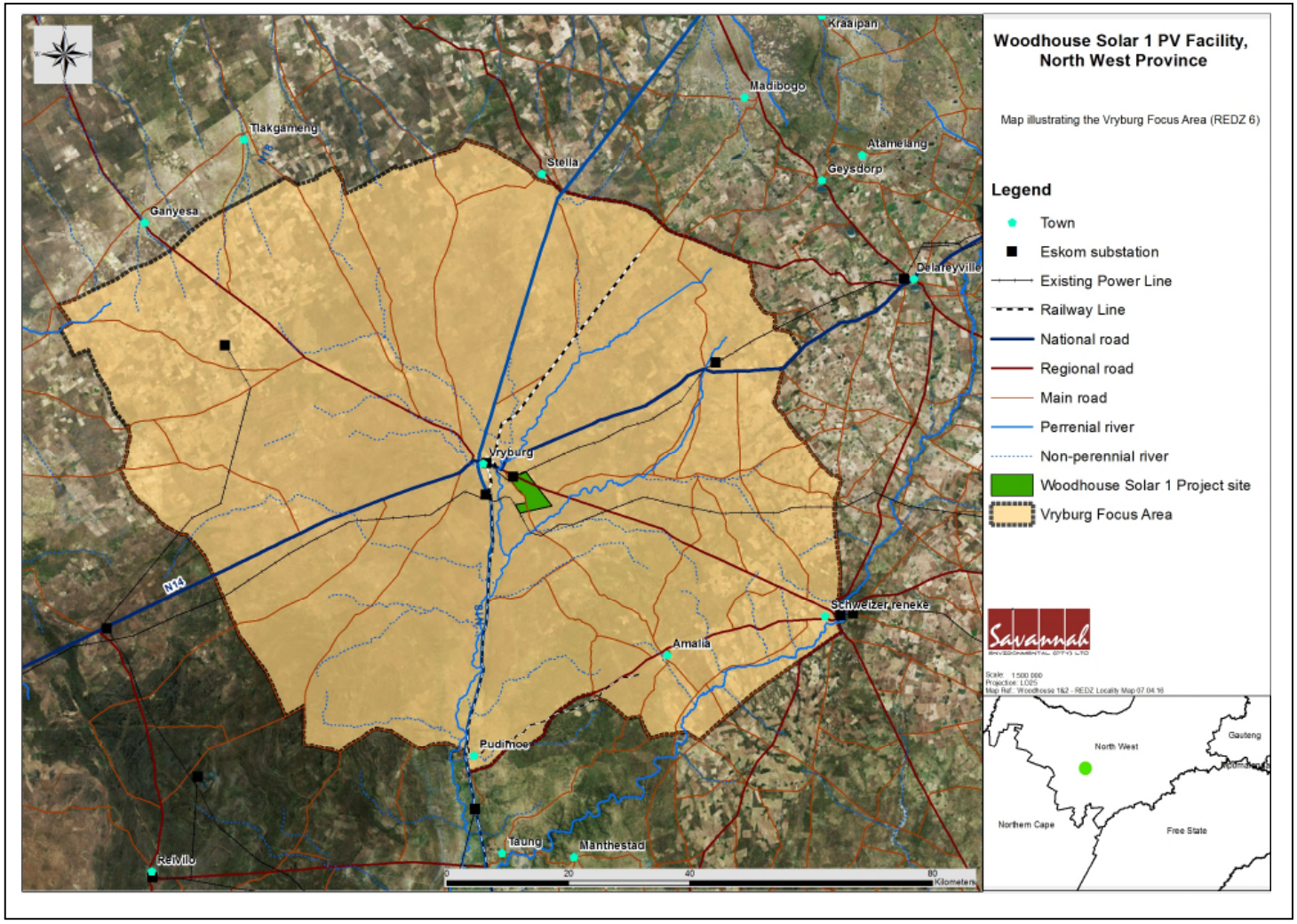


Figure 2.2: The Woodhouse Solar 1 PV Facility project site is centrally located within the REDZ Zone 6, known as the Vryburg Focus Area.

2.2.4 Benefits of Renewable Energy Developments

The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits are detailed below and provides further motivation for the selection of the specific site chosen for this project:

Increased energy security: The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation, diversification and stabilisation. In addition, given that renewable energy projects can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive distribution losses. These real benefits have already been enjoyed by citizens, with renewable energy generation since early 2012 making an increasingly important contribution to supply security.

Resource saving: It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings (i.e. water not required for energy generation related to PV solar energy facilities) of approximately 16.5 million kilolitres per annum, which also translates into revenue savings of R26.6 million per annum. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability. Other non-renewable resources which will experience reduced usage pressure is the use of fossil fuels (i.e. coal) as a resource for the generation of electricity.

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

Economics: As a result of the excellent resource and competitive procurement processes, both solar PV power and wind power are now proven in South Africa as cheaper forms of energy generation than coal power. They offer value for money to the economy and citizens of South Africa. In addition, such technologies van be deployed faster and more expediently than other conventional power generation plants. The economics of the country and communities surrounding the solar PV and wind power developments also experience upliftment as a result of the Department of Energy's REIPPP Programme, which requires the establishment of a Community Trust for the economic enhancement, development and growth of communities. From a broader perspective another economic benefit to South Africa is the possible avoidance of load shedding through diesel fuel savings amounted to a nett benefit to the economy of R 5 billion in 2015 (Bishoff-Niemz, CSIR).

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

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

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

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

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

Support to a new industry sector: The development of renewable energy offers the opportunity to establish a new industry within the South African economy, which will create jobs and skill local communities which have potential for further renewable energy projects. The new industry will also attract interest and investment from abroad which further enhances the economic advancement.

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

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

impacts, maximise benefits, and promote compliance with the principles of environmental management and sustainable development.

2.3. Project and Site Description

The proposed project entails the development of the Woodhouse Solar 1 PV Facility on a project site located approximately 10km south east of Vryburg which is situated within the Naledi Local Municipality and the greater Dr Ruth Segomotsi Mompati District Municipality. The project site the PV facility will be located in includes the Remaining Extent of the farm Woodhouse 729. The full extent of the project site (i.e. 2264ha) has been considered through a feasibility level assessment as well as the Scoping Phase of the EIA process, within which the development area[9] for the PV facility (approximately 287ha in extent) has been appropriately located. Based on the specialist studies and limited field survey undertaken in the Scoping phase, sensitivities were identified within the project site which could potentially be impacted on by the development of the Woodhouse Solar 1 PV Facility. In order to avoid these areas of potential sensitivity and ensure that detrimental environmental impacts are not associated with the development, the developer identified the preferred and most suitable development area within which the development footprint[10] of the PV facility will be located, as to avoid the sensitive areas identified in the Scoping Phase.

The development area (~287ha) is situated in the northern portion of the project site and is located to the west of the regional road, R34 (refer to **Figure 2.3**). The development area will house the development footprint of the PV facility which will include the PV panels, on-site substation, inverters, buildings, septic tank etc. but does not include the full extent of the projects linear components – that is the grid connection power line and the main access road to the facility.

The development footprint of the PV facility will be located within the development area. The purpose of the proposed PV facility will be to generate electricity to be fed into the national electricity grid.

[9] The Development Area (287ha in extent) is a smaller focus area within the project site which has been selected as the best practicable option for the facility, considering technical preference and environmental constraints identified in the Scoping Phase. The development area has been subject to detailed assessment in the EIA phase, and provides the boundary within which the development footprint (~240ha) of the PV facility will be located, so as to be able to avoid the sensitive areas identified.

[10] The total development footprint in the development area for the PV facility, including associated infrastructure is ~240ha in extent.

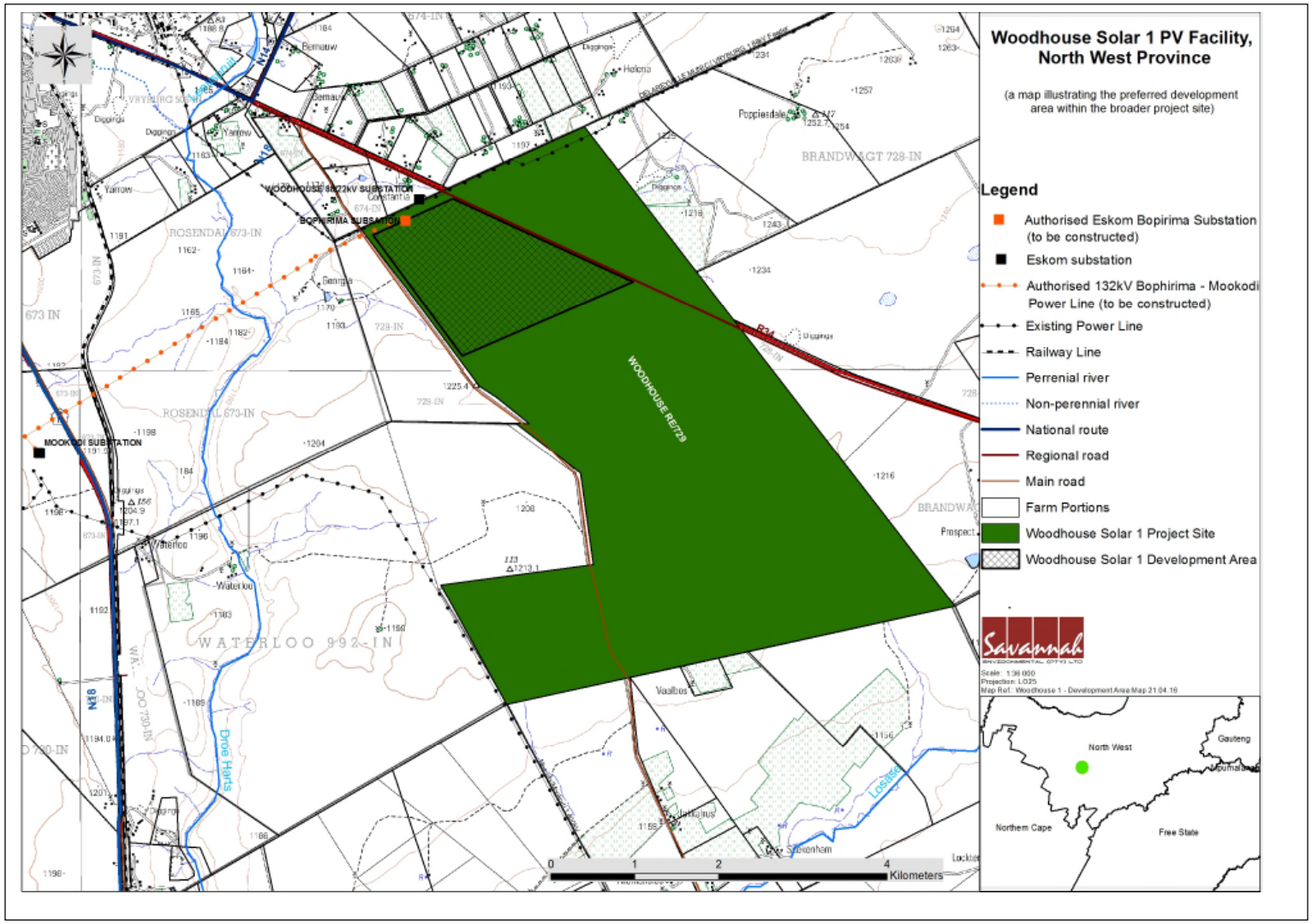


Figure 2.3: A map illustrating the development area (~287ha) within the project site for the Woodhouse Solar 1 PV Facility.

Table 2.1 provides the details of the project site and technology proposed for the Woodhouse Solar 1 PV Facility, including the main infrastructure and services.

Table 2.1: Details of the proposed project and associated infrastructure

Component	Description/ Dimensions
Location of the project site	Remaining Extent of the farm Woodhouse 729
Municipal Jurisdiction	» Naledi Local Municipality » Dr Ruth Segomotsi Mompati District Municipality
SG Code	T0IN00000000072900000
Extent of the project site	2264ha (extent of the affected property)
Extent of the facility development area	The development area of the PV facility will be up to 287ha
Extent of the facility development footprint	The development footprint, located within the development area, will be up to 240ha
Contracted capacity of facility	Up to 100MW
Technology	Static or tracking photovoltaic PV System
Internal access	Gravel roads of ~5.6km in extent and 4m in width
Site access	Direct access to the site is possible via the regional road (R34) which traverses the northern portion of the project site. Alternatively, access can be gained via a secondary main road, known as the Amalia Road, which is located along the western boundary of the project site.
Details of the PV panels	» Type: Single axis PV solar tracking system » Height: ~5m from ground level
PV Panel Area	Up to 211ha
On-site substation	150m x 150m = 22 500m^2
Power line	» Capacity – 132kV » Servitude width – 32m » Length: *Alternative 1* - ~160m *Alternative 2* – ~747m *Alternative 3* – ~146m *Alternative 4* – ~80m » Height of the towers – 28-30m
Grid connection options	» *Alternative 1*: A direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property (i.e. the Remaining Extent of the farm Woodhouse 729); » *Alternative 2*: A direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property; » *Alternative 3*: A turn-in turn-out connection to the existing Delareyville Munic / Vryburg 1 88kV Feeder located along the

Component	Description/ Dimensions
	northern boundary of the affected property; and » *Alternative 4*: A turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line to be constructed by Eskom.
Number of inverters required.	Up to 40 inverters
Area occupied by buildings and associated infrastructure	12m x 4m = 48m^2
Services required	» Refuse material disposal - all refuse material generated from the proposed development will be collected by a contractor and will be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required. » Sanitation – all sewage waste will be stored on site within a septic tank which will be emptied by the municipality for disposal. » Water - on site boreholes to supply the PV facility during the construction and operation phase. » Electricity supply - electricity will be supplied to the facility via the Delareyville Munic/Vryburg 1 88kV Feeder traversing the northern boundary of the project site.
Temporary infrastructure required during the construction phase (which is estimated to be 12-18 months)	» Construction camps; » Construction yard; and » Storage areas. Total area to be occupied: up to 500 x 100m within the development area.

The corner point coordinates and the grid connection (power line) alternative are included in **Appendix K**.

The development footprint of the Woodhouse Solar 1 PV Facility (PV facility, including associated infrastructure, up to 240ha in extent) is proposed to accommodate the PV panels and the following associated infrastructure:

» Arrays of single axis PV tracking panels or fixed tilt PV with a capacity of up to 100MW.
» Mounting structures to support the PV panels.
» A new 132kV power line between the on-site substation and the Eskom grid connection point. Four alternatives are being considered for the grid connection:
  * *Alternative 1*: a direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property;
  * *Alternative 2*: a direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property;

- *Alternative 3*: a turn-in turn-out connection to the existing Delareyville Munic / Vryburg 1 88kV Feeder located along the northern boundary of the affected property; and
- *Alternative 4*: A turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line to be constructed by Eskom[11].

» Cabling between the project components, to be laid underground where practical.
» Offices and workshop areas for maintenance and storage.
» Temporary laydown areas.
» Internal access roads and fencing around the development area

2.4. Project Alternatives under consideration for the Solar Energy Facility

In accordance with the requirements outlined in Appendix 3 of the EIA Regulations 2014, the consideration of alternatives including site, activity, technology and site access alternatives, as well as the "do-nothing" alternative should be undertaken. The following sections address this requirement.

2.4.1 Site specific and layout design alternatives: PV facility

The consideration of the suitability of the project site and the identified development area was in line with a typical mitigation hierarchy:

1. First mitigation: the avoidance of adverse impacts as far as possible by the use of preventative measures.
2. Second mitigation: minimisation or avoidance of sensitive areas
3. Third Mitigation: remedy or compensation for adverse residual impacts, which are unavoidable and cannot be reduced further.

In determining the development area and development footprint/facility layout for the proposed Woodhouse Solar 1 PV Facility, a 'funnel-down approach' was used and commenced with the consideration of the larger 2264ha site.

Phased Sensitivity Analysis

Step 1: In order for the facility to operate successfully and reach the electricity generation goal of up to 100MW sufficient space is required. Various parcels of land were considered by the developer for the development of a PV facility with a generating capacity of up to 100MW, specifically in the Vryburg area as it is located within a REDZ

[11] In the event that Eskom is unable to complete the construction of the proposed 132kV Eskom Bopirima-Mookodi Overhead Line Genesis Eco-Energy Developments would consider undertaking the construction of the authorised power line within the authorised corridor (DEA Ref.: 12/12/20/1929) to connect the PV Facility via the completed 132kV power line to the existing Mookodi 400/132KV Substation located to the west of the project site.

(Zone 6) (the Remaining Extent of the farm Woodhouse 729 was also included in the land parcel considerations). The parcels that were considered are located to the west of the Remaining Extent of the farm Woodhouse 729 (identified project site). These parcels were considered from a land availability and environmental perspective, but as a result of environmental and technical constraints within the land parcels, they were deemed unsuitable for the development of this PV Facility and were discarded by the developer.

The preferred project site was selected on the basis of i) the available grid connection infrastructure within and immediately adjacent to the project site, ii) consent of the landowner to undertake the development of the Woodhouse Solar 1 PV Facility development within his property, iii) technical suitability of the broader project site for the development of a solar energy facility, iv) the location of the project site within a REDZ (Vryburg Focus Area) (which are soon to be gazette), and therefore compatible with planned future land uses in the area, and v) sufficient space available within the project site in order to successfully develop and operate the PV facility. As the Remaining Extent of the farm Woodhouse 729 (project site) complies with the above characteristics, this is considered to be the most reasonable and feasible alternative site for the development. As such, no alternative project sites are further considered for the development of the PV facility.

Therefore, the preferred project site for the PV Facility was identified as the Remaining Extent of the farm Woodhouse 729.

Step 2: The full extent of the 2264ha identified project site was considered in the Scoping Phase undertaken as part of the EIA process for the Woodhouse Solar 1 PV Facility. During the scoping phase, desktop specialist studies and limited field survey by the ecologist were undertaken in order to provide the developer and the competent authority with site specific information from a desktop level regarding the larger project site considered for the development. Areas to be avoided by the development were identified, which specifically relates to ecological features and sensitivities present within the project site. The Scoping Phase studies and the identified sensitivities were utilised as a tool by the developer to identify and locate the development area of the PV facility within the broader project site, as well as locate the development footprint within the identified development area for the PV facility. This was undertaken with the aim of avoiding all possible sensitive areas within the development area and development footprint as to ensure that no major impacts will be associated with the development. The northern portion of the project site was identified by the developer as the preferred location for the development area.

This preferred location of the development area within the project site is considered as the most feasible and appropriate location for the woodhouse Solar 1 PV Facility, based on the following considerations; i) the identified development area is located in close proximity to the proposed grid connection options (less than 1km) considered for the facility which shortens the length of the power line required to be constructed for the

connection into the national grid, ii) the landowner provided consent for the development area of the PV facility within that particular portion of the farm to be constructed and operated, iii) sufficient space is available within the development area for the development footprint to avoid the sensitivities identified in the Scoping Phase and iv) the development area is considered suitable for the development of a PV facility from a technical perspective to ensure the success of the development. Therefore no development area alternatives within the identified project site are being considered for the construction and operation of the PV facility as the preferred development area is strongly supported by various characteristics, as mentioned above.

A technically viable preliminary layout (i.e. development footprint) within the identified development area was designed by the developer for the Woodhouse Solar 1 PV Facility. This development area (which is inclusive of the development footprint/layout) was assessed through the undertaking of specialist field-surveys and assessments (refer to **Appendices D-I**). As per the findings of the specialist assessments and field surveys undertaken in the EIA Phase, this preliminary layout infringes on the recommended buffers of an ephemeral tributary (high ecological sensitivity) located in the south western corner and an artificial dam and the associated wetland (high ecological sensitivity) located in the south eastern corner of the development area.

Step 3: The preliminary layout/development footprint designed, which was subject to field-surveys and specialist assessments was further amended (as a mitigation strategy) in order to completely avoid the high sensitivities and their buffer areas, as identified by the specialists when in the field, which were located within the preferred development area and the preliminary layout/development footprint. Therefore, this step included optimising the preliminary layout/development footprint of the Woodhouse Solar 1 PV Facility within the identified development area in order to create an optimised development footprint/optimised layout which is considered as the *least intrusive* on the environment. Therefore Step 3 is considered as a mitigation strategy, as is discussed further in Chapter 8 of the EIA report.

2.4.2 Activity and Technology Alternatives

Genesis Woodhouse Solar 1 (Pty) Ltd is a Special Purpose Vehicle (SPV) established by Genesis Eco-Energy Developments, a renewable energy project developer and as such will only consider renewable energy technologies for the generation of electricity. Wind power is however not considered as a viable alternative to the power generation activity, due to the limited wind resource in the greater Vryburg area, rendering the project uncompetitive in the market. The greater Vryburg area and the preferred project site has a strong solar resource for the development of PV solar energy facilities. This is supported by the fact that the area is demarcated as a REDZ, and that there are 5 other solar energy facilities located within a 10km radius from the site. In this regard, no further activity alternatives were considered as the activity presented the best technical and environmental option.

Few technology options are available for PV facilities (i.e. tracking or static PV systems), 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 project 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.

The primary differences between the 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). 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.

2.4.3 Grid connection Alternatives

The grid connection for the project will be finalised based on input from Eskom and the outcome of the environmental assessment. The following is being considered at this point of the assessment process:

» **Substation Site Alternatives**

The on-site substation proposed for the development of the Woodhouse Solar 1 PV Facility is proposed to be located within the north west corner of the development footprint. As per the above phased sensitivity analysis the layout for the PV facility within the identified development area considers the placement of all the project related infrastructure. Due to the optimum space utilisation within the development site for the placement of the substation there were no viable technical alternatives to be considered for an alternative substation position. In this regard no further substation alternatives were considered as the presented position of the substation provides the best technical and environmental option, as the grid connection alternatives from this position on the site would be the shortest.

» **Grid Connection Power Line Route Alternatives**

In order to establish a connection between the Woodhouse Solar 1 PV Facility on-site substation (located in the north western corner of the development area) and the grid connection point where the generated electricity will be evacuated into the Eskom national electricity grid, a connection needs to be created. The connection between the

on-site substation and the grid connection point will be established through the construction of a 132kV overhead line. Four alternative power line routes are being considered for the PV facility. The lengths of the proposed alternative power line routes are not extensive and are therefore highly favourable in terms of the construction of the facility power line and the proximity to the proposed alternative grid connection points. The following power line lengths will be associated with the grid connection power line alternatives (Alternative 1-4).

Alternative 1: will be the construction of a 132kV power line between the on-site facility substation and the authorised Eskom Bophirima Substation to be constructed in the northern portion of the project site. The 132kV power line will start on the western boundary of the on-site substation and will extend towards the west to connect to the Eskom Bophirima Substation. The length of the power line required to be constructed for this connection will be ~160m.

Alternative 2: includes the construction of a 132kV power line between the on-site substation and the existing Woodhouse 88/22kV Substation. The connection will start on the northern boundary of the on-site substation and will extend north to the existing Delareyville Munic-Vryburg 1 88kV Feeder power line. The route will then turn east, following the existing power line up to the existing Woodhouse 88/22kV Substation. The length of power line to be constructed is approximately 747m and is the longest power line route alternative considered for the Woodhouse Solar 1 PV Facility.

Alternative 3: includes the construction of a 132kV power line between the on-site facility substation and the existing Delareyville Munic-Vryburg 1 88kV Feeder line located on the northern boundary of the project site. The 132kV power line will start on the northern boundary of the facility on-site substation and extend north to connect into the power line via a turn-in turn-out connection. The length of the power line required to establish the connection is approximately 146m, and would be required to be a double circuit line.

Alternative 4: includes the construction of a 132kV power line between the on-site substation and the authorised 132kV Eskom Bophirima–Mookodi power line (to be constructed). The route will start on the northern boundary of the on-site substation and extend north to connect into the power line via a turn-in turn-out connection. The length of power line is approximately 80m, and would be required to be a double circuit line and is the shortest power line route alternative considered for the Woodhouse Solar 1 PV Facility.

Input from Eskom, technical studies, and commercial viability will be considered in terms of the final grid connection point.

2.4.4 Site Access Alternatives

Direct access to the site is possible via the surfaced regional road (R34) which traverses the northern portion of the project site or via an unsurfaced main road, known as the Amalia Road, which is located along the western boundary of the project site. These existing roads will provide direct access to the main entrance of the Woodhouse Solar 1 PV Facility.

The developer has indicated that access off the R34 is the technically preferred option to be utilised for the main access to site. Access to the on-site substation, located in the north western corner of the development area, will be via the unsurfaced main road, known as the Amalia road (presents the shortest route to access the substation position). As these two access points (i.e. main access to the PV facility and access to the facility on-site substation) is considered as technically viable and the shortest possible routes to access the PV Facility and the on-site substation no site access alternatives are being considered.

These two access routes to the PV facility and the on-site substation will be gravel roads with a width of 4m and will be constructed during the construction phase.

In addition to the PV facility and the on-site facility substation access routes, internal access roads will be constructed between the PV arrays for construction and maintenance purposes. These internal roads will be 4m in width and gravel roads.

The total extent of the access roads for the PV facility will be approximately 5.6km in extent.

2.4.5 The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the Woodhouse Solar 1 PV Facility on the Remaining Extent of the farm Woodhouse 729. The main reasons why the do-nothing alternative is not preferred in relation to this solar energy facility project are discussed below, namely:

» The current land use regime of the site;
» The need for additional energy generation capacity in South Africa; and
» The need to diversify the energy mix in South Africa.

The land use regime of the project site is limited to grazing activities undertaken by the landowner. As a result of the severe limitations of the soils in terms of the potential for agricultural activities the site is not considered suitable for the undertaking of intense agricultural activities such as crop production and is thus limited to grazing. Therefore, the "do nothing" alternative would leave land-use restricted to the current grazing

activities, losing out on the opportunity to generate renewable energy from the solar resource as additive thereto (i.e. current grazing activities would continue). Therefore, from a land-use perspective, the 'do nothing' alternative is not preferred.

The electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity and the resultant restrictions are severely damaging to the economy. There is, therefore, a need for additional electricity generation options to be developed throughout the country in order to diversify and stabilise the national grid. The 'do nothing' option in terms of implementing renewable energy projects results in a scenario where a fossil fuel or nuclear facility must rather be developed as the need for power does not subside. Environmental considerations aside, these have long lead times (considerably longer than the time required to implement renewable energy projects) and hence the South African economy and its citizens will suffer. Furthermore, the development of a renewable energy facility, as promoted by the South African Government, would also not be realised and the reliance on fossil fuel energy sources would not be reduced, as has been committed to.

The purpose of the proposed solar energy facility is to add new capacity for generation of renewable energy to the national electricity mix and to aid in achieving the goal of a 43% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE). It is fully aligned with government policy and aligns with policy at all three levels of government (i.e. national, provincial and local) (see Chapter 3 of this Environmental Impact Assessment Report).

The 'do nothing' alternative is therefore not a preferred alternative. If the solar energy facility is not developed the following positive impacts will not be realised:

» Job creation from the construction and operational phases.
» Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
» Meeting of pent up demand for additional generation in a most economic and rapid manner.
» Provision of clean, renewable energy in an area where it is optimally available.

2.5. PV Technology considered for the Woodhouse Solar 1 PV Facility and the Generation of Electricity

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

A (PV) cell is made of silicone that acts as a semi-conductor used to produce the photovoltaic effect. Individual PV cells are linked and placed behind a protective glass

sheet to form a PV panel. The PV cell is positively charged on one side and negatively charged on the other side and electrical conductors are attached to either side to form a circuit. This circuit then captures the released electrons in the form of an electric current (direct current). An inverter must be used to change the direct current (DC) to alternating current (AC). The electricity is then distributed through a power line to the national grid for use.

The PV panels can either comprise a fixed/static support structure set at an angle (fixed-tilt) so to receive the maximum amount of solar irradiation (as illustrated in **Figure 2.4**), or a single or double axis support structure which can be either fixed or tracking. The angle of the panel is dependent on the latitude of the proposed facility and the angles may be adjusted to optimise for summer or winter solar irradiation characteristics.

Figure 2.4: Photovoltaic (fixed-tilt/static) panel array (Photo: used with permission from Genesis Eco-energy Developments).

The PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance.

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

Photovoltaic Cells

A PV cell is made of silicone that acts as a semiconductor used to produce the photovoltaic effect. A single cell is sufficient to power a small device such as an emergency telephone. However, to produce up to 100MW of power, the proposed facility will require numerous cells arranged in multiples/arrays which will be placed behind a protective glass sheet and fixed to a support structure. Each PV cell is positively charged on one side and negatively charged on the other side, with electrical

conductors attached to either side to form a circuit. This circuit captures the released electrons in the form of an electrical current (direct current).

The Inverter

An inverter is used to convert the electricity which is produced as direct current into alternating current for the purpose of grid connection. In order to connect a large solar facility to the national grid, numerous inverters will be arranged in several arrays to collect, and convert the produced power.

The Support Structure

The PV panels will be fixed to a support structure set at an angle (fixed-tilt) so to receive the maximum amount of solar irradiation. The angle of the panel is dependent on the latitude of the proposed facility and the angles may be adjusted to optimise for summer or winter solar radiation characteristics.

2.6. Water Requirements

The PV project will require the usage of water during both the construction and operation phases. Water will be required during construction for dust suppression, as well as potable water on the site for the construction crew. During the operation phase, water will be required to clean the PV panels. Water requirements for the 100MW PV facility are low, being approximately 15200m^3 for the construction phase over 12-18 months, and approximately 5050m^3 of water per year for the operation phase (over the 20 year lifetime of the project) for the cleaning of panels.

Water will be sourced from boreholes to be located by the developer within the preferred development footprint. Or alternatively be obtained from the local municipality via their municipal supply.

2.7. Proposed Activities during the Project Development Stages

In order to construct the Woodhouse Solar 1 PV 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

Pre-planning: Several post-authorisation factors are expected to influence the final design of the facility and could result in small-scale modifications of the PV array or associated infrastructure. While an objective of the Engineering, Procurement and Construction (EPC) Contractor who will be responsible for the overall construction phase of the project will be to comply with the approved facility design as far as possible, it should be understood that the construction process is dynamic and that unforeseen

changes to the project specifications will take place. This EIA Report therefore describes the project in terms of the best available knowledge at the time. The final facility design is required to be approved by the DEA. Importantly, should there be any substantive changes or deviations from the original scope or layout of the project, the DEA will need to be notified and where relevant, approval obtained.

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 phase will entail a series of activities including:

Procurement and employment

The proposed Solar Facility is likely to create approximately 300-400 employment opportunities depending on the final design. Of this 60% of the opportunities (240 employees) will be available to low-skilled workers (construction labourers, security staff etc.), 25% (100 employees) to semi-skilled workers (drivers, equipment operators etc.), and 15% (60 employees) to skilled personnel (engineers, land surveyors, project managers etc.). Approximately 50% of the low-skilled and semi-skilled employment positions will be sourced from local communities (i.e. the town of Vryburg). The injection of income into the area in the form of wages will represent a significant opportunity for the local economy and businesses in the greater Vryburg area. The total wage bill for the construction of the Woodhouse Solar 1 PV Facility is estimated to be in the region of R50 million (2015 Rand value).

Establishment of an Access Road to the Site

The project site proposed for the development is accessible through the use of the R34 which is located within the northern portion of the project site or alternatively via a secondary unsurfaced road, known as the Amalia Road, which is located along the western boundary of the project site. Within the site itself, access will be required from new/existing roads for construction purposes (and limited access for maintenance during operation). Internal access roads of up to 4m in width will be required.

New access roads may be required to be constructed in order to access the project site; internal access roads will be required to access the individual components within the facility during construction and operation. Where necessary, it may be required, in some areas, to strip off the existing vegetation and level the exposed ground surface to form

an access track surface. The final layout of the access roads will be determined following the identification of site related sensitivities.

Undertake Site Preparation

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

Transport of Components and Equipment to Site

The components for the proposed facility will be transported to site by road. For the proposed solar facility, transport of components would most likely be via the R34. Some of the components (i.e. substation transformer) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[12] by virtue of the dimensional limitations. Typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the mounting of the PV support structures, construction of the substation and site preparation.

Establishment of Laydown Areas on Site

Laydown and storage areas will be required for the typical construction equipment. Once the required equipment has been transported to site, a dedicated equipment construction camp and laydown area will need to be established adjacent to the workshop area. The equipment construction camp serves to confine activities and storage of equipment to one designated area to limit the potential ecological impacts associated with this phase of the project. The laydown area will be used for the assembly of the PV panels and the general placement/storage of construction equipment.

Erect PV Cells and Construct Substation and Invertors

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

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

Power Conversion Stations (PCS) to the on-site AC electrical infrastructure and ultimately the project's on-site substation.

Figure 2.5: Frame, structural details (Photo courtesy of Igeam, 2011)

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 power line for connection to the Eskom national grid, workshop, storage and laydown areas, gatehouse and security complex, as well as a temporary contractor's equipment camp.

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

Construction of the power line

A power line is constructed by surveying the power line route, construction of foundations for the towers, installation of the towers, stringing of conductors and finally the rehabilitation of disturbed area and protection of erosion sensitive areas.

Undertake Site Remediation

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

2.7.3 Operation Phase

The proposed Woodhouse Solar 1 PV Facility is expected to be operational for a minimum of 20 years. 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 maintenance activities, as needed will be required. Key elements of the Operation and Maintenance plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security of the project. The operation phase of the PV Facility will create up to 60 full-time employment positions. No large scale energy storage mechanisms for the facility which would allow for continued generation at night or on cloudy days are proposed.

2.7.4 Decommissioning Phase

Depending on the continued economic viability of the facility following the initial 20-year operation period, the PV 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 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 be removed, and the surface restored to its original contours. Much of the above ground wire, steel, and PV panels, of which the system is comprised, are recyclable materials and would be recycled to the extent feasible. The components of the plant would be deconstructed and recycled or disposed of in accordance with regulatory requirements. The site will be rehabilitated and can be returned to the agricultural or other beneficial land use.

Future plans for the site and infrastructure after decommissioning

The plant capacity would have degraded by ±15% over 20 years. The plant will have the opportunity to generate power for a Merchant Market operation (i.e. the client would sell power on bid basis to the market).

REGULATORY AND LEGAL CONTEXT CHAPTER 3

This chapter provides insight into the policy and legislative context within which the Woodhouse Solar 1 PV Facility is located and document the manner in which the development of the PV facility complies with and responds to the policies and legislation. The listed activities triggered requiring environmental authorisation, as per the EIA Regulations of 2014, are also included within this chapter.

3.1. Legal Requirements as per the EIA Regulations for the undertaking of an Environmental Impact Assessment Report, 2014

This chapter of the EIA report includes the following information required in terms of Appendix 3: Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(d)(i) a description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for.	All listed activities triggered and applied for are included in section 3.2.
3(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	The policies and legislation associated with the development is included in sections 3.3-3.5.

3.2. Relevant Listed Activities

In terms of sections 24 and 24D of NEMA, as read with Government Notices R982, R983, R984, R985, a Scoping and EIA process is required for the proposed Woodhouse Solar 1 PV Facility. The key listed activity contained in GN R984 which triggered a full EIA process is Listed Activity 1 of GN R984: 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 have a contracted capacity of up to 100MW. **Table 3.1** below contains the listed activities in terms of the EIA Regulations of December 2014 which apply to the Woodhouse Solar 1 PV Facility, and for which an Application for Environmental Authorisation has been applied. The table also includes a description of the specific project activities which relate to the applicable listed activities.

Table 3.1: Listed activities triggered by the proposed Woodhouse Solar 1 PV Facility

Number and date of the relevant notice:	Activity No:	Description of each listed activity as per the project description:
GN 983, 08 December 2014	11 (i)	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 a 132KV overhead distribution power line outside an urban area, with a capacity of less than 275kV.***
GN 983, 08 December 2014	28 (ii)	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used 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 ***Total area of land zoned as agriculture to be developed for the PV facility (special use or light industrial use) is larger than 1 hectare and outside an urban area. The area required for the development is 244ha in extent.***
GN 984, 08 December 2014	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 total electricity output for the facility will be 100MW.***
GN 984, 08 December 2014	15	The clearance of an area of 20 hectares or more of indigenous vegetation ***The clearance of more than 20 hectares of indigenous vegetation will be undertaken during construction of the facility.***
GN 985, 08 December 2014	4 (e)(i)(ee)	The development of a road wider than 4 meters with a reserve less than 13,5 meters (e) in North West (i) outside urban areas, in: (ee) Critical biodiversity areas (Terrestrial Type 1 and 2) as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. ***The development of access roads wider than 4 meters are required for the facility. The project***

Number and date of the relevant notice:	Activity No:	Description of each listed activity as per the project description:
		site is located within critical biodiversity areas as identified in the North West Province bioregional plan.
GN 985, 08 December 2014	12 (a)(ii)	The clearance of an area of 300 square meters or more of indigenous vegetation (a) in North West (ii) within critical biodiversity areas identified in bioregional plans. ***The clearance of more than 300 m^2 will be required for the construction of the facility. The project site is located within critical biodiversity areas as identified in the North West Province bioregional plan.***

On the basis of the above listed activities, an EIA process is being undertaken for the proposed Woodhouse Solar 1 PV Facility. The Scoping Phase was completed and accepted by the competent authority, DEA, in February 2016. And the EIA Phase is currently in progress. This process comprises of two phases:

» The Scoping Phase included the identification of potential issues associated with the proposed project through a desktop study and consultation with affected parties and key stakeholders. Areas of sensitivity within the broader site were identified and delineated in order to identify any environmental fatal flaws, and sensitive or no go areas. Following a 30-day review period of the Scoping report, this phase culminated in the submission of a final Scoping report and Plan of Study for EIA to the DEA (the Scoping Phase has already been completed).
» The EIA Phase involves a detailed assessment of potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase includes detailed specialist investigations and public consultation. Following a review period of the EIA report, this phase will culminate in the submission of a final EIA report and an Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to DEA for review and decision-making.

3.3. Strategic Electricity Planning in South Africa

The need to expand the electricity generation capacity in South Africa is based on national policy and is informed by on-going strategic planning undertaken by the DoE (Department of Energy). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as solar energy facilities is illustrated in **Figure 3.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of the proposed Woodhouse Solar 1 PV Facility.

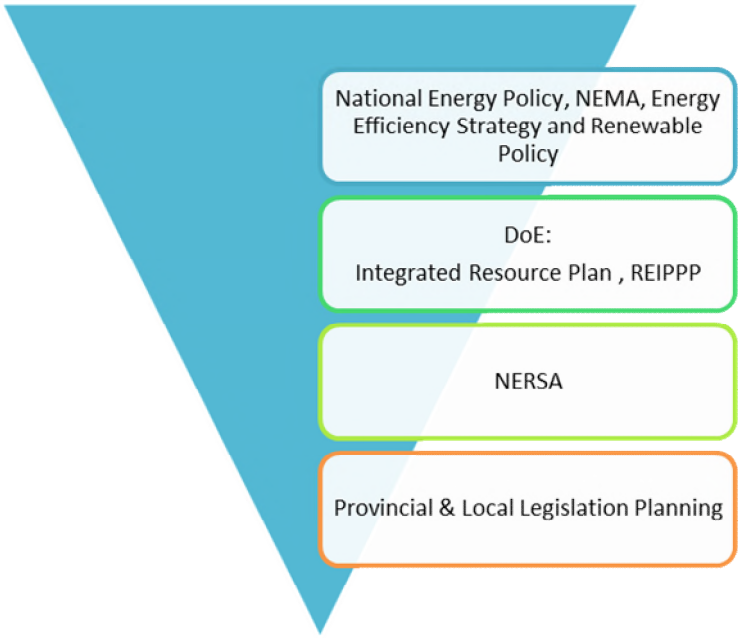


Figure 3.1: Hierarchy of electricity generation and supply policy and planning documents.

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

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

» *Department of Energy (DoE):* This Department is responsible for policy relating to all energy forms, including renewable energy, and is responsible for forming and approving the Integrated Energy Plan (IEP) and the IRP (Integrated Resource Plan for Electricity).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for solar energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.

- *Department of Transport – South African Civil Aviation Authority (SACAA):* This Department is responsible for aircraft movements and radar, which are aspects that influence renewable energy development location and planning.
- *National Department of Agriculture, Forestry, and Fisheries (DAFF):* This Department is responsible for activities pertaining to subdivision and rezoning of agricultural land. This Department has published a guideline for the development of solar energy facilities on agricultural land. The forestry section is responsible for the protection of tree species under the National Forests Act (Act No 84 of 1998).
- *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 Mineral and Petroleum Resources Development Act in terms of section 53 of the Mineral and Petroleum Resources Development 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.
- *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.
- *South African National Roads Agency (SANRAL):* This Agency is responsible for the regulation and maintenance of all national routes.

At a **Provincial Level**, the main regulatory agencies are:

- *Provincial Government of the North West – North West Department of Rural, Environmental and Agricultural Development (READ):* This Department is the commenting authority for the project as well as being responsible for issuing of any biodiversity and conservation-related permits which may be required.
- *North West Department of Community Safety and Transport Management*: This Department provides effective co-ordination of crime prevention initiatives, provincial police oversight, traffic management and road safety towards a more secure environment.
- *North West Provincial Heritage Resources Agency (NWPHRA)*: This department identifies, conserves and manage heritage resources throughout the North West Province.

At the **Local Level,** the local and district municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the North West Province, both the local and district municipalities play a role. The local municipality is the Naledi Local Municipality which forms part of the greater Dr Ruth Segomotsi Mompati District Municipality.

» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

3.4. National Policy

Further to the South African government's commitment in August 2011 to support the development of renewable energy capacity, the Department of Energy (DoE) initiated the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme to procure renewable energy from the private sector in a series of rounds. To date, the DoE has procured more than 6 000MW of renewable energy capacity from 92 independent power producers (IPPs), with 37 IPP facilities having started commercial operation, adding 1 860MW to the national grid and aiding in the diversification and stabilisation of the electricity supply of the country. National policies have to be considered for the construction and operation of the PV facility to ensure that the development is in line with the national planning of the country.

A brief review of the most relevant national policies are provided below. The development of the proposed Woodhouse Solar 1 PV Facility is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

3.4.1 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 solar 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.

3.4.2 White Paper on the Energy Policy of the Republic of South Africa, 1998

The White Paper on Renewable Energy Policy 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 the 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: i) financial instruments, ii) legal instruments, iii) technology development, iv) awareness raising, v) capacity building and education, and vi) 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.

3.4.3 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:

> *"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.

3.4.4 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 funding of the energy regulator for the purpose of regulating the electricity industry. The Act establishes a national regulatory framework for the electricity supply industry and introduces the National Energy Regulator as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licences and registration as the manner in which generation, transmission, distribution, trading and the import and export of electricity are regulated.

3.4.5 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 Woodhouse Solar 1 PV Facility, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The 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 addressing 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.

3.4.6 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 Woodhouse Solar 1 PV Facility 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 the primary-energy needs, while gas and renewable energy resources – especially solar, wind and imported hydroelectricity – will play a much larger role.

3.4.7 Strategic Integrated Projects (SIPs)

In 2010, a National Development Plan was drafted to address socio economic issues affecting development in South Africa. These issues were identified and placed under 18 different Strategic Integrated Projects (SIPs) to address the spatial imbalances of the past by addressing the needs of the poorer provinces and enabling socio-economic development. Amongst these is the green energy in support of the South African Economy i.e. SIP 8 (*Green energy in support of the South African economy)* and the generation of electricity in support of socio-economic development i.e. SIP 9 (*Electricity generation to support socio-economic development).* These SIPs aim to support sustainable green energy initiatives and socio-economic growth on national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP, 2010). The following are relevant:

SIP 8: Green energy in support of the South African Economy:
The proposed Woodhouse Solar 1 PV Facility is a potential SIP 8 Project as green energy will be generated while supporting the county's economy. It would become a SIP project if selected as a Preferred Bidder project by the Department of Energy. SIP 8 supports 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).

SIP 9: Electricity generation to support socio-economic development
The proposed Woodhouse Solar 1 PV Facility is a potential SIP 9 Project as electricity will be generated and social and economic upliftment, development and growth will take place within the surrounding communities. It would become a SIP 9 project if selected as a Preferred Bidder project by the Department of Energy. SIP 9 supports the acceleration of the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances.

3.4.8 Integrated Energy Plan (IEP)

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, which 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 the 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 and 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 in South Africa.

3.4.9 Final Integrated Resource Plan (IRP) 2010 - 2030

The Integrated Resource Plan (IRP) 2010-2030 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 almost twice 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 9.6GW; 6.3GW of coal; 17.8GW of renewables (including solar and wind); and 8.9GW of other generation sources. This means that 75% of new generation capacity by 2030 will be derived from energy sources other than coal.

3.4.10 Department of Energy Process for Independent Power Producers (IPPs)

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources. In order to meet the long-term goal of a sustainable renewable energy industry and to diversify the energy-generation mix in South Africa, a goal of 17.8GW of renewable energy by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with solar and wind comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Genesis Woodhouse Solar 1 (Pty) Ltd, an Independent Power Producer (IPP), proposes the establishment of the Woodhouse Solar 1 PV Facility and associated infrastructure on a site, located approximately 10km south east of Vryburg, in the North West Province to add new capacity to the national electricity grid. Genesis Woodhouse Solar 1 (Pty) Ltd will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA), as well as a power purchase agreement from Eskom or other relevant parties (i.e. typically for a period of 20 - 25 years) in order to build and operate the solar energy facility. As part of the agreement, Genesis Woodhouse Solar 1 (Pty) Ltd would be remunerated per kWh by

Eskom or a subsequent authority/market operator. Depending on the economic conditions following the lapse of this period, the facility can either be decommissioned, or the power purchase agreement renegotiated and extended.

The IPP will participate in a bidding process called the Renewable Energy Independent Power Producers Procurement (REIPPP) Programme, in which the Department of Energy (DoE) will determine Preferred Bidders. A Preferred Bidder will be held to compliance with the price and economic development proposals in its bid, with regular reporting to demonstrate compliance during the life of the project.

The DoE REIPPP Programme commenced in 2011. Genesis Woodhouse Solar 1 (Pty) Ltd intends to bid the proposed PV facility to the DoE in the next available round of the REIPPP Programme.

3.5. Provincial Level Developmental Policy

A brief review of the most relevant provincial and local policies is provided below. The proposed development is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

3.5.1 North West Provincial Growth and Development Strategy (PGDS) (2004-2014)

Goals and objectives of the North West Provincial Growth Development Strategy are to fight poverty and unemployment, improve the low level of expertise and skills which are classified as both immediate and long term goals and require primary goals for sustained growth and economic development. The proposed facility will contribute to employment creation and skills development which is in line with the goals and objectives of the North West PGDS.

The North West Provincial Growth Development Strategy aims at building a sustainable economy to eradicate poverty and improve social development. The proposed PV facility will contribute to growth and development of the local area by expanding the economic base and creating employment opportunities.

3.5.2 North West Province Spatial Development Framework (SDF) – North West Environmental Management Series 7 (2008)

The North West Provincial Government (NWPG) has recently adopted a ten-year growth and development strategy for the Province known as North West 2014. In order to fight poverty, unemployment and low levels of skills and expertise, this strategy has two goals. The *Economic Goal* which requires an average economic growth rate of 6.6% per annum and the *Poverty Eradication Goal* to wipe out the basic needs backlog which

annually will require investment estimated at R854 million. The key pillars for growth and economic development are:

» Agriculture and rural development
» Mining and energy
» Manufacturing
» Trade and finance
» Tourism
» Construction and infrastructure
» Small Medium and Micro Enterprise
» Training and skills development

The strategy lists a number of transversal objectives of which one is "Ensuring sustainable development through resource and environmental management". The Provincial Spatial Development Framework and Environmental Management Plan (PSDF–EMP) is one of the fundamental implementation instruments of North West 2014 and provides the spatial dimension for this strategy. The key emphasis is on economic growth and poverty eradication. This version mainly provides statements of objectives, key development issues, development concepts/ principles, and the spatial development rationale. The Spatial Development Framework (SDF) addresses the need for spatial planning, socio-economic development, infrastructure and conservation of natural resources. Key socio-economic issues which would require strategic planning provision include: employment (including youth and women); poverty eradication; attracting investment; economic growth; HIV / AIDS and other diseases; food security; physical infrastructure (including availability of industrial land); illiteracy; tourism development; population growth, urbanization and migration. Natural resource issues include inadequate water resources for future development; bush encroachment and alien invasive species; land and soil degradation; and overgrazing. With regard to spatial planning, the legacies of Apartheid-era policy is identified as a key issue and residents of the North West are consequently extremely underdeveloped.

The development of the proposed PV facility will contribute to economic growth and development, which will in turn help eradicate poverty through job creation and skills development in the region which will be in line with the North West SDF.

3.6. Local Authority Level Developmental Policy

The development policies at the district and local level have similar objectives for the respective area, namely economic growth, create jobs, uplift communities and alleviate poverty. The development of the proposed Woodhouse Solar 1 PV Facility is considered to align with the aims of these policies, even if contributions to achieving the goals therein are considered minor.

3.6.1 Dr Ruth Segomotsi Mompati District Municipality Integrated Development Plan (IDP) (2015/2016)

The mission of the district is, "to ensure optimal utilization of available resources through effective, efficient, sustainable integrated planning and corporate governance."

The existing level of development and challenges in Dr Ruth Segomotsi Mompati District Municipality can be summarised as follows:

» Dr Ruth Segomotsi Mompati District Municipality is endowed with minerals but this sector remains a small contributor to GDP of the Province;
» Population is largely African with low education, low incomes, high unemployment and with minimal access to water and sanitation;
» The large African population is largely young with a small percentage of adults who are economically active;
» Functional literacy does not favour Africans. There is a great challenge in the provision of education to empower Africans;
» Heavy dependency on public administration as employer. There is a critical need to develop the private sector in agriculture and mining involvement. The development of the Small Medium Micro Enterprise (SMME) sector both in the formal and informal sectors is critical.
» Current access to water and sanitation services is a concern.

The above calls for associated action to improve delivery of the needed services for socio and economic development in the Dr Ruth Segomotsi Mompati District Municipality.

The Key Performance Areas (KPA) of the district are as follows:

» *Service delivery and infrastructure development:* The objective is to eradicate backlogs in order to improve access to services and ensure proper operations and maintenance.
» *Public participation and good governance (governance structures):* The objective is to promote a culture of participatory and good governance.
» *Institutional development and transformation:* The objective is to improve organizational cohesion and effectiveness.
» *Financial viability:* The strategic objective is to improve overall financial management in the municipalities by developing and implementing appropriate financial management policies, procedures and systems.
» *Local economic development:* The strategic objective is to create an environment that promotes the development of the local economy and facilitate job creation.
» *Community services & development:* All citizens have a right to an environment that is not detrimental to human health, and it imposes a duty on the State to promulgate legislation and to implement policies aimed at ensuring that this right is upheld.

The strategic objective of the North West Department of Rural, Environment and Agricultural Development (READ) is to facilitate and promote local economic

development in the district through existing and shared partnerships. The district is an agricultural hub within the Province and as a result, special attention is given to promoting agricultural initiatives and ensuring value chain benefits from the sector. While it is acknowledged that agriculture is one of the main sectors contributing effectively to the Province's GDP, the district needs to ensure equitable focus on other sectors of the economy.

The following were identified as key strategic intervention areas to be prioritized from 2014 -2017:

» Promotion of Local Economic Development (Agriculture, Agri-Business, Land and Rural Development)
» Service Delivery (Infrastructure Development and Transportation)

Attraction of major investments to the district remains a challenge because of the poor infrastructure conditions, more specifically roads, water networks or reticulation, communication, electricity and transport networks. The critical importance of commitment to transforming the economy of the district therefore remains emphasised. This will ensure that job opportunities are increased for the unemployed masses (mainly the youth) of the Dr Ruth Segomotsi Mompati District Municipality.

The IDP aims at promoting local economic growth and social development in order to provide a better life for the communities. The proposed Woodhouse Solar 1 PV Facility will provide employment opportunities and contribute in assisting the district municipality in achieving local economic development and building a sustainable economy through introducing a relatively new sector into the local economy.

3.6.2 Naledi Local Municipality (NLM) Integrated Development Plan (IDP) (2015-2016)

One of the primary objectives of the IDP process for the NLM was to create a new vision for the Naledi Local Municipality's future local economic development based on its unique strengths and its capacity to leverage existing assets to generate revenue.

Based on the needs analysed in the IDP processes and the Naledi Spatial Development Framework (SDF, 2013), the following key strategic interventions are proposed by the Naledi Local Municipality:

» *Strategic Intervention A:* Regional development hub
» *Strategic Intervention B:* CBD Revitalisation
» *Strategic Intervention C:* Development of the cattle industry
» *Strategic Intervention D:* Growth of the game farming, hunting and eco-tourism industries
» *Strategic Intervention E:* Maximise revenue opportunities
» *Strategic Intervention F:* Uninterrupted basic service delivery

» *Strategic Intervention G:* Attract major renewable energy solar projects

The development of the Woodhouse Solar 1 PV Facility falls in line with the Strategic Intervention G (attract major renewable energy projects into the area), as the project is a planned 100MW facility. The development will contribute to employment creation and economic growth, which in turn will have a positive multiplier effect on the local area. The IDP 2015/2016 supports the investment of renewable energy developments in the Naledi Local Municipality.

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

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

- National Environmental Management Act (NEMA) 107 of 1998
- EIA Regulations, published under Chapter 5 of NEMA (GNR R982 in Government Gazette No 38282 of December 2014)
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - Public Participation in the EIA Process (DEA, 2010)
  - Integrated Environmental Management Information Series (published by DEA)
- North West Biodiversity Sector Plann(2015)
- Naledi Local Municipality Integrated Development Plan (IDP) (2015-2016)
- Dr Ruth Segomotsi Mompati District Municipality Integrated Development Plan (IDP) (2015/2016)
- International guidelines – the Equator Principles and the International Finance Corporation and World Bank Guidelines.

Several other Acts, standards or guidelines have also informed the project process and the scope of issues assessed in this report. A listing of relevant legislation is provided in **Table 3.2**, where the level of applicability of the legislation or policy to the activity/project is detailed.

Table 3.2: Relevant legislative permitting requirements applicable to the proposed Woodhouse Solar 1 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 section 24(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 R982, R983, R984 and R985 of December 2014, a Scoping and EIA Process is required to be undertaken for the proposed project.	» National Department of Environmental Affairs (DEA) – competent authority. » North West Department of Rural, Environment and Agricultural Development (READ) - commenting authority.	The listed activities triggered by the proposed Woodhouse Solar 1 PV Facility have been identified and assessed in the EIA process being undertaken. The EIA report is to 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 section 28(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.	» National Department of Environmental Affairs (DEA) - as regulator of NEMA.	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section is applicable during the EIA phase (currently in process) and will continue to apply throughout the life cycle of the project.

Environment Conservation Act (Act No 73 of 1989)	In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces, but the Northern Cape province have not yet adopted provincial regulations in this regard. Allows the Minister of Environmental Affairs to make regulations regarding noise, among other concerns.	» National Department of Environmental Affairs (DEA). » North West Department of Rural, Environment and Agricultural Development (READ). » Naledi Local Municipality.	Noise impacts are expected to be associated with the construction phase of the PV facility 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 general authorisation in terms of S39 and GN 1191 of GG 20526 October 1999. In terms of Section 19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	» Department of Water and Sanitation (DWS).	A water use license (WUL) is required in terms of sections 21(c) and 21 (i) of the National Water Act, if wetlands or drainage lines are impacted on, 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 sections 21(a) and 21 (b) of the National Water Act.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	According to section 27 of the act, any person who wishes to apply to the Minister for a mining permit must simultaneously apply for an environmental authorisation and must lodge the application (repealed by section 23 (b) of Act 49 of 2008). Requirements for Environmental Management Programmes and Environmental Management Plans are set out in section 39 of the Act (repealed by section 33 of Act 49 of 2008) Section 53 - 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). Section 42 of Act 49 of 2008 (Repealed of section of S53) states that the Minister may cause an investigation to be conducted if it is alleged that a person intends to use the surface of any land in any way that could result in the mining of mineral resources being detrimentally affected.	» Department of Mineral Resources (DMR).	Should material not be sourced from a commercial source and a borrow pit(s) be considered necessary, the Contractor shall source and apply for the relevant permit from the DMR.
National Environmental Management: Air Quality Act (Act No	Measures in respect of dust control (section 32) and National Dust Control Regulations of November 2013. Measures to control noise (section 34) - no regulations	» National Department of Environmental Affairs (DEA). » Naledi Local Municipality.	No permitting or licensing requirements arise from this legislation

39 of 2004)	promulgated yet.		The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act. The air quality officer may require a dust monitoring programme as per the Regulations for dust control. The draft EMPr however makes provision for managing and mitigating potential dust impacts (refer to **Appendix J**).
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; and » any development or other activity which will change the character of a site exceeding 5000m^2 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 5000m²; or the re-zoning of a site exceeding 10 000m² in extent. This notification must be provided in the early stages of initiating the	» National Department of Environmental Affairs (DEA) – where a heritage assessment is a component of the EIA. » SAHRA – National heritage sites (grade 1 sites) as well as all historic graves and human remains. » North West Provincial Heritage Resources Agency (NWPHRA)	An Archaeological and Palaeontological Impact Assessment (together forming the Heritage Impact Assessment of the PV Facility) was undertaken as part of the EIA process to identify heritage sites (refer to **Appendix F and G**). The overall project site is considered as having a low archaeological and palaeontological significance (with the implementation of appropriate mitigation

	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.		measures) as there is a lack of heritage resources located within the project site and the surrounding areas. The relevant mitigation measures for the protection of heritage resources are included in the draft EMPr (refer to **Appendix J**).
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 (section 53). A list of threatened and protected species has been published in terms of section 56(1) - Government Gazette 29657. Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the	» National Department of Environmental Affairs (DEA). » North West Department of Rural, Environment and Agricultural Development (READ).	Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. An ecological study has been undertaken as part of the EIA Phase (refer **to Appendix D**). As such the potential occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered. A permit may be required should any listed plant species be disturbed or destroyed as a

	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 R1002), 9 December 2011). Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. The Act also regulates alien and invader species. The Proponent has a responsibility for: » The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). » Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity. Limit further loss of biodiversity and conserve endangered ecosystems.		result of the proposed PV facility.
Conservation of Agricultural Resources Act	Regulation 15 of GN R1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GN R1048. Declared Weeds and Invaders in South	» Department of Agriculture, Forestry and Fisheries (DAFF).	While no permitting or licensing requirements arise from this legislation, this Act is applicable

(CARA) (Act No 43 of 1983)	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 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.		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 addition, a weed control and management plan must be implemented. The draft EMPr provides mitigation for soil erosion and weed control and management (refer to **Appendix J**). The permission of agricultural authorities will be required if the development of the PV facility requires the draining of vleis, marshes or water sponges on land outside urban areas.
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'.	» Department of Agriculture, Forestry and Fisheries (DAFF). » North West Department of Rural, Environment and Agricultural Development (READ).	A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest. A permit will be required for the destruction, removal or relocation of the *Acacia erioloba*

	Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence.		species present within the project site.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of section 12 the landowner would be required to burn firebreaks to ensure that should a veldfire occur on the property, that it does not spread to adjoining land. In terms of section 12 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. In terms of section 17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	» Department of Agriculture, Forestry and Fisheries (DAFF).	While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operational phase of the PV facility. The relevant management and mitigation measures have been included in the EMPr (refer to **Appendix J**).
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	» 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.

	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 substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. Section 2 to 4 provide general principles for land development and conflict resolution.	» North West Department of Rural, Environment and Agricultural Development (READ).	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA (Development Facilitation Act).
National Environmental Management: Waste Act (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	» National Department of Environmental Affairs (DEA) - Hazardous Waste. » North West Department of Rural, Environment and Agricultural Development (READ) – General Waste.	No waste disposal site is to be associated with the PV facility. In terms of GN R921, no permit is required. Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, (GN R926, of November 2013) and

	(GN R921 of November 2013), 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. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.		as detailed in this EMPr (refer to **Appendix J** of the EIA report).
Subdivision of Agricultural Land Act (SALA) (Act No 70 of 1970)	Details the subdivision of agricultural land and provisions under which the act is triggered. It also provides for the approval of such division by the Minister of Agriculture. Applies for subdivision of all agricultural land and long-term leasing of portions of agricultural land.	» Department of Agriculture, Forestry and Fisheries (DAFF). » North West Department of Rural, Environment and Agricultural Development (READ). » Naledi Local Municipality.	Long-term leases on portions or subdivision of the site properties will require an approval of the Minister of Agriculture. An application to DAFF will need to be submitted detailing the areas to be subdivided or leased for the purposes of the proposed development. An application in terms of SALA will need to be undertaken and submitted following the issuing of an environmental authorisation for

			the proposed project.
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.	» North West Department of Community Safety and Transport Management - Provincial Roads. » South African National Roads Agency Limited (SANRAL) - National 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 project components may not meet specified dimensional limitations (height and width).
Astronomy Geographic Advantage Act (Act No. 21 of 2007)	The Astronomy Geographic Advantage Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto.	» Department of Science and Technology	Approval and input from the Square Kilometer Array South Africa project office is required in order to confirm that SKA infrastructure is not significantly impacted on by the development of the PV facility. The site falls

	Chapter 2 of the Act allows for the declaration of astronomy advantage areas whilst Chapter 3 pertains to the management and control of astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following: * Restrictions on use of radio frequency spectrum in astronomy advantage areas * Declared activities in core or central astronomy advantage area * Identified activities in coordinated astronomy advantage area; and * Authorisation to undertake identified activities.		outside of the Northern Cape and the area governed by the AGA.
Provincial			
Transvaal Nature Conservation Ordinance (No. 12 of 1983)	The Nature Conservation Ordinance accompanied by all amendments is regarded by the North West Department of Rural, Environment and Agricultural Development as the legal binding, provincial documents, providing regulations, guidelines and procedures with the aim of protecting game and fish, the conservation of flora and fauna and the destruction of problematic species. In its entirety, with special reference to: » Schedule 2: Protected Game » Schedule 3: Specially Protected Game » Schedule 4: Protected Wild Animals » Schedule 5: Wild Animals » Schedule 7: Invertebrates » Schedule 11: Protected Plants	» North West Department of Rural, Environment and Agricultural Development (READ).	Approval from READ will be required in terms of the protection and conservation of fauna and flora in the North West Province.

	» Schedule 12: Specially Protected Plants		
Bophuthatswana Nature Conservation Act (Act 3 of 1973)	The Nature Conservation Ordinance accompanied by all amendments is regarded by the North West Department of Rural, Environment and Agricultural Development as the legal binding, provincial documents, providing regulations, guidelines and procedures with the aim of protecting game and fish, the conservation of flora and fauna and the destruction of problematic species. In its entirety, with special reference to: » Schedule 1: Protected Game » Schedule 1A: Specially Protected Game » Schedule 2: Ordinary Game » Schedule 3: Wild Animals In Respect Of Which The Provision Of Section 3 (a) (ii) Apply » Schedule 4: Wild Animals To Which The Provisions Of Section 4 (1) (b) Do Not Apply » Schedule 7: Protected Plants » Schedule 7: Specially Protected Plants	» North West Department of Rural, Environment and Agricultural Development (READ).	Approval from READ will be required in terms of the protection and conservation of fauna and flora in the North West Province.
North West Biodiversity Sector Plan	The Biodiversity Sector Plan informs land use planning, environmental assessments, land and water use authorisations, as well as natural resource management, undertaken by a range of sectors whose policies and decisions impact on biodiversity. This is done by providing information of biodiversity priority areas, referred to as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), with accompanying land use planning and decision making guidelines.	» North West Department of Rural, Environment and Agricultural Development (READ).	Approval from READ will be required for the development of the Woodhouse Solar 1 PV Facility.

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 4

An Environmental Impact Assessment (EIA) process refers to the process 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 as per the EIA Regulations, 2014.

The EIA process for the proposed Woodhouse Solar 1 PV Facility is being undertaken in accordance with section 24(5) of NEMA (No 107 of 1998). In terms of the EIA Regulations (2014) of GN R982 as well as GN R983, GN R984 and GN R985, Scoping and EIA studies are required to be undertaken for the development of the proposed PV Facility. In order to ensure that a comprehensive assessment is provided to the competent authority and I&APs regarding the impacts of the proposed PV facility, environmental studies were undertaken within the two phases of the EIA process (Scoping Phase and EIA Phase).

4.1. Legal Requirements as per the EIA Regulations for the undertaking of an Environmental Impact Assessment Report, 2014

This chapter of the EIA report includes the following information required in terms of Appendix 3: Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(h)(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs.	The public participation process followed throughout the EIA process of the Woodhouse Solar 1 PV Facility is included in section 4.3 and copies of the supporting documents and inputs are included in Appendix C.
3(h)(iii) a summary of the issues raised by interested and affected parties, and an	The main issues raised through the undertaking of the public participation process

indication of the manner in which the issues were incorporated, or the reasons for not including them.	within the EIA Phase including consultation with I&APs will be included in section 4.3.4 of the final EIA report (including all comments raised during the review period) and the Comments and Responses Report included in Appendix C.
3(h)(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks.	The methodology used to determine and rank the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks is included in section 4.3.5.
3(p) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed.	A description of the assumptions and limitations is included in section 4.3.6.

4.2. Scoping Phase

During the Scoping Phase of the EIA process various specialist studies within various fields were undertaken to provide input regarding the proposed Woodhouse Solar 1 PV Facility. The specialist studies included ecology, archaeology, palaeontology, soils, land-use, land capability and agricultural potential, visual and social. All of these fields were included in the Plan of Study for the EIA Phase with the exception of the soils, land-use, land capability and agricultural potential as a result of the severe limitations on the agricultural potential resulting in an overall low agricultural potential of the entire project site, limiting the use of the site to livestock grazing. As a result of the findings no further studies were required to be undertaken during the EIA Phase in terms of soils, land-use, land capability and agricultural potential, this was accepted by DEA.

A Scoping report was released for review from 13 November 2015 – 14 December 2015 for a 30-day comment period. Following the review period, a final Scoping report was submitted to DEA in January 2016. This together with the Plan of Study for the EIA was accepted by the DEA, as the competent authority, in February 2016. In terms of this acceptance, and in line with Regulation 23, an EIA phase was required to be undertaken for the Woodhouse Solar 1 PV Facility.

The Scoping study provided interested and affected parties (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 solar energy facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA Phase. This was achieved through an evaluation of the proposed PV facility, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and I&APs.

4.3. Environmental Impact Assessment Phase

The EIA Phase aims to achieve the following:

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

The EIA Report addresses potential direct, indirect, and cumulative[13] 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 Woodhouse Solar 1 PV Facility.

4.3.1. Tasks completed during the EIA Phase

The EIA Phase for the proposed PV facility has been undertaken in accordance with the EIA Regulations published in GN 38282 in December 2014, in terms of the 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 Chapter 6 of Government Notice R982 of 2014 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.
» Undertaking of independent specialist studies in accordance with Appendix 6 of Government Notice R982 of 2014.
» Preparation of an EIA Report in accordance with Appendix 3 of the EIA Regulations, Government Notice R982 of 2014.

These tasks are discussed in detail below.

[13] "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

In terms of the Energy Response Plan, the DEA is the competent authority for all energy related projects. As the project falls within the North West, the North West Department of Rural, Environmental and Agricultural Development (READ) is the commenting authority for the project. A record of all authority consultation undertaken is included within this EIA report. Consultation with the regulating authorities (i.e. DEA and North West READ) has continued throughout the EIA process. On-going consultation included the following:

» Submission of the application for authorisation to DEA;
» Submission of the Scoping report for review by the competent authority from 13 November 2015 to 14 December 2015.
» The final Scoping report was submitted in January 2016. Acceptance of the Scoping report was received from the competent authority (DEA) in February 2016.
» The EIA report will be made available for a 30-day review period for comment and input.

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

» Submission of a final EIA report to DEA following the 30-day review period of the EIA report including the receipt of the comments from the DEA and READ on the EIA report.
» If required, an opportunity for DEA and READ representatives to visit and inspect the proposed development area.
» Notification and consultation with Organs of State (refer to **Table 4.1**) that may have jurisdiction over the project, including:
  * National and Provincial departments
  * Parastatals and Non-Governmental Organisations
  * Local Municipality and 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 is made available to potential stakeholders and I&APs.
» Participation by potential I&APs is facilitated in such a manner that all potential stakeholders and I&APs are provided with a reasonable opportunity to comment on the proposed project.

» Comments received from stakeholders and I&APs are 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:

» 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.
» Focus group meetings (pre-arranged and stakeholders invited to attend, including with directly affected and surrounding landowners).
» The EIA Report 30-day review period from 03 May 2016 – 02 June 2016. The comments received from I&APs, the competent authority, the commenting authority and the relevant Organs of State departments will be captured within a Comments and Response Report, and will be included within the final EIA Report, for submission to the competent authority (DEA) for decision-making.

In terms of the requirement of Chapter 6 of the EIA Regulations of December 2014, the following key 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 EIA Report for a 30-day review period
» Preparation of a Comments and Responses Report which documents all of the comments received and responses from the project team.

In compliance with the requirements of Chapter 6: Public Participation of the EIA Regulations, 2014, the following summarises the key public participation activities conducted to date.

» **Placement of Site Notices**
Site notices (in English and Afrikaans) were placed at visible points on the affected property (i.e. the Remaining Extent of the farm Woodhouse 729) boundary fence in two locations, along the R34 and the Amalia Secondary gravel road, in accordance with the requirements of the EIA Regulations. Further notices were placed at the Naledi Local Municipality offices and the Vryburg Public Library located in the town of Vryburg. Copies of all the site notices are included within **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** below).

Table 4.1: Summary of Stakeholders identified for inclusion in the project database during the Public Participation Process of the Woodhouse Solar 1 PV Facility 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)
Department of Science and Technology (DST)
Government Bodies and State Owned Companies
Eskom SOC Limited
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
North West Provincial Department of Rural, Environment and Agricultural Development
North West Provincial Heritage Resources Agency
North West Provincial Department of Community Safety & Transport Management
Local Government Departments
Naledi Local Municipality
Dr Ruth Segomotsi Mompati 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**
During the scoping phase, a newspaper advert was placed to notify and inform the public of the propose project and the availability of the Scoping report for review. The advert was placed in the Overvaal local newspaper on 13 November 2016 which is distributed and read in the surrounding areas of the proposed development.

During the EIA phase, a second newspaper advert has been placed to inform the public of the availability of the EIA report for review. The advert will be placed in the Overvaal local newspaper on 06 May 2016.

Proof of the newspaper advertisements are included in **Appendix C**.

» **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 **Table 4.2** below:

Table 4.2: Consultation undertaken with I&APs for the Woodhouse Solar 1 PV Facility.

Activity	Date
Placement of site notices on-site.	05 November 2015
Distribution of letters announcing the EIA process and the availability of the Scoping report for review for a 30-day comment period. These letters were distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups.	13 November 2015
30-day review period for the Scoping report for comment.	13 November 2015 – 14 December 2015
The EIA process and the availability of the Scoping report for review was advertised in the Overvaal local newspaper.	13 November 2015
Focus Group Meeting with key stakeholders.	2 - 3 December 2015
Distribution of letters announcing the availability of the EIA Report for review for a 30-day comment period. These letters were distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups.	03 May 2016
The availability of the EIA Report for review and the date of the public meeting advertised in the Overvaal local newspaper.	06 May 2016
30-day review period of the EIA Report for comment	03 May 2016 – 02 June 2016
Public Participation meetings to be held during the 30-day review period: » Public Meeting	19 May 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 Reports which is included in **Appendix C**. The Comments and Responses Report includes detailed responses from members of the EIA project team and/or the project proponent.

During the Scoping Phase of the EIA process focus group meetings were held with key stakeholders in order to provide them with background information regarding the project. These key stakeholders included the adjacent landowners and the Ward Counsellor of the affected ward within which the project is proposed (Ward 5).

4.3.5. Assessment of Issues Identified through the Scoping Process

Issues which required further investigation within the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated in **Table 4.3**below.

Table 4.3: Specialist consultants who have assessed the potential impacts associated with the Woodhouse Solar 1 PV Facility

Specialist	Area of Expertise	Refer Appendix
Gerhard Botha of Eco-Care Consultancy	Ecology, Flora, Fauna, Water Resources and Ecosystems	Appendix D
Blair Zoghby of Simon Todd Consulting	Avifauna	Appendix E
Jaco van der Walt of Heritage Contracts and Archaeological Consulting	Heritage and archaeological resources	Appendix F
Elize Butler of the National Museum of Bloemfontein	Palaeontology	Appendix G
Jon Marshall of Afzelia Environmental Consultants	Visual Impacts	Appendix H
Candice Hunter of Savannah Environmental and Neville Bews of Neville Bews and Associates	Social Impacts	Appendix I

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the Woodhouse Solar 1 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 the developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. An EMPr is included as **Appendix J**.

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 the developer and I&APs to the environmental team was correct and valid at the time it was provided.
» It is assumed that the development site/footprint for the PV facility identified by the developer represents a technically suitable site for the establishment of the proposed Woodhouse Solar 1 PV Facility which is based on the design undertaken by technical consultants for the project.
» It is assumed correct that the proposed connection to the Eskom national grid is correct in terms of viability and need.
» 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 – I** for specialist study specific limitations.

DESCRIPTION OF THE RECEIVING ENVIRONMENT CHAPTER 5

This section of the EIA Report provides a description of the environment that may be affected by the Woodhouse Solar 1 PV Facility. This information is provided in order to assist the reader in understanding the receiving environment within which the proposed solar energy facility will be located. Features of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from existing information available for the area, as well as from the specialist investigations undertaken for this EIA, and aims to provide the context within which this EIA process is being conducted. A comprehensive description of each aspect of the affected environment is included within the specialist reports contained within **Appendices D-I**.

5.1 Legal Requirements as per the EIA Regulations for the undertaking of an Environmental Impact Assessment Report, 2014

This chapter of the EIA report includes the following information required in terms of Appendix 3: Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(h)(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	The environmental attributes associated with the surrounding areas and the project development footprint is included in this chapter as a whole.

5.2 Regional Setting: Location of the Study Area

The North West Province shares its boundaries with the Free State, Limpopo and Gauteng provinces, and is the gateway to Botswana. It covers an area of ~104 882km². Much of the Province consists of flat areas of scattered trees and grassland. The Vaal River flows along the southern border of the Province. Mahikeng (previously Mafikeng) is the capital, and the largest towns are Mmabatho, Potchefstroom and Klerksdorp. The North West Province is divided into four district municipalities which include: Bojanala District Municipality, Ngaka Modiri Molema District Municipality, Dr Ruth Segomotsi District Municipality and Dr Kenneth Kaunda District Municipality, which are further subdivided into 19 local municipalities.

The project site for the proposed Woodhouse Solar 1 PV facility is located approximately 10km south-east of Vryburg on the Remaining Extent of the Farm Woodhouse 729 (refer to **Figure 5.1**). The site falls under the jurisdiction of the Naledi Local Municipality (NLM) and within the greater Dr Ruth Segomotsi Mompati District Municipality (DRSMDM).

The associated land parcel for the development of the facility is owned by a private landowner, and a lease-agreement with Genesis Woodhouse Solar 1 (Pty) Ltd will be undertaken for the life of the facility. The farm is ~2264 ha in extent. The project site is located close to the head of a shallow valley that breaks through a range of low hills which extends roughly in a south west to north eastern direction towards Gauteng, dividing the West Griqualand in the north from the Karoo in the south. A small portion of the project site has been used for cultivation activities.

The farm portion is situated within an area where national, regional and local main roads are present. The farm portion is traversed by the R34 which is located in the northern boundary of the property and which divides the property into two portions along the road. A secondary main road, known as the Amalia Road (of a gravel nature) is located along the western boundary of the property. Two national roads are located within the vicinity of the project site including the N14 which is located to the north of the project site and the N18 located to the west of the project site and west of the Amalia Road. This enables relatively easy access to the site. Within the vicinity of the project site and the surrounding areas other existing infrastructure is present which includes power lines and substations. Within the northern portion of the project site and along the boundary of the project site lies the Delareyville Munic/Vryburg 1 88kV Feeder power line and just north of the project site boundary is the existing Woodhouse Substation. Future construction of power infrastructure is also present within the project site and includes the construction of the authorised Eskom Bophirima Substation, to be located within the northern portion of the project site and the construction of the authorised 132kV Eskom Bophirima–Mookodi power line.

The location of the site falls within a Renewable Energy Development Zone (REDZ 6). These zones have been identified as areas earmarked for the development of renewable energy facilities. The entire town of Vryburg and its surrounding areas are included within this zone, which is considered suitable for the development of solar energy facilities. Assessments have been undertaken by the CSIR to determine what the landscape sensitivity is within the REDZ. **Figure 5.2** below provides an illustration of the landscape sensitivity within the Vryburg REDZ 6. The site falls almost completely within an area classified as a low landscape sensitivity. Therefore, the proposed site can be considered as preferred and suitable for the development of PV facility.

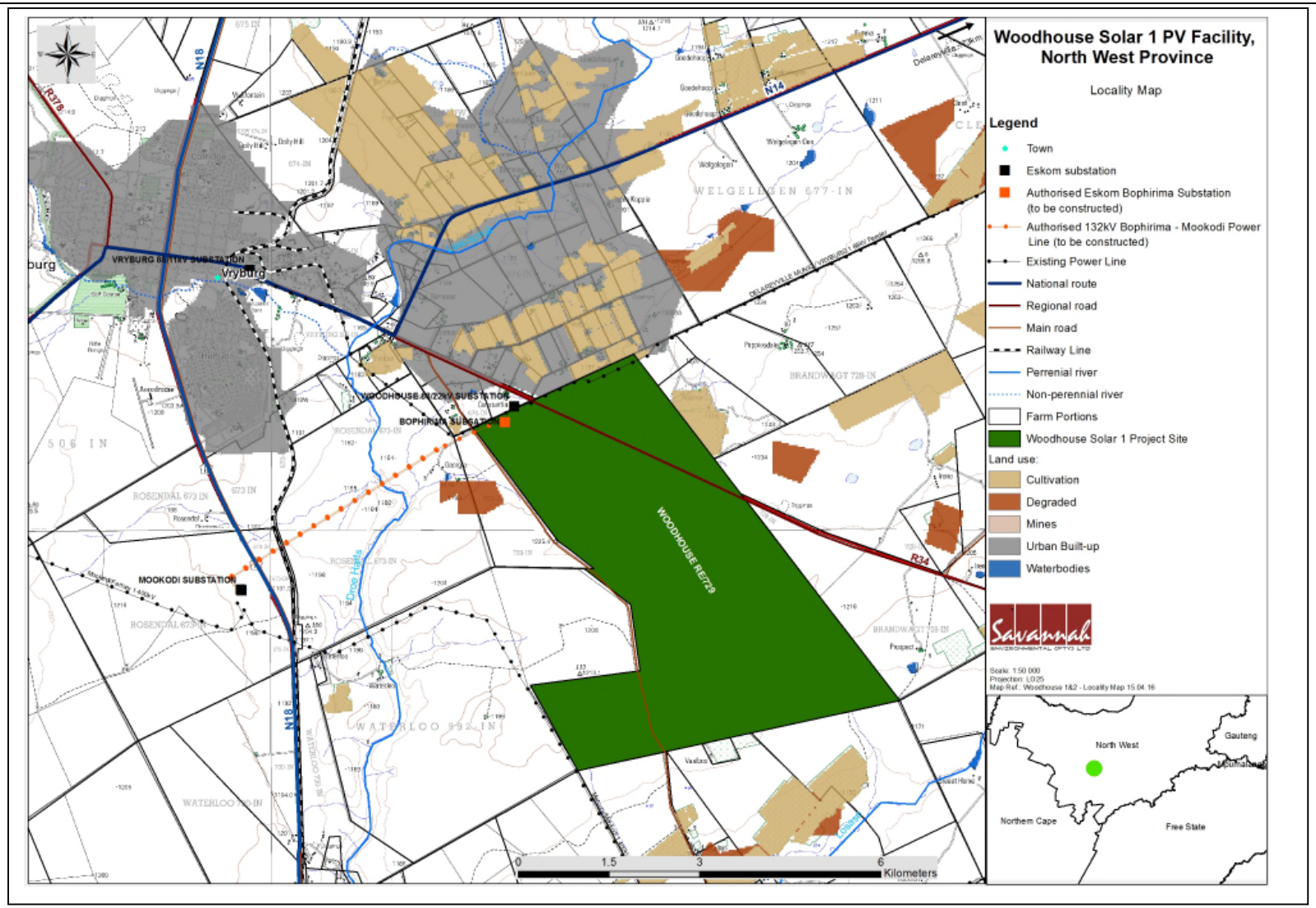


Figure 5.1: Regional context of the Woodhouse Solar 1 PV Facility project site relative to the town of Vryburg.

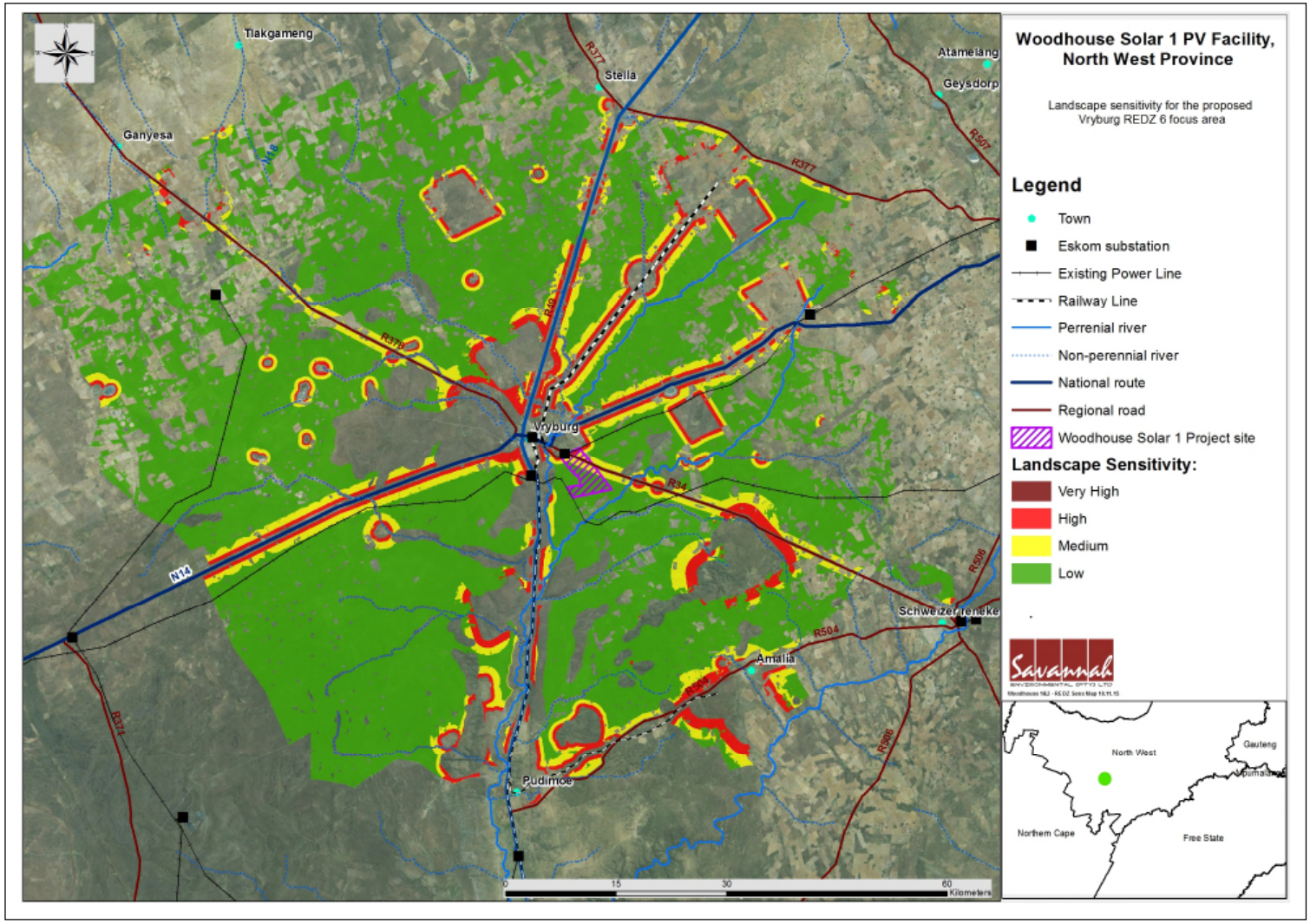


Figure 5.2: An illustration of landscape sensitivity of the Woodhouse Solar 1 PV Facility site as per the REDZ Zone 6 (refer to **Appendix K**).

5.3 Existing land-uses

The current land use on site is agricultural, although limited to grazing activities due to the low agricultural potential and severe limitations on crop production. The current landowner utilises the whole extent of the farm as grazing space for his cattle. Trampled cattle paths and bare patches of exposed soil are present as a result of the combination of historical and current grazing activities and the drought conditions experienced within the area. The dominance of *Eragrostis rigidior* in the area is an indication of past disturbance and overgrazing. Through the historical and current grazing taking place within the farm, over an extended period of time, disturbance of the natural habitat has taken place. Other disturbances within the area include the existing Eskom overhead power lines, a network of service and farm gravel roads, the regional road (R34) located to the east of the development area, boarder fences surrounding the property and the Woodhouse Substation. The project site has already been subject to varying degrees of disturbance and degradation caused by past and present land-use practises. Evidence of high stocking rates and grazing pressure is apparent.

In addition to general uses there are a number of service uses present:

» Adjacent roads including the N14, N18, R34 and the Amalia Road (gravel main road);
» A railway line is located to the west of the proposed site which traverses the town of Vryburg
» A local mine site located to the north of the project site;
» Agri-industrial areas including areas of stock pens;
» Existing electrical infrastructure including overhead power lines that run close to the northern and southern boundary of the site; and
» Isolated transportation uses within the rural area.

5.4 Access and Transport Routes in the Region

The proposed project site is accessible via the regional road (R34) which traverses the northern portion of the project site and divides the property into two separate portions. Alternatively, access can be gained via the national route (N18) situated to the west, or a secondary unsurfaced main road, known as the Amalia Road, which is located along the western boundary of the project site.

5.5 Biophysical Characteristics of the Study Area

5.5.1 Climatic Conditions

The climate of Vryburg has the following characteristics:
i) rainfall occurs mainly in summer and autumn with very dry winters;

ii) the mean annual rainfall is about 477 mm with January being the wettest month averaging at about 89 mm and July being the driest with an average of only 4 mm;
iii) the average annual temperature in Vryburg is 17.9 °C with January being the warmest (Ave. 24.8 °C) and July being the coldest (Ave 9.3 °C); and
iv) frost is frequent to very frequent in winter (mean frost days: 40).

The North West Province receives a high average daily direct normal and global horizontal irradiation (2120-2240 kWh/m^2/annum) which indicates that the regional location is appropriate for the solar energy facility. Factors contributing to the location of the PV facility includes the relatively high number of daylight hours and the low number of rainy days experienced in this region.

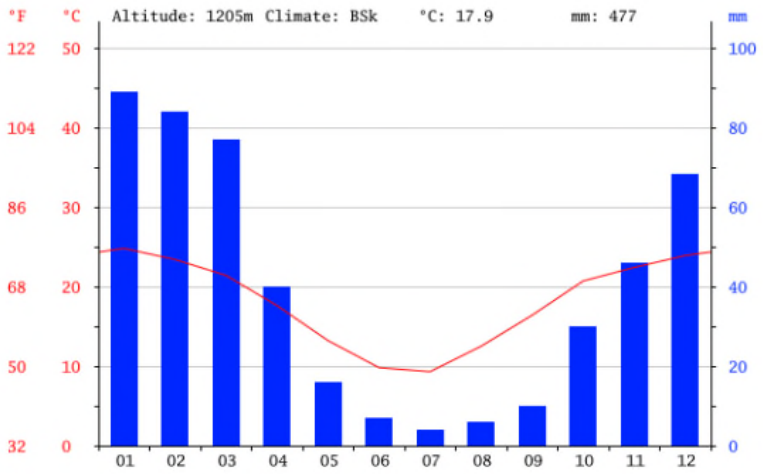


Figure 5.3: Climate graph for the town of Vryburg, North West Province.

5.5.2 Topography

The region within which the project site is located can be described as a flat plateau. The average slope of the area is between 0% and 2%. The development site is situated at elevations of between 1 197m and 1 230m above sea level with an average slope of less than 1.5% and a maximum slope of 5.8%. The largest portion and central part of the site is situated on a relatively flat plateau with gradual slopes towards lower lying areas to the north, south and the north-west of the site.

The topography can be described as gently undulating with the head of the valley being approximately 60m above the valley floor. Minor ridgelines that extend into the valley in the vicinity of the site are approximately 20 – 30m above the valley floor. The proposed project site straddles two low ridgelines close to the head of the valley on the eastern side of the main watercourse.

Within the centre of the project site proposed for the Woodhouse Solar 1 PV Facility lies a ridge (crest and upper slope). This ridge traverses the project site in a west-east direction and is also affected by the regional road, R34.

5.5.3 Soils, Land Types and Agricultural Potential

Soils

The underlying geology of the study area is dominated by andesite and basalt lavas of the Ventersdorp Supergroup. Quartzite of the Vryburg formation and Dwyka tillite occur sporadically in places. Dolerite, diabase and calcrete may also be spread across the proposed site.

The most relevant soil properties of the site are described below (refer to **Figure 5.4**):

» **Land type Ae** covers a large area of the proposed site. Soils of this land type are red and yellow well-drained sandy soils with a high base status found directly on semi-shallow underlying rock. Rock-soil complexes cover a large percentage of the area. An orthic A horizon is mostly found directly on top of hard rock, or on a red apedal B and seldom on a yellow-brown apedal B. The B horizon may contain fragments of the eroded mother material. High clay content B horizons are also present and occupy ~ 10% of the area. Soils of this type form part of the Shortlands soil form.

» **Land type Ag** is rocky with almost 20% rock outcrops present. Shallow Mispah and Glenrosa soil forms are abundantly found. Some red and yellow well-drained sandy soil with high base status may occur in places.

» The general soil pattern is classified as LP1 which is described as soils with limited pedological development, usually shallow on hard or weathering rock, with or without intermittent diverse soils, and CM which are red soils with a high base status. Lime is generally absent in the landscape but the geology does produce alkaline soils (Fey, 2010).

» Soil classes provided by Fey, 2010, indicate that lithosols are very abundant and hard rock outcrops are also present. Lithosols are shallow soils on hard or weathering rock (Fey, 2010). They may receive water runoff from associated rock and are not generally deep because of their association with depth limiting rock layers. Soil horizons associated with the lithic group are lithocutanic B and hard rock, which occur in Glenrosa, Mispah and Cartef soil forms.

» There are also cumilic soils present which are complementary to the lithosols but are found in lower areas of the landscape where deposition is on-going (Fey, 2010). Soil horizons associated with the cumulic group are neocutanic or neocarbonate B, regic sand, deep E or stratified alluvium, which occur in Tukulu, Oakleaf, Montagu, Augrabies, Namib, Vilafontes, Kinkelbos, Fernwood and Dundee soil forms.

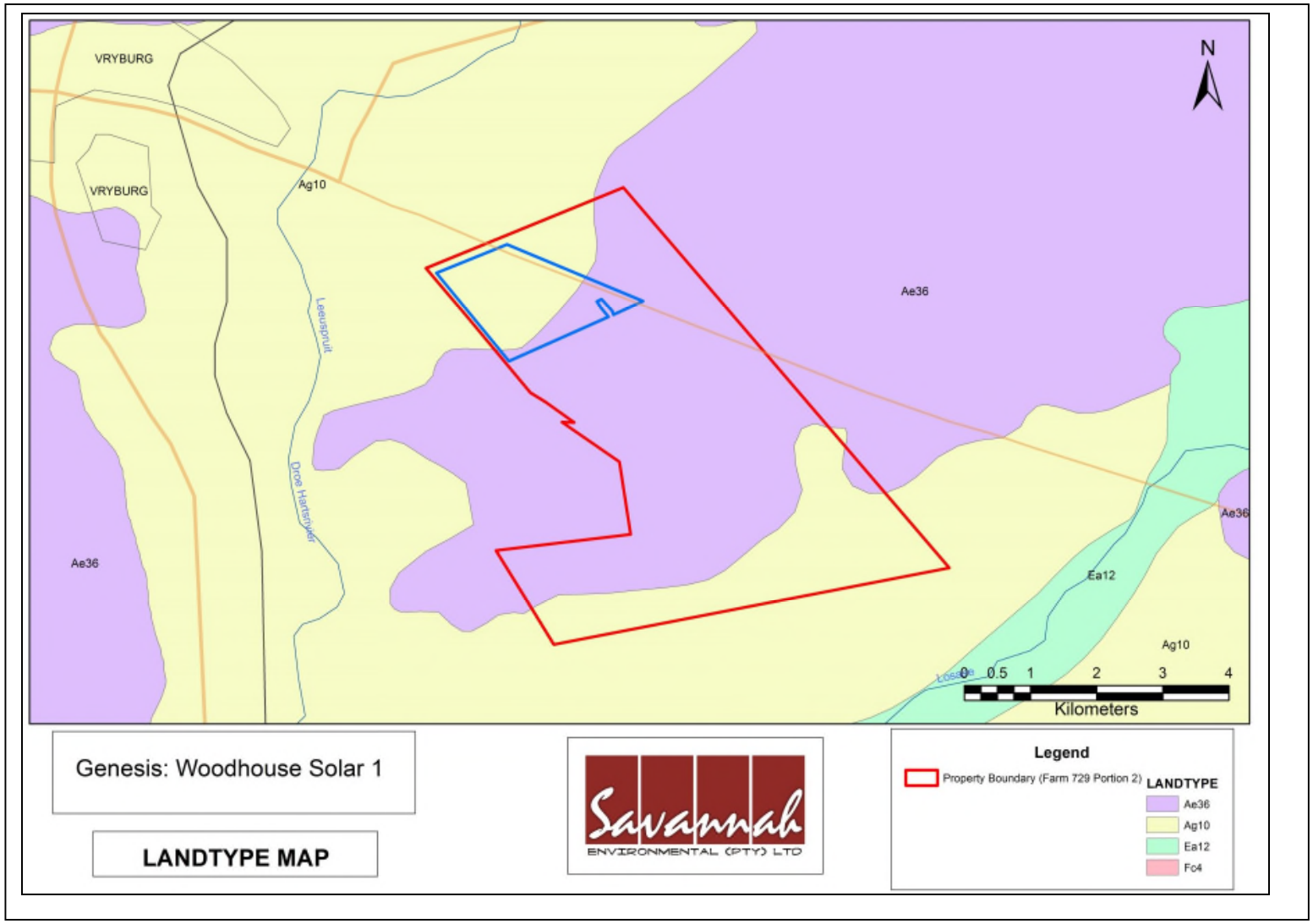


Figure 5.4: Land type properties of the Woodhouse Solar 1 PV Facility Project site.

Agricultural Potential

The entire Woodhouse Solar 1 PV Facility project site is classified as Land Class V, which is associated with little or no erosion hazard but has other limitations which are impractical to remove that limit the use of the land mainly to grazing and habitat for wildlife. These limitations restrict the type of plants that can be grown and prevent normal tillage of cultivated crops. The landscape is nearly flat. Some areas are stony, while others have climatic limitations, or have some combination of these limitations.

The climatic conditions of the site are associated with a moisture availability of class 4 which equates to moderate to severe limitations accompanied by low and unreliable rainfall. Temperature and rainfall variations are high and restrict regular crop production. Various factors have constraints that prohibit crop production and lead to insignificant agricultural activities except that of grazing. The agricultural potential of the site can be described as low.

5.5.4 Geohydrology

Regarding the geohydrology of the broader area, in which the Woodhouse Solar 1 PV Facility project site is located, a study was conducted by Tessema and Nzotta (2014) wherein groundwater resource potential in the Naledi Local Municipality were evaluated. From the study the following conclusions were made:

Based on similarity in hydrological properties, the area can be broadly subdivided into three potential aquifer types.

» *Basement Aquifers*: Consisting of Kraaipan, Ventersdorp volcanics and Archaean intrusive rocks. These aquifer types extend over a very large area, but are concealed by a veneer of Tertiary-to-Quaternary terrestrial sedimentary rocks.
» *Inter-granular aquifers*: Comprise of alluvial gravel and clastic sedimentary rocks of the Ventersdorp and Kalahari Group. The alluvial gravel aquifers often occur along major rivers that are located southeast of Stella and south of Vryburg towns.
» *Karst aquifers*: These aquifers are associated with the Malmani Subgroup of the Transvaal basin and consist out of limestone, dolomite and calcareous sedimentary rocks that largely cover the area south of Vryburg town.

The study found that the southern part of the Naledi Local Municipality is characterised by good groundwater potential. The most significant zone covers approximately 14% of the municipality and is located within carbonate rocks to the south of the municipality and includes a very small section of the project site. These areas also play an important role as recharge zones. The tritium[14] enrichment of groundwater suggest that the groundwater recharge zone takes place through the process of infiltration of rain and

[14] A radioactive isotope of hydrogen with a mass approximately three times that of the usual isotope.

surface water. In addition, dissolution of carbonate rocks in these areas, by water that percolates through pre-existing fractures leading to enlarged fracture apertures, may consequently result in the development of large cavities.

The zone of good groundwater potential within the Ventersdorp Supergroup coincides with maximum concentration of fractures joints and fissures. Rocks of the Ventersdorp and Transvaal Supergroups in the western edge of the Kaapvaal craton are block faulted during 'cratonic updoming' at approximately 2.1 billion years ago. As a result of this process most of the rocks were deformed and fractured. Surface water or mildly acidic rain water percolates along these features (i.e. fractures and faults) and dissolve the underlying carbonate rocks. This suggests that pre-existing structures within carbonate rocks played a significant role in the development of high yielding wellfields within the region. In addition, younger and coarse sedimentary rocks of the Karoo Supergroup and Kalahari sand were deposited atop the Transvaal carbonate rocks which enhanced the seepage of rainwater.

Moderate-to-good groundwater potential zones locally follow the main rivers within the Ventersdorp and Kalahari Group suggestive of proximity to river channels as one of important indicators of groundwater potential.

5.5.5 Surface hydrology and water resources

The affected property/project site (i.e. Remaining Extent of the farm Woodhouse 729) is situated in the catchment areas of the Losase River and the Droë Harts River. Non-perennial (ephemeral) watercourses traverse the farm property most of which flow in a north to south and north-east to south-east direction. According to NFEPA wetland classification, two wetland depressions and two small wetland flats, as well as two channelled valley bottom wetlands can be found within the farm property, none of which is located in close proximity to the development area for Woodhouse Solar 1 PV Facility. Prior a desktop delineation and a site visit, four depression wetlands, one valley bottom wetland which has been transformed by the presence of a small dam, one flat/depression wetland which also seems to have been dammed and two other artificially constructed dams, were identified within the affected property. Most of these wetland bodies area located well beyond the boundary of the proposed Woodhouse Solar 1 PV Facility development area. The only wetland body located in close proximity to the site as an artificial dam located in the north-east portion of the development area. As mentioned, non-perennial (most likely) or perennial drainage lines traverse the farm property. Most of these drainage systems are ephemeral tributaries which link up with larger ephemeral streams to eventually terminate into either the Losase River or the Droë Harts River. Two small ephemeral tributaries are present in the south west and south east of the development area and flows in a south-western direction to terminate in the Droë Harts River.

The project site is also situated close to the head of a shallow valley that breaks through a range of low hills which extends roughly in a south west to north eastern direction towards Gauteng, dividing the West Griqualand in the north from the Karoo in the south. The head of the valley is a watershed between catchments. The watercourse that flows south through the valley, known as the Harts River, is a tributary of the Vaal River. A number of non-perennial streams flow through the side valleys into this watercourse.

Refer to **Figure 5.5** and **Figure 5.6** below for a map of the water resources/features.

5.6 Ecological Profile

The ecological profile of the area comprising the project site makes up a large majority of the proposed Woodhouse Solar 1 PV Facility development area. The majority of the north-western section of the project site is moderately overgrazed and trampled cattle paths and bare patches of exposed soil are present as a result of the combination of historical and current grazing activities and the drought conditions experienced within the area. The dominance of *Eragrostis rigidior* in the area is an indication of past disturbance and overgrazing. Other disturbances within the area include the existing Eskom overhead power lines, a network of service and farm gravel roads, the regional road (R34) located to the east of the development area, boarder fences surrounding the property and the Woodhouse Substation. The project site and the proposed development area have already been subject to varying degrees of disturbance and degradation caused by past and present land-use practises. Evidence of high stocking rates and grazing pressure is apparent.

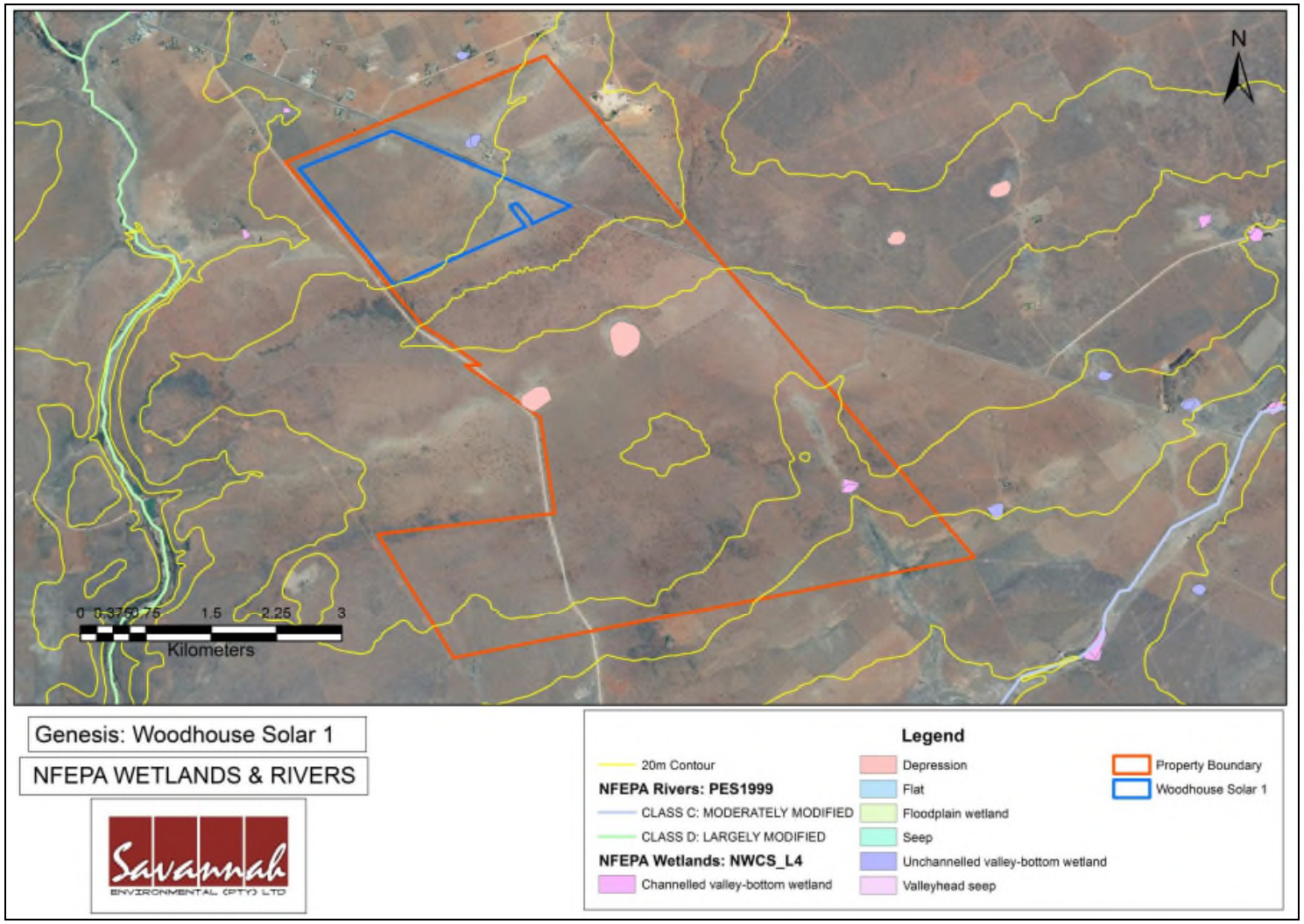


Figure 5.5: A map illustrating the NFEPA wetlands and rivers located within and surrounding the project site.

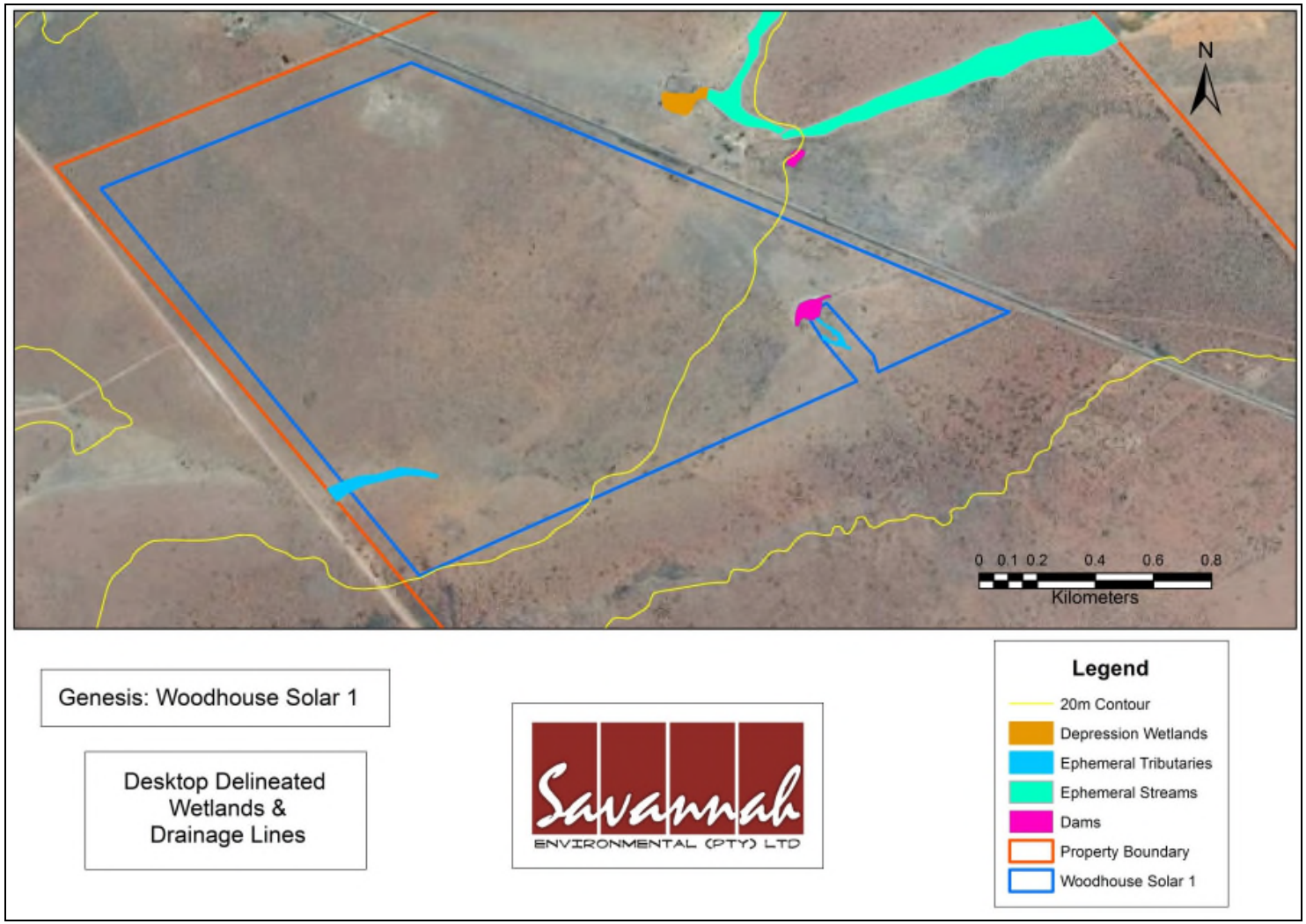


Figure 5.6: A map illustrating the desktop delineated wetlands and drainage lines located within the project site

5.6.1 Flora

Broad vegetation types

The Woodhouse Solar 1 PV Facility project site is situated in the Savanna biome and Eastern Kalahari Bushveld Bioregion. The vegetation in and surrounding the study area is Ghaap Plateau Vaalbosveld (SVk 7).

The distribution of the vegetation type is spread across the Northern Cape and North West Province, from the area close to Campbell in the south east of Danielskuil through Reivilo to around Vryburg in the north. This vegetation type has been described by Mucina and Rutherford (2006) as a flat plateau with well-developed shrub layer with *Tarchonanthus camphoratus* and *Acacia karroo*. Open tree layer has *Olea europaea* subsp. *africana*, *A. tortilis*, *Ziziphus mucronata* and *Searsia lanceae*. *Olea* is more important in the southern parts of the unit, while *A. tortilis*, *A. hebeclada* and *A. mellifera* are more important in the north and part of the west of the unit. Much of the south-central part of this unit has remarkably low cover of Acacia species for an arid savanna and is dominated by the non-thorny *T. camphoratus, R. lanceae* and *O. europaea* subsp. *africana.*

A total of 369 indigenous species have been recorded in the Vryburg region according to the SANBI database. It is highly unlikely that all of these species will occur within the project area. Alien invasive species (33) have also been recorded within the relevant quarter degree grids.

Conservation status of broad vegetation types

According to Mucina and Rutherford (2006) none of the vegetation type associated with the project site (i.e. Ghaap Plateau Vaalbosveld) is protected within formal conservation areas, but only 1% of this unit has been transformed. The conservation status of this unit is classified as Least Threatened and is not listed under the National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environment Management: Biodiversity Act (Act No. 10 of 2004) (refer to **Table 5.1** below).

Table 5.1: Conservation status of the vegetation type occurring in and around the project site.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation Status	
				Driver *et al.*, 2005; Mucina & Rutherford, 2006	National Ecosystem List (NEM:BA)
Ghaap Plateau Vaalbosveld	16%	0	1%	Least Threatened	Not Listed

Red list and protected plant species within the broader area

A species list was obtained from POSA for the relevant degree grids (http://posa.sanbi.org, Grid reference 2624 and 2724). The species on this list were

evaluated to determine the likelihood of any of them occurring in the study area. Of the species that are considered to occur within the geographical area under consideration, there were 19 species which are regarded conservation-worthy. Three species recorded in the degree grids are listed on the Red List plant species. According to the South African Red List Categories, one is listed as Rare (*Gnaphalium nesonii*), one Vulnerable (*Rennera stellata*) and one Near Threatened (*Lithops lesliei*). *Boscia albitrunca* is the only tree species protected according to the National Forest Act (NFA) and from a broader perspective that may potentially occur within the broader study area surrounding the project site (however the presence of the species within the project site has not been recorded). The remaining 15 species are protected within the Transvaal Nature Conservation Ordinance (TNCO) and Bophuthatswana Nature Conservation Act (BNCA).

Fine scale vegetation description

The development area is situated within a very uniform habitat with little variation in terms of geology, pedology, slope etc. Subsequently the vegetation also depicts this flat monotonous habitat consisting out of a single vegetation unit consistent with the vegetation classification provided by Mucina & Rutherford (2006) (Ghaap Plateau Vaalbosveld). The vegetation unit covering the development footprint area is classified: *Enneapogon cencroides – Grewia flava* open bushveld.

This unit stretches well beyond the development area and forms the dominant unit within the farm portion as well as beyond the affected farm boundary. This unit is extensively used for grazing and subsequently has been steadily transformed over a very long period of time due to long term grazing (overgrazing). Although in a semi-natural state, this unit still provides valuable ecological functions. One of the effects of historical grazing pressure within this unit is the increase in the woody component (bush encroachment), especially *Tragonanthus camphoratus* and *Grewia flava*. Even with this increase in woody species this area comprises a high diversity of grass species (over 35 species). From the field survey, the vegetation unit can be described as a relative open bushveld consisting out of mainly medium to small sized broad leaved trees and shrubs. The grass layer is relatively well developed and dense, consisting mainly of subclimax increaser 2 species, which is indicative of overgrazed veld. The small ephemeral tributary is diffuse with no clear channels distinguishing the tributary from the surrounding environment. *Themeda triandra* is relative prominent within this tributary, whereas *T. triandra* is almost absent from the surrounding environment.

Species characterising this unit include:

» Medium sized trees: *Acacia mellifera, Acacia robusta subsp. robusta,*
» Small trees / Shrubs: *Tragonanthus camphoratus, Grewia flava*
» Dwarf Shrubs: *Lycium cinereum, Asparagus nelsii, Lippia javanica*
» Herbs: *Monsonia burkeana, Senna italic, Convolvulus sagittatus, Aptosimum elongatum, Heliotropium ciliatum, Waltheria indica, Hermbstaedtia odorata, Cleome monophylla, Barleria macrostegia, Commelina Africana*

» Climbers: *Pergularia daemia var. daemia, Coccinia rehmannii*
» Geophytes: *Moraea stricta, Bulbine narcissifolia, Ammocharis coranica*
» Succulent herbs: *Protulaca oleraceae, Aloe grandidentata*
» Grasses: *Cymbopogon pospischilii, Tragus berteronianus, Anthephora pubescens, Pennisetum spp., Centropodia glauca, Aristida adscensionis, Enneapogon cenchroides, Schmidtia pappophoroides, Eragrostis trichophora, Eragrostis rigidior, Eragrostis curvula, Digitaria eriantha, Urochloa mosambicensis, Eragrostis lehmannaina*

Confirmed red list and protected plant species

A total of four conservation-worthy species were noted within the development area namely:

» *Aloe grandidentata* (TNCO & BNCA)
» *Ammocharis coranica* (TNCO & BNCA)
» *Acacaia erioloba* (NFA)
» *Boophone disticha* (Declining)

Of the four conservation worthy species, *Aloe grandidentata* (succulent) and *Ammocharis coranica* (geophyte) were quite prominent within this unit and was regularly encountered. *Acacia erioloba* (tree) as well as *Boophone disticha* (geophyte) were sparsely distributed through this unit. The aloe species as well as the geophytic species can be easily removed and transplanted.

Confirmed Alien Invasive Plants (AIPs)

Although a few AIPs and weeds were noted during the survey, these species were sparsely distributed throughout the unit and never formed dominant stands. These species were mostly present where the soil has been disturbed (trampling by livestock) or along farm roads or were other forms of disturbances has occurred.

Alien Invasive Plants confirmed on the site include:

» *Prosopis glandulosa* (Category 1b – only one species noted at the small gravel dam located to the south-east of the development area),
» *Flaveria bidentis* (Category 1b),
» *Xanthium strumarium* (Category 1b),
» *Datura stramonium* (Category 1b),

Other weeds and exotics confirmed during the survey includes the *Chloris virgata, Tragus berteronianus, Tribulus terrestris, Conyza bonariensis, Schkuhria pinnata* and *Alternanthera pungens*

5.6.2. Mapped Critical Biodiversity Areas (CBA) and broad scale ecological processes

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making tools.

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services.
At a desktop level, CBAs have been identified to be present within the project site (as per the North West Biodiversity Sector Plan, 2015). The North West Biodiversity Sector Plan (2015) which outlines areas that are important to take into consideration during new development planning to ensure that long-term conservation and ecosystem services targets are met.

As part of this North West Biodiversity Sector Plan (2015), the importance of various types of wetlands/pans in the stability of overall ecosystem functioning and eco–services is emphasised. In addition, the North West Biodiversity Sector Plan (2015) delineated features as well as links and corridors extending across the North West Province. The corridors are considered to be relatively wide (~6km) and traverse the broader study area. The corridors have been proposed with the purpose of maintaining a corridor for movement between some of the major wetland/pan systems present in the region and beyond. Portions of the project site (i.e. the Remaining Extent of the farm Woodhouse 729) are included in the Aquatic and Terrestrial Critical Biodiversity Areas described in the North West Biodiversity Sector Plan (2015). The largest portion of the CBA located within the project site consists of Ecological Corridors (Terrestrial 2 CBA) which primarily refers to ecosystems and species which are largely intact and undisturbed. A Terrestrial 1 CBA is located within a small section of the north western corner of the project site. The development area is located within an Aquatic 2 CBA due to its location within a sub-Quaternary catchment (Droë Harts) as identified by the CSIR national assessment.

Figures 5.7 and **5.8** below provide maps of the desk-top CBAs identified through the North West Biodiversity Sector Plan (2015) which overlap with the project site proposed for the Woodhouse Solar 1 PV Facility.

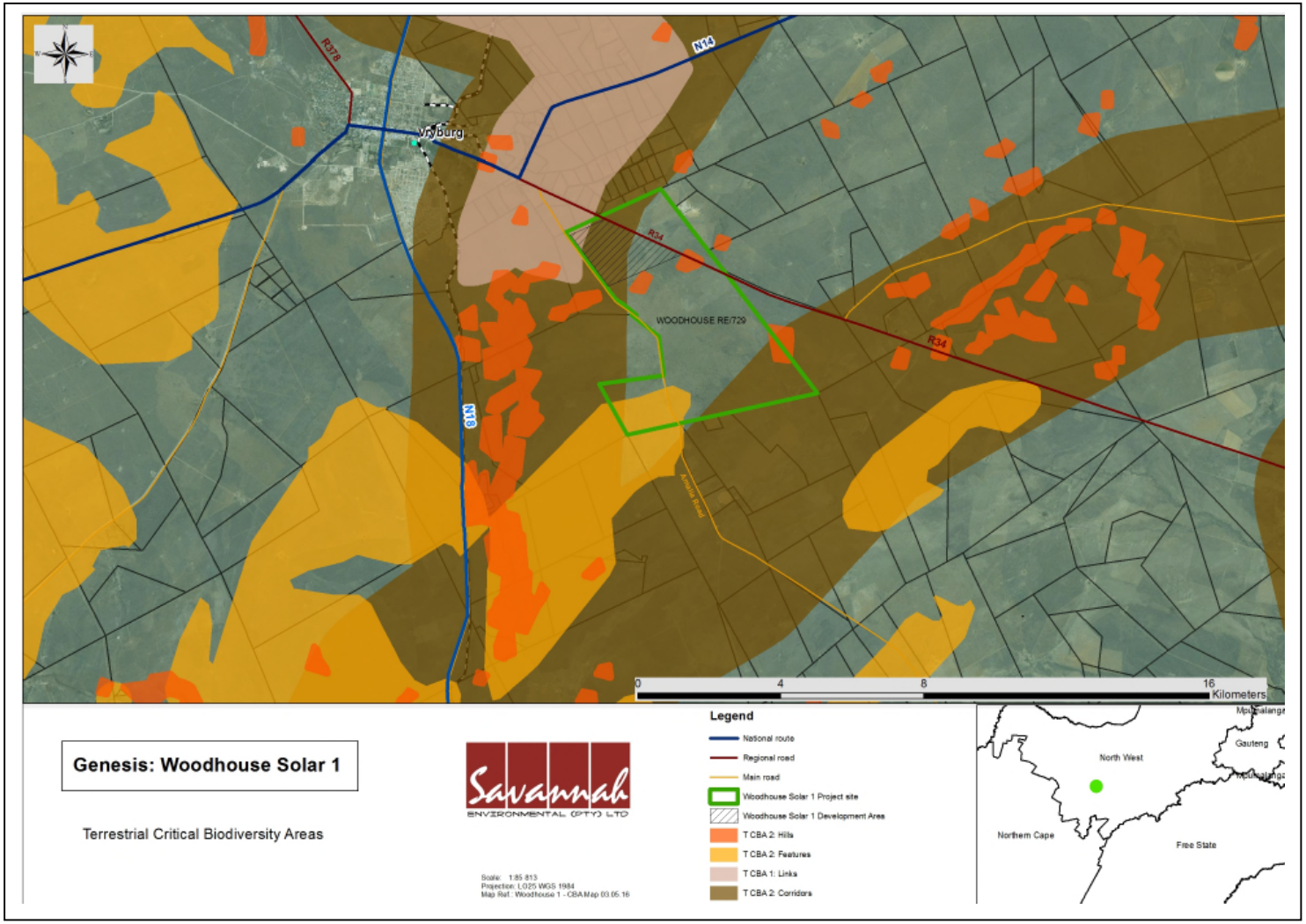


Figure 5.7: Map illustrating the Terrestrial Critical Biodiversity Areas (listed in the North West Biodiversity Sector Plan (2015)) mapped for the area where the Woodhouse Solar 1 PV Facility project site and development area are planned.

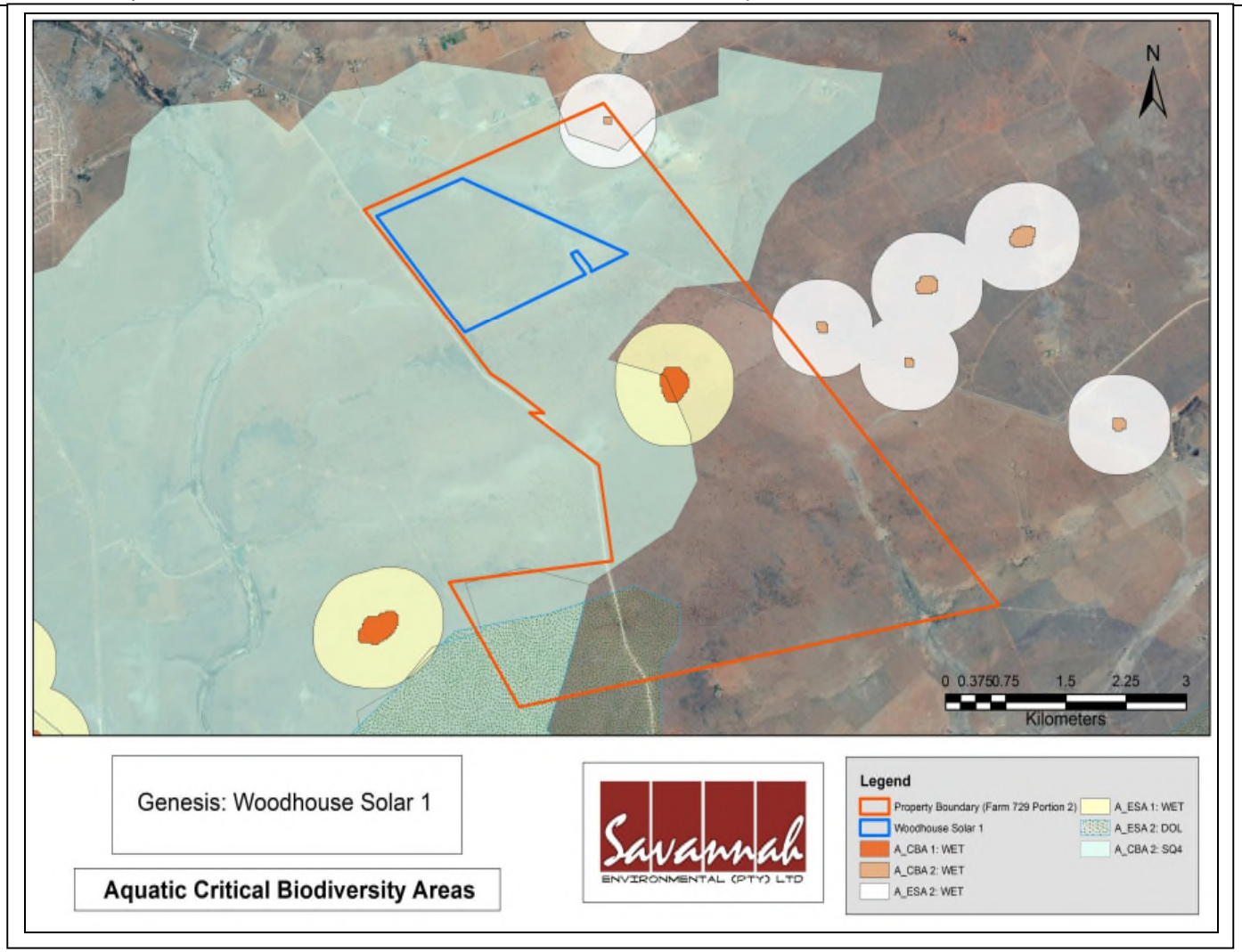


Figure 5.8: Map

illustrating the Aquatic Critical Biodiversity Areas (listed in the North West Biodiversity Sector Plan (2015)) mapped for the area where the Woodhouse Solar 1 PV Facility project site and development area are planned.

The CBAs as listed in the North West Biodiversity Sector Plan (2015) are based on information mapped at a desk-top level, and based on an extrapolation of data collected for similar areas (similar abiotic and biotic environment) in the Dr Ruth Segomotsi Mompati District. Through the undertaking of field surveys in two seasons (November 2015 and April 2016) the following field observations were made regarding the listed CBAs within the project site which provides a more accurate description of the actual state or condition the demarcated CBA areas located within the project site. The ecological field data collected for the purposes of the ecological study suggested that it can be considered reasonable that the areas shown as terrestrial CBA corridors which traverse the site have a low contribution to the functioning of the corridor. The study concluded that due to the level of anthropogenic disturbance in the corridors, these would not be required to be excluded from the developable area. There are areas, however, which are listed as pans or wetland areas, or Aquatic CBA 1 areas that should be buffered and be excluded from the developable area (i.e. avoidance of identified ecologically sensitive areas – or Step 1 in Mitigation Hierarchy).

Terrestrial 1 CBA (T1 CBA) (Critical linkage and core corridor zone)

This semi-natural Kalahari Bushveld can be described as a low lying plains shrub veld, with a dense, short woody layer dominated by *Trachonanthus camphoratus* and *Grewia flava.* The majority of the north-western section of the project site is moderately overgrazed. A few trampled cattle paths and bare patches of exposed soil are present as a result of the combination of grazing and the drought conditions experienced within the area. The dominance of *Eragrostis rigidior* in the area is an indication of past disturbance and overgrazing. Other disturbances within the area include the existing Eskom overhead power lines, service and farm gravel roads, boarder fences and the Woodhouse Substation.

The edge of this T1 CBA link area overlaps with the development area, with the bulk of the CBA link being to the north western corner and south eastern corner of the project site, well outside of the development area. The function of this area as a CBA would be to form a link or corridor area between the upper dry Kalahari Bushveld and the lower lying Droë Hartsrivier Valley. When considering the small size of the T1 CBA located within the proposed development area, the fractured nature of this area and the number of barriers isolating this section from the rest of the T1 CBA, including numerous fences, the provincial gravel road (to Amalia) and the numerous smaller farm tracks and service roads traversing the area, the capabilities of this small portion of T1 CBA to contribute as an important linkage and corridor is considered to be extremely limited. Furthermore the loss of this small section of semi-natural T1 CBA as a result of development is expected to have an insignificant effect on the limit of acceptable change within this T1 CBA unit, as well as a on the potential loss of irreplaceable biodiversity patterns. Therefore, the contribution of this area to ecological processes in this demarcated link/corridor is currently low. **Figure 5.9** below provides a visual aid on the landscape located within the Terrestial 1 CBA.

Figure 5.9: Visual illustration of the landscape falling within the T1 CBA (Linkage & Corridor Zone) which has been degraded through various anthropogenic activities, and the contribution of this area to ecological processes in this demarcated link area is currently low.

Terrestrial 2 CBA (T2 CBA) (Corridor Zones) as well as Aquatic 2 CBA (A2 CBA) (SQ4 or Sub-Quaternary Catchment Areas)

The majority of the T2 CBA areas within the project site are associated with corridor zones linking the lower lying valleys (Droë Harts- and Losase Rivers) with the higher lying dry Kalahari bushveld. These areas also fall within A2 CBAs (SQ4). Most of the T2/A2 CBA within the farm portion falls within a landscape similar to that described for the T1 CBA, namely a semi-natural dry Kalahari Bushveld, moderately disturbed, mainly due to overgrazing. Furthermore, the landscape is highly fractured by access roads, fencing and the larger gravel road (i.e. the Amalia Road) as well as the R34 Road. Having said this, the area still provides habitat for numerous smaller mammals as well as reptile species. According to the description of a T2 Corridor Zone within the North West Province Biodiversity Conservation Assessment Technical Report, these corridor/sub-Quaternary catchment networks should focus on all biodiversity patterns

and ecological processes. Taking this into account together with the field observations and the nature of the proposed development, the most significant impacts are expected to be during the construction phase. However with careful planning and the necessary mitigation measures in place, the affected development area can be restored and rehabilitated to an extent where ecological function and biodiversity is restored and maintained albeit in a slightly altered state. Thus although the area was confirmed as T2/A2 CBAs it can be concluded that the proposed development will not result in a severe alteration of the functionality of the area. **Figure 5.10** below provides a visual aid on the landscape and vegetation within the T2 CBA and the A2 CBA (SQ4).

Figure 5.10: Visual illustration of the vegetation and landscape characterising the T2 CBA (Corridor) and A2 CBA (SQ4). As in the case of the T1 CBA (Linkage and Critical Corridor Zone) the area is disturbed due to overgrazing and the contribution of this area to ecological processes in this demarcated link area is currently low.

5.6.3 Faunal Communities

Mammals

Although the potential diversity of mammals within the broader study area is high with, as many as 55 terrestrial mammals and 9 bat species present, there are several factors which have reduced the actual number of species present within the project site. This includes the proximity to the town of Vryburg and vehicle movement along the roads (including the R34 and the unsurfaced Amalia road) in the area.

Listed mammals which may occur in the area include the White-tailed Mouse *Mystromys albicaudatus* (Endangered), Brown Hyena *Hyaena brunnea* (Near Threatened), Black-footed Cat *Felis nigripes* (Vulnerable), Honey badger *Mellivora capensis* (IUCN LC, SA RDB EN), South African hedgehog *Atelerix frontalis* (SA RDB NT) and Ground Pangolin *Smutsia temminckii* (VU). None of these species were recorded during the field-survey.

During the field survey the following faunal species were confirmed on site:

» Small colony of rodent burrows (most likely Pouched Mouse – *Saccostomus campestris* and/or Bushveld Gerbil – *Gerbilliscus leucogaster* and/or Four-striped Grass Mouse – *Rhabdomys pumilio*)
» Single rodent burrows (most likely Pygmy Hairy-footed Gerbil – *Gerbillurus paeba*)
» Common Mole-rat (*Cryptomys hottentotus*)
» Cape Porcupine (*Hystrix afrecaeaustralis*)
» Slender Mongoose (*Galerella sanguinea*)
» Yellow Mongoose (*Cynictis penicillata*)
» Relative large burrows (likely to have been made and utilized by Aardwolf – *Proteles cristatus* and/or Aardvark – *Orycteropus afer*)
» Greater Kudu (*Tragelaphus strepsiceros*)
» Steenbok (*Raphicerus campestris*)
» Common Duiker (*Sylvicapra grimmia*)

None of these species noted are listed and or protected species. Furthermore most of these species are highly mobile and will move away from the construction activities associated with the development and may move back during the operation phase of the PV facility.

Reptiles and Amphibians

Of the 27 reptilian species that have been recorded with the 2624 and 2724 degree grids, eight species have been recorded within the quarter degree grids (2624DD, 2724BB). None of these species are listed as Red Data species.

15 Amphibian species have been recorded within the degree grids and of these 15 species eight species were recorded for the quarter degree grids (QDG) within which the study area is located. One near threatened species (*Pyxicephalus adspersus*, Giant Bull Frog) has been recorded for the quarter degree grid square (QDGS). Although this

species was not recorded for the QDGS, it is still likely for this species to occur within the project site where suitable habitat (pans, wetlands or drainage lines) are available.

5.6.4 Avifauna

The project site is not considered as a unique habitat in the landscape and has already been subject to varying degrees of transformation and degradation. Overall, the avifauna of the project site and the broader impact zone of the facility is not considered unique and is typical of what occurs across large areas of the Savannah Biome, which therefore suggests that, from an avian perspective, the area is not of any great significance.

Avian micro-habitats

While broad-scale vegetation patterns influence the distribution and abundance of bird species holistically, it is the fine-scale vegetation patterns and various avian microhabitats in an area that determine local avifauna populations.

A number of different avian microhabitats were identified at the project site. These units include:

- *Cultivated/modified land:* This habitat unit makes up a large majority of the proposed Woodhouse Solar 1 PV Facility development area. Although this habitat unit is considered disturbed due to human modification, it represents a significant feeding area for many bird species. The land preparation process opens up the soil and makes insects, seeds, bulbs and other food sources readily accessible to birds.
- *Vaalbos shrubland:* This habitat unit represents the majority of the vegetation present within the project site (Ghaap Plateau Vaalbosveld) and is largely made up of extensive plains of low shrubs *Tarchonanthus camphoratus* (an encroaching species in overgrazed or disturbed veld – which is evident in the project site). This habitat unit does not support high diversity and abundance of bird species.
- *Bushveld:* This habitat unit is found patchily throughout the project and is characterised by a mix of larger trees, shrubs and interspersed open plains. The higher biomass and structural and compositional variation in the vegetation supports a high diversity and abundance of bird species, with large trees potentially providing roosting and nesting for many bird species (no important roosting or nesting sites were however recorded in the project site).
- *Ephemeral pan:* There are two ephemeral pans (which will only hold water after heavy rains) that are considered important from an avian perspective. This habitat unit is important for numerous species, as it is a reliable source of surface water in the area and because the vegetation supports numerous wetland bird species.
- *Drainage line:* A tributary of the Losase River traverses the south east corner of the project site and although it may seldom contain surface water, it is important for ecosystem functioning. The slightly deeper soils support a marginally higher biomass including woody species and provide a structural and compositional variation in the vegetation to the surrounding shrublands.

The project area has already been subject to varying degrees of disturbance and degradation caused by past and present land-use practises. Evidence of high stocking rates and grazing pressure is apparent. There is also a network of minor farm roads throughout and within the project site, and specifically the proposed development area, which borders the R34 regional road.

Avifauna species

Overall, the avifauna of the project site and the broader impact zone of the PV facility is not considered unique and is typical of what occurs across large areas of the Savannah Biome. Up to 177 bird species are known to occur within the broader study area and broader impact zone of the development, including 17 red-listed or threatened species, 12 endemic species and 28 near-endemic species. Of these, 35 species were recorded during the site survey, most notable of which, despite being recorded outside of the project site (but included due to their transient nature which could bring them into contact with the development), being the sightings of White-backed Vulture *Gyps africanus* and Greater Flamingo *Phoenicopterus roseus*.

The birds of greatest potential relevance and importance in terms of the possible impacts of the PV facility and its associated power infrastructure are likely to be local populations of threatened or endemic passerines (Ant-eating Chat *Myrmecocichla formicivora* and Cape Longclaw *Macronyx capensis*), shy ground-nesting species (Burchell's Courser *Cursorius rufus* and Double-banded Courser *Rhinoptilus africanus*), resident or visiting large terrestrial birds (Secretarybird *Sagittarius serpentarius*, Abdim's Stork *Ciconia abdimii*, Black Stork *Ciconia nigra* and Blue Crane *Anthropoides paradieus*), resident or passing raptors (Martial Eagle *Polemaetus bellicosus,* Tawny Eagle *Aquila rapax,* Lanner Falcon *Falco biarmicus* and Red-footed Falcon *Falco vespertinus* and White-back Vulture) and transient waterbirds (Greater Flamingo*,* Lesser Flamingo *Phoenicopterus minor,* South African Shelduck *Tadorna cana* and Yellow-billed Stork *Mycteria ibis*).

At the time of the field-survey (11-13 April 2016) bird species diversity and abundance was relatively low across the entire project site. The *Bushveld* habitat unit supported the highest species diversity and abundance due to the structural variation provided by the composition of trees, shrubs and grass patches. This habitat unit was also associated with a low ridge line which bisects the study area and provides niche habitats for certain species. The *Cultivated/modified land* habitat unit within the proposed development area had a low bird species diversity and abundance, but has the potential to support priority species such as Secretarybird, Abdim's Stork and Black Stork. On the basis of the observations recorded during the field survey, and in combination with already documented information on the avifauna of the project site, 17 priority species are relevant (refer to **Table 5.2**). These are mostly threatened species which are known to occur, or could occur, in relatively high numbers in the project site and the broader impact zone of the development and which are likely to be, or could be, negatively affected by the PV Facility. Two species, White-backed Vulture and Greater Flamingo were recorded outside of the direct impact zone of the development.

Table 5.2: Priority species list potentially relevant to the proposed Woodhouse Solar 1 PV Facility site, selected on the basis of conservation status.

Common name	Scientific name	Conservation status	Regional endemism	Estimated importance of local population	Preferred habitat	Likelihood of occurring in study area	Susceptible to
Bustard, Kori	*Ardeotis kori*	Near-threatened	-	Low	Dry open savanna woodland, dwarf shrubland and occasionally grassland	Low	Collision
Courser, Burchell's	*Cursorius rufus*	Vulnerable	Near-endemic	Moderate	Sparsely vegetated arid regions	Moderate	Habitat loss/disturbance
Crane, Blue	*Anthropoides paradieus*	Near-threatened	Endemic	Low	Grasslands, but also in wetlands, cultivated pastures and croplands	Moderate	Collision
Duck, Maccoa	*Oxyura maccoa*	Near-threatened	-	Moderate	Inland water bodies with emergent vegetation; flyover	Low	Habitat loss/disturbance
Eagle, Martial	*Polemaetus bellicosus*	Endangered	-	Low	Open savanna and woodland on plains, also semi-arid shrublands	Moderate	Collision; electrocution
Eagle, Tawny	*Aquila rapax*	Endangered	-	Moderate	Open savanna woodland	Moderate	Habitat loss/disturbance; electrocution
Falcon, Lanner	*Falco biarmicus*	Vulnerable	-	Low	Open grassland or woodland near cliff or electricity pylons	Low	Habitat loss/disturbance; collisions
Falcon, Red-footed	*Falco vespertinus*	Near-threatened	-	High	Open semi-arid and arid savannas	High	Habitat loss / disturbance
Flamingo, Greater	*Phoenicopterus ruber*	Near-threatened	-	Moderate	Saline or brackish water bodies; flyover		Collisions
Flamingo, Lesser	*Phoenicopterus minor*	Near-threatened	-	Moderate	Eutrophic shallow wetlands, saltpans; flyover	Moderate	Collisions
Roller, European	*Coracias garrulus*	Near-threatened	-	Low	Open woodlands	Moderate	Habitat loss / disturbance
Secretarybird	*Sagittarius serpentarius*	Vulnerable	-	Moderate	Open grassland with scattered trees and shrubs	High	Habitat loss/disturbance; collisions
Stork, Abdim's	*Ciconia abdimii*	Near-threatened	-	Moderate	Grassland, savanna woodland and cultivated lands	Moderate	Habitat loss/disturbance; collisions
Stork, Black	*Ciconia nigra*	Vulnerable	-	Moderate	Mountainous regions	Moderate	Collision; electrocution
Stork, Yellow-billed	*Mycteria ibis*	Endangered	-	Low	Inland freshwater bodies, occasionally in estuaries	Moderate	Habitat loss/disturbance
Vulture, Cape	*Gyps coprotheres*	Endangered	Near-endemic	Low	Mountainous regions, but range widely in surrounding areas	Low	Habitat loss/disturbance; collisions; electrocutions
Vulture, White-backed	*Gyps africanus*	Critically Endangered	-	Low	Savanna woodland and bushveld	Low	Habitat loss/disturbance; collisions; electrocutions

5.7 Visual Quality of the Area

5.7.1. Landscape Character

Landscape character is defined as "a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another". Landscape Character is a composite of a number of influencing factors including:

» Landform and drainage
» Nature and density of development
» Vegetation patterns

Landform and drainage

The project site is located close to the head of a shallow valley that breaks through a range of low hills that extend roughly in a south west to north-east direction towards Gauteng, dividing West Griqualand in the north from the Karoo in the south. The head of the valley is a watershed between catchments. The watercourse that runs south through the valley, the Harts River, is a tributary of the Vaal River. A number of non-perennial streams flow through side valleys into this water course.

The topography can be described as gently undulating with the head of the valley being approximately 60m above the valley floor. Minor ridgelines that extend into the valley in the vicinity of the site are approximately 20 – 30m above the valley floor. The proposed project site straddles two low ridgelines close to the head of the valley on the eastern side of the main water course.

Given the relatively low nature of the proposed development, minor ridges within and in close proximity to the proposed site could play a major role in either helping to screen or make the development obvious in the landscape.

Nature and Density of Development

The general development pattern within the surrounding areas includes:

1. The urban area of Vryburg.

This is a dense urban area which, typically of many small towns, is set out on a grid pattern with roads traversing north/south and east/west. The two closest areas of the town to the proposed site include:

» A light industrial area that extends along the N14 / R34 to the north west.
» The residential township of Huhudi that extends along the N18 to the west north west.

In terms of visual implications, the following conclusions may be drawn;

» The area of dense development which includes the Huhudi suburb is likely to result in views of the surrounding landscape from the town only being possible from the urban edges and possibly along the straight roads that are likely to channel narrow views of surrounding rural area into the urban area.
» The light industrial area to the north west is unlikely to be sensitive to the proposed development.

2. An area of smallholdings directly to the east of Vryburg.

This area is comprised of smallholdings. Development in this area is mixed and includes:

» Social facilities including a local church;
» Semi-industrial uses associated with transportation; and
» Residential uses.

In terms of visual implications, the openness of this settlement area could mean that it is more exposed to views of the proposed facility than the main urban area.

3. The rural area surrounding Vryburg.

The majority of this area is used for cattle grazing. The area is well known for cattle rearing and is referred to as the Texas of South Africa having some of the largest cattle herds in the world. Within the agricultural area there are numerous farmsteads that are comprised of farm houses, agricultural buildings and farm worker's accommodation.

In addition to general uses there are a number of service uses that also have an influence on localised landscape character including:

» Adjacent roads;
» A railway line runs to the west of the proposed site;
» A local mine site;
» Agri-industrial areas including areas of stock pens;
» Existing electrical infrastructure including overhead power lines that run close to the northern and southern boundary of the site; and
» Isolated transportation uses within the rural area.

These elements all have the effect of eroding the natural character of the area. To the south of the town of Vryburg the main ridgeline that cuts across the southern portion of the project site provides a distinct boundary, to the north of which the landscape is affected by these urban elements and to the south of which the landscape appears relatively natural with little obvious development influence.

Vegetation Patterns

The following vegetation types are evident within the project site:

» Natural vegetation that is generally associated with the rural landscape; and
» Ornamental vegetation and street planting that is generally associated with the urban area as well as the homesteads that occur within the rural area.

Natural vegetation

The vegetation is fairly dense bushveld composed of shrubs and sometimes small trees in a mixed grassland mosaic. This natural vegetation is recorded as being under pressure from grazing. However, it is evident that the general pattern of small trees and shrubs in grassland exists over much of the area surrounding Vryburg. Whilst the density of taller shrubs and small trees is relatively sparse, in a flat landscape and over distance, these are likely to combine to provide significant screening of low elements.

Ornamental vegetation

Ornamental trees and shrubs are generally located within gardens in the urban area of Vryburg and surrounding farmsteads in the rural area. This has the following visual effects;

i) it makes the location of farmsteads obvious in the landscape and
ii) it helps to screen views of the surrounding landscape from both farmsteads and from within the urban area.

5.7.2. Landscape character area

Landscape Character Areas (LCAs) are defined as "single unique areas which are the discrete geographical areas of a particular landscape type". The affected landscape can generally be divided into the following LCAs which are largely defined by vegetation and drainage patterns.

Rural areas surrounding Vryburg: these are likely to be used for cattle grazing and appear relatively natural.

The urban area of Vryburg: this area is generally inward looking drawing little character influence from external areas.

The semi-rural area: that is comprised of the smallholdings to the east of Vryburg. This is a relatively open developed area from which views into the surrounding rural landscape are likely to be possible.

5.8 Social Characteristics of the Study Area and Surrounds

This section provides a strategic understanding of the socio-economic profile of the North West Province, Dr Ruth Segomotsi Mompati District Municipality and Naledi Local Municipality, in order to develop a better understanding of the socio-economic performance as a background to the development of the facility.

5.8.1 Regional Context

1. North West Province

Most of the economic activity of the North West Province is concentrated in the southern region of the Province between Potchefstroom and Klerksdorp, as well as Rustenburg and the eastern region. The North West Province is predominantly a rural with the main economic activities being mining and agriculture. Mining of diamond, marble and gold bring in substantial wealth.

The Province is a world leader in platinum production. Mining is the major contributor to the North West economy and represents almost a quarter of South Africa's mining industry as a whole. The province produces a quarter of South Africa's gold, as well as granite, marble, fluorspar and diamonds (NAFCOC, 2014). The North West Province is well known for cattle farming, while the areas around Rustenburg and Brits are fertile where mixed-crop farming land occurs. Maize and sunflowers are the most important crops, and the province is a major producer of white maize in the country (South Africa Info, 2014). The Province has a number of major tourist attractions, including the internationally famous Sun City, the Pilanesberg National Park, the Madikwe Game Reserve and the Rustenburg Nature Reserve.

2. Dr Ruth Segomotsi Mompati District Municipality (DRSMDM)

Dr Ruth Segomotsi Mompati District Municipality is one of the four districts of the North West Province. The district municipality covers the following local municipalities: Naledi, Greater Taung, Kagisano-Molopo, Mamusa and Lekwa-Teemane. The seat of the district is the town of Vryburg. The DRSMDM has a population of ~439 637 people which is 13.2% of the population of the North West Province. The majority of the population within the DRSMDM speak Setswana (Census, 2011). The DRSMSM is South Africa's largest beef producing district, with Hereford cattle being the most popular. Maize and peanuts are important crops produced in the district (Local Government Handbook, 2012).

The settlement pattern in the DRSMDM is fragmentary with small, low-intensity urban areas scattered throughout and surrounded by vast rural areas. The more urban areas, or towns, comprise of higher density settlements with mainly a residential character, except for the only regional urban center or node, being Vryburg, which has a mix of land uses, varying from residential, retail, institutional to manufacturing and industrial. The major towns are surrounded by very low-density, scattered rural settlements, villages and vast rural areas. The DRSMDM area is described to be the rural hinterland of the North West Province (DRSMDM IDP 2015/2016). The main towns in the district include: Amalia, Bloemhof, Christiana, Piet Plessis, Pomfret, Pudimoe, Reivilo, Schweizer-Reneke, Stella, Taung and Vryburg. The primary economic sectors within the district are as follows: community services (33.1%), agriculture (17.1%), finance

(16.2%), trade (12.7%), transport (9%), manufacturing (4%), mining (3.2%), and construction (3.2%).

5.8.2 Local Context

Naledi Local Municipality (NLM)

The Naledi Local Municipality is situated in the Dr Ruth Segomotsi Mompati District Municipality in the North West Province. The NLM covers an area of approximately ~7 264 km² and is divided into nine wards. This land mass is makes up 15% of the total area of the DRSMDM. The NLM is separated into the following main places, namely; the town of Vryburg, Huhudi Township, Colridge Township, Stella, Devondale and Dithakwaneng village. The two primary towns in the area include Vryburg and Stella.

Agriculture and hunting are the strongest contributors to the municipality's economy, jointly responsible for 21% of employment. Other important job creating sectors are finance and insurance (8%), public administration (8%), health and social (5.8%) and transport (5%). This makes the Municipality the main employer within the district and most significant contributor to the GDP. According to the NLM IDP 2015/2016, the NLM is an agriculture-based municipality and falls within the Extensive Agricultural Development Zone. The NLM has a strong beef breeding industry and most of the income is derived from the agricultural sector. The NLM is identified as a Priority Two Investment Area in terms of the Provincial Spatial Development Framework serving as the:

» Hub for regional growth needs
» Main trading centre in the district
» Main district administrative centre

The NLM is located on the intersection of the Western Frontier and N14 Transport Corridor. Good national road and rail infrastructure is present within the area increasing the ease of accessibility. However, the N18 road between Vryburg and Stella is often congested with trucks. However, the NLM faces challenges with the lack of upgrading and maintenance of infrastructure. Industries are hesitant to locate in the NLM due to the inefficient and haphazard supply of basic services such as water and electricity.

The greatest social problems in the NLM are illiteracy, poverty and lack of basic service infrastructure. The NLM has been experiencing a declining economy. The income distribution is distorted in the NLM to the disadvantage of the less economically secured people, who also represents the majority of the municipal area. Poor households are a result of a lack of wage income, either due to unemployment or low-paying jobs. Access to basic services such as electricity, toilets and piped water is also closely correlated with poverty.

Baseline Characteristics of the Naledi Local Municipality

General baseline characteristics and challenges of the NLM are as follows (Census, 2011 & NLM IDP 2015/2016):

- The municipality has a population of ~66 781 which is 14.4% of the total population of the DRSMDM.
- Of the ~66 781 population, about 49.83% are female and 50.17% are male.
- In the NLM there are approximately ~18 572 households, with an average household size of ~3.4 persons per household. Of the ~18 572 households in NLM approximately 82% live in formal dwellings.
- More than 74% of the population comprise the Black African ethnic group.
- The most spoken language in the NLM is Setswana (68.8% of the population).
- The Economically Active Population (EAP) (individuals that are aged 15-64 that are either employed or actively seeking employment) accounts for 64% of the entire population.
- The population aged 0–14 years comprise 31% of the population and those aged 65 years and above accounts for 5% of the entire municipal population.
- The dependency ratio (amount of individuals that are below the age of 15 and over the age of 64, who are dependent on the EAP) in the NLM comprises 36% of the population.
- There are low levels of literacy amongst the members of the community. The level of education influences growth and economic productivity of a region. In the NLM 16.6% of the population have no schooling, 22% have completed matric and only 9.1% of the population have received higher education. This means that majority of the population have a low-skill level and would need employment in low-skill sectors.
- The Municipality's unemployment rate stands at 26.4% (in 2011).
- Households that have either no income or low income that fall within the poverty level (R0- R38 200 per annum) accounts for 66.9%. A middle-income is classified as earning between R38 201 - R307 600 per annum. Approximately 28.2% of the households earn a middle income and 4.9% of households earn a high income that is classified as earning R307 601 or more per annum. A high percentage of household income falls within the poverty level. The high poverty level has social consequences such as not being able to pay for basic needs and services.
- Approximately 63.9% of the population have access to electricity. For all the population that have access to electricity; 77% use it for lighting, 50.7% use it for heating and 64.5% for cooking.
- Approximately 69% of households within the municipality have access to a flush toilet. Approximately 11.8% of the population are using a pit toilet and 4.5% of households use the bucket toilet system.
- 69.7% of the municipal households have their refuse disposal removed by the municipality, whereas only 20.5% use their own refuse dump.
- 97% of households have access to piped (tap) water. From this percentage, 40.9% have access inside their dwelling units, 37% inside their yards, 14% access tap

water on a community stand that is a distance of less than 200m from their yards and 3% travel between 200m and 500m to access tap water.

- The NLM has a declining economy despite being the most diverse economy in the district.
- The NLM does not have a detailed settlement plan for rural villages. There are also limited business and Small Medium Micro Enterprise development infrastructure within the rural villages. The NLM also lacks a proper Land Use Management System.
- The NLM lacks rental housing units which discourages skilled and professional people from coming into the area.
- The NLM has an underdeveloped tourism sector and no local tourism strategy.
- Availability and affordability of land/business space in Vryburg is a constraint especially for emerging entrepreneurs and business initiatives.

5.9 Heritage features of the region

5.9.1 Heritage and archaeology

The wider geographical area is known to contain archaeological sites dating to the Middle and Later Stone Age. Previous discoveries in the area indicated that pans, drainage channels and ridges are sensitive from a heritage perspective (Van der Walt 2013, Van Schalkwyk 2008 and 2012). The affected property has been inhabited from the 1800's onwards. In terms of the built environment, several farm labourer ruins were recorded in the Woodhouse Solar 1 PV Facility development area. In terms of the archaeological component, Middle Stone Age (MSA) and Later Stone Age (LSA) artefacts were recorded scattered in varying densities across the proposed footprint. Most of these artefacts are scattered too sparsely to be of any significance. However discreet knapping sites were recorded in the north eastern portion of the proposed development area. Graves can be expected anywhere on the landscape. Several stone cairns were noted close the recorded farm labourer ruins that could indicate graves. No significant cultural landscape elements were noted.

5.9.2 Palaeontology (Fossils)

The northern portion of the affected property (and location of the development area) is underlain by the Vryburg Formation of the Ghaap Group, and the Dwyka Group of the Karoo Supergroup. The geologically older Vryburg Formation (2.6 billion year-old) consists of fluvial and shallow marine quartzites, mudrocks and conglomerates, while the Dwyka Group (317 Million years) consists of Permo-carboniferous glacial sediments. The Dwyka Group (Karoo Supergroup) is represented by small outcrops in the north of the development footprint. Although trace fossils and plants could be present in the Dwyka Group the likelihood of significant fossil heritage in the Vryburg area is considered to be low. The southern portion of the development area consists of the Vryburg Formation, which is considered as unfossiliferous in this area (refer to **Figure 5.11**).

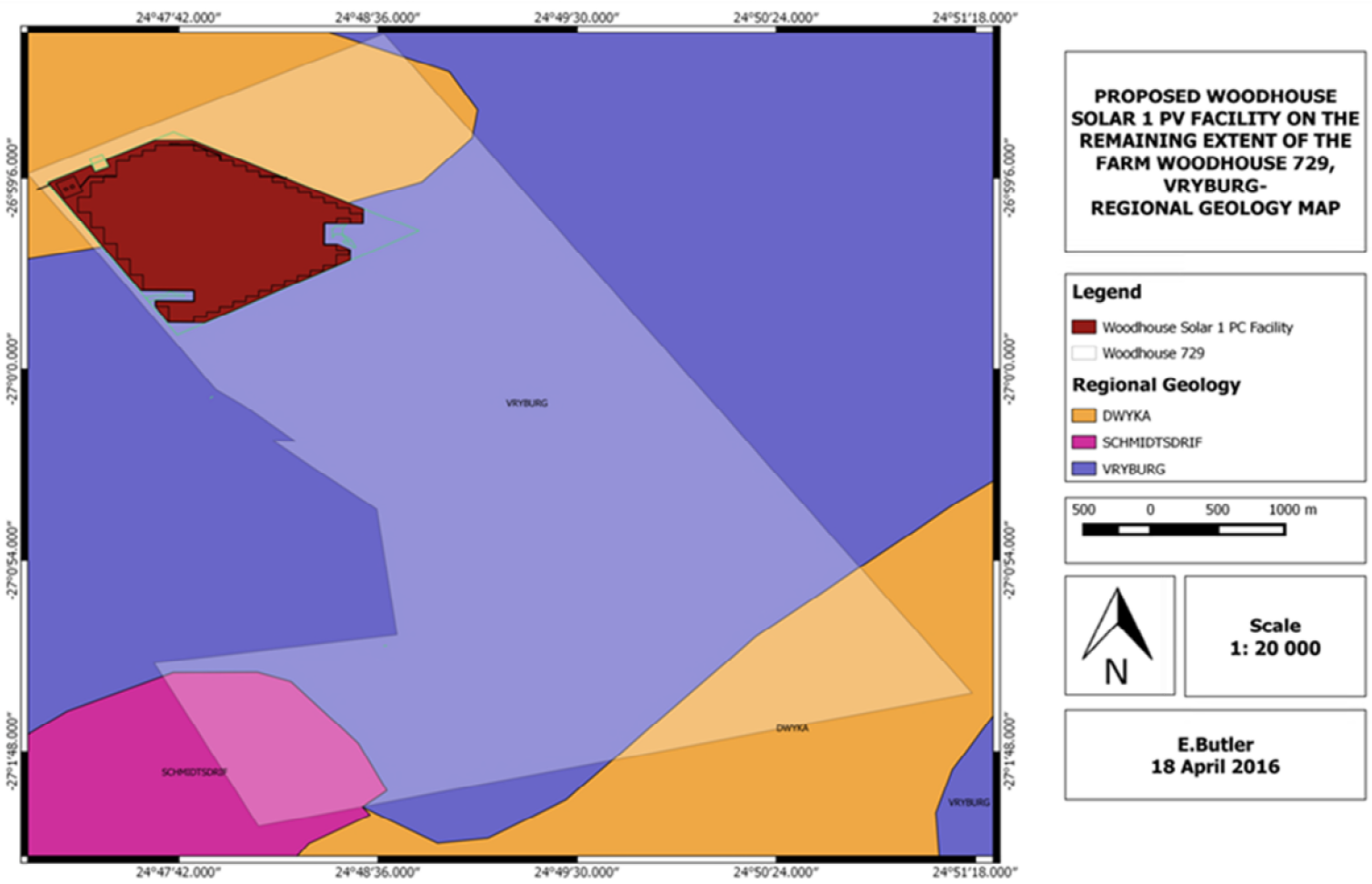


Figure 5.11: The surface geology of the proposed Woodhouse Solar 1 PV Facility development area on the Remaining Extent of the farm Woodhouse 729. The development area is underlain by Dwyka Permo-Carboniferous glacial sediments and Vryburg Formation (Ghaap Group, Transvaal Supergroup).

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 Woodhouse Solar 1 PV Facility and associated infrastructure (refer to **Figure 6.1**). This assessment has considered the construction of a 100MW PV facility and all related infrastructure, including:

» Arrays of single axis PV tracking panels or fixed tilt PV with a capacity of up to 100MW.
» Mounting structures to support the PV panels.
» A new 132kV power line between the on-site substation and the Eskom grid connection point. Four alternatives are being considered for the grid connection:
  * *Alternative 1*: a direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property (i.e. the Remaining Extent of the far Woodhouse 729);
  * *Alternative 2*: a direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property;
  * *Alternative 3*: a turn-in turn-out connection[15] to the existing Delareyville Munic-Vryburg 1 88kV Feeder located along the northern boundary of the affected property; and
  * *Alternative 4*: A turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line to be constructed by Eskom.
» Cabling between the project components, to be laid underground where practical.
» Offices and workshop areas for maintenance and storage.
» Temporary laydown areas.
» Internal access roads and fencing around the development area.

The proposed PV facility will have a development footprint of approximately 240ha, within which the solar field (PV panels) and other associated infrastructure is included. This footprint is to be developed within a development area of approximately 287ha. Refer to **Figure 6.1** for an illustration of the development area assessed in this EIA Phase. The development of the PV 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 stormwater management plan. The construction

[15] A turn-in turn-out connection would require the construction of a double circuit power line.

phase for the Woodhouse Solar 1 PV Facility is expected to take approximately 12-18 months.

» *Operation* – will include the operation of the PV facility and the generation of electricity which will be fed into the national grid via the facility on-site substation and an overhead power line. The operation phase of the PV facility is expected to be 20 - 25 years.

» *Decommissioning* – depending on the economic viability of the plant, the length of the operation phase may be extended beyond a 20 year period. At the end of the plant life, 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 those associated with construction activities. Therefore, these impacts are not considered separately within this chapter.

6.1. Legal Requirements as per the EIA Regulations for the undertaking of an Environmental Impact Assessment Report, 2014

This chapter of the EIA report includes the following information required in terms of Appendix 3: Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(h)(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts (aa) can be reversed, (bb) may cause irreplaceable loss of resources, and (cc) can be avoided, managed or mitigated.	The impacts and risks identified to be associated with the construction and operation of the Woodhouse Solar 1 PV Facility and the associated infrastructure is included within this chapter. This assessment of the impacts and risks include the nature, significance, magnitude, extent, duration and probability of the impacts as well as the degree to which the impacts can be reversed, may cause irreplaceable loss of resources and can be voided or mitigated. This is included in the sections 6.3.3, 6.4.3, 6.5.3, 6.6.3, 6.7.3.
3(h)(viii) the possible mitigation measures that could be applied and the level of residual risk.	Possible mitigation measures and the residual risks are included in sections 6.3.3, 6.4.3, 6.5.3, 6.6.3, 6.7.3.
3(i) a full description of the process undertaken to identify, assess and rank the impacts, the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including (i) a description of the environmental issues and risks that were identified during the environmental impact assessment process and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and	A description of the environmental issues and risks that were identified during the environmental impact assessment process and an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures are included in sections 6.3.2, 6.3.3, 6.4.2, 6.4.3, 6.5.2, 6.5.3, 6.6.2, 6.6.3, 6.7.2, 6.7.3.

risk could be avoided or addressed by the adoption of mitigation measures,.	
3(j) an assessment of each identified potentially significant impact and risk, including (i) cumulative impacts, (ii) the nature, extent, and consequences of the impact and risk, (iii) the extent and duration of the impact and risk, (iv) the probability of the impact and risk occurring, (v) the degree to which the impact and risk can be reversed, (vi) the degree to which the impact and risk may cause irreplaceable loss of resources and (vii) the degree to which the impact and risk can be mitigated.	An assessment of each potentially significant impact and risk including the cumulative impacts, the nature, extent, and consequences of the impact and risk, the extent and duration of the impact and risk, the probability of the impact and risk occurring, the degree to which the impact and risk can be reversed, the degree to which the impact and risk may cause irreplaceable loss of resources and the degree to which the impact and risk can be mitigated is included in sections 6.3.3, 6.4.3, 6.5.3, 6.6.3, 6.7.3. A separate cumulative assessment is included in Chapter 7.
3(m) based on the assessment, and where applicable, recommendations from the specialist reports, the recording of proposed impact management objective and, the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions for authorisation.	Recommendations from the specialists and mitigation measures from the specialist reports for inclusion in the EMPr is within sections 6.3.3, 6.4.3, 6.5.3, 6.6.3, 6.7.3 and within the EMPr which is included as **Appendix J**. The EMPr also includes the recording of the management objective and the impact management outcomes.

6.2 Alternatives Assessment

The following alternatives have been considered and assessed through this EIA report. The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects are considered. The details pertaining to each alternative considered, as well as the technical preference are provided below:

Grid connection: In order to evacuate the generated solar electricity into the national electricity grid a grid connection point has to be established. Four grid connection alternatives are being considered, each presenting an alternative power line connection. The grid connection points are in an existing grid node located directly north of the proposed development site, and the alternative grid connection routes largely fall within a single corridor of 200m in width, each of the four possible alternatives have been considered separately in this report and comparatively assessed. These include the following:

- *Alternative 1*: a direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property;
- *Alternative 2*: a direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property;

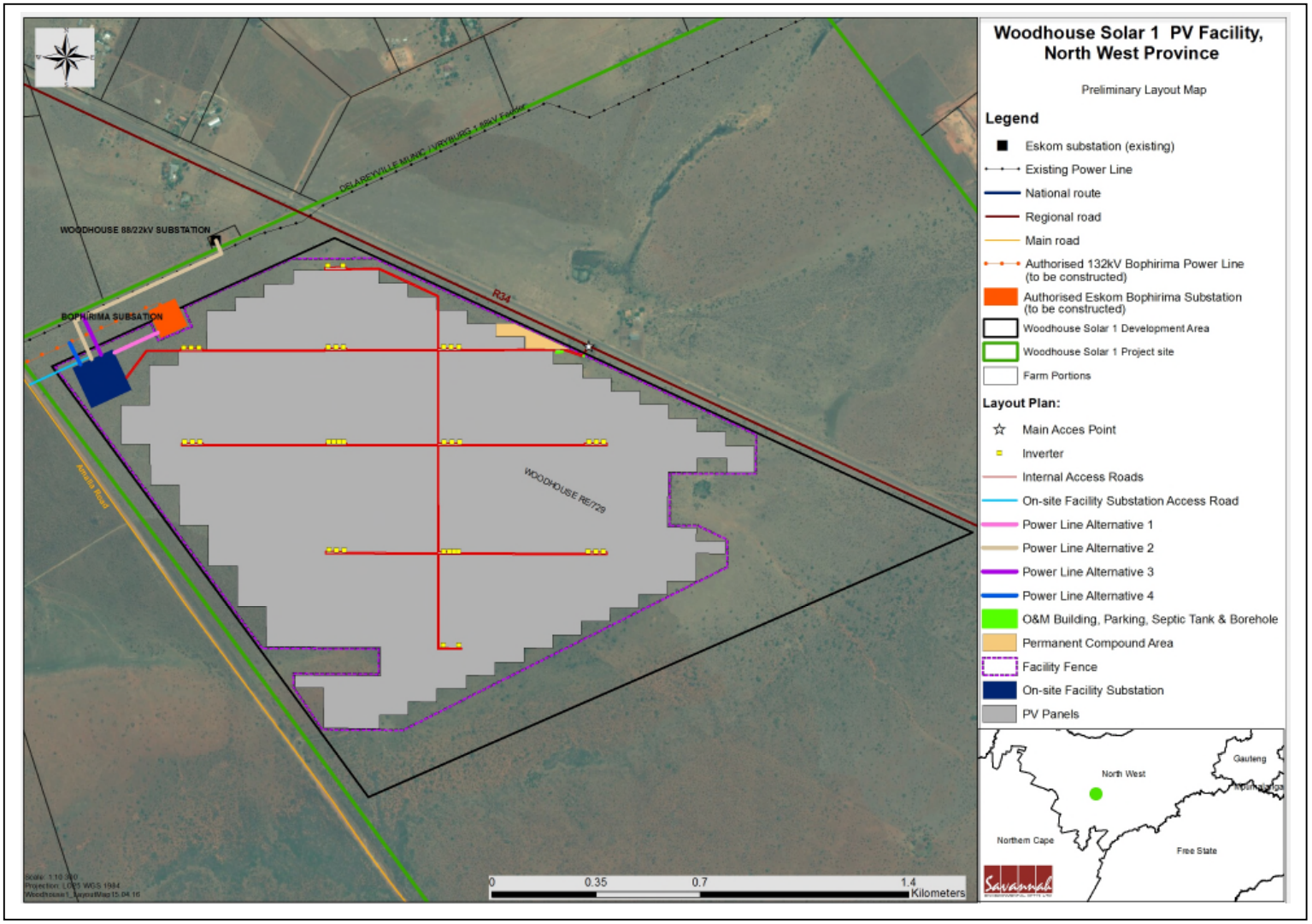


Figure 6.1: Map showing the preliminary layout as well as alternatives for the Woodhouse Solar 1 PV Facility and associated infrastructure located within the Remaining Extent of the farm Woodhouse 729.

» *Alternative 3*: a turn-in turn-out connection to the existing Delareyville Munic-Vryburg 1 88kV Feeder located along the northern boundary of the affected property; and
» *Alternative 4*: A turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line to be constructed by Eskom[16].

In the event that Eskom is unable to complete the construction of the proposed 132kV Eskom Bopirima-Mookodi Overhead Line Genesis Eco-Energy Developments would consider undertaking the construction of the authorised power line within the authorised corridor to connect the PV facility to the national grid. As the corridor for the construction of the 132kV Eskom Bophirima–Mookodi power line has already received authorisation under another application (DEA Ref.: 12/12/20/1929) it is not assessed as part of the Woodhouse Solar 1 PV Facility EIA process.

The four power line route alternatives are described below (refer to **Table 6.1** and **Figure 6.2**). All alternatives originate from one common planned substation. The location of this substation is considered to be ideal as it located close to Eskom substations and power lines and therefore allows for close connection solutions. This is therefore a feasible and preferred location for the substation, and there is no alternative location assessed within this EIA.

Table 6.1: The four grid connection alternatives considered for the Woodhouse Solar 1 PV Facility

Alternative	Grid connection point	Power line Length	Colour as per Figure 6.2
1	Authorised Eskom Bophirima Substation	~160m	Pink
2	Existing Woodhouse 88/22kV Substation	~747m	Brown
3	Existing Delareyville Munic-Vryburg 1 88kV Feeder power line	~146m	Purple
4	Authorised 132kV Eskom Bophirima–Mookodi power line	~80m	Blue

The grid connection for the PV facility will be finalised based on input from Eskom and the environmental assessment. The connection to the authorised Eskom Bophirima Substation (Alternative 1) is considered to be technically preferred alternative. **Figure 6.2** below provides an illustration of the grid connection alternatives.

[16] In the event that Eskom is unable to complete the construction of the proposed 132kV Eskom Bopirima-Mookodi Overhead Line Genesis Eco-Energy Developments would consider undertaking the construction of the authorised power line within the authorised corridor (DEA Ref.: 12/12/20/1929) to connect the PV facility via the completed 132kV power line to the existing Mookodi 400/132KV Substation located to the west of the project site.

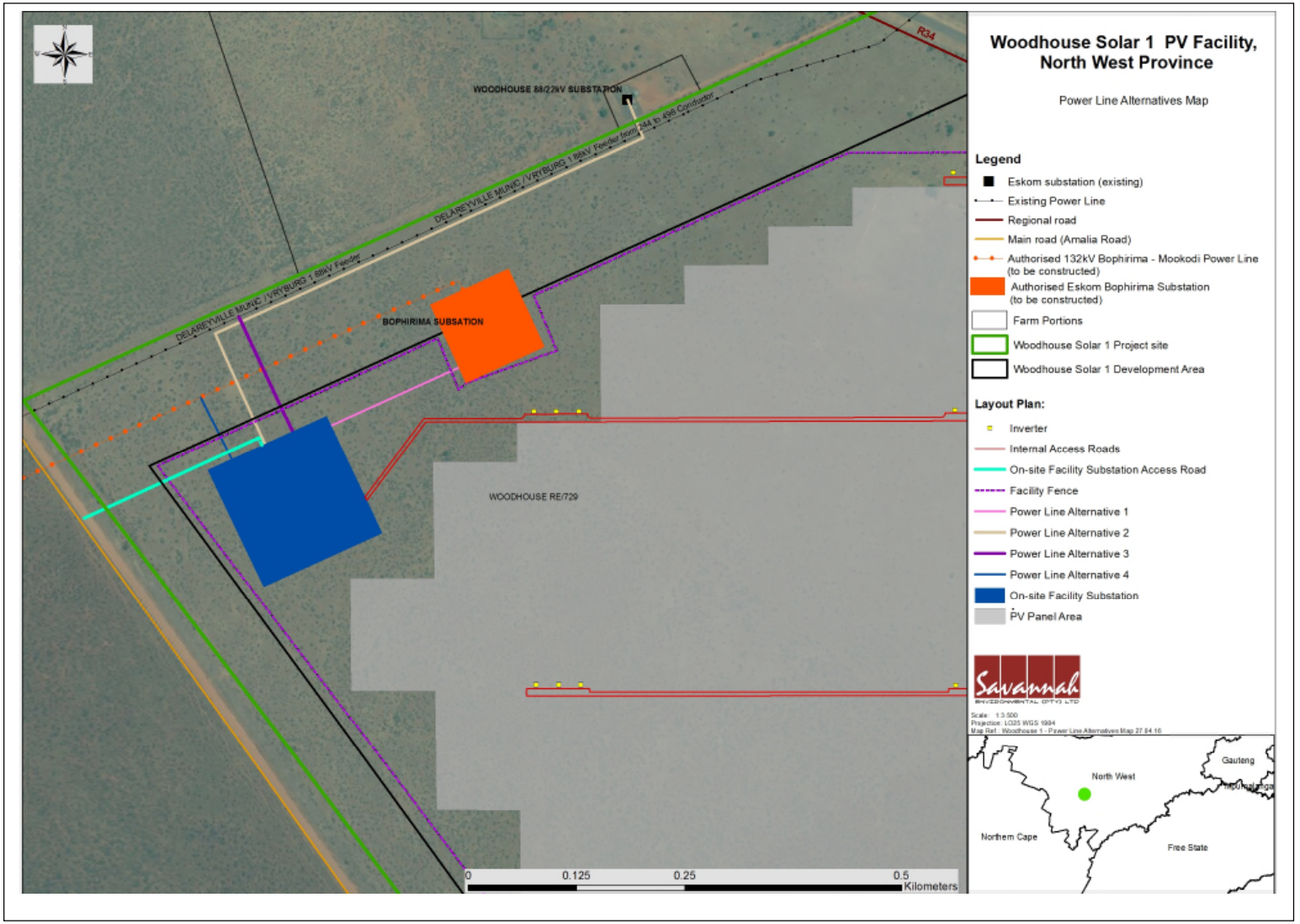


Figure 6.2: A map illustrating the grid connection (power line route) alternatives for the Woodhouse Solar 1 PV Facility.

Potential impacts pertaining to the project development footprint, access roads and grid connection are assessed in the sections below, and a comparative assessment of these alternatives is provided.

6.3 Potential Impacts on Ecology (Ecology, Flora, Fauna, Water Resources and Functional Ecosystems)

A development area of ~287ha has been assessed for the 100MW PV Facility, which includes the development footprint of the facility (~240ha). The development footprint includes the PV panels and other associated infrastructure (i.e. facility on-site substation, inverters, internal roads etc.). Negative impacts on ecological resources will be due to loss of habitat which may have direct or indirect impacts on individual species or the loss of connectivity/corridors between CBA areas, however due to historical anthropogenic activities within the CBA areas a change has occurred in terms of their functioning. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix D** for more details).

6.3.1. Results of the Ecological Study

The development area is located within a uniform habitat within which there are little variation in terms of geology, pedology, slope etc. Subsequently the vegetation also depicts that this flat homogenous habitat consists of a single vegetation unit consistent with the vegetation of the Ghaap Plateau Vaalbosveld. The Ghaap Plateau Vaalbosveld is classified as a Least Threatened ecosystem and is not listed as per the National Ecosystem List of the National Environmental Management Biodiversity Act (NEM:BA). Only 1% of this ecosystem has been transformed. The vegetation unit covering the development footprint area can be classified as: *Enneapogon cencroides – Grewia flava* open bushveld. This open bushveld has been used extensively for long term grazing activities within the development area and the broader property and has subsequently been transformed over a long period of time (evidence of intense grazing pressure and overgrazing). However, this unit is still considered to be in a semi-natural state which can still provide valuable ecological functions. As a result of historical grazing pressure and overgrazing within this unit an increase in bush encroachment has occurred, especially the *Tragonanthus camphoratus* and *Grewia flava*. Even with an increase in bush encroachment the area still comprises of a high diversity of grass species.

A total of four conservation-worthy species were noted within the development area namely:

» *Aloe grandidentata* (Transvaal Nature conservation Ordination & Bophuthatswana Nature Conservation Act)
» *Ammocharis coranica* (Transvaal Nature conservation Ordination & Bophuthatswana Nature Conservation Act)

» *Acacaia erioloba* (National Forest Act)
» *Boophone disticha* (Declining)

Critical Biodiversity Areas (CBAs) are listed to overlap with development area of the Woodhouse Solar 1 PV Facility (North West Biodiversity Sector Plan,2015). These CBAs include both Terrestrial and Aquatic CBAs. The Aquatic CBA class represents priority quaternary catchments, and are not considered to be of sensitivity as these cover large areas that, in the specialist's opinion, are not uniformly sensitive. However, aquatic features, wetlands or watercourses have been considered as sensitive environments to be avoided. The Terrestrial CBAs as listed in North West Biodiversity Sector Plan are mapped at a desk-top level, and based on an extrapolation of data collected for similar areas (similar abiotic and biotic environment). Through the undertaking of field surveys in two seasons (November 2015 and April 2016 - owing to the widespread drought conditions experienced across the country) the following field observations were made regarding the listed CBAs within the project site which provides a more accurate description of the actual state or condition the demarcated CBA areas located within the project site.

» The area has clear evidence of heavy grazing pressure and overgrazing in some parts.
» A few trampled cattle paths and bare patches of exposed soil are present as a result of the combination of grazing and the drought conditions experienced within the area. The dominance of *Eragrostis rigidior* in the area is an indication of past disturbance and overgrazing.
» Other disturbances within the area include the existing overhead power lines, service and farm gravel roads, boarder fences and the Woodhouse Substation.
» The edge of a T1 CBA link area overlaps with the development area. When considering the small size of the T1 CBA, the fractured nature of this area and the number of barriers isolating this section from the rest of the T1 CBA, including numerous fences, the provincial gravel road (to Amalia) and the numerous smaller farm tracks and service roads traversing the area, the capabilities of this small portion of T1 CBA to contribute as an important linkage and corridor is considered to be extremely limited.
» The majority of the T2 CBA areas within the affected property are moderately disturbed, mainly due to overgrazing. Furthermore, the landscape is highly fractured by access roads, fencing and the larger provincial gravel road as well as the R34 Road. However, the area still provides habitat for numerous smaller mammals as well as reptile species. With the implementation of necessary mitigation measures, the affected areas, within the development footprint can be restored and maintained, albeit in a slightly altered state.

The ecological field data collected for the purposes of the ecological study suggested that it can be considered reasonable that the areas shown as terrestrial CBA corridors which

traverse the site have a low contribution to the functioning of the corridor. Due to historical anthropogenic activities which have taken place within the development area (including overgrazing over a long period of time; roads; power lines), the areas shown as being CBAs are considered as being of a medium-low sensitivity[17]. These medium-low areas are also associated with open bushveld and are located across the majority of the development footprint. The ecological study concluded that due to the level of anthropogenic disturbance in the corridors, these would not be required to be excluded from the developable area.

The areas, however, which are listed as pans or wetland areas under the Aquatic CBA 1 areas should be buffered and be excluded from the developable area (i.e. avoidance of identified ecologically sensitive areas in terms of the Mitigation Hierarchy). The high ecological sensitivity areas located within the development area include ephemeral tributaries located within the west and east of the development area and an artificial dam and the associated wetland located in the west. In order to preserve these high ecological sensitivity areas buffers are recommended which includes a 35m buffer around the ephemeral tributaries, as well as a 35m buffer around the artificial dam and its associated wetland.

A ridge (including the crest and upper slope) is located within the project site and is situated to the west of the R34. This feature is outside of the development footprint proposed for the Woodhouse Solar 1 PV Facility and traverses the project site in a east-west fashion. This ecological feature is considered as having a medium-high ecological sensitivity and is avoided by the development area.

Figure 6.3 provides the detail of the ecological sensitivities located within the development area of the Woodhouse Solar 1 PV Facility. The demarcation of the facility footprint as indicated on Figure 6.3 shows that all the high sensitivity areas can be avoided through a minor shift in the facility fence line, as development would be restricted to within the facility fence area. Therefore, with the avoidance of all high sensitivity areas, the significance of impacts on ecology would be low.

[17] This assessment correlates with the findings of the aquatic and terrestrial biodiversity assessment undertaken for the CSIR SEA for the Renewable Energy Development Zones (Part 3, Section 4).

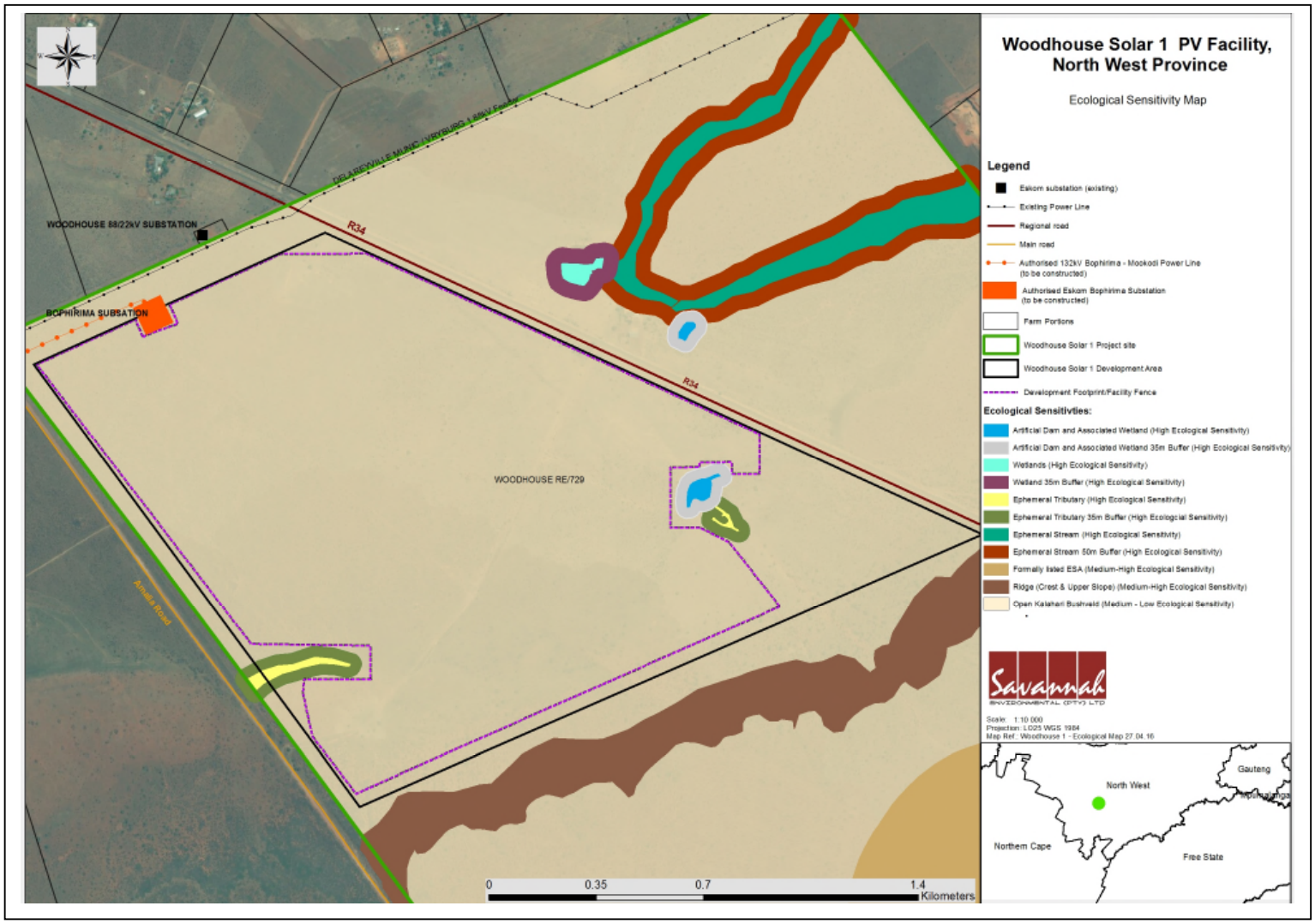


Figure 6.3: Ecological sensitivity map of the Woodhouse Solar 1 PV Facility development area.

6.3.2 Description of Ecological Impacts

The following impacts are identified as the major impacts associated with the development of both the PV facility and the associated infrastructure which are assessed, for the preconstruction, construction and operational phases of the development.

» Impacts on vegetation and protected plant species*:*

The most likely and significant impact will be on vegetation. The development of the PV facility may lead to a direct loss of vegetation. Consequences associated with the impact include i) a general loss of habitat for sensitive species; ii) loss in variation within habitat due to loss of portions of it; iii) general reduction in biodiversity; iv) increased fragmentation; v) disturbance to processes maintaining biodiversity and ecosystem goods and services; and vi) a loss of ecosystem goods and services.

Protected and red data species occur within the Quarter Degree Grid encompassing the project site. Of these listed species only *Ammocharis coranica* and *Aloe grandidentata* were confirmed during the survey of the development area. The protected *Acacia erioloba* (under the National Forest Act) and the declining *Boophone disticha* was also observed during the field-survey in low numbers. Such species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat. Threatened species (red data species) include those listed as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possible extinction. This may arise if the proposed infrastructure is located where it will impact on such an individual or populations. Consequences may include:

* Fragmentation of populations of affected species;
* Reduction in area of occupancy of affected species; and
* Loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival.

The impacts can be largely mitigated through avoidance of potential sensitive areas and listed species, by allowing a minimum clearance of vegetation (restricted to the affected area only) or translocation of specimens, where feasible (and permitted) to do so.

» Direct faunal impacts:

Faunal species will primarily be affected by the overall loss of habitat. Increased levels of noise, pollution, disturbance and human presence will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species and species confined and dependent on specified habitats would not be able to avoid the construction activities and might be killed. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. This impact is highly likely to occur during the construction-phase and would also potential occur with resident fauna within the facility after construction.

Threatened species (red data species) include those listed as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possible extinction. This may arise if the proposed infrastructure is located where it will impact on such individual or populations. Consequences may include:

- Fragmentation of populations of affected species;
- Reduction in area of occupancy of affected species; and
- Loss of genetic variation of affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival.

Disturbance of faunal species can be maintained to a minimum and low significance by implementing effective mitigation measures.

» Impacts on ephemeral tributaries and other water bodies:

Construction may lead to some direct or indirect loss of or damage drainage lines and ephemeral tributaries. This will lead to localised loss of these habitats and may lead to downstream impacts that affect a greater extent of wetlands or impact on wetland function and biodiversity (downstream). Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to these ephemeral tributaries can have an impact on the functioning of those wetlands. Consequences may include:

* Increased loss of soil;

- Loss of or disturbance to indigenous wetland vegetation;
- Loss of sensitive wetland habitats;
- Loss or disturbance to individuals of rare, endangered, endemic and/or protected species that occur in wetlands;
- Fragmentation of sensitive habitats;
- Impairment of wetland function;
- Change in channel morphology in downstream wetlands, potentially leading to further loss of wetland vegetation; and
- Reduction in water quality in wetlands downstream.

By implementing mitigation measures, including the exclusion of these drainage lines and ephemeral tributaries, along with determined buffer areas (minimum of 35m), from the proposed development footprint, these habitat types can retain their character and functionality. Where watercourses cannot be avoided (e.g. access road crossings and power line crossings), carefully considered mitigation measures, such as culvert design, size and placement as well as measures to control water flow (especially flash floods) and erosion (e.g. gabion structures, bank revegetation and rehabilitation etc.), should be in place. Furthermore the necessary licensing and/or application should be obtained from the relevant authorities.

» Soil erosion and associated degradation of ecosystems:

Soil erosion is a frequent risk associated with PV facilities on account of the vegetation clearing and disturbance associated with the construction phase of the development and may continue occurring throughout the operation phase. The development area earmarked for the development of the Woodhouse Solar 1 PV Facility is located on a flat, outstretched low-lying plain and subsequently erosion within this section is likely to be low. Internal roads and panels will generate an increase in runoff during intense rainfall events and may potentially exaggerate the effects of erosion. These eroded materials may enter the nearby streams, wetlands and rivers and may potentially impact these systems through siltation and change in chemistry and turbidity of the water.

With effective mitigation measures in place, including regular monitoring of the occurrence, spread and potential cumulative effects of erosion may be limited to an absolute minimum.

» Alien Plant Invasions:

Major factors contributing to the invasion by alien invader plants includes habitat disturbance and associated destruction of indigenous vegetation. Consequences of this may include:

- Further loss and displacement of indigenous vegetation;

- Change in vegetation structure leading to change in various habitat characteristics;
- Change in plant species composition;
- Change in soil chemistry properties;
- Loss of sensitive habitats;
- Loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
- Fragmentation of sensitive habitats;
- Change in flammability of vegetation, depending on alien species;
- Hydrological impacts due to increased transpiration and runoff; and
- Impairment of wetland function.

Alien Invasive Plants confirmed to occur on the site include:

- *Prosopis glandulosa* (Category 1b – only one species noted at the small gravel dam located to the south-east of the site),
- *Flaveria bidentis* (Category 1b),
- *Xanthium strumarium* (Category 1b),
- *Datura stramonium* (Category 1b),

Other weeds and exotics confirmed during the survey:

- *Chloris virgata, Tragus berteronianus, Tribulus terrestris, Conyza bonariensis, Schkuhria pinnat*a and *Alternanthera pungens*.

Although the potential severity of this impact may be high, it can be easily mitigated through regular alien control.

» Impacts on Critical Biodiversity Areas and Broad-Scale Ecological Processes:

The development area is located within Critical Biodiversity Areas (links and corridors). Development would potentially impact the ecological functioning of the CBAs (terrestrial CBA links and corridors and aquatic CBA areas).

The ecological field data collected for the purposes of the ecological study suggested that it can be considered reasonable that the areas shown as terrestrial CBA corridors which traverse the site have a low contribution to the functioning of the corridor. Due to historical anthropogenic activities which have taken place within the development area (including overgrazing over a long period of time; roads; power lines), the areas shown as being CBAs are considered as being of a medium-low sensitivity[18].

[18] This assessment correlates with the findings of the aquatic and terrestrial biodiversity assessment undertaken for the CSIR SEA for the Renewable Energy Development Zones (Part 3, Section 4).

These medium-low areas are also associated with open bushveld and are located across the majority of the development footprint. The ecological study concluded that due to the level of anthropogenic disturbance in the corridors, these would not be required to be excluded from the developable area. Impact on these Critical Biodiversity Areas can be maintained to an absolute minimum or even avoided by restricting the development to disturbed and transformed areas within the areas listed as CBAs. By furthermore implementing effective mitigation measures the functionality off these areas and connectivity between these areas may be maintained.

The areas, however, which are listed as pans or wetland areas under the Aquatic CBA 1 areas should be buffered and be excluded from the developable area (i.e. avoidance of identified ecologically sensitive areas). The high ecological sensitivity areas located within the development area include ephemeral tributaries located within the west and east of the development area and an artificial dam and the associated wetland located in the west.

» Reduced ability to meet conservation obligations and targets:
The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the countries' ability to meet its conservation targets. The receiving vegetation types in the study area are classified as Least Threatened and they are extensive vegetation types that are still more than 99% intact. The development of the site would result in the loss of 287ha (and possibly up 600ha with the consideration of two adjacent facilities) of intact, albeit degraded, habitat which on its own is not considered highly significant. Where other developments may be constructed within the same area, the possibility for cumulative impact on the affected vegetation types or on more localised plant communities is a potential concern.

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

The impacts assessed below apply to the development area, including the PV panels, access roads as well as the grid connection infrastructure for the Woodhouse Solar 1 PV Facility. The development area of the four alternative grid connection routes comprise the same habitat type, open Kalahari bushveld, considered to be of low sensitivity, and do not differ in any significant way as far as the impacts on ecology is concerned. Therefore, there is no significant difference in the potential impacts associated with the alternative power line routes, and the impacts for these alternatives are not comparatively assessed in the assessment tables below, but the comparison between the alternatives is summarised in Section 6.3.4.

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

Nature: Removal of vegetation, compaction and disturbance of soils, creation of runoff zone, increased erosion risk, destruction of animal burrows, possible traversing of drainage areas (ephemeral tributaries), impact on protected species, alteration of soil surface properties

Relevant listed activities:
GN R983 Activity: 28(ii)
GNR 984 Activity: 1
GNR 985 Activity:4(e)(i)(ee)

	Without mitigation	**With mitigation**
Extent (E)	Local (1)	Local (1)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Low (3)	Minor (1)
Probability (P)	Highly Probable (4)	Highly Probable (4)
Significance (S = E+D+M)*P	**Medium (32)**	**Low (24)**
Status (positive, neutral or negative)	Negative	*Neutral* where on transformed areas or on existing access roads *Negative* on undisturbed areas *Minimal new negative impacts expected*
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably well	

Mitigation:

» After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - Protected plant species: must be relocated
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor

» During construction: create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas

» Keep the clearing of natural and semi-natural grasslands to a minimum

» If filling material is to be used, this should be sourced from areas free of invasive species

» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil

» Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas

» Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required) » Access roads (where unavoidable) may cross drainage lines or ephemeral tributaries as well as the 35m buffer zones (with necessary mitigation measures in place). » Ensure adequate drainage where access roads cross drainage lines or ephemeral tributaries. » 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 road or portion thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable revegetation program
Cumulative impacts: » Possible erosion of areas lower than the access road, possible contamination of lower-lying drainage lines, ephemeral tributaries and 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

Fencing area – may also serve as maintenance track to PV panels and as fire-break

Nature: Removal of vegetation, compaction of soils, creation of runoff zone, impact on protected species, impact on terrestrial vertebrates. *Note: Fencing already exists around the entire northern, eastern and western boundaries, but will most likely be upgraded and reinforced.*		
Relevant Listed activities: GNR 983 Activity: 28(ii) GNR 984 Activity: 1		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (3)	Small (0)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (32)**	**Low (15)**
Status	Negative	Neutral where on transformed areas Slightly Negative on natural areas Minimal new negative impacts expected
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources	Probable	Not likely

Can impacts be mitigated?	Reasonably well	

Mitigation

- After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
- Protected plant species: must be relocated
- Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- During the design phase, the possible impact of burrowing vertebrates and rodents on the development must be determined, and fencing must be designed to either exclude such fauna if it will be detrimental or enable occasional migration of smaller vertebrates onto and across the site (which could be beneficial to small vertebrate populations)
- Minimise area affected, especially during construction
- During construction: strictly prohibit any off-road driving or parking of vehicles and machinery outside the footprint areas
- Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
- Monitor the establishment of alien and indigenous invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
- If the area will be used as fire-break as well, maintain a suitably low grass layer by regular mowing or appropriate species selection, but do not leave soil bare. Alternatively, ensure that the soil has a covering that prevents erosion

Cumulative Impacts

- Possible erosion of cleared areas and associated accelerated erosion from surrounding areas.
- Possible loss of ecosystem functioning due to increase in invasive species

Residual Impacts

- Altered vegetation composition
- Compacted topsoils
- Possibility for erosion and invasion by alien invasives

Construction and operation of facility on semi-natural vegetation and disturbed areas

Nature: Removal of or excessive damage to vegetation, compaction of topsoil, creation of runoff zone, redistribution and concentration of runoff from panel surfaces, artificial shading of vegetation, displacement of terrestrial vertebrates, reduced buffering capacities of the landscapes during extreme weather events

Relevant Listed activities:
GNR 983 Activity: 28(ii)
GNR 984 Activity: 1, 15
GNR 985 Activity: 12(a)(ii)

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (6)	Moderate (5)
Probability	Definite (5)	Definite (5)

Significance	**Medium (55)**	**Medium (50)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources	Highly Probable	Slight Probability
Can impacts be mitigated?	Reasonably	

Mitigation

» After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and active animal burrows
» Protected plant species: must be relocated
» Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
» Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
» Clear as little indigenous 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 species that were part of the original indigenous species composition similar to the remaining natural vegetation as listed in the specialist report, or sow with *Digitaria eriantha* and *Themeda triandra*.
» Shading from panels may prevent or slow the re-establishment of desirable grass species, thus re-establishment must be monitored and species composition adapted if the above species fail to establish sufficiently.
» A strong herb layer will also suppress the re-emergence of weed species from existing seed banks
» Aim to maintain a buffer zone of a minimum of 35 m around drainage lines / ephemeral tributaries
» Remove all invasive vegetation before and after construction and continuously up to decommissioning
» If filling material is to be used, this should be sourced from areas free of invasive species
» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
» Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
» Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro-topography and revegetation or soil erosion control efforts accordingly
» Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
» 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 followed the following could occur:
    * erosion of areas around the panels and continued erosion of the development area

with associated siltation and/or erosion of lower-lying wetlands * contamination of drainage lines, lower-lying rivers or wetlands * alteration of occupancy by terrestrial fauna beyond the project area, possible reduction of available habitat and food availability to terrestrial fauna * spread and establishment of invasive species
Residual Impacts » altered topsoil characteristics » altered vegetation composition

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

Nature: Limited removal of vegetation, compaction of soils, temporary or permanent damage to animal burrows. *Note: This is applicable for all grid connection alternatives.*		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(i) GNR 984 Activity: 1		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Low (28)**	**Low (20)**
Status	Negative	Neutral to slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation » After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows * Protected plant species: must be relocated where affected by towers, maintenance tracks or construction * Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor » During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas » Limit clearing of indigenous vegetation to tower 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 » Avoid any placement of towers within drainage lines, ephemeral tributaries or depressions as		

well as within their designated buffer areas (all alternatives currently avoid these features).
Cumulative Impacts Possible erosion of surrounding areas if no mitigation is implemented, no significant cumulative impact on flora or fauna expected (excluding avifauna) due to existing degradation
Residual Impacts Very localised alteration of soil surface characteristics

Construction of substation and other facility buildings, workshops, offices, guardhouses, as well as temporary laydown and/or storage areas.

***Nature*:** Removal of vegetation, compaction and alteration of topsoils, creation of runoff zone, redistribution and concentration of runoff from sealed surfaces, displacement of terrestrial vertebrates

Relevant Listed activities:
GNR 983 Activity: 11(i), 15, 28(i)
GNR 984 Activity: 1
GNR 985 Activity: 12(a)(ii)

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (5)	Minor (2)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (40)**	**Low (28)**
Status	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation

- Exclude high sensitivity zones from this footprint
- After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - Protected plant species: must be relocated
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- Aim to maintain a buffer zone of a minimum of 35m around drainage lines/ephemeral tributaries
- Limit disturbance to footprint area as far as practically possible
- Place infrastructure as far as possible on sites that have been transformed already
- During construction: stay within demarcated footprint areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
- Prevent spillage of construction material and other pollutants, contain and treat any spillages

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

Cumulative Impacts
- If mitigation measures are not strictly followed the following may, although regarded as unlikely, occur:
  - erosion of areas around sealed surfaces and continued erosion of the development area with associated siltation and/or erosion of lower-lying ephemeral streams and downstream wetlands
  - contamination of drainage lines, lower-lying rivers or wetlands
  - spread and establishment of invasive species
- alteration of occupancy by terrestrial fauna, small reduction of available habitat and food availability to terrestrial fauna

Residual Impacts
- altered topsoil characteristics
- altered vegetation composition

General construction activities related to the construction phase

Nature: Alien plants are likely to invade the site as a result of the large amounts of disturbance created during construction

Relevant Listed activities:
GNR 983 Activity: 11(i), 28 (ii),
GNR 984 Activity 1, 15

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Probable (4)	Improbable (3)
Significance	Medium (40)	Low (21)
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	No	No

Can impacts be mitigated?	Yes
Mitigation » Due to the disturbance at the site as well as the increased runoff generated at the site, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. » Rehabilitation of cleared areas with indigenous species after construction to reduce alien invasion potential. » Regular monitoring for alien plants within the development footprint. » Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible and should only be used for woody species which resprout following manual control.	
Cumulative Impacts Alien invasion would contribute to cumulative habitat degradation in the area, but if alien species are controlled then, then cumulative impact from alien species would not be significant.	
Residual Impacts If alien species at the site are controlled, then there will be very little residual impact.	

6.3.4 Comparative Assessment of Alternatives

Grid connection alternatives

The grid connection alternatives proposed for the development of the Woodhouse Solar 1 PV Facility will be shorter than 1km and will be located within a medium-low ecological sensitivity area known as open Kalahari Bushveld. The area proposed for the power line alternatives includes existing power infrastructure as well as proposed power infrastructure to be constructed in the near future. The area is no longer considered to be in a natural state and the loss of habitat in this area is considered to be acceptable loss.

All of the proposed power line alternatives proposed for the Woodhouse Solar 1 PV Facility are considered suitable and acceptable from an ecological perspective (with the implementation of appropriate mitigation measures). Therefore the most preferred power line alternative will be based on the most technically suitable alternative for the PV facility. The preference from an ecological perspective would then be linked to technical preference, and so Alternative 1 is nominated as the preferred alternative for development.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Ecology	Acceptable – » Located within a medium-low ecological sensitive area. » Does not impact on sensitive ecological features.	Acceptable – » Located within a medium-low ecological sensitive area. » Does not impact on sensitive ecological features.	Acceptable – » Located within a medium-low ecological sensitive area. » Does not impact on sensitive ecological features.	Acceptable – » Located within a medium-low ecological sensitive area. » Does not impact on sensitive ecological features.

6.3.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the severity of ecological impacts of the PV facility can be reduced to low, or avoided. The PV facility can be developed and ecological impacts managed by taking the following into consideration:

» Care should be taken regarding the presence of *Acacia erioloba* (presence confirmed during the field-survey), which is a protected species according to the National Forest Act (NFA).
» All ephemeral tributaries and drainage lines must be excluded from the development footprint area and an appropriate buffer of 35m should be placed around these areas. The assessed development footprint must be adjusted in order to remain outside of these buffer areas.
» While solar PV facilities may be able to retain a proportion of the preconstruction biodiversity, the resulting habitat is fairly isolated from the surrounding landscape and will be largely anthropogenic in nature. Care must be taken to prevent the encroachment and spread of alien species.
» Potentially significant negative impacts on the ecological environment could be soil degradation issues because of construction activity; possible introduction of alien invasive plants, a long-term (more than 8 months) low or absent vegetation cover after construction and impacts on protected plant species.
» With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of these impacts can be minimised.
» The impact on fauna is expected to be small to negligent. Presence of indigenous terrestrial vertebrates within the study area is relative low. 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 the ephemeral tributaries and drainage lines.

» Potential for soil erosion within the development area is considered low as a result of the nature of the soils. Due diligence would however need to be taken in order to prevent water and wind erosion in exposed areas. Excavated topsoil will require appropriate management to ensure no loss of this resource. Mitigation procedures as well as hands on maintenance (good soils management measures) will ensure that medium to long term impacts can be avoided.

» Poor topsoil management may lead to the loss of nutrient rich topsoil. Levelling of slopes/topographical high points, excavations for discharge water and discarding of building rubble storage significantly affect soil resources. With the implementation of appropriate management measures, these impacts are unlikely to occur and would be of low significance.

6.4 Potential Impacts on Avifauna

A development area of ~287ha has been assessed for the 100MW PV Facility, which includes the development footprint of the facility (~240ha). The development footprint includes the PV panels and other associated infrastructure (i.e. facility on-site substation, inverters, internal roads etc.). The impact of the proposed development on the avifauna has been assessed as low (after mitigation) as a result of a lack of unique habitats within the development area and previous disturbance. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E** for more details).

6.4.1 Results of the Avifaunal Study

The avian sensitivities associated with the development of the Woodhouse Solar 1 PV Facility is based on the integration of avian microhabitats present within the development area and the project site and avifaunal information collected during the field-survey. Important avian microhabitats play an integral role within the landscape, providing nesting, foraging, and reproductive benefits to the local avifauna.

The majority of the site falls within low sensitivity areas associated with the Vaalbos habitat unit. The vegetation in this habitat unit is homogenous, lacking structural and compositional variation, and did not support a high diversity and abundance of bird species. Similarly so, cultivated/modified land habitat is also classified as Medium-Low sensitivity.

Patches of Bushveld throughout the project site were assessed as being of Medium sensitivity. These areas are to the east of the R34. These areas supported a relatively high diversity and abundance of bird species, due to the structural and compositional

variation in the vegetation, but were also subject to varying degrees of degradation throughout. The elevated ridgeline to the south of the development area was also assessed as being of medium sensitivity, and a 100m buffer has been applied to this feature from the base of the foothill.

The location of the project site and more specifically the development area are not considered unique habitats in the landscape and are already subject to varying degrees of transformation and degradation. Although two threatened and/or priority species were recorded within the broader study area – White-backed Vulture and Greater Flamingo respectively – these are widespread species, the area is not considered critical for their conservation, and the extent of habitat loss for these species would be considered low.

In terms of the direct impacts of the development in isolation, the development area is considered optimal for the development due to the homogenous nature of the vegetation, the level of degradation already present and the lower bird species diversity and abundance recorded in this area.

The Woodhouse Solar 1 PV Facility and its associated infrastructure has been assessed as having a medium-low impact to priority species and general avifauna occurring in the development area and the broader impact zone of the development.

The development of the Woodhouse Solar 1 PV Facility and associated infrastructure is likely to have little, if any, significant long-term impact on the avifauna of the wider area, especially after mitigation, and as such, is considered to have an acceptably low level of impact. Refer to **Figure 6.4** below for the avifaunal sensitivity map.

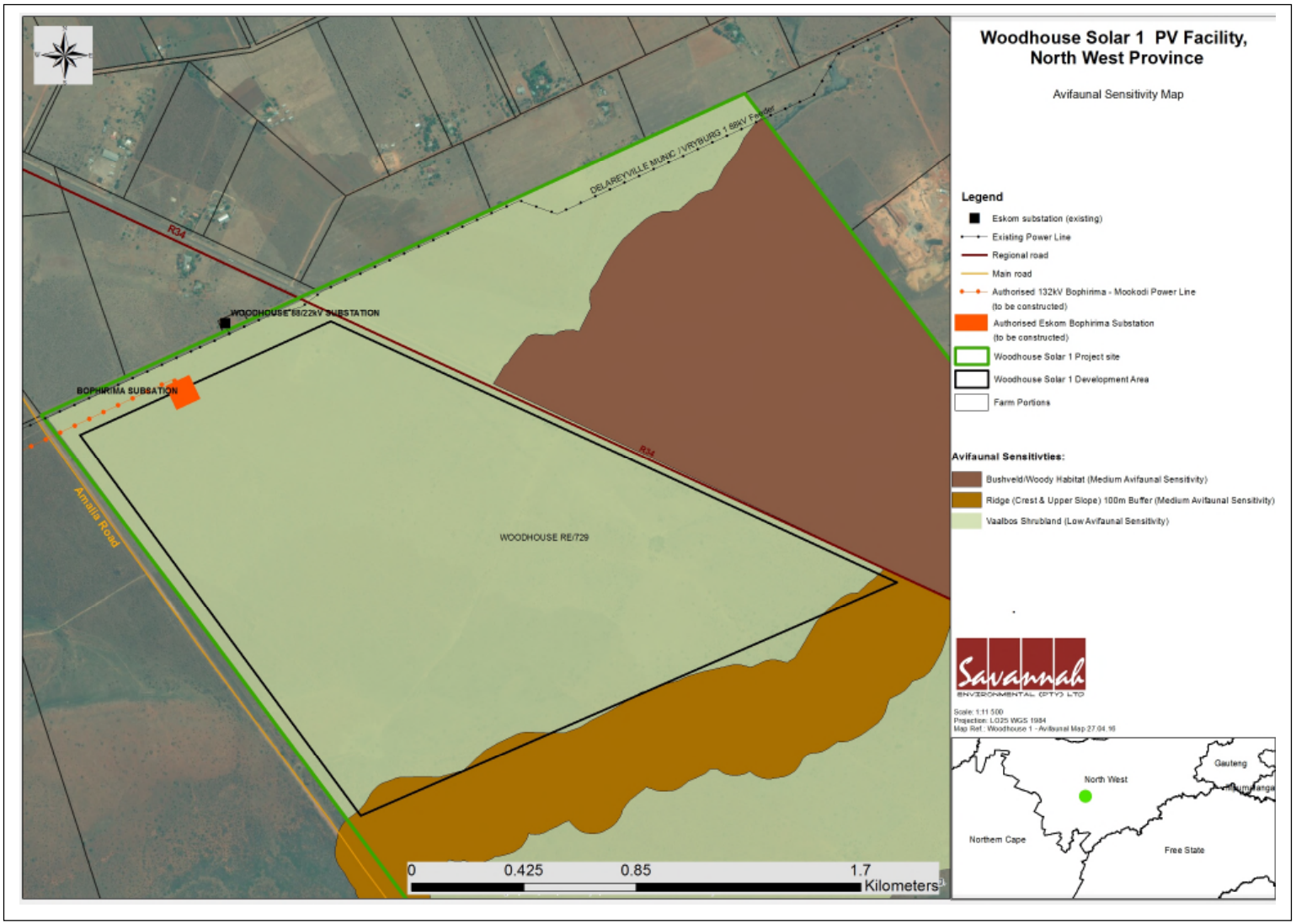


Figure 6.4: Map illustrating the avifaunal sensitivity within the Woodhouse Solar 1 PV Facility development area.

6.4.2 Description of Avifaunal Impacts

The following impacts (i.e. impacts of solar energy facilities and impacts of associated infrastructure) are identified as the major impacts associated with the development and which are assessed, for the pre-construction, construction and operation phases of the development (refer to **Appendix E**).

Impacts of solar energy facilities on avifauna

» *Habitat loss*
Although the degree of this impact is dependent on the location and scale of the development, this is potentially the most significant impact associated with the construction and operation (maintenance) of solar energy facilities. Extensive areas of vegetation (habitat) are cleared to accommodate the considerable amount of infrastructure required at these facilities, reducing the amount of habitat available to birds for foraging, roosting and breeding (Smallie, 2013). Given the considerable space requirements of commercially viable facilities (> 200 ha), this effect could be significant in some instances, particularly given the possibility that the initial footprint of successful facilities may be expanded over time, allowing for the possible cumulative effects of multiple facilities in one area. This impact is likely to affect smaller bird species (i.e. larks and pipits) with small home ranges, as entire territories could be removed during construction activities.

» *Disturbance and displacement*
Construction of solar energy facilities requires a significant amount of machinery and labour to be present on site for a period of time (~12-18 months). For shy, sensitive species or ground-nesting birds resident in the area, construction activities are likely to cause a temporary disturbance or even result in displacement from the site entirely. In addition, species commuting around the site may become disorientated by the reflected light and consequently fly longer distances to avoid the area, potentially resulting in displacement and energy implications (Smallie, 2013). Similarly, but to a lesser extent, ongoing maintenance activities at the operational facility are likely to cause some degree of disturbance to birds in the general vicinity.

» *Mortality*
Bird mortality has been shown to occur due to direct collisions with solar panels. Species affected include waterbirds, small raptors, doves, sparrows and warblers (Kagan et al., 2014). The reflective surfaces of PV panels may confuse approaching birds and in some cases act as an attractant, being mistaken for large water bodies, resulting in injuries and/or mortalities when birds attempt to land on the installations.

» *Human conflict*
Certain bird species may seek to benefit from the installations, using the erected structures as prominent perches, sheltered roost sites or even nesting sites, and possibly foraging around the infrastructure in response to changes in the distribution of preferred foods (i.e. plants growing under the panelling and other animals attracted to the facility). This may result in the fouling of critical components in the solar array, bringing local bird populations into conflict with facility operators.

Impacts of associated power infrastructure

» *Collisions with power infrastructure*
Power lines pose a significant collision risk to birds, affecting a particular suite of collision prone species. These are mostly heavy-bodied birds such as bustards, cranes, storks, large eagles and various species of waterbirds that have limited manoeuvrability in flight, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (Anderson, 2001; van Rooyen 2004a; Jenkins et al., 2010).

» *Electrocutions on power line and power infrastructure*
Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the gap between live components and/or live and earthed components (van Rooyen, 2004b; Lehman et al., 2007). Electrocution risk is strongly influenced by the power line voltage and the design of the pole structure and mainly affects larger, perching species such as vultures, eagles and storks that are capable of spanning the spaces between energised components.

Project specific assessment of impacts

Specific impacts associated with the Woodhouse Solar 1 PV Facility and associated infrastructure could include the following as listed below. However, in general, the anticipated impacts on avifauna of the proposed development are not considered to be of any great significance if mitigation measures are applied. There will be some habitat loss for endemic passerines, some species – endemic passerines, large terrestrial species and raptors – may be displaced from a broader area either temporarily by construction and maintenance activities, or more permanently by the disruptive, reflective properties of the solar panels and ongoing activities at the operational development, and some species (large terrestrials, raptors and transient waterbirds) may be killed in interactions (collisions and electrocutions) with the new power lines and power infrastructure, but numbers affected are likely to be low.

» Disturbance and displacement of local endemic passerines – Ant-eating Chat and Cape Longclaw – and shy ground-nesting species – Burchell's Courser and Double-

banded Courser – from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the solar energy facility.

» Disturbance and displacement of resident or visiting large terrestrial species – Secretarybird, Abdim's Stork, Black Stork and Blue Crane – from nesting and/or foraging areas by construction and/or operation and/or decommissioning of the solar energy facility, and/or mortality of these species in collisions with new power lines whilst flying *en route* to distant resource areas.
» Disturbance and displacement of resident or visiting raptors – Martial Eagle, Tawny Eagle, Lanner Falcon and White-backed Vulture – from foraging areas by construction and/or operation and/or decommissioning of the solar energy facility, and/or mortality of these species in collisions with new power lines or by electrocutions when perched on power infrastructure.
» Injury or mortality of transient waterbirds – Greater Flamingo, Lesser Flamingo and Yellow-billed Stork – using possible flight paths in and out of resource areas in the broader impact zone of the solar energy facility in collisions with solar panels and/or new power lines.

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

The impacts assessed below apply to the development area, including the PV panels, access roads as well as the grid connection infrastructure for the Woodhouse Solar 1 PV Facility. The development area of the four alternative grid connection routes are located within an area considered as low avifaunal sensitivity and is not considered as a unique habitat. Therefore, there is no significant difference in the potential impacts associated with the alternative power line routes, and the impacts for these alternatives are not comparatively assessed in the assessment tables below, but the comparison between the alternatives is summarised in Section 6.4.4.

Habitat loss during the construction phase

Nature: All construction activities would result in a loss of vegetation and habitat affecting endemic passerines, large terrestrial species and raptors through site clearance for solar panels, the construction of internal roads and the establishment of auxiliary buildings. The habitat is however already degraded to varying degrees across the developable area and the habitat is not unique within the landscape. *All priority species could potentially be affected by this impact.*		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity:1, 15 GNR 985 Activity: 12(a)(ii)		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)

Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (44)**	**Medium (36)**
Status	Negative	Negative
Reversibility	Low (Habitat will be lost during construction)	Low (Habitat will be lost during construction)
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Partially, due to the space requirements, some land and avian microhabitats will be impacted.	Partially, due to the space requirements, some land and avian microhabitats will be impacted.

Mitigation measures:

» All construction activities must be carried out according to the generally accepted environmental best practise and the temporal and spatial footprint of the development should be kept to a minimum.
» Care must be taken in the vicinity of sensitive microhabitats such as Ephemeral pans and Drainage lines.
» Existing roads must be used as much as possible for access during construction.
» The boundaries of the development area are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint.
» Provide adequate briefing for site personnel.
» Any bird nests that are found during the construction phase must be reported to the Environmental Control Officer (ECO).
» The above measures must be covered in a site specific EMPr and controlled by an ECO.

Cumulative impacts:

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the loss of natural habitat within the area. However, as the wider landscape is already somewhat degraded due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.

Residual impacts:

Moderate. The vegetation within the development area can be rehabilitated after the life time of the facility if proposed mitigation measures are put in place.

Disturbance during construction

Nature: All construction activities would result in a disturbance impact affecting endemic passerines, large terrestrial species and raptors through the noise and movement of construction equipment and personnel. The proposed development area has already been subject to disturbance through agricultural practises and is in close proximity to the town of Vryburg and as such the local avifauna has already experienced a degree of disturbance. As a result, the disturbance of birds by the proposed PV facility is anticipated to be of moderate significance as birds will move away from the area temporarily. It must however be noted, that species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during the construction phase.

All priority species could potentially be affected by this impact.

Relevant Listed activities:

GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity:1, 15
GNR 985 Activity: 12(a)(ii)

	Without mitigation	**With mitigation**
Extent	Low (2)	Low (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (32)**	**Low (15)**
Status	Negative	Negative
Reversibility	Low (species will be disturbed)	Low (species will be disturbed)
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Partially	Partially

Mitigation measures:

» Strict control must be maintained over all activities during construction, in line with an approved construction EMPr.
» During construction, if any priority species identified in this report are observed to be roosting and/or nesting and breeding in the vicinity, the ECO must be notified.
» The construction camps and laydown areas and site offices etc. must be as close to the site as possible.
» Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
» Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all internal roads.

Cumulative impacts:

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the disturbance of avifauna within the area. However, as the wider landscape is already somewhat disturbed due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.

Residual impacts:

Moderate. Some disturbance during the construction phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

Disturbance during operation

Nature: All maintenance and operational activities would result in a disturbance impact affecting endemic passerines, large terrestrial species and raptors through the noise and movement of maintenance equipment and personnel.
All priority species could potentially be affected by this impact.

Relevant Listed activities:
GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity:1

	Without mitigation	**With mitigation**
Extent	Low (2)	Low (20
Duration	Long-term (4)	Long-term (4)
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	None	None
Can impacts be mitigated	Partially	Partially

Mitigation measures:

» If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical short, soiling of panels or other problems, birds should be prevented from accessing nesting sites by using mesh or other manner of excluding them. Birds should not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds already with eggs and chicks should be allowed to fledge their chicks before nests are removed.
» If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation.
» Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
» Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all access roads.

Cumulative impacts:

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the disturbance of avifauna within the area.

Residual impacts:

Moderate. Some disturbance during the operational phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

Collisions with PV panels

Nature: The PV facility is comprised of reflective panelling occupying a large area. Avifauna can be disorientated by the reflected light and consequently be displaced from an area more extensive than just the development footprint. Waterbirds have been known to mistake the reflective surface for an expanse of water and attempt to land on the panels, resulting in injuries and even death.
Large terrestrial species, raptors and waterbirds could potentially be affected by this impact.

Relevant Listed activities:
GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity:1

	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (20)**	**Low (16)**
Status	Negative	Negative
Reversibility	Low (birds may be injured or killed)	Low (birds may be injured or killed)
Irreplaceable loss of resources	None	None
Can impacts be mitigated	No	No

Mitigation measures:

» Monitor all avifaunal incidents or mortalities observed within the facility (recorded and

documented with photographs to ensure correct identification).
» If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice.

Cumulative impacts:
Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the area being covered by solar panels thus increasing the probability of collisions.

Residual impacts:
None. Once the solar panels are decommissioned the injuries and mortalities will cease.

Habitat loss due to power line construction

***Nature*:** All construction activities would result in a loss of vegetation and habitat affecting endemic passerines, large terrestrial species and raptors, through site clearance for substations and power line infrastructure and servitudes which have to be cleared of excess vegetation at regular intervals in order to allow access to power lines for maintenance and to prevent vegetation from intruding into the legally prescribed clearance gap, minimising the risk of fire.
The habitat is however already degraded to varying degrees across the developable area and the habitat is not unique within the landscape. All power line alternatives are less than 1km in length, and the associated impact is low as the area is currently degraded and has exiting impacts (other power lines, roads and bare soils from overgrazing).
All priority species could potentially be affected by this impact.

Relevant Listed activities:
GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity:1

	Without mitigation (applicable to all four alternatives)	**With mitigation (applicable to all four alternatives)**
Extent	Low (1)	Low (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (1)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (18)**
Status	Negative	Negative
Reversibility	Low (habitat will be lost during construction)	Low (habitat will be lost during construction)
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes

Mitigation measures:
» All construction activities must be carried out according to the generally accepted environmental best practise and the temporal and spatial footprint of the development should be kept to a minimum.
» Existing roads must be used as much as possible for access during construction.
» The boundaries of the development area are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint.
» Provide adequate briefing for site personnel.
» Any bird nests that are found during the construction phase must be reported to the Environmental Control Officer (ECO).

» The above measures must be covered in a site specific EMPr and controlled by an ECO.

Cumulative impacts:

Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the loss of natural habitat within the area. However, as the wider landscape is already somewhat degraded due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.

Residual impacts:

Moderate. The vegetation within the development area can be rehabilitated after the life time of the facility if proposed mitigation measures are put in place.

Avifaunal disturbance due to grid connection construction activities

***Nature*:** All construction activities would result in a disturbance impact affecting endemic passerines, large terrestrial species and raptors through the noise and movement of construction equipment and personnel. The relatively small scale of the proposed developable area has already been subjected to disturbance through agricultural practises and is in close proximity to the town of Vryburg and as such the local avifauna has already experienced a degree of disturbance. As a result, the disturbance of birds by the associated power infrastructure is anticipated to be of low significance as birds will move away from the area temporarily. The power line is also short (<1km) and in close proximity to existing infrastructure. It must however be noted, that species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during both the construction and operational phases.

All priority species could potentially be affected by this impact.

Relevant Listed activities:

GNR 983 Activity: 11(i), 28(ii)

GNR 984 Activity:1

	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (15)**
Status	Negative	Negative
Reversibility	Low (species will be disturbed)	Low (species will be disturbed)
Irreplaceable loss of resources	Yes – bird fatalities	Yes – bird fatalities
Can impacts be mitigated	Partially	Partially

Mitigation measures:

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

» During construction, if any priority species identified in this report are observed to be roosting and/or nesting and breeding in the vicinity, the ECO must be notified.

» The construction camps and laydown areas and site offices etc. must be as close to the site as possible.

» Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.

» Driving must take place on existing roads and a speed limit of 50 km/h must be implemented

on all internal roads.
***Cumulative impacts*:** Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the disturbance of avifauna within the area. However, as the wider landscape is already somewhat disturbed due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.
Residual impacts: Moderate. Some disturbance during the construction phase is inevitable. It is likely that some species will be disturbed and potentially be displaced by the development.

Disturbance along power line during operation

Nature: All maintenance and operational activities would result in a disturbance impact affecting endemic passerines, large terrestrial species and raptors through the noise and movement of maintenance equipment and personnel. *All priority species could potentially be affected by this impact.*		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity:1		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (20)**	**Low (15)**
Status	Negative	Negative
Reversibility	Low (species will be disturbed)	Low (species will be disturbed)
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Partially	Partially
Mitigation measures: » If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical short, soiling or panels or other problems, birds should be prevented from accessing nesting sites by using mesh or other manner of excluding them. Birds should not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds already with eggs and chicks should be allowed to fledge their chicks before nests are removed. » If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation. » Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted. » Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all access roads.		
Cumulative impacts: Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the disturbance of avifauna within the area. However, as the wider landscape is already somewhat disturbed due to agricultural practises in the area and the proximity to the town of Vryburg, the contribution would be small and the overall significance low.		

Residual impacts:
Moderate. Some disturbance during the operational phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

Avian electrocutions on power infrastructure during operation

Nature: Electrocutions of birds on associated power infrastructure results in injuries or death and could potentially affect large, perching species in the area such as raptors and storks. Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the gap between live components and/or live and earthed components (van Rooyen, 2004b; Lehman et al., 2007).
Of the priority species, Martial Eagle and White-backed Vulture could potentially be affected by this impact.

Relevant Listed activities:
GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity:1

	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (32)**	**Low (24)**
Status	Negative	Negative
Reversibility	Low (birds will be injured or killed)	Low (birds will be injured or killed)
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes

Mitigation measures:
» A "Bird Friendly" structure, with a bird perch (as per standard Eskom guidelines) should be used for the power infrastructure.
» All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting, 2002).
» Installation of artificial bird space perches and nesting platforms, at a safe distance from energised components (Goudie, 2006; Prinsen et al., 2012).

Cumulative impacts:
Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the length of power infrastructure in the area and therefore the subsequent risk.

Residual impacts:
Moderate. The power line infrastructure will be within the area over a long period of time, if not permanently. However, if the power line infrastructure is removed the impacts associated (avian injuries and mortalities) will cease.

Avian collisions with power lines during operation

Nature: Collisions are the single biggest threat posed by power lines in South Africa (van Rooyen, 2004). Avian species most susceptible and impacted upon are large, heavy-bodied birds such as bustards, storks, korhaans and certain raptors.
All priority species could potentially be affected by this impact, but specifically, Secretarybird, Blue

Crane, Martial Eagle, White-backed Vulture and Greater and Lesser Flamingo.		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity:1		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (32)**	**Low (24)**
Status	Negative	Negative
Reversibility	Low (birds will be injured or killed)	Low (birds will be injured or killed)
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	Yes
Mitigation measures: » High sensitivity sections of the power line should be marked with Bird Flight Diverters (BFDs), on the earth wire of the line, 5 metres apart, alternating black and white to increase the visibility of the power line and reduce the likelihood of collisions. » The power line route should be scanned at least twice a month for the first year after construction to identify and locations of high impact. All mortalities along the power line route should be recorded and if there are any sites where repeated mortalities have occurred, an avifaunal specialist should be consulted for advice on additional mitigation measures to be implemented.		
Cumulative impacts: Moderate. The development borders the proposed Woodhouse Solar 2 PV Facility which will also contribute to the length of power infrastructure in the area and therefore the subsequent risk.		
Residual impacts: Moderate. The power line infrastructure will be within the area over a long period of time, if not permanently. However, if the power line infrastructure is removed the impacts associated (avian injuries and mortalities) will cease.		

6.4.4 Comparative Assessment of Alternatives

Grid connection alternatives

All of the grid connection alternatives are less than 1km in length and are located within a low avifaunal sensitivity area. The location of the power line alternatives are situated within an area which is not considered as being a unique habitat in the landscape and has already been subject to varying degrees of transformation and degradation. The area surrounding the power line alternatives include existing power infrastructure and proposed infrastructure to be constructed in the near future. Therefore all of the power line alternatives are considered to be feasible and acceptable from an avifaunal perspective (with the implementation of appropriate mitigation measures) due to the fact that the proposed power line routes are located within/span the low sensitive area associated with cultivated/modified land and shrubland habitat units. Therefore, the

most preferred power line alternative will be based on the most technically suitable alternative for the PV facility. The preference from an avifauna perspective would then be linked to technical preference, and so Alternative 1 is nominated as the preferred alternative for development.

6.4.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the severity of impacts of the Woodhouse Solar 1 PV Facility can be reduced to low, or avoided. The PV facility can be developed and impacts on avifauna managed by taking the following into consideration:

Aspect	Alternative 1	Alternative2	Alternative 3	Alternative 4
Avifauna	Acceptable – » No unique habitats affected » Located within a low sensitive area	Acceptable – » No unique habitats affected » Located within a low sensitive area	Acceptable – » No unique habitats affected » Located within a low sensitive area	Acceptable – » No unique habitats affected » Located within a low sensitive area

- » Implementation of the required mitigation measures should reduce the construction phase and operation phase impacts to acceptable levels.
- » Every effort should be made to monitor impacts throughout the life cycle of the Woodhouse Solar 1 PV Facility.
- » A post construction avifauna monitoring programme be initiated at the site, if required, and include a wet and dry season survey.

6.5 Assessment of Impacts on Heritage Sites

The 100MW PV facility has a development area of ~287ha, with a development footprint of ~240ha. Negative impacts on heritage resources will be due to loss during construction activities. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix F** - Archaeological Report and **Appendix G** – Palaeontology Report for more details).

6.5.1 Results of the Heritage Survey

The development area is underlain by the Vryburg Formation of the Ghaap Group, and the Dwyka Group of the Karoo Supergroup. The geologically older Vryburg Formation (2.6 billion year-old) consists of fluvial and shallow marine quartzites, mudrocks and conglomerates, while the Dwyka Group (317 Million years) consists of Permo-carboniferous glacial sediments. The Dwyka Group (Karoo Supergroup) is represented by small outcrops in the north of the development area. Although trace fossils and

plants could be present in the Dwyka Group the likelihood of significant fossil heritage in the Vryburg area is considered to be low. The southern portion of the development area consists of the Vryburg Formation, which is considered as unfossiliferous in the Vryburg area. Therefore, there are no areas located within the development area considered as sensitive.

In terms of the built environment, several farm labourer ruins were recorded in the Woodhouse Solar 1 development area. Middle Stone Age (MSA) and Later Stone Age (LSA) artefacts were recorded scattered in varying densities across the proposed development area. Most of these artefacts are scattered too sparsely to be of any significance apart from noting their presence, which has been done within the specialist report (refer to **Appendix F**). However discreet knapping sites (Field no 407 – 408) were recorded at an existing quarry in the north eastern portion of the proposed footprint. Graves can be expected anywhere on the landscape. Several stone cairns were noted close the recorded farm labourer ruins that could indicate graves. No significant cultural landscape elements were recorded.

6.5.2 Description of heritage impacts

Palaeontological resources: There is a scarcity of fossil heritage and a lack of appropriate exposure within the proposed development area which indicates that the impact of Woodhouse Solar 1 PV Facility on the Remaining Extent of the farm Woodhouse 729 is of low significance in palaeontological terms.

Stone Age Find spots (Field Nr 402, 403, 404, 406, 409 – refer to **Figure 6.4**):
Isolated Middle Stone Age artefacts are scattered over the development area in low densities (less than 3 artefacts per 5m²). More artefacts can be expected sub surface but is now covered with apedal soils. These low density scatters are of low significance and are found over large areas. Artefacts consist mostly of miscellaneous flakes and broken pointed flakes with faceted striking platforms. Raw material consists of quartzite andesitic/ basaltic lava and chert. Heritage significance: Generally Protected C (GP.C).

Stone Age Site (Field Nr 407 - 408 – refer to **Figure 6.4**):
The site is located in the southern eastern portion of the development footprint proposed for Woodhouse Solar 1 and a direct impact is foreseen on the site. The site is marked by an existing quarry where a calcrete substrata is visible under the apedal soils. Artefacts are scattered around this quarry on top of the calcrete and consist of both MSA and LSA lithics. As MSA and LSA material is not well dated in this area the site is of slightly higher significance as the calcrete matrix in which the stone tools occur can be dated. Heritage significance: Generally Protected B (GP.B).

Ruins (Field Nr 410, 412 -415 - Refer to **Figure 6.4**):
Several ruins were recorded in the south western portion of the development area. Apart from the fairly recent ruin (Field No 410) the others consist of ephemeral single

row rectangular and square stone wall foundations. It must be remembered that sites like these might contain unmarked graves. Heritage significance: Generally Protected B (GP.B); the ruins are of low significance but it should be noted that structures like these are often associated with informal graves. Graves are of high social significance.

Stone Cairns (Field Nr 405, 411 and 416 - Refer to **Figure 6.4**):
The stone cairns are located close to the recorded ruins, the purpose of these cairn are unknown but could be grave dressings marking graves. Field no 411 resembles a grave. The farm owner was consulted regarding graves and although the farm has been in their family for at least three generations he is not aware of any graves.

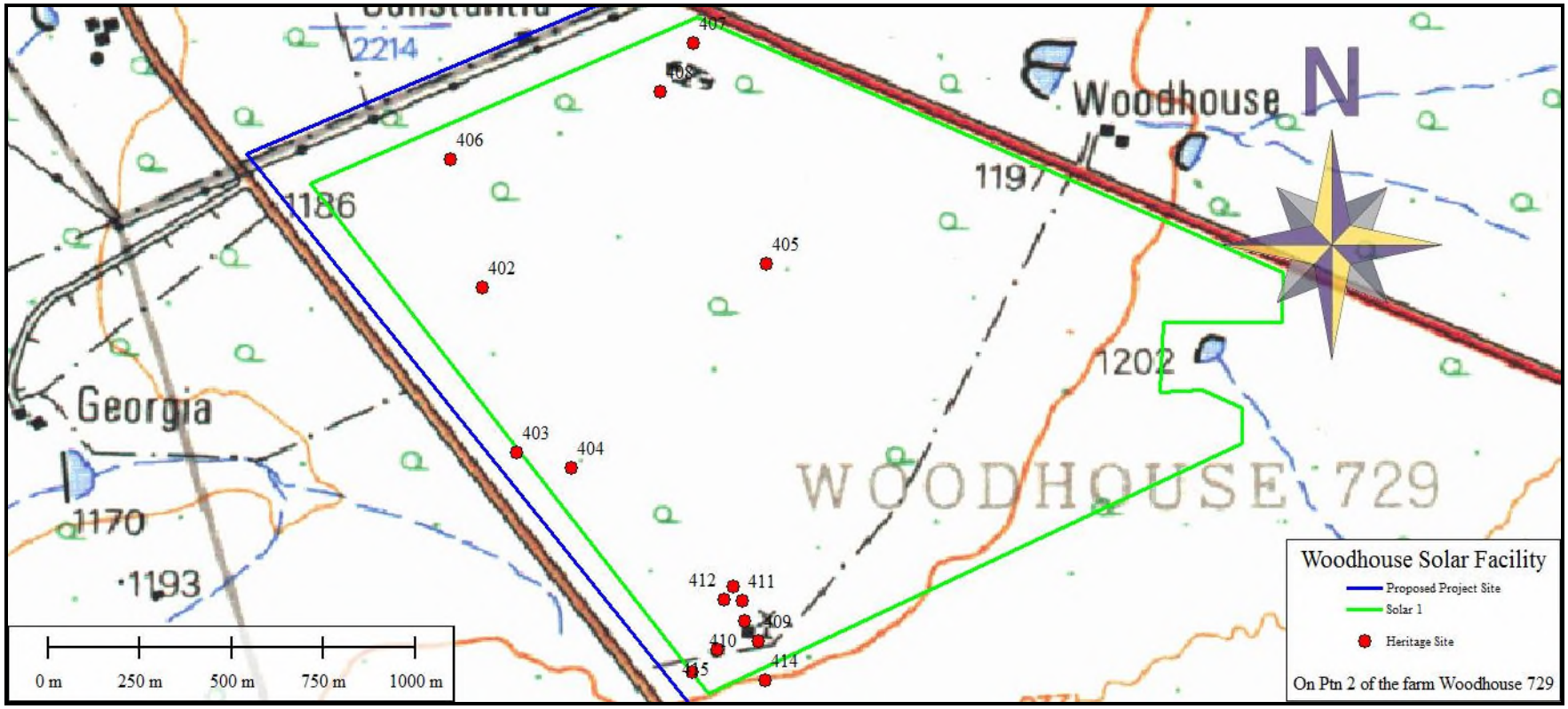


Figure 6.4: Distribution of recorded features in the development area of the Woodhouse Solar 1 PV Facility.

6.5.3 Impact tables summarising the significance of impacts on heritage resources (i.e. archaeology and palaeontology) (with and without mitigation)

The impacts assessed below apply to the development area, including the PV panels, access roads as well as the grid connection infrastructure for the Woodhouse Solar 1 PV Facility. The development area of the four alternative grid connection routes are located within an area considered to be unfossiliferous and a without any significant cultural landscape elements. Therefore, there is no significant difference in the potential impacts associated with the alternative power line routes, and the impacts for these alternatives are not comparatively assessed in the assessment tables below, but the comparison between the alternatives is summarised in Section 6.5.4.

Stone Age Scatter Find Spots

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 4(e)(i)(ee), 12(a)(ii)		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (1)	Low (1)
Probability	Most Likely (4)	Most Likely (4)
Significance	**Low (28)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes – limited mitigation required.	
Mitigation: No preconstruction mitigation needed. The artefacts within the development area are scattered too sparsely to be of any significance apart from noting their presence, which has been done in the archaeology report (refer to **Appendix F**).		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.		
Residual Impacts: Depletion of archaeological record of the area.		

Stone Age Site

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.

Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 4(e)(i)(ee), 12(a)(ii)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (1)
Probability	Most Likely (4)	Likely (3)
Significance	**Medium (40)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: If the site cannot be preserved *in-situ* it is recommended that a surface sample is collected and that the site is dated (possibly the calcrete matrix in which the tools are found) prior to applying for a destruction permit from the SAHRA.		
Cumulative impacts: Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.		
Residual Impacts: Depletion of archaeological record of the area**.**		

Ruins

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 4(e)(i)(ee), 12(a)(ii)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (1)
Probability	Most Likely (4)	Likely (3)
Significance	**Medium (40)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: The ruins are not of high significance, but informal graves are often associated with structures like these. It is recommended that the possible presence of graves should be confirmed during the social consulting process and if graves are indicated these should be avoided or relocated following the correct procedure.		

Cumulative impacts: Heritage sites and burials are non-renewable and any impact will be permanent and destructive.
Residual Impacts: N/A

Stone Cairns

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 4(e)(i)(ee), 12(a)(ii)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (1)
Probability	Most Likely (4)	Likely (3)
Significance	**Medium (40)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: It is recommended that the Stone Cairns should be demarcated and excluded from the development if possible. If this is not possible social consultation should confirm the presence of graves prior to construction. If graves are present they should be relocated following the correct procedures.		
Cumulative impacts: Heritage sites are non-renewable and any impact will be permanent and destructive.		
Residual Impacts: N/A		

Palaeontological resources

Nature: The excavations and site clearance during the construction phase will involve substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb, damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific research. This impact is likely to occur only within the construction phase. No impacts are expected to occur during the operation phase.		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 4(e)(i)(ee), 12(a)(ii)		
	Without mitigation	**With mitigation**

Extent	Local (1)	N/A
Duration	Permanent (4)	N/A
Magnitude	Minor (2)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (14)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Irreversible	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	No	
Mitigation: Trace fossils and plants could be present in the Dwyka but the likelihood of significant fossil heritage is considered to be low. The southern area of the development area consists of the Vryburg Formation, which is unfossiliferous in this area.		
Cumulative impacts: Heritage sites are non-renewable and any impact will be permanent and destructive.		
Residual Impacts: N/A		

6.5.4 Comparative Assessment of Alternatives

Grid connection alternatives

The power line alternatives all traverse the Dwyka Group, and the likelihood of significant fossil heritage to occur is considered to be low. From an archaeological perspective, no significant archaeological elements were noted and the impacts which the development will have on the archaeological resources are considered acceptable if the correct mitigation measures are implemented. It should also be taken into account that power line alternatives proposed will not exceed 1km in length and that there are existing power infrastructure (i.e. substations and power lines) located within the vicinity of the development area as well as proposed infrastructure to be constructed in the near future.

Therefore, all the power line alternatives proposed for the Woodhouse Solar 1 PV Facility are considered to be feasible and acceptable for a heritage perspective (with the implementation of the appropriate mitigation measures). The most preferred power line alternative will be based on the most technically suitable alternative for the PV facility. The preference from a heritage perspective would then be linked to technical preference, and so Alternative 1 is nominated as the preferred alternative for development.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Archaeology and Palaeontology	Acceptable – » Artefacts identified are scattered too sparsely to be of any significance. » No significant heritage finds » Fossil potential low.	Acceptable – » Artefacts identified are scattered too sparsely to be of any significance. » No significant heritage finds » Fossil potential low.	Acceptable – » Artefacts identified are scattered too sparsely to be of any significance. » No significant heritage finds » Fossil potential low.	Acceptable – » Artefacts identified are scattered too sparsely to be of any significance. » No significant heritage finds » Fossil potential low.

6.5.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the severity of impacts of the PV facility can be reduced to low, or avoided. The PV facility can be developed and impacts on heritage resources managed by taking the following into consideration:

» Middle Stone Age (MSA) and Later Stone Age (LSA) artefacts are scattered in varying densities across the proposed development area. Most of these artefacts are scattered too sparsely to be of any significance.
» Discreet knapping sites (Field no 407 – 408) recorded at an existing quarry in the north eastern portion of the proposed footprint are considered to be of a slightly higher significance as MSA and LSA material is not well dated in the area.
» Several ruins were recorded, which have a low significance. It must be taken into account that sites like these might contain unmarked graves which are considered as being of a high social significance.

6.6 Assessment of Visual Impacts

The 100MW PV facility has a development area of ~287ha, with a development footprint of ~240ha, predominantly to be occupied by PV panels. Negative impacts on visual receptors will be during the undertaking of construction activities and the operation of the facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix H** - Visual Report for more details).

6.6.1 Results of the Visual Impact Assessment

The area that is likely to be affected by visual impacts associated with the proposed Woodhouse Solar 1 PV Facility will be limited to the area immediately to the south of the urban area of Vryburg, within an approximate 5km extent of visibility from the facility.

This area is predominately urban and urban fringe development. Due to the ridgeline to the south of the proposed development area, this facility will not impact visually on areas to the south that are more natural in character and where the landscape character is not influenced by development. The area of visual influence is therefore to the west and north west of the facility. Due to the nature of the development, the overall sensitivity rating was defined as low on receptors.

It is likely that broken views of the facility will be possible from the N14 to the north, the N18 to the west and the edge of the Huhudi Township. The overall sensitivity rating was defined as low.

From where the R34 traverses the northern boundary of the affected property up to the ridgeline to the south of the proposed project, travellers on the R34 will have an overview of the PV facility. The overall sensitivity rating was defined as moderate on users of the R34.

There are a small number of receptors in close proximity to the development that are likely to be sensitive to change in their views. This includes residential properties located east of the R34 as well as an agricultural homestead immediately to the north of the development which is also used as a guesthouse.

The power line alternatives required to establish the connection are located within an area which already includes existing power infrastructure, as well as proposed construction of future power infrastructure. The visual quality of the area is already impacted by existing power line and substation infrastructure.

The following photos provide an illustration of the different landscapes within the area (refer to **Figures 6.5, 6.6, 6.7, 6.8, 6.9, 6.10** below).

Figure 6.11 below provides an illustration of the zones of theoretical visibility associated with the Woodhouse Solar 1 PV Facility.

Figure 6.5: Huhundi – Urban LCA

Figure 6.6: Vryburg South – Urban LCA

Figure 6.7: Ridgeline North – Natural LCA

Figure 6.8: Ridgeline South – Natural LCA

Figure 6.9: Transport Business – Semi Natural LCA

Figure 6.10: Transport Business – Semi Natural LCA

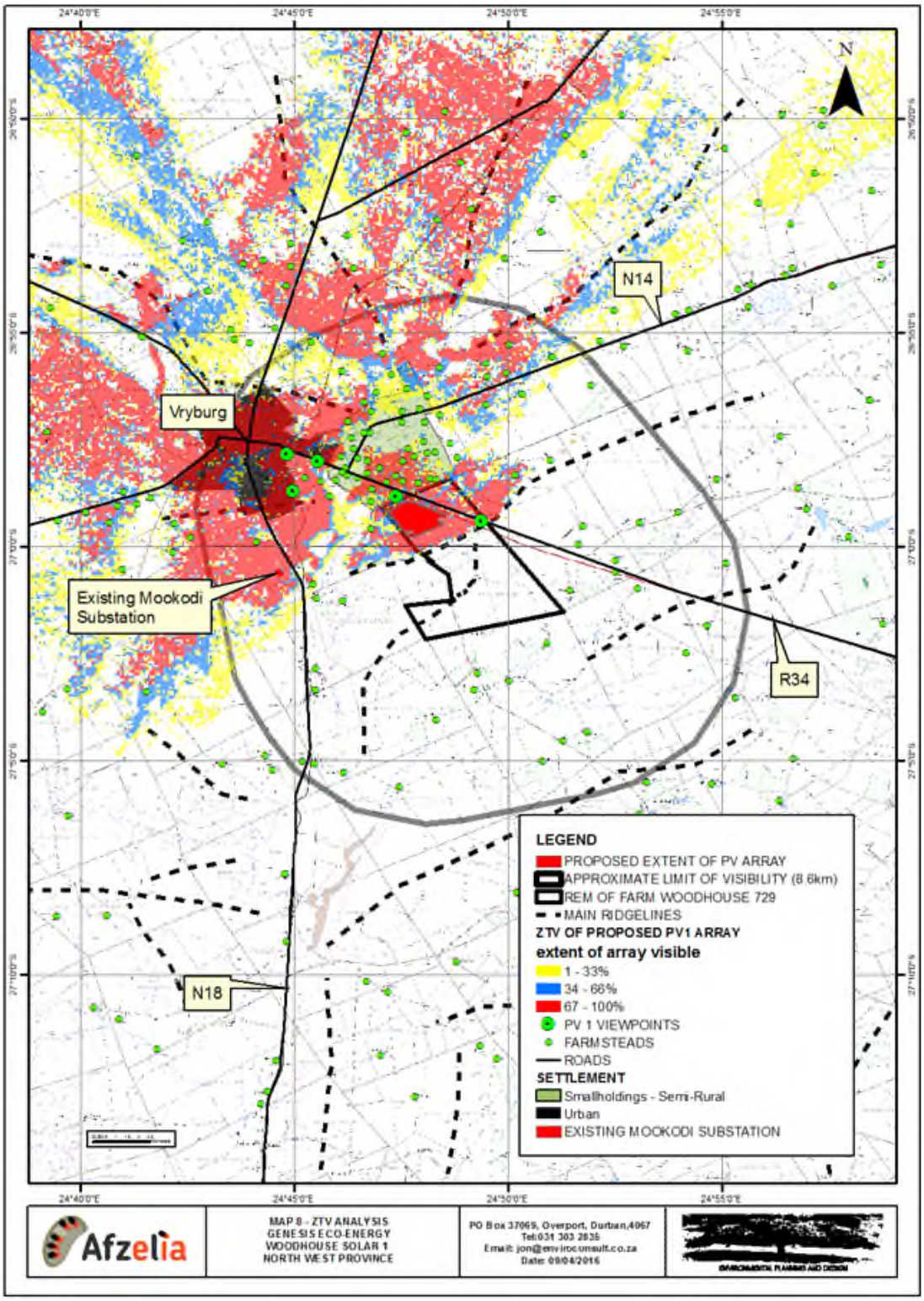


Figure 6.11: A map illustrating the zone of theoretical visibility (ZTV) associate with the Woodhouse Solar 1 PV Facility.

6.6.2 Visual Assessment

Landscape Character Areas and Visual Absorption Capacity

The landscape character associated with the Woodhouse Solar 1 PV Facility can be divided into three distinct Landscape Character Areas (LCAs):

Rural areas surrounding Vryburg
These are most predominantly used for cattle grazing and appear relatively natural. The flatness of the landscape combined with scattered shrubs and small trees are likely to help provide screening for low elements within the landscape. With relatively low vegetation and a shallow undulating topography, the height of the PV units is likely to be critical in maximising the little absorption capacity that exists. Vegetation is unlikely to provide significant screening for views over development from adjacent low ridgelines. This LCA can be further sub divided by the area of urban influence that occurs to the north of the ridgeline that bisects the southern section of the subject property and the rural area that is relatively free of urban influence to the south of the same ridgeline.

The urban area of Vryburg
This area is generally inward looking drawing little character influence from external areas. It is unlikely that the proposed development will have much influence on these areas other than perhaps at the edges of the urban area that face onto the proposed development area.

The semi-rural area
This area is comprised of smallholdings located to the east of Vryburg. This is a relatively open developed area from which views into the surrounding rural landscape are likely to be possible. VAC is generally therefore likely to be limited but will depend on localised features such as ornamental vegetation particularly around residential properties that could provide significant VAC for small areas.

Visual Impact

Visual impacts associated with the development of the Woodhouse Solar 1 PV Facility are likely to include:

a) The general change in character of the landscape due to the proposed development was assessed as low to medium significance without mitigation and low significance with mitigation. This is due to the fact that only an area that is already impacted by urban and urban fringe development will be impacted.
b) The likely change in view that is likely to result for smallholdings to the north was generally assessed as low due to the extent that existing vegetation and minor ridgelines provide screening. However impacts are likely to be more significant for

those properties that are close to the development particularly for the homestead to the south which is also used as a guesthouse and residential properties on the opposite side of the R34. Because of this, the impact was assessed as having a medium significance which could be reduced to low with mitigation. Key mitigation measures include the retention and management of a natural buffer area between the development and receptors.

c) Visual impacts on homesteads outside the marked area of smallholdings was assessed as low. This was due to distance as well as the screening effect of landform.
d) The impact on views as seen from the urban edge which includes Huhudi were assessed as of low significance.
e) Visual impacts on both the N14 and N18 were also considered to be of low significance.
f) The visual impact on the adjacent R34 was assessed as of medium significance. Views across the extent of the development are likely to be possible from the higher sections of this road. This impact can be mitigated to a degree, however, it will not be possible to totally screen views across the extent of the development from higher sections of the road. The retention and management of a natural buffer area between the development and the R34 is the key mitigation measure that is required.
g) The impact of lighting was considered to have a low significance with the exception of residential and guest house properties in close proximity to the development because of which it was assessed to have a medium significance. With the careful design and the minimisation of lighting this can be reduced to a low significance.
h) Glint and glare from the PV panels for adjacent sections of the R34 and the southerly approach to the Vryburg airstrip is rated as a low significance impact. This could result in an intermittent occasional impact which will only occur when lighting conditions and sun angles combine during limited periods of the year and day. Mitigation is possible, where required, through selection of finish to the PV panels.

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

The impacts assessed below apply to the development area, including the PV panels, access roads as well as the grid connection infrastructure for the Woodhouse Solar 1 PV Facility. The development area of the four alternative grid connection routes are located within an area where there already is a strong visual influence from urban and urban fringe development, changes to the landscape quality are not likely to be problematic. Therefore, there is no significant difference in the potential impacts associated with the alternative power line routes, and the impacts for these alternatives are not comparatively assessed in the assessment tables below, but the comparison between the alternatives is summarised in Section 6.7.4.

Impact of the proposed development on the General Landscape Character

Nature: The proposed PV facility will introduce industrial elements into the rural landscape immediately to the south of Vryburg. This area is already highly influenced by urban development.		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 4(e)(i)(ee), 12(a)(ii)		
	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility		
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	N/A
Mitigation: Planning: » Plan levels to minimise earthworks to ensure that levels are not elevated; » Plan to maintain the height of structures as low as possible; » Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development; » Retain natural buffer areas adjacent to the R34 and on the northern boundary Operation: » Reinstate any areas of vegetation that have been disturbed during construction; » Remove all temporary works; » Monitor rehabilitated areas post-construction and implement remedial actions; » Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area. » Maintain natural buffer areas adjacent to the R34 and on the northern boundary. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site; » Rehabilitate and monitor areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The proposed PV facility will increase the influence of urban development but this increase will be limited due to the existing ridgeline to the south of the project which will screen the development from more natural landscape areas. The proposed project will also extend the general influence of solar projects on the character of the landscape surrounding Vryburg.		
Residual Risks: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.		

The proposed development could be visible to and impact on an extended area of small holdings located to the north

Nature: The issue relates to the fact that this is a mixed development area with some sites used for social uses such as a church, others used for light industrial and transport related activities

and others have been developed as residential properties. It is the residential use that is likely to be most sensitive to possible industrialisation of the landscape that the properties overlook.

The ZTV indicates that a portion of the area of smallholdings immediately to the north of the proposed development could be affected.

In reality the majority of houses are set amongst trees which will help to screen them from the development. The properties to the north of the N14 are also set a a level lower than the road which foreshortens views to the south from this area.

Properties close to the R34 on both the northern and southern sides of the roads are the only properties that are likely to be impacted. This includes a property that has been developed as a guest house which is located close to the northern boundary of the proposed development as well as a number of private houses on the opposite side of the road to the development.

Relevant Listed activities:
GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity: 1

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Minot to Low (2-4)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (48)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility		
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:
Planning:
» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
» Retain natural buffer areas adjacent to the R34 and on the northern boundary
Operations:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.
» Maintain natural buffer areas adjacent to the R34 and on the northern boundary.
Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate areas to their natural state;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.
Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Cumulative impacts:
As other solar PV projects are unlikely to be obvious to the affected properties, the cumulative impact will equate to the impact imposed by this project.

Residual Risks:
The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

The proposed development could change the character of the landscape as seen from the urban edge of Vryburg.

Nature: This issue is associated with two areas;

» The southern edge of Vryburg is generally comprised of light industrial development and large scale retail. This area is unlikely to be sensitive to potential change in outlook. The area is also relatively low when compared with the site and there is a significant amount of tall vegetation on the urban edge that will almost certainly screen views of the proposed development.
» The housing area of Huhudi which is located approximately 3.5km to the west of the proposed development. This is a dense housing area so views towards the development will only be possible from the eastern edge of the settlement area. Mitigating effects include;
  * There is a substantial amount of vegetation on the urban edge that will help to soften views of the development.
  * The urban area is set at approximately the same level as the proposed development which means that extensive overviews of the array will not be seen.

While residents may not appreciate views of the development, the nature of the settlement is such that change in outlook is unlikely to impact on property values.

Relevant Listed activities:
GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity: 1

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility		
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:
Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;

» Monitor rehabilitated areas post-construction and implement remedial actions; » Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site; » Rehabilitate areas to their natural state; » Rehabilitated and monitor areas post-decommissioning and implement remedial actions.
Cumulative impacts: The proposed development is likely to increase the extent of solar projects visible from the urban edge
Residual Risks: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

The proposed project is likely to be visible to and impact on a short length (approximately 3km) of the N14.

Nature: Whilst the ZTV analysis indicates that the development may be visible from the N14, it is likely that any views of the development from this road will be for short sections of the road and views will be softened and broken up by intervening vegetation.		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1		
	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (20)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility		
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	No
Mitigation: No mitigation possible		
Cumulative impacts: As the proposed project is not likely to be obvious from the road the significance of cumulative impacts is likely to be low.		
Residual Risks: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.		

The proposed project is likely to be visible intermittently to and impact on approximately 5-6km of the R34.

Nature: The N34 runs along the northern site boundary. Views of the development are likely to be obvious for motorists travelling in both directions along the road. However views over the extent of the development from an elevated position will only be possible for travellers moving in

an east to west direction. The widest view over the development will be possible as the traveller crests the ridgeline to the south of the site and starts moving down the slope towards Vryburg.

While the R34 is an important regional route, it is not likely to carry as high a proportion of tourism related traffic as a national route.

As the traveller approaches Vryburg from the east the landscape surrounding the road appears relatively natural until the crest of the ridgeline to the south of the site. Views from the section of affected road are generally influenced by urban and urban fringe elements. While there is nothing of the scale as the proposed development obvious, this is likely to mean that the introduction of a new industrial element is not likely to be seen as such a major detractor as if it were located within a more natural area.

Relevant Listed activities:
GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity: 1

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate to high (7)	Low to moderate (5)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (52)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility		
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:
Planning:
» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
» Retain natural buffer areas adjacent to the R34 and on the northern boundary
Operations:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.
» Maintain natural buffer areas adjacent to the R34 and on the southern boundary.
Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Cumulative impacts:
As the proposed project is one of the closest projects to the road the significance of cumulative impacts are similar to above.

Residual Risks:
The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of

the proposed project. It is therefore critical that effective rehabilitation is undertaken.

The proposed project is likely to be visible to and impact on the N18.

Nature: There are two possible areas of impact;
The proposed array with associated infrastructure, the possible connection to the Bophirima Substation and the possible upgrade of the Bophirima to Mookodi over-head power line will all be visible to approximately 3.5km of the road to the south of Huhudi.
The upgrade of the power line is likely to have a similar impact as the original line that will be installed by Eskom irrespective of the project proceeding.
The proposed array with associated infrastructure and buildings will also impact on a similar area as the power line upgrade.
The above impacts will be part screened by the existing railway infrastructure and associated vegetation which will help to part screen views over the development.
The level of the road is also at a similar level as the development which means that overviews of the project will not occur.

The possible second area of impact could include development of a new overhead power line from the on-site substation directly to the Mookodi Substation. This will only occur if the Bophirima Substation and the connecting power line to Mookodi is not installed. This will be a 132kV power line that will be constructed in an area that is already impacted by HV power lines entering the Mookodi Substation. The impact of this power line will be relatively small compared with the HV lines.

All impacts will occur within a landscape where the character of the area is influenced by urban and urban fringe development. More natural areas to the south will not be affected.

Relevant Listed activities:
GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity: 1

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	N/A
Duration	Long term (4)	N/A
Magnitude	Minor to low (3)	N/A
Probability	Probable (3)	N/A
Significance	**Low (27)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility		N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	No	N/A

Mitigation:
Mitigation not possible

Cumulative impacts:
If the Bophirima to Mookodi power line is not constructed by Eskom then the project will add to the electrical infrastructure that is evident in the area. The proposed PV facility will increase the influence of urban development but this increase will be limited due to the existing ridgeline to the south of the project which will screen the development from more natural landscape areas. The proposed project will also extend the general influence of solar projects on the character of

the landscape surrounding Vryburg
Residual Risks: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

The project is likely to impact on agricultural homesteads however, homesteads within 5km of the proposed study area are less likely to be affected by the proposed project than homesteads at a greater distance.

Nature:

The ZTV indicates that there are approximately eight homesteads outside the area that is indicated as smallholdings that might be affected. Of these;

» Three are in the valley between the proposed development and Huhudi and any residents will view the development from a lower position.

» One is located 1.5km to the north west of the Mookodi substation and will be screened from the development by vegetation. Views of the substation are likely to be prominent.

» The remainder are located more than 4km to the north of the project and to the north of the N14. From this area, partial views may be possible but existing vegetation will soften views if not totally screen them.

Relevant Listed activities:

GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity: 1

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor to low (3)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility		
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;

» Plan to maintain the height of structures as low as possible;

» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:

» Reinstate any areas of vegetation that have been disturbed during construction;

» Remove all temporary works;

» Monitor rehabilitated areas post-construction and implement remedial actions;

» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site;

» Rehabilitate areas to their natural state; » Rehabilitated and monitor areas post-decommissioning and implement remedial actions.
Cumulative impacts: The proposed solar PV project will increase the influence of urban development but this increase will be limited due to the existing ridgeline to the south of the project which will screen the development from more natural landscape areas. The proposed project will also extend the general influence of solar projects on the character of the landscape surrounding Vryburg.
Residual Risks: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Glare from the proposed project could cause nuisance on adjacent roads and for flightpaths associated with the Vryburg airport.

Nature: Research indicates that glint and glare problems are most likely to occur to the west and north-west of a facility in the morning, to the east and north-east in the afternoon and evening. While PV panels are designed to absorb light energy, light is often reflected when the angle of incidence is acute as happens when the sun is bright and low in the sky[19]. Given the fact that the R34 to the east of the site is higher than the site, it is possible that sections of this road will be affected. It is also possible that the flightpath into the airstrip to the west could be affected. This air strip however, is not operated commercially nor is it lit so it is relatively unlikely that planes travelling to Vryburg will land in the early morning or late afternoon. It is possible however, that local private pilots could use the airstrip during these periods. The distance is such that if this does occur it is likely to be a nuisance issue that may result in momentary persistence of vision. It needs to be understood that if these impacts do occur, they will be dependent on appropriate conditions that are likely to occur during specific months of the year and time of day. The impacts are therefore likely to be intermittent and not ongoing.		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1		
	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low to Minor (3)	Low(2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility		
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

[19] At the scoping stage it was indicated that the glint and glare assessment tools on the Sandia National Laboratories web site would be used to assess this issue. These tools have become the standard for such an assessment and are a requirement of the US FAA for solar developments in the vicinity of airports. Unfortunately these tools are no longer available. Discussion has been undertaken with the developer who has confirmed that they are being transformed into a commercial operation. In the absence of these tools comment is provided on the basis of the likelihood of reflected light affecting sensitive receivers.

Mitigation:

» The use of non-reflective finishes and coatings to the surface of PV panels.
» The use of a natural buffer area between the R34 and the facility.
» Should problems occur on the R34, the use of screen fencing.
» Should problems occur on the flightpath into the airstrip, the issuing of a general notice to pilots using the airstrip.

Cumulative impacts:

Other PV projects proposed in the area could also create similar impacts. It is possible that this project could add to glint and glare issues experienced in the area.

Residual Risks:

No residual risk has been identified.

The potential visual impact of operational, safety and security lighting of the facility at night on observers.

Nature: The area surrounding the site is currently affected by lighting from the adjacent urban area. street lighting on the busy R34/N14 section of the road north of the N14 junction and lighting associated with transport operations and homesteads to the south of Vryburg. It is not therefore a dark area at night. No specific detail has been provided other than confirmation of the need for lighting at sufficient level to enable security cameras to be used at night. This is likely to result in the development adding to existing light impacts in the area. However, it will not affect the relatively undeveloped, more natural landscape to the south.

Relevant Listed activities:

GNR 983 Activity: 11(i), 28(ii)
GNR 984 Activity: 1

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Small to minor (0-2)
Probability	Definite (5)	Improbable (2)
Significance	**Medium (50)**	**Low (10-14)**
Status (positive or negative)	Negative	If lights are generally not visible then the occasional light is unlikely to be seen as negative.
Reversibility		
Irreplaceable loss of resources?	It would be possible to change the lighting system so the impact cannot be seen as irreplaceable loss	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

» Use low key lighting around buildings and operational areas that is triggered only when people are present.
» Plan to utilise infra-red security systems or motion sensor triggered security lighting;

» Ensure that lighting is focused on the development with no light spillage outside the site; and » Keep lighting low, no tall mast lighting should be used.
Cumulative impacts: There is potential for security lighting and operational lighting associated with solar energy projects to further impact on the area but this is likely to be of low significance.
Residual Risks: No residual risk has been identified.

6.6.4 Comparative Assessment of Alternatives

Grid connection alternatives

From a visual perspective all four of the proposed power line alternatives are considered as visually acceptable as there is already exiting power line and substation infrastructure located within the vicinity. .

The shortest power line route is considered as the most preferred from a visual perspective, that is, the turn-in turn – out connection of the authorised 132kV Eskom Bophirima-Mookodi power line (to be constructed) as the connection is only ~80m.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Visual impacts	Acceptable – » located in close proximity to existing power infrastructure (Woodhouse Substation and Delareyville Munic/Vryburg 1 88kV Feeder) and infrastructure to be constructed in the near future (authorised Eskom Bophirima Substation and authorised 132kV Eskom Bophirima–Mookodi power line). » Length of the power line:	Acceptable - Least Preferred – » located in close proximity to existing power infrastructure (Woodhouse Substation and Delareyville Munic/Vryburg 1 88kV Feeder) and infrastructure to be constructed in the near future (authorised Eskom Bophirima Substation and authorised 132kV Eskom Bophirima–Mookodi power line). » Length of the	Acceptable – » located in close proximity to existing power infrastructure (Woodhouse Substation and Delareyville Munic/Vryburg 1 88kV Feeder) and infrastructure to be constructed in the near future (authorised Eskom Bophirima Substation and authorised 132kV Eskom Bophirima–Mookodi power line). » Length of the power line:	Acceptable – **Preferred Alternative** » located in close proximity to existing power infrastructure (Woodhouse Substation and Delareyville Munic/Vryburg 1 88kV Feeder) and infrastructure to be constructed in the near future (authorised Eskom Bophirima Substation and authorised 132kV Eskom Bophirima–Mookodi power line). » shortest power line alternative (~80m), therefore least visual impact

	~160m	power line: ~747m (longest power line alternative)	~146	

6.6.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the severity of impacts of the PV facility can be reduced to low, or avoided. The PV facility can be developed and impacts on visual resources managed by taking the following into consideration:

» As a result of the development of the Woodhouse Solar 1 PV Facility mainly impacting on an area where there is already a strong visual influence from an urban and urban fringe development, changes to the landscape quality are not likely to be problematic.
» There are receptors in close proximity to the proposed development that are likely to be sensitive to a change in outlook associated with the development. Sensitive receptors however are likely to be limited to residential homesteads and a guest house that are in close proximity to the development.
» In order to mitigate anticipated impacts it will be necessary to implement and manage a natural buffer between the development area and the identified sensitive receptors.
» Maintain the height of structures as low as possible, including structures for security lighting.

6.7 Assessment of Social Impacts

Potential social impacts and the relative significance of the impacts associated with the development of the Woodhouse Solar 1 PV Facility are summarised below (refer to **Appendix I** - Social Report for more details).

6.7.1 Results of the Social Study

From a social perspective it is concluded that the development of the Woodhouse Solar 1 PV Facility is supported, but that mitigation measures should be implemented and adhered to. Positive and negative social impacts have been identified. The assessment of the key issues indicated that there are no negative impacts that can be classified as fatal flaws and which are of such significance that they cannot be successfully mitigated. Positive impacts could be enhanced by implementing appropriate enhancement measures and through careful planning.

Majority of the surrounding area is considered as large open spaces and agricultural areas (livestock and minor game framing). The affected property is currently being utilised as grazing space for cattle owned by the landowner. There are farmsteads and smallholdings located within the surrounding areas of the project site. Other land-uses within the area includes the presence of roads (i.e. national roads, regional and main roads). The development of the PV Facility will impact on the daily commuters utilising the roads, however this will be concentrated in the construction phase and then significantly reduced during the operation of the Woodhouse Solar 1 PV Facility.

Based on the social assessment, the following general conclusions and findings have been made:

» The potential negative social impacts associated with the construction phase are typical of construction related projects and not just focussed on the construction of the proposed PV facility (these relate to influx of non-local workforce and jobseekers, intrusion and disturbance impacts, safety and security) and could be reduced with the implementation of the mitigation measures proposed.
» Employment opportunities will be created in the construction and operation phase and the impact is rated as positive even if only a small number of individuals benefit in this regard.
» The proposed project could assist the local economy in creating entrepreneurial development, especially if local business could be involved in the provision of general material and services during the construction and operational phases.
» Capacity building and skills training among employees are critical and would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other sectors.
» The proposed PV facility also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the increased awareness of climate change, represents a positive social benefit for society as a whole.

6.7.2 Description of Social Impacts

The following impacts are identified as the major impacts associated with the development and which are assessed, for the preconstruction, construction and operation phases as well its associated infrastructure

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

» As a workforce will be required for the construction of the PV facility direct employment will be generated.
» The development of skills, especially of a potable nature, will take place during the construction phase. Specific skills training for local communities have the opportunity to develop local employee potential.
» Economic multiplier effects associated with opportunities for local businesses to provide services and materials for the construction phase.

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

» An influx of jobseekers looking for economic opportunities could result in pressure on economic and social infrastructure on the local population.
» Impacts on the daily living and movement patters due to construction and heavy vehicles which could create short-term disruptions and safety hazards for current and frequent road users.
» A perceived decline in security during the construction phase as a result of an influx of workers and/or outsiders to the area.
» Nuisance impacts (including noise and dust) associated with construction activities.

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

» Creation of employment and business opportunities. The operation phase will also create opportunities for skills development and training.
» Benefits associated with the development of clean, renewable energy infrastructure.
» Benefits associated with the REIPPPP socio-economic development plans and community trust.

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

» The visual impacts and associated impact on the sense of place.
» Impacts associated with the loss of agricultural land for livestock grazing.

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

The impacts assessed below apply to the development area, including the PV panels, access roads as well as the grid connection infrastructure for the Woodhouse Solar 1 PV Facility. The development area of the four alternative grid connection routes are located within an area where existing power infrastructure is already present. Therefore, there is no significant difference in the potential impacts associated with the alternative power line routes, and the impacts for these alternatives are not comparatively assessed in the assessment tables below, but the comparison between the alternatives is summarised in Section 6.8.4.

Construction Phase Impacts

Direct employment and skills development

The proposed PV facility will create employment opportunities for the local community. It is estimated that during the construction phase (for the period of approximately 12-18 months) approximately ~300-400 employment opportunities will be generated for the proposed PV facility. In terms of skills requirements, it is common that highly skilled or skilled labour such as engineers, technical staff and project managers will constitute

about 15% of the work force; skilled staff would typically be required to operate machinery and will constitute about 25% of employees, while unskilled staff such as construction and security workers will constitute about 60% of the work force. Employment opportunities for the proposed PV facility will peak during the construction phase and significantly decline during the operation phase. The estimated salary and wage bill will equate to approximately R50 million (2016 Rand value).

Under the REIPPP Programme, developers are obliged to make a real contribution to local economic development that is to be fulfilled within a 50km radius of the project site (WWF, 2015). Awarded projects are required to employ between 12% and 20% of residents from local communities (located within 50km of the project site). Only "in the event that there are no residential areas or villages within 50km from the project site (are project developers allowed to source workers) in the nearest residential areas or villages to the project site" (DoE 2011).

The developer will need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members of the local community. It is likely that an Engineering, Procurement and Construction (EPC) contractor will be appointed by the developer who will hire the necessary employees. The applicant has indicated that training will also be provided to employees during the construction phase of the proposed PV facility. Specific skills training for local communities have the opportunity to develop local employee potential. This is crucial to long-term development of skills and education in the area. This will accelerate the positive benefits and impacts of the development on the economy.

Nature: The creation of employment opportunities and skills development opportunities during the construction phase for the country and local economy		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1		
	Without enhancement	**With enhancement**
Extent	Local- Regional (3)	Local- Regional (3)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (36)**	**Medium (44)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement measures: » If possible, efforts should be made to employ local contractors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria.		

» It is recommended that local employment policy is adopted to maximise the opportunities made available to the local labour force (sourced from nearest towns/settlements). » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. » Where feasible, training and skills development programmes should be initiated prior to the commencement of the construction phase. » 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. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained by the Contractor and monitored by the ECO to record all complaints and queries relating to the project and the action taken to resolve the issue.
Residual impacts » Improved pool of skills and experience in the local area » Economic growth for small-scale entrepreneurs » Temporarily employment during construction phase will result in jobs losses and struggles for construction workers to find new employment opportunities

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 PV facility. The site is located approximately 10km south east of Vryburg in the North West Province. Given the relative proximity of the site to Vryburg, the proponent has indicated that no on-site accommodation is envisaged for the construction phase. Employees will be sourced from the local areas (where possible) and those who have been sourced out of town will be transported to and from site for the duration of the construction phase from their place of residence. Off-site accommodation in the nearest towns 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.

The total construction capital expenditure associated with the establishment of the solar energy facility and associated infrastructure is estimated to be in the region of R5.5-7 billion (2016 Rand value). Some of the capital expenditure will be spent on local goods and services required for the development of the solar energy facility. In terms of business opportunities for local companies, expenditure during the construction phase will create business opportunities for the regional and local economy. The increase in demand for new materials and services in the nearby area may stimulate local business and local economic development (however locally sourced materials and services may be limited due to availability). There is likely to be a direct increase in industry and indirect increase in secondary businesses.

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 increase the opportunities for the local area.

Nature: Significance of the impact from the economic multiplier effects from the use of local goods and services		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1		
	Without enhancement	**With enhancement**
Extent	Local- Regional (4)	Local- Regional (4)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (36)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement measures: » It is recommended that a local procurement policy is adopted by the developer to maximise the benefit to the local economy. » Where feasible, the developer should create a database of local companies, specifically Historically Disadvantaged (HD) which qualify as potential service providers (e.g. construction 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. » It is recommended that goods and services are sourced from the local area as much as possible; engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers, where feasible.		
Residual impacts Improved local service sector, growth in local business		

Influx of jobseekers

The proposed PV facility will create a range of employment possibilities and thus this will attract jobseekers. An influx of people looking for economic opportunities could result in pressure on economic and social infrastructure on the local population (rise in social conflicts and change in social dynamics). Influx of jobseekers into the area, could lead

to a temporary increase in the level of crime, cause social disruption and put pressure on basic services. Influx of jobseekers could potentially create conflict between locals and outsiders mainly due to difference in racial, cultural and ethnic compositions. The high unemployment rates and expectations of job creation is already a potential source of competition among locals and could be exacerbated through outsiders coming into the area resulting in conflict. A further negative impact that could result due to an inflow of jobseekers is that local unemployment levels could rise due to an oversupply of an available workforce, particularly with respect to semi and unskilled workers.

The towns and settlements located the closest to the proposed PV facility site (i.e. Vryburg) is seen as a sensitive social receptor and 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 includes pressure on local services and infrastructure. This includes municipal services such as sanitation, electricity, water, waste management, health facilities, transportation and availability of housing. Informal 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 in the spreading of HIV/Aids and STDs and unwanted pregnancies.

Nature: Added pressure on economic and social infrastructure and increase in social conflicts during construction as a result of in-migration of jobseekers		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » It is recommended that local employment policy is adopted to maximise the opportunities made available to the local labour force. » A 'locals first' policy should be adopted for construction employment opportunities, especially for semi and low-skilled job categories. Enhance employment opportunities for the immediate local area; (i.e. Vryburg), and if this is not possible, then the broader focus areas should be considered for sourcing workers such as NLM and DRSMDM. » Tender document should stipulate the use of local labour as far as possible. » Prior to construction commencing representatives from the local community (e.g. ward		

councillor, surrounding landowners) should be informed of details of the construction schedule and exact size of the workforce.
» Recruitment of temporary workers at the gates of the development should not be allowed. A recruitment office should be established by the contractor in a nearby town to deal with jobseekers.
» A security company is to be appointed and appropriate security procedures to be implemented.
» Establish procedures for the control and removal of loiterers at the construction site.
» A comprehensive employee induction programme should address issues such as HIV/ AIDS and sexually transmitted diseases. The induction should also address a code of conduct for employees that would align with community values.
» 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. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained by the Contractor and monitored by the ECO to record all complaints and queries relating to the project and the action taken to resolve the issue.

Residual impacts

Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure and services.

Impacts on daily living and movement patterns (traffic impacts)

An increase in traffic due to construction vehicles and 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 access road will be constructed off the R34 located approximately 10km south east of Vryburg. The access road will traverse the northern portion of the Remaining Extent of the farm Woodhouse 729; this will be the main access road used to access the proposed site. The primary roads that will be used for transportation of project components and equipment will be the R34 and the gravel access road that will be located off the R34. Increased traffic due to construction vehicles and heavy vehicles could cause disruptions to road users and increase safety hazards. The use of local roads and transport systems may cause road deterioration and congestion. This impact will be magnified since gravel roads are not designed to carry heavy traffic and are prone to erosion. 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 developer has indicated that the number of construction vehicle trips per day would be in the region of ~15-20 trips. There will be an increase in the movement of people during the construction phase. Low and semi-skilled workers will likely be transported to site with busses. Noise, vibrations, dust and visual pollution from construction vehicles and heavy vehicle traffic during the construction phase could cause temporary disruptions in daily living, movement patterns and quality of life for local community members.

***Nature*:** Impacts from an increase in traffic disruptions and movement patterns during the construction phase		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 12(a)(ii)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and made aware of the potential 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. » It is the developer and engineering, procurement and construction (EPC) contractor's responsibility to ensure that the roads utilised are either maintained in the present condition or upgraded if disturbed due to project activities. » A comprehensive employee induction programme must be implemented to cover land access protocols and road safety. » 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. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained by the Contractor and monitored by the ECO to record all complaints and queries relating to the project and the action taken to resolve the issue.		
Residual impacts None anticipated		

Safety and security impacts

The perceived decline of security during the construction phase of the proposed project due to the influx of workers and/ or outsiders to the area (as influx of newcomers or jobseekers are usually associated with an increase in crime) may have indirect effects, such as increased safety and security risk for neighbouring properties and damage to property, increased 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. All of the farms in the study area are utilised for livestock farming and/or game farming, therefore the

development coming into the rural area may expose these farming activities to potential stock theft and poaching. There are no residents living in or near the proposed site.

The impacted and adjacent farm owners utilise their farms for livestock and/or game farming. There are also minor game farming activities on nearby farms. The influx of construction workers and people coming into the area does increase the risk of stock theft and poaching.

The portion of land (i.e. development area) identified by the developer for the construction and operation of the proposed PV facility and associated infrastructure will be leased from the landowner. The landowner currently utilises the farm for livestock grazing and the farm is securely fenced around the boundary. The landowner will continue his grazing activities on the areas of his farm that aren't utilised for the proposed PV facility. The proposed access road and entrance gate will be located off the R34 and will be 4m wide for heavy construction vehicles and trucks carrying abnormal loads that will require access to the site. As a result of the construction of the access road off the R34 this may negatively impact the fences and gates on the Remaining Extent of the farm Woodhouse 729. The areas associated with the project (i.e. access road and proposed site) would need to be fenced off for security reasons and safety of livestock crossing over the internal access roads. It would be necessary for there to be an access control point at the entrance of the access road on the Remaining Extent of the farm Woodhouse 729 off the R34 to ensure that the access gate is controlled.

It is viable for the appointed EPC contractor to implement appropriate security measures. It is therefore recommended that the appointed EPC contractor takes these points into consideration and it is important that a security company is appointed and appropriate security procedures and measures implemented.

An increase of traffic from the rise in construction vehicles is a potential safety concern for road users and local communities in the area. The movement of construction related activities crossing over the R34 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.

***Nature*:** Temporary increase in safety and security concerns associated with the influx of people during the construction phase		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Improbable (2)	Very improbable (1)

Significance	**Low (27)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation

» Working hours should be kept within daylight hours during the construction phase, and/or as any deviation that is approved by the surrounding landowners.
» The perimeter of the construction site should be appropriately secured. The fencing of the site should be maintained throughout the construction periods.
» The appointed EPC contractor must appoint a security company and appropriate security procedures and measures are to be implemented.
» Access in and out of the site should be strictly controlled by a security company.
» Provide workers with identity tags and prohibit the access of unauthorized people to the construction site.
» The developer and engineering, procurement and construction (EPC) contractors must ensure that there is a dedicated safe entrance to the site, and an access control point at the entrance gate off the R34 on the Remaining Extent of the farm Woodhouse 729.
» The developer and engineering, procurement and construction (EPC) contractor's must ensure that the fencing or entrance gates along the access road must either be maintained in the present condition, improved upon or repaired if disturbed due to project activities.
» 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.
» The developer and engineering, procurement and construction (EPC) contractors must ensure that any damage / wear and tear to the roads caused by construction related traffic/ project activities are repaired
» Provision of adequate and strategically placed traffic warning signs and control measures along the access road and R34 to warn road users of the construction activities taking place and displaying road safety messages and speed limits. Warning signs must be visible at all times.
» A comprehensive employee induction programme, covering land access protocols, fire management and road safety. This must be addressed in the construction EMPr as the best practice.
» All vehicles must be road worthy and drivers must be qualified and made aware of the potential road safety issues and follow the speed limits.
» The contractor should have personnel trained in first aid on site to deal with smaller incidents that require medical attention.
» 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. The EPC contractor should appoint a designated staff member to implement grievance procedure and address issues and complaints.

Residual impacts

None anticipated

Nuisance Impacts (noise and dust)

Impacts associated with construction related activities include noise, dust and disruption or damage to adjacent properties and is considered as a potential issue. Experience from construction of other solar energy facilities in the area indicate that site clearing and construction vehicles traveling on gravel roads does increase the risk of dust and noise being generated, which can in turn impact on adjacent properties. The potential impacts can be addressed by implementing effective mitigation measures. The primary sources of noise during construction would be from the construction equipment and other sources of noise including vehicle/truck traffic, and general construction activities. Noises levels can be audible over a large distance however are generally short in duration. The generation of dust would come from construction activities as well as trucks/ vehicles driving on the gravel access road. With the in-migration of people and construction workers into the area, this will also increase noise impacts. This impact will negatively impact social sensitive receptors. The immediate local area is sparsely populated with a few homesteads located near the proposed site. The area is primarily utilised for livestock farming. The movement of heavy construction vehicles along the gravel access roads has the potential to generate dust pollution. The nuisance impacts from the construction activities are expected to be negative however have a low significance.

Nature: Nuisance impacts in terms of a temporary increase in noise and dust		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 4(e)(i)(ee), 12(a)(ii)		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Probable (3)
Significance	**Low (15)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » Dust suppression measures must be implemented on a regular basis along the gravel access road and on the proposed site. » Vehicles used to transport sand and building materials must be fitted with tarpaulins or covers when travelling on roads. » Speed limits must be imposed on internal roads to limit dust generation. » Ensure all vehicles are roadworthy, drivers are qualified and are made aware of the potential noise and dust issues. » 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. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained by the Contractor and monitored by the ECO to record all complaints and queries relating to the project and the action taken to resolve the issue.
Residual impacts Damage to roads that is not fixed could affect road users.

Operation Phase Impacts

The solar energy facility is designed to be operational for at least ~20-25 years. The potential positive and negative social impacts which could arise as a result of the operation of the proposed project include the following:

Direct employment and skills development

The operation phase of the project will require a workforce and therefore direct employment will be generated. Although the exact number of permanent workers is not confirmed at this stage, it is estimated that approximately ~25-30 jobs will be generated for the lifetime of the project (approximately ~20-25 years). The creation of permanent employment opportunities will help aid the unemployment rate (26.4%) within the Naledi Local Municipality. 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 area. These employees would include skilled engineers (specialised in both electrical and mechanical engineering). Employees that can be sourced from the local municipal pool include the less skilled such as safety and security staff and maintenance crew. Routine activities would include operation of the solar energy facility to produce power, and regular monitoring and maintenance activities to ensure safe and consistent operation. Maintenance will be carried out throughout the lifespan of the solar energy facility and associated infrastructure. Typical activities during maintenance include washing PV panels routinely (in the evening) and vegetation control and maintenance around the solar energy facility and along the power line route. Employment opportunities will be created during the operation phase and this 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: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1		
	Without enhancement	**With enhancement**
Extent	Local- Regional (2)	Local- Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (40)**	**Medium (48)**

Status (positive or negative)	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 to maximise the opportunities made available to the local community. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. » Vocational training programs for employees should be established to promote the development of skills.		
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. The use of low quality coals is the main contributor to GHG emission. The energy-intensive sectors of the economy emit carbon emissions that are higher than those of most developed economies. The use of solar irradiation for power generation is considered a non-consumptive use of a natural resource which produces zero GHG 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). As most of the sources are local 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 (Energy Research Centre UCT, 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.

Increasing the contribution of the renewable energy sector to the local economy may contribute to the diversification of the local economy and provide greater economic stability. The growth in the solar energy sector could introduce skills and development into the area. The development of a solar energy facility could therefore add to the stability of the economy, and even though this project is small scale in comparison to the overall potential of the sector, it could contribute to the local economy. The overall contribution to South Africa's total energy requirements of the proposed solar energy

facility plant is small; however, the 100MW PV facility will help contribute to offset the total carbon emissions associated with energy generation in South Africa.

Nature: Development of clean, renewable energy infrastructure		
Relevant Listed activities: GNR 984 Activity: 1		
	Without enhancement	**With enhancement**
Extent	Local- Regional- National (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Minor (2)	N/A
Probability	Highly probable (4)	N/A
Significance	**Medium (40)**	N/A
Status (positive or negative)	Positive	N/A
Reversibility	Yes	
Irreplaceable loss of resources	Yes (impact of climate change)	
Can impacts be enhanced	No	
Enhancement None anticipated		
Residual impacts » Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming. » Contribution towards security of electricity supply.		

Benefits associated with REIPPP socio-economic development plans and community trust

According the Department of Energy (DoE) renewable energy projects under the Renewable Energy Independent Power Producer Procurement programme (REIPPPP) are obliged to make a real contribution to local economic development in the area. Awarded projects are required to spend a certain amount of their generated revenue on Socio-Economic Development (SED) and Enterprise Development (ED) and share ownership in the project company with local communities (DoE, 2011).

The developer is required to establish a community trust funded by revenue generated from the sale of energy. The community trust will generate a reliable and steady income stream over a 20 year period. The trust will be used to fund development initiatives in the area and support local economic and community development. As the community trust will run for the entire operation phase of 20 years, it allows the local municipality and communities to undertake long term planning. This provides opportunities for positive benefits to the local area. However these benefits can be enhanced. Consultations took place with key local authorities from the NLM and the Ward Councillor for Ward 5. The solar energy development is supported by the local authorities and it was noted that the development has the potential to bring in more positive impacts to the local area however the issue raised need to be addressed with new developments coming into the area. Socio-economic spin-offs from the proposed PV facility could

contribute to better infrastructure provision and educational investment in the local areas.

An in-depth community needs assessment (CNA) will need to be carried out at a later stage to make sure that the real needs of communities are addressed (in line with the local government) and the correct representatives of the community are appointed to run the community trust; in order to significantly contribute towards local economic growth, SED and ED.

Nature: Benefits to the local area from SED/ ED programmes and community trust from REIPPPP social responsibilities		
Relevant Listed activities: GNR 984 Activity: 1		
	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly probable (4)
Significance	**Low (30)**	**Medium (48)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be enhanced	No	
Enhancement » An in-depth community needs assessment (CNA) will need to be carried out to make sure that the real needs of communities are addressed (in line with the local government) and the correct representatives of the community are appointed to run the community trust. » Engagement and involvement of the local municipality (NLM) with social responsibility plans must be undertaken.		
Residual impacts Improvements in local communities through socio-economic development and enterprise development.		

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 community perceptions.

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 from the proposed solar energy facility and associated infrastructure.

The impacted and majority of the adjacent landowners are farmers that utilise the land for livestock / game farming activities. There are homesteads located near the R34 and sparsely located on a few neighbouring farms. The proposed PV facility will only impact on a small number of homesteads, however there were no concerns raised during the stakeholder consultation process. The proposed site is also located in a REDZ. The anticipated impact on the areas visual quality and sense of place is expected to be low.

***Nature*:** Visual impacts and sense of place impacts associated with the operation phase of the solar energy facility and associated infrastructure		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 4(e)(i)(ee), 12(a)(ii)		
	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 (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » Implement mitigation measures and recommendations proposed by the visual specialist as part of the VIA.		
Residual impacts None anticipated if the visual impact will be removed after decommissioning, provided the site is rehabilitated to its original (current) status.		

Impacts associated with the loss of agricultural land for livestock grazing

Direct occupation of land by the proposed solar energy facility has the effect of taking the impacted land out of agricultural production, through the occupation of the site by the footprint of the facility (less than 300ha for the 100MW PV facility). Currently the site and surrounding study area has limited potential for cultivation as a result of the nature of the soils and limited water availability, and is utilised for livestock and cattle grazing. Although the area is currently classified as grazing land, there is evidence that the capacity to support livestock is very limited and that the surrounding areas around the development area would suffice for grazing alternatives. The proposed PV facility is proposed to generate up to 100MW in capacity and will be constructed over an area of less than 300ha in extent within the broader property (~2 264ha). The activities

associated with the operation phase will result in a loss of farmland available for grazing for the operation period of 20-25 years. However, the impacted landowner has noted that the grazing activities will still take place on the other portions of the farm that are not occupied by the solar energy facility. Therefore the solar energy development will not interfere with livestock farming operations, and thereby the impact is assessed to be of low significance.

Nature: Impacts associated with loss of farmland available for livestock grazing due to occupation of land by the solar energy facility		
Relevant Listed activities: GNR 983 Activity: 11(i), 28(ii) GNR 984 Activity: 1, 15 GNR 985 Activity: 4(e)(i)(ee), 12(a)(ii)		
	Without mitigation	**With mitigation**
Extent	Local (1)	N/A
Duration	Long-term (4)	N/A
Magnitude	Minor (2)	N/A
Probability	Highly probable (4)	N/A
Significance	**Low (28)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Yes	
Irreplaceable loss of resources	At the development footprint for the duration of the operation phase of the solar energy facility	
Can impacts be mitigated	No	
Mitigation None anticipated		
Residual impacts Overall loss of farmland, income generation for the landowner and a change in livelihood		

6.7.4 Comparative Assessment of Alternatives

Grid connection alternatives

From a social perspective all four of the proposed power line alternatives are considered as socially acceptable as there is already exiting power line and substation infrastructure located within the vicinity. .

The shortest power line route is considered as the most preferred from a social perspective, that is, the turn-in turn – out connection of the authorised 132kV Eskom Bophirima-Mookodi power line (to be constructed) as the connection is only ~80m, which is as result of reduced social impacts (visual and construction impact). The least preferred power line route is Alternative 2 (connection to the Woodhouse 88/22kV Substation), as it is the longest route.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Social	Acceptable– » Length of power line is 160m » Development to take place on Woodhouse RE/729.	Acceptable- Least preferred » Longest power line route (747m) » Development to take place on Woodhouse RE/729. » Located parallel to an existing Eskom power line.	Acceptable– » Length of power line is 146m » Development to take place on Woodhouse RE/729.	Acceptable – **Preferred Alternative** » Shortest power line route (80m) » Development to take place on Woodhouse RE/729.

6.7.5 Implications for Project Implementation

With the implementation of mitigation measures and enhancement measures by the developer, contractors, and operational staff, the severity of impacts can be mitigated and can be reduced to low, or avoided and the benefits of the development enhanced. The PV facility can be developed and impacts on the social environment managed by taking the following into consideration:

- The establishment of a Community Trust will also create an opportunity to support local economic development in the area.
- From a social perspective it is recommended to choose the Alternative 4 power line route as it is the shortest power line route which reduces some social impacts (visual and construction impacts)
- 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.
- Negative social impacts during construction and operation can be managed to acceptable levels through the implementation of mitigation measures.

6.8 Assessment of the Do Nothing Alternative

The 'Do-Nothing' alternative is the option of not constructing the proposed Woodhouse Solar 1 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 energy facility.

a) Land use and agriculture

The current land-use is restricted to grazing of livestock. The natural grazing capacity of the larger solar farm site is low. The greater farm portion (i.e. Remaining Extent of the farm Woodhouse 729) is not being farmed intensively due to climate and agricultural constraints and it is unlikely that the farm will become productive from this perspective in the long-term. Should the current land use activities continue, grazing of livestock would continue as the land use practise indefinitely. The potential to utilise the site sustainably (due to the very low agricultural potential) will therefore not be realised. It is the intention of the landowner to continue with grazing activities on the portions of the farm not occupied by the PV facility. The change in the land use for a portion of the farm is therefore not considered significant. The development footprint of ~240ha for the proposed Woodhouse Solar 1 PV Facility is ~10% of the total extent of the affected property (i.e. the Remaining Extent of the farm Woodhouse 729).

b) 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 an influx of jobseekers into the Vryburg area, 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 lost in terms of job creation, skills development and associated economic business opportunities for the local economy, as well as a loss of the opportunity to generate energy from a renewable resource without creating detrimental effects on the environment.

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: New business sales that will be stimulated as a result of the establishment of the project, albeit for a temporary period, will be lost. 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, such as the town of Vryburg and Huhundi. 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.

Employment: About 300-400 Full Time Equivalent jobs will be created during the 12-18 months construction phase. The majority of low-skilled and semi-skilled opportunities are likely to be available to local workers (± 200). The Naledi Local Municipality's employment rate stands at 26.4%. The development of the Woodhouse

Solar 1 PV Facility within the Naledi Local Municipality will aid in a reduction of the unemployment rate, however if the PV Facility is not developed then the unemployment rate will stay fixed at 26.4% or could possibly be increased.

Skills development: The establishment of the Woodhouse Solar 1 PV Facility will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. Various PV projects are already being constructed in the North West Province, which means that the transfer of skills from foreign experts to the local engineers and construction workers already takes place.

Municipal goals: The development and growth goals of the Dr Ruth Segomotsi Mompati District Municipality (in terms of energy development, manufacturing growth through energy development and techno-tourism) will not be met to the extent possible should the Woodhouse Solar 1 PV Facility not be constructed.

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.

c) Regional scale impact

At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. The North West Province has an ample solar resource. Based on existing infrastructure and the locations of the REDZ, one of the best suited areas in the North West Province for solar energy facilities is close to and surrounding the town of Vryburg. Although the facility is only proposed to contribute up to 100MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

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

» **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations; this translates into revenue savings of R26.6 million. As an already

water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability.

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

» **Pollution reduction:** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation.

» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for ~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 renewable energy facilities have significant potential for job creation in South Africa.

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

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

The 'do nothing' alternative will do little to influence the macro-level renewable energy targets set by government due to competition in the sector, and the number of renewable energy projects being bid to the DoE, specifically around the Vryburg area. However, as the project site experiences ample irradiation in the country and optimal grid connection opportunities are available, not developing the Woodhouse Solar 1 PV Facility would see such an opportunity being lost. The loss of the land to this project is, therefore, not considered significant. In addition the North West Province grid will be deprived of an opportunity to benefit from the additional generated power being

evacuated directly into the Province's grid. The "Do Nothing" alternative is therefore not preferred as South Africa needs to diversify electricity generation sources and stabilise the national grid, to which this development will contribute.

d) Lost opportunity within Renewable Energy Development Zone

The location of the site falls within a Renewable Energy Development Zone (REDZ 6). These zones have been identified as areas earmarked for the development of renewable energy facilities. The entire town of Vryburg and its surrounding areas are included within this zone, which is considered suitable for the development of solar energy facilities. Assessments have been undertaken by the CSIR to determine what the landscape sensitivity is within the REDZ. The site falls almost completely within an area classified as a low landscape sensitivity. Therefore, the proposed site can be considered as preferred and suitable for the development of PV facility.

As the greater Vryburg area has been identified as an area within which a concentration of renewable energy developments, and in particularly solar energy developments, will be located the development of the Woodhouse Solar 1 PV Facility is considered as a significant opportunity to take part of the creation of the REDZ nodes with the associated spin-off benefits. This opportunity, and the success thereof, will hold numerous benefits for the surrounding areas including the creation of employment, growth and development within the region, ensuring upliftment for the local communities as well as national benefits including the generation of clean energy.

The strengthening of the grid infrastructure within the REDZ will take place for the connection of the renewable energy projects. This is a benefit for the country as a whole as the strengthening of the grid network ensures better transmission and distribution networks with the added benefit of enhanced and assured distribution.

If the Woodhouse Solar 1 PV Facility is not developed the benefits expected to take place within the REDZ zone 6 will not be realised and will be considered as a lost opportunity for the country, the greater Vryburg area, the local surrounding communities and the developer. The movement towards the use renewable energy in South Africa and the Vryburg area will also be delayed if this opportunity is not fully exploited and utilised for renewable energy growth and development.

ASSESSMENT OF CUMULATIVE IMPACTS CHAPTER 7

PV facilities may have effects (positive and negative) on natural resources, the social environment and on the people living in the broader project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with the Woodhouse Solar 1 PV Facility largely in isolation (from other similar developments).

The Department of Energy, under the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, released in 2011 a request for proposals (RFP) to contribute towards Government's renewable energy target and to stimulate the industry in South Africa. The REIPPP Programme has been rolled out in bid windows (rounds) over the past 4 years, in which developers submit proposed renewable energy projects for evaluation and selection. The bid selection process considers a number of qualification and evaluation criteria. The proposed tariff, as well as socio-economic development contributions by the project and the bidder are the main basis for selection after the qualification criteria have been met.

As result of the REIPPP Programme, there has been a substantial increase in interest in PV facility developments in South Africa (largely in areas which have an ample solar resource which includes the North West Province). As detailed within this report, the development of renewable energy generation capacity is supported at a National and Provincial level from a policy perspective.

The proposed Woodhouse Solar 1 PV Facility is located within the Renewable Energy Development Zones (REDZs) Vryburg Focus Area (i.e. Zone 6) which was selected by the Department of Environmental Affairs (DEA) as an area highly suitable for the development of PV facilities given a range of factors considered. The cumulative impacts discussed below also considered the location of the project in the REDZs area.

As a result of the location of the Woodhouse Solar 1 PV facility within an identified solar energy development node, it can be expected that projects of a similar nature will be developed in this node which will ultimately concentrate the impacts (both positive and negative) of PV facilities in identified areas where it is deemed suitable to develop solar energy facilities as well as beneficial for the surrounding communities. This approach to the development of PV facilities will also ensure that impacts of the developments are located together rather than being disbursed throughout the country.

It is therefore important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts[20] are considered and avoided where

[20] Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (GN R953) as meaning "the impact of an activity that in itself may not be significant, but may

possible. This chapter provides an assessment of the cumulative impacts expected to be associated with the proposed project when considered together with other similar developments in the area.

7.1 Legal Requirements as per the EIA Regulations for the undertaking of an Environmental Impact Assessment Report, 2014

This chapter of the EIA report includes the following information required in terms of Appendix 3: Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(j) an assessment of each identified potentially significant impact and risk , including (i) cumulative impacts, (ii) the nature, extent, and consequences of the impact and risk, (iii) the extent and duration of the impact and risk, (iv) the probability of the impact and risk occurring, (v) the degree to which the impact and risk can be reversed, (vi) the degree to which the impact and risk may cause irreplaceable loss of resources and (vii) the degree to which the impact and risk can be mitigated.	This chapter focuses on the assessment of the cumulative impacts associated with the Woodhouse Solar 1 PV Facility as a whole. It should be noted that Chapter 6 also considers cumulative impacts within the impact tables.

7.2 Approach Taken to Assess Potential Cumulative Impacts

A cumulative impact, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

The cumulative impacts that have the potential to be compounded through the development of the Woodhouse Solar 1 PV Facility and its associated infrastructure in proximity to other similar developments include impacts such as those listed below. The role of the cumulative assessment is to test if such impacts are relevant to the development of the Woodhouse Solar 1 PV Facility in the proposed location/project site (that is, within the Remaining Extent of the farm Woodhouse 729 situated approximately 10km south east of the town of Vryburg in the North West Province) when considered together with other similar developments:

become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area".

- Unacceptable loss of threatened or protected vegetation types or species through clearing, resulting in an impact on the conservation status of such flora or ecological functioning;
- Unacceptable risk to avifauna through loss of habitat, infringement on breeding areas, or priority species;
- Complete or whole-scale change in sense of place and character of an area and unacceptable visual intrusion;
- Unacceptable loss of heritage resources;
- Positive contribution from a socio-economic perspective; and
- Contribution to climate change mitigation.

The scale at which the cumulative impacts are assessed is important. For example, the significance of the cumulative impact on the regional or national economy will be influenced by solar developments throughout South Africa, while the significance of the cumulative impact on visual quality may only be influenced by solar developments that are in close proximity to each other, in this instance the approximate limit of visibility is less than 9km from the Woodhouse Solar 1 PV Facility. For practical purposes a sub-regional scale has been selected for this cumulative evaluation.

Figure 7.1 below illustrates the location of the Woodhouse Solar 1 PV Facility in relation to other known solar energy project developments in the broader area. Another stand-alone PV facility (known as the Woodhouse Solar 2 PV Facility) is proposed to be developed within the project site (i.e. on the Remaining Extent of the farm Woodhouse 729), which will also be considered within this cumulative impact assessment. **Figure 7.2** provides an illustration of the Woodhouse Solar 1 and Woodhouse Solar 2 PV Facilities located within the project site.

The surrounding solar energy project developments were identified through the use of the Department of Environmental Affairs' Geographic Information System digital data developed by the CSIR[21] as well as current knowledge of projects being proposed in the area. In the case of the proposed Woodhouse Solar 1 PV Facility, there are 5 renewable projects located within a 10km radius of the broader project site (refer to **Figure 7.1** and **Table 7.1**). All of these projects are located within the Vryburg REDZ (to be gazetted in 2016). The potential for cumulative impacts are summarised in the sections which follow and have been considered within the detailed specialist studies, where applicable (refer to **Appendices D – I**).

The cumulative effects or impacts are presented as follows:

- Cumulative impacts potentially occurring due to the cumulative effects of the Woodhouse Solar 1 PV Facility in addition to all other renewable energy facilities in the Vryburg area. These impacts will be registered throughout the Vryburg area (or

[21] Available online at https://dea.maps.arcgis.com/

the Vryburg REDZ (zone 6)) requiring mitigation through planning at a regional level (refer to **Figure 7.3** for a map illustrating the landscape sensitivity of the Vryburg REDZ in terms of the development of renewable energy projects).

» Cumulative impacts potentially occurring due to the cumulative effects of two PV facilities proposed to be located within one project site i.e. the Remaining Extent of the farm Woodhouse 729. These impacts will be registered within the boundaries of the greater farm portion.

It should be noted that not all the PV facilities presently under consideration by various developers will be built for operation. Not all proposed developments will be granted the relevant permits by the relevant authorities (DEA, DOE, NERSA and Eskom) in order to undertake the construction of the facilities and evacuate the generated solar electricity into the national grid. This is the result of the following reasons:

» There are stringent requirements to be met by applicants in terms of the REIPPP Programme and a highly competitive process that only rewards the most competitive and efficient projects;
» Not all proposed facilities will eventually be granted a generation license by NERSA and sign a Power Purchase Agreement with Eskom;
» Not all developers will be successful in securing financial support to advance their projects further.
» There may be limitations to the capacity of the existing or future Eskom grid, or the timing of expansion of the grid; and
» Not all applications will be able to reduce negative impacts to acceptable levels or able to mitigate adequately (fatally flawed) and may therefore not receive a positive environmental authorisation.

The cumulative impacts of other known renewable energy developments (mainly PV) in the broader area and the Woodhouse Solar 1 PV facility are therefore qualitatively assessed in this Chapter. As these cumulative impacts are explored in more detail, the trade-offs between promoting renewable energy (and the associated benefits in terms of reduction in CO_2 emissions – a national interest) versus the local and regional environmental and social impacts and benefits can be considered. It is only when these trade-offs are fully understood at a National level, that the true benefits of renewable energy can be assessed.

The potential for cumulative impacts that could occur due to the development of the Woodhouse Solar 1 PV Facility and the associated infrastructure in proximity to each other include impacts such as:

» Visual intrusion
» Socio-economic impacts

- Loss of vegetation and impacts on ecology, including fauna and avifauna or sensitive ecosystems
- Impacts to soil and agricultural potential
- Impacts on heritage resources which includes archaeological and palaeontological resources

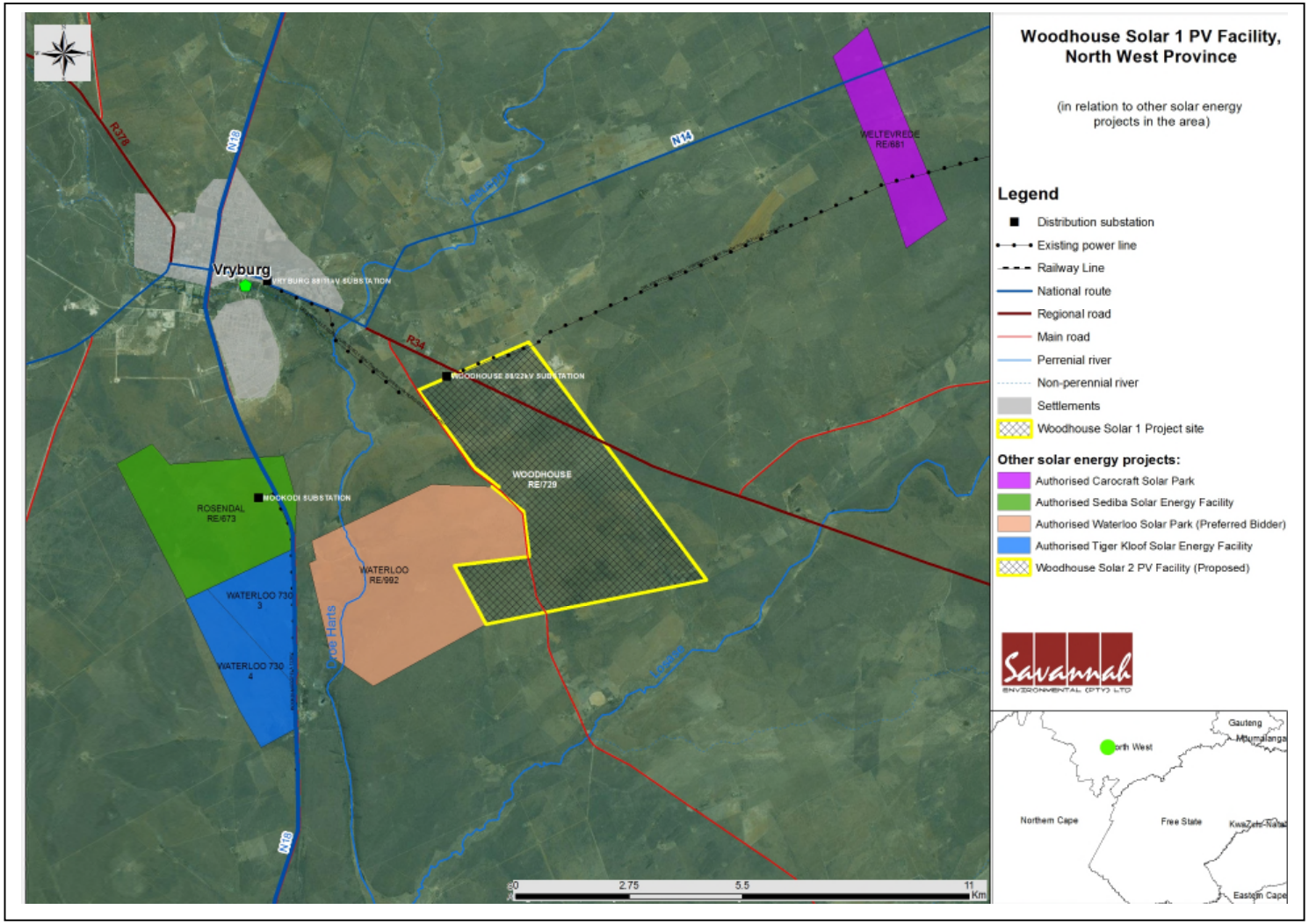
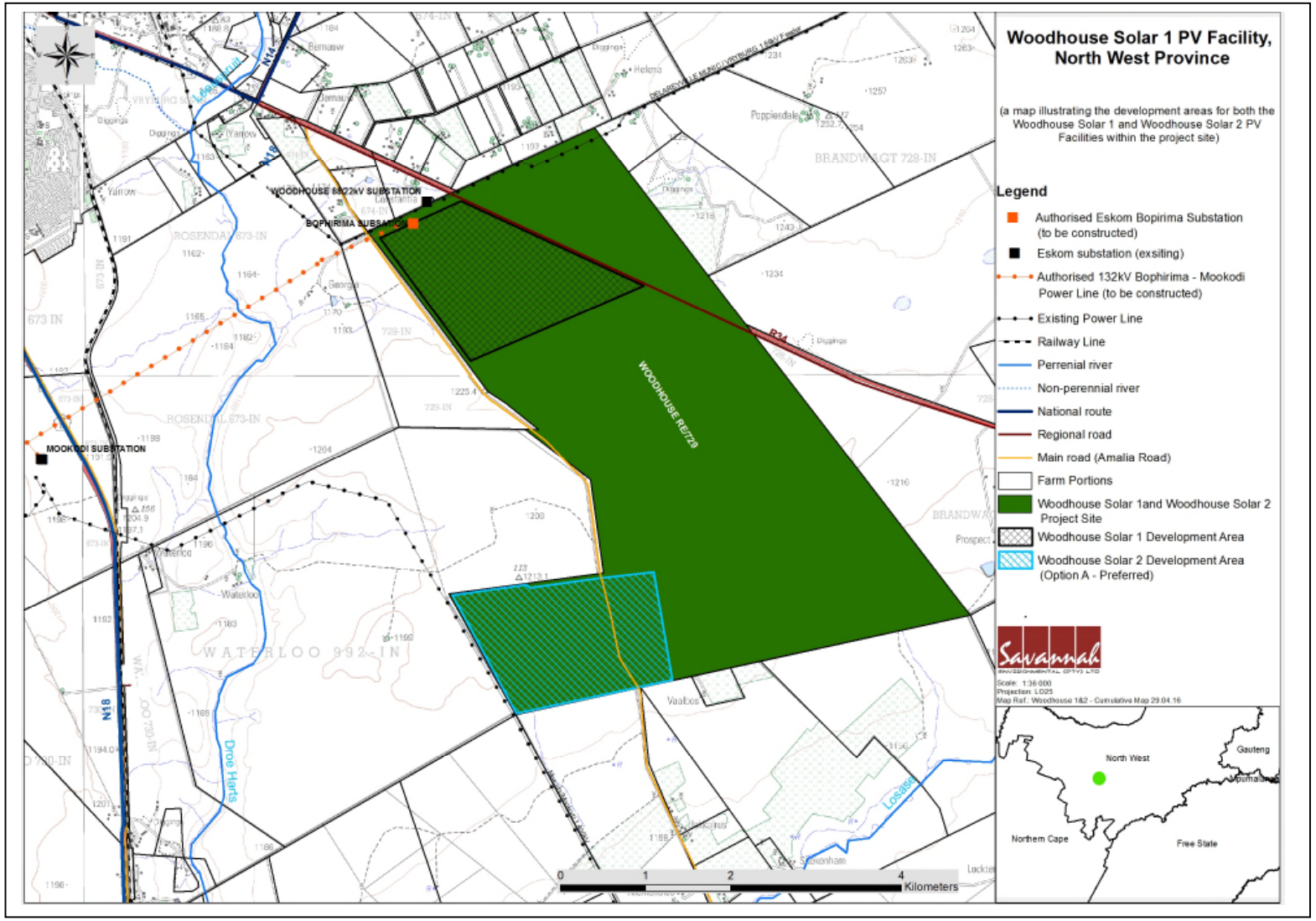


Figure 7.1: Map showing the affected properties on which other projects in the broader area are located (i.e. within a 10km radius). These projects were identified using the Department of Environmental Affairs Geographic Information System digital data developed by the CSIR.


Woodhouse Solar 1 PV Facility, North West Province
(a map illustrating the development areas for both the Woodhouse Solar 1 and Woodhouse Solar 2 PV Facilities within the project site)
Legend
Authorised Eskom Bopirima Substation (to be constructed)
Eskom substation (exsiting)
Authorised 132kV Bophirima - Mookodi Power Line (to be constructed)
Existing Power Line
Railway Line
Perrenial river
Non-perennial river
National route
Regional road
Main road (Amalia Road)
Farm Portions
Woodhouse Solar 1and Woodhouse Solar 2 Project Site
Woodhouse Solar 1 Development Area
Woodhouse Solar 2 Development Area (Option A - Preferred)
WOODHOUSE 88/22kV SUBSTATION
BOPHIRIMA SUBSTATION
MOOKODI SUBSTATION
WOODHOUSE RE/729
N14
N18
R34
Drie Harts
Losasse
0 1 2 4 Kilometers
North West
Gauteng
Northern Cape
Free State

Figure

7.2: A map illustrating the locations of the development areas proposed for the Woodhouse Solar 1 and Woodhouse Solar 2 PV Facilities within the Remaining Extent of the farm Woodhouse 729.

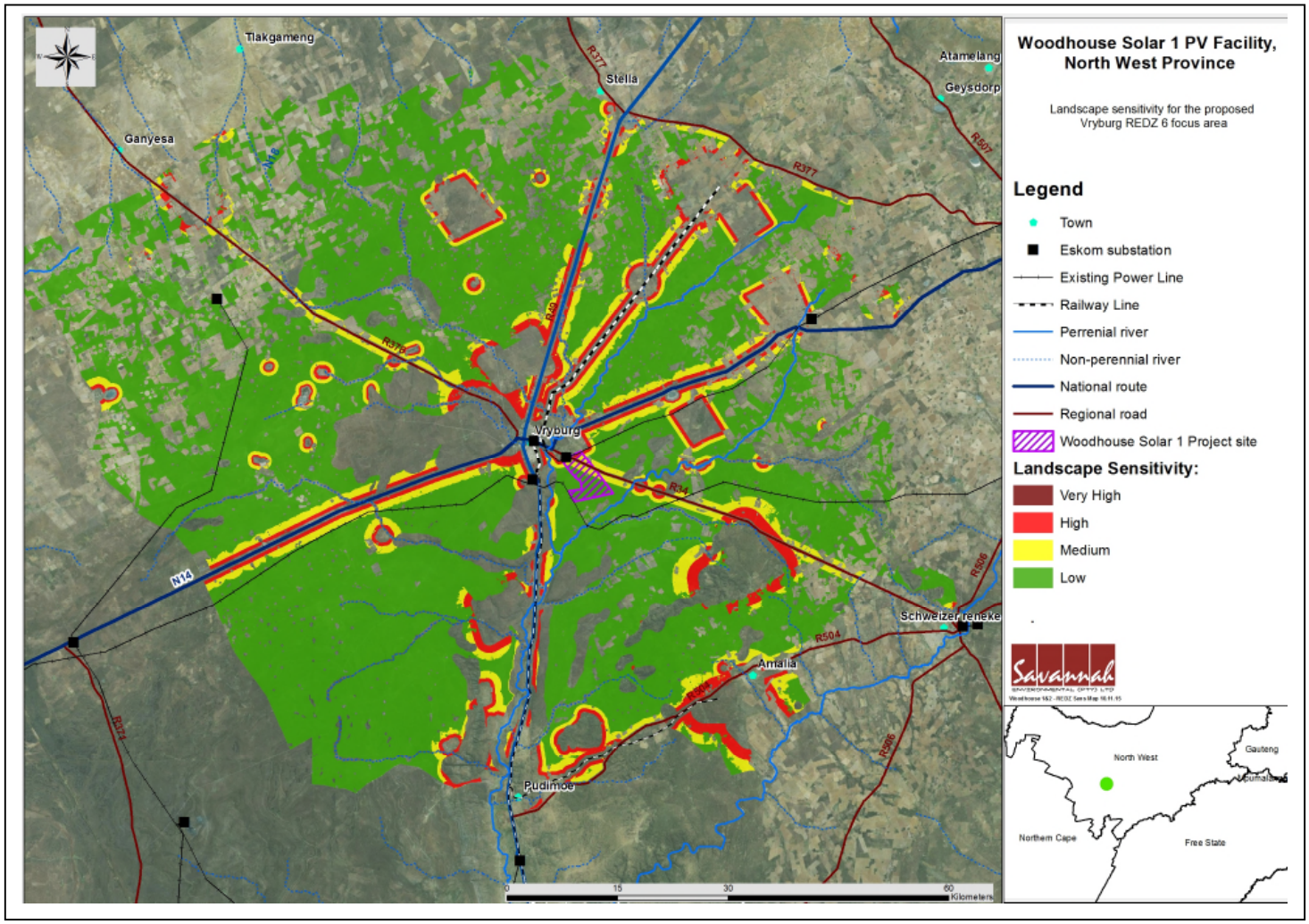


Figure 7.3: An illustration of the landscape sensitivity associated with the Vryburg REDZ in relation to the Woodhouse Solar 1 PV Facility Project Site. The location of the development site is within an area of low landscape sensitivity, and is preferred for the development of a renewable energy facility.

7.3 Cumulative Impacts of Renewable Energy facilities in the Region

The area surrounding Vryburg, and especially within the Vryburg REDZ has been identified for a number of solar energy projects. There are five projects that are proposed and authorised in the area, and one preferred bidder project located on the adjacent farm portion. The projects in the vicinity of the Solar Facility include:

Table 7.1: Renewable solar energy facilities located within a 10km radius from the Woodhouse Solar 1 PV Facility Project Site (based on information available at the time of compiling this report).

Project Name	Location	Approximate distance from the project site (measured from the centre)	Project Status
60MW Carocraft PV Solar Park	Remaining Extent and Portion 1 of Farm Weltevrede 681	~11.9km to the north east of the site	Authorised
75MW Sediba Solar Energy Facility	Remaining Extent of the Farm Rosendal 673	~8.4km to the west of the site	Authorised
Tiger Kloof Solar Energy Facility	Portion 3 (RE) and Portion 4 of the Farm Waterloo 730	~8.2km to the west of the site	Authorised
Waterloo Solar Park	Remaining Extent of Farm Waterloo 992	Located adjacent (west) of the Remaining Extent of the farm Woodhouse 729	Authorised: Preferred Bidder Round 4.5
Proposed Woodhouse Solar 2 PV Facility	Remaining Extent of the Farm Woodhouse 729	Located within the same farm portion as the Woodhouse Solar 1 PV Facility, i.e. the Remaining Extent of the farm Woodhouse 729.	EIA in process

In the sections below the potential cumulative impacts of several solar facilities within a 10km radius of the proposed Woodhouse Solar 1 PV Facility are explored, with particular reference the preferred bidder projects in the proximity of the site.

7.3.1 Ecological Processes

The project site proposed for the development of the Woodhouse Solar 1 PV Facility is located within the Ghaap Plateau Vaalbosveld vegetation type. The distribution of the vegetation type is spread across the Northern Cape and North West Province, from about

Campbell in the south east of Danielskuil through Reivilo to around Vryburg in the north. This vegetation type is classified as a Least Threatened ecosystem and is not listed as protected under the National Environment Management: Biodiversity Act (Act No. 10 of 2004). Only 1% of this unit has been transformed and is not protected within formal conservation areas. The development of the Woodhouse Solar 1 PV Facility within the identified development area will require the removal of up to 240ha of this vegetation type. From a project-specific perspective the removal of up to 240ha of the vegetation type will not cause concern as a result of the nature of the vegetation type. However, as the development area is located in an area where other projects are planned, it must be considered whether multiple projects could have the potential to result in the removal of large areas of this vegetation type contributing to cumulative habitat loss and broad-scale ecological processes outside of the project site and ultimately leading to a possible increased concern of the conservation of the vegetation. Due to the vast distribution of the vegetation type throughout the North West Province and the Northern Cape the magnitude of the impact would be considered to be low and the loss of this vegetation type as a result of the facilities would be considered as an acceptable loss without unacceptable risks.

Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESA) fall within the project site, greater Vryburg area and Zone 6 of the REDZ. Development within CBAs is not encouraged as such development may compromise the ecological functioning of the CBA or result in direct biodiversity loss within the CBA. Those CBA corridor areas within the development of the Woodhouse Solar 1 PV Facility are, however, as a result of historical and current anthropogenic activities and disturbance (as confirmed by the ecology report – **Appendix D**) no longer considered to be significant for ecological functioning. The site is considered appropriate for the development of a PV facility, which does not warrant whole-scale clearing of the development footprint and still allows for the functioning of areas as movement corridors. Therefore, the development of both the Woodhouse Solar 1 and Woodhouse Solar 2 PV facilities within the transformed CBAs of the project site are considered acceptable in terms of the loss of the CBAs excluding any unacceptable risks or unacceptable increase in the impact. As a result, the magnitude of the impact would be low. From a regional perspective and considering the presence of CBAs within the Vryburg REDZ it must be taken into account that although the CBAs are transformed within the project site proposed for the Woodhouse Solar 1 PV Facility, this might not be the case for other project sites proposed for other solar energy developments.

This assessment is also supported by the DEA as much of the area within the REDZ is shown to be of low landscape sensitivity, and preferred for the development of renewable energy facilities within the REDZ area. It is considered acceptable by DEA that there will be a concentration of solar energy developments within the Vryburg area within the demarcated REDZ area.

The cumulative loss of habitat resulting from the current and as well as the 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 little impacted by transformation to date. Cumulative ecological impacts include:

» Excessive clearing of slow growing trees, especially *Acacia erioloba,* 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.
» Excessive clearing of vegetation and landscaping will influence runoff and stormwater flow patterns and dynamics, which could cause accelerated erosion of plains, and impact small ephemeral to larger intermittent drainage lines as well as wetland features which occur in the greater Vryburg area (protection of water resources is required).
» 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.

Cumulative ecological impacts associated with the development of the Woodhouse Solar 1 PV Facility in relation to the Woodhouse Solar 2 PV Facility and future solar energy projects is considered acceptable in terms of loss and risk, without an unacceptable increase in impact. The development footprints of both facilities avoid all features of high ecological sensitivity.

Nature: Reduced Ability to meet conservation targets. The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the countries' ability to meet its conservation targets. The area is not included within a National Protected Areas Expansion Strategy focus area, and falls outside any threatened and or endangered ecosystem type / vegetation type. Although the vegetation type in the study area are classified as Least Threatened, it is poorly protected and certain habitats or communities may be disproportionately affected.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Low (4)
Probability	Very Improbable (1)	Improbable (2)

Significance	**Low (5)**	**Low (22)**
Status	Negative	Negative
Reversibility	Partially reversible	Low Reversibility
Irreplaceable loss of resources?	Not Likely	Improbable
Confidence in finding	High	
Mitigation: » Preconstruction walk-through of the facility to ensure that sensitive habitats are avoided. » Minimise the development footprint as far as possible.		

Nature: Impact on Critical Biodiversity Areas. Transformation within CBAs would potentially disrupt the functioning of the CBA or result in biodiversity loss. In addition, the presence of the facility and associated infrastructure could potentially contribute to the disruption of broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions. There are a number of other renewable energy facilities in the broad area the cumulative impact of these on habitat loss and the broad scale disruption of landscape connectivity is a potential concern.

	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent	Local (1)	Regional (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Moderate (6)
Probability	Very Improbable (1)	Probable (3)
Significance	**Low (5)**	**Medium (39)**
Status	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» An open space management plan for the development should be developed.
» Preconstruction walk-through of the facility, especially the roads and turbine locations to ensure that sensitive habitats are avoided and that species of conservation concern can be translocated.
» Minimise the development footprint as far as possible.
» Stringent construction-phase monitoring of activities at the site to ensure that mitigation measures are adhered to and that the overall ecological impact of the development is

maintained at a low level.
» The use of structures which may inhibit movement of fauna, such as mesh and electric fencing should be avoided.

7.3.2 Avifauna

Up to 177 bird species are known to occur within the project site and the broader area, including 17 red-listed or threatened species, 12 endemic species and 28 near-endemic species. The birds of greatest potential relevance and importance in terms of the possible impacts of the solar energy facility and its associated power infrastructure are likely to be local populations of endemic passerines, shy ground-nesting species, resident or visiting large terrestrial birds, resident or passing raptors and transient waterbirds. Overall, the avifauna of the project site and the broader area is not considered unique and is typical of what occurs across large areas of the Savannah Biome, which therefore suggests that the sensitivity of the development area and the project site will not be of any great significance.

The impact of solar energy facilities generally relates to habitat loss, disturbance and displacement, mortality, human conflict, collisions with power infrastructure (including power lines) and electrocutions as a result of power lines and power infrastructure.

The development of the Woodhouse 1 Solar PV Facility will result in a loss of habitat (~240ha), although not considered as a unique habitat from an avian perspective. With the Woodhouse Solar 1 PV Facility located within the REDZ, there is a high probability of the development of more solar energy facilities to be located within the area which will ultimately result in more habitat loss. However, the avifauna present within the broader area are not considered as unique. This is largely due to the homogenous nature of the site, low avian diversity and abundance. The impact of displacement due to habitat transformation will be moderate, and should only affect a few non-Red Data species at a local level. Therefore, the development of the Woodhouse Solar 1 PV Facility is considered acceptable in terms of the loss of habitat from a cumulative perspective and will not result in unacceptable loss or risk.

In order to evacuate the solar power generated by the Woodhouse Solar 1 PV Facility a new 132kV power line will have to be constructed to connect the PV facility via the facility on-site substation to the proposed grid connection points. As there are existing infrastructure and proposed future power infrastructure located within and surrounding the project site it is considered acceptable to construct the new 132kV power line (of less than 1km) for the Woodhouse Solar 1 PV facility within the proposed project site. As the location of the project site falls within a REDZ various power infrastructure (including power lines) will be constructed in order to evacuate the generated solar power of various solar energy developments into the national grid. This could potentially increase the cumulative impact of the developments from an avifaunal perspective.

Cumulative avifaunal impacts associated with the development of the Woodhouse Solar 1 PV Facility in relation to the Woodhouse Solar 2 PV Facility and future solar energy developments is considered acceptable in terms of loss and risk, without an unacceptable increase in impact.

Nature: Cumulative impact on the avifauna in the area as a result of habitat loss and increased risk associated with power line infrastructure.		
	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent	Low (2)	Medium (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (5)**	**Medium (39)**
Status	Negative	Negative
Reversibility	High	Low
Irreplaceable loss of resources?	Yes (birds may be displaced, injured or killed)	Yes (birds may be displaced, injured or killed)
Can impacts be mitigated?	Partially	Partially
Confidence in findings	High	High
Mitigation: » Recommendations to be followed as per the impact assessment undertaken in Chapter 6.		

7.3.3 Heritage Resources

In general, cumulative impacts on heritage resources are relatively insignificant in this area because, aside from the landscape itself, heritage resources are sparsely distributed.

From an archaeological perspective the impact of the development on the heritage landscape and sites is considered as being of a low significance, however as more solar energy developments take place within the area (which is also classified as a REDZ) there will be an increase in the destruction of these sites through development. The archaeological sites identified to be associated with the development of the Woodhouse Solar 1 PV Facility can be appropriately conserved through the implementation of appropriate mitigation measures, and does not present a risk to unacceptable loss of heritage resources. Therefore, the contribution of the proposed facility to the cumulative

impact is expected to be limited. It still remains important for each renewable energy facility to observe mitigation measures and to incorporate any sensitive heritage features into the layout plans where possible. Through the implementation of appropriate mitigation measures for the Woodhouse Solar 2 PV Facility and other solar energy developments the cumulative impacts on archaeological resources within the area can be considered as acceptable, without any unacceptable loss or risks.

From a palaeontological perspective the cumulative impacts are considered to be low as a result of the low significance of fossil heritage present within the Dwyka Group and the Vryburg Formation being unfossiliferous within the area. Therefore, no unacceptable loss or risks is considered to occur with the development of the Woodhouse Solar 1 PV Facility, the Woodhouse Solar 2 PV Facility and other solar energy facilities within the surrounding area (including the REDZ).

Cumulative heritage impacts associated with the development of the Woodhouse Solar 1 PV Facility in relation to the Woodhouse Solar 2 PV Facility and future solar energy developments is considered acceptable in terms of loss and risk, without an unacceptable increase in impact. However, care and proper mitigation will have to be taken with the development of future projects to ensure that there will be no unacceptable increase in the impact.

Nature: Heritage impacts associated with the establishment of PV facilities on the archaeology of the area		
	All projects (cumulative) without mitigation	**All projects (cumulative) with mitigation (preservation/excavation of sites)**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (3)
Probability	Not probable (2)	Not probable (2)
Significance	**Low (22)**	**Low (20)**
Status	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes (unless sites can be preserved)
Can impacts be mitigated?	Yes	Yes, through preservation or excavation of sites.
Mitigation: Identified resources are being recorded and mitigated for projects such as these that would have otherwise remained unidentified. In terms of the impact on the cultural landscape the impact is		

considered low, with the correct mitigation measures as well as the vast physical area in which these projects are constructed.

Nature: Cumulative impacts on fossil remains preserved at or beneath the ground surface		
	Cumulative Contribution of Proposed Project	**Cumulative Impact without Proposed Project**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (1)	Minor (1)
Probability	Very improbable (1)	Very improbable (1)
Significance	**Low (6)**	**Low (6)**
Status	Neutral	Neutral
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	None required	None required
Confidence in findings	High	High
Mitigation: None required		

7.3.4 Visual Intrusion

The construction of a solar project together with the associated infrastructure will increase the cumulative visual intrusion of industrial type infrastructure within the region. This is relevant in light of the Waterloo PV project which is a preferred bidder project (to commence construction in 2016) on the adjacent property, as well as other authorised renewable energy facilities proposed in the region (as reflected in Figure 7.1).

As the location of the PV facility is located within a REDZ (zone 6) it can be expected that the construction of various facility and power infrastructure will take place. From a cumulative perspective it must be considered that, in this area, existing electricity infrastructure is already present within the project site and the surrounding areas (including Woodhouse Substation, Mookodi Substation and Delareyville Munic/Vryburg 1 88kV Feeder power line), additional or new electricity infrastructure is to be constructed (including Eskom Bophirima Substation and 132kV Eskom Bophirima–Mookodi power line), with other visual disturbance to the rural landscape such as urban development. All existing infrastructure has already resulted in a change in the sense of place of the

area. Given the vastness of the area, and the proximity of the planned facilities to existing disturbances, the significance of the impact on the areas sense place and character is likely to be low. The cumulative impact on the areas landscape character will also be reduced by the concentration of a number of solar energy facilities in one area as opposed to being spread out over a larger area. The construction of the Woodhouse Solar 1 PV Facility and Woodhouse Solar 2 PV Facility within the project site will be acceptable form a visual perspective with no unacceptable loss or risks. The development of other solar energy facilities within the surrounding areas and the REDZ will however contribute to the cumulative visual impacts as it is expected to expand with the development of future solar energy facilities.

Landscape Change

Nature: The proposed solar PV facility will increase the influence of urban development but this increase will be limited due to the existing ridgeline to the south of the project which will screen the development from more natural landscape areas. The proposed project will also extend the general influence of solar projects on the character of the landscape surrounding Vryburg.

	All projects (cumulative) without mitigation	**All projects (cumulative) with mitigation**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	N/A

Mitigation:

Planning:

- Plan levels to minimise earthworks to ensure that levels are not elevated;
- Plan to maintain the height of structures as low as possible;
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
- Retain natural buffer areas adjacent to the R34 and on the northern boundary

Operations:

- Reinstate any areas of vegetation that have been disturbed during construction;
- Remove all temporary works;
- Monitor rehabilitated areas post-construction and implement remedial actions;

» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.
» Maintain natural buffer areas adjacent to the R34 and on the southern boundary.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Impact on smallholdings

Nature: As other solar PV projects are unlikely to be obvious to the affected properties, the cumulative impact will equate to the impact imposed by this project.

	All projects (cumulative) without mitigation	**All projects (cumulative) with mitigation**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Low (0)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
» Retain natural buffer areas adjacent to the R34 and on the northern boundary

Operations:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.
» Maintain natural buffer areas adjacent to the R34 and on the southern boundary.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate areas to their natural state;

» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

The visibility impact on the urban edge of Vryburg

Nature: The proposed development is likely to increase the extent of solar projects visible from the urban edge. However, the only section of the urban edge likely to be affected is the eastern edge of Huhudi. It should be noted that there is a solar project planned for the area between the proposed project and Huhudi. It is therefore likely that the proposed project will marginally increase cumulative impacts on the urban area.

	All projects (cumulative) without mitigation	**All projects (cumulative) with mitigation**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	**Low (18)**	**Low (18)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, to a minor degree	Yes, to a minor degree

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;

» Plan to maintain the height of structures as low as possible;

» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:

» Reinstate any areas of vegetation that have been disturbed during construction;

» Remove all temporary works;

» Monitor rehabilitated areas post-construction and implement remedial actions;

» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site;

» Rehabilitate areas to their natural state;

» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Cumulative impact on the N14

Nature: As the proposed project is not likely to be obvious from the road the significance of

cumulative impacts is likely to be low.		
	All projects (cumulative) without mitigation	**All projects (cumulative) with mitigation**
Extent	Site and surroundings (2)	N/A
Duration	Long-term (4)	N/A
Magnitude	Small (0)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (12)**	N/A
Status	Negative	N/A
Reversibility	High	N/A
Irreplaceable loss of resources?	No irreplaceable loss	N/A
Can impacts be mitigated?	No	No
Mitigation: No mitigation possible		

Cumulative impact on the R34

Nature: As the Woodhouse 1 and 2 projects are the closest projects to the road the significance of cumulative impacts are higher considering the facilities.		
	All projects (cumulative) Without mitigation	**All projects (cumulative) With mitigation**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate to high (7)	Low to moderate (5)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (52)**	**Medium (33)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: Planning: » Plan levels to minimise earthworks to ensure that levels are not elevated; » Plan to maintain the height of structures as low as possible;		

» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

» Retain natural buffer areas adjacent to the R34 and on the northern boundary

Operations:

» Reinstate any areas of vegetation that have been disturbed during construction;

» Remove all temporary works;

» Monitor rehabilitated areas post-construction and implement remedial actions;

» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

» Maintain natural buffer areas adjacent to the R34 and on the northern boundary.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site;

» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Cumulative impact on the N18

Nature: As the proposed project is one of the closest projects to the road the significance of cumulative impacts are likely to be significant.

	All projects (cumulative) without mitigation	**All projects (cumulative) with mitigation**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Low probability (3)	Probable (3)
Significance	**Low (30)**	**Low (27)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;

» Plan to maintain the height of structures as low as possible;

» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:

» Reinstate any areas of vegetation that have been disturbed during construction;

» Remove all temporary works;

» Monitor rehabilitated areas post-construction and implement remedial actions;

» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site;

» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Cumulative impact on homesteads

Nature: The proposed solar PV facility will increase the influence of urban development but this increase will be limited due to the existing ridgeline to the south of the project which will screen the development from more natural landscape areas. The proposed project will also extend the general influence of solar projects on the character of the landscape surrounding Vryburg. It will however only impact on a small number of homesteads and these will be impacted on more severely by other planned solar projects.

The cumulative significance is therefore likely to be low.

	All projects (cumulative) Without mitigation	**All projects (cumulative) With mitigation**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Low probability (3)	Probable (3)
Low (27)	**Low (27)**	**Low (27)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, to a small degree	Yes, to a small degree

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;

» Plan to maintain the height of structures as low as possible;

» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

Operations:

» Reinstate any areas of vegetation that have been disturbed during construction;

» Remove all temporary works;

» Monitor rehabilitated areas post-construction and implement remedial actions;

» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site;

- » Rehabilitate areas to their natural state;
- » Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Possible impact on glint and glare

Nature: Other PV projects proposed in the area could also create similar impacts. It is possible that this project could add to glint and glare issues experienced in the area. It is likely however that the proposed project will have a low impact therefore the contribution to cumulative impacts is also likely to be low.

	All projects (cumulative) without mitigation	**All projects (cumulative) with mitigation**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low to minor (3)	Low (2)
Probability	Probable (3)	Improbable (2)
Low (27)	**Low (27)**	**Low (16)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

- » The use of non-reflective finishes and coatings to the surface of PV panels.
- » The use of a natural buffer area between the roads and the facility.
- » Should problems occur on the flightpath into the airstrip, the issuing of a general notice to pilots using the airstrip.

Night time lighting impacts

Nature: The cumulative impact of the lighting associated with other solar energy projects in the area. Currently lighting in the area is comprised of urban lighting. This is not generally an area that is likely to be sensitive to lighting impacts, however, immediate neighbours including a guest house may be sensitive. There is potential for security lighting and operational lighting associated with solar energy projects to further impact on the area but this is likely to be of low significance.

	All projects (cumulative) without mitigation	**All projects (cumulative) with mitigation**
Extent	Site and surroundings (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)

Probability	Probable (3)	Improbable (2)
Low (27)	**Low (24)**	**Low (10)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Use low key lighting around buildings and operational areas that is triggered only when people are present. » Plan to utilise infra-red security systems or motion sensor triggered security lighting; » Ensure that lighting is focused on the development with no light spillage outside the site; and » Keep lighting low, no tall mast lighting should be used.		

7.3.5 Socio-Economic Impacts

Possible cumulative impacts as a result of other similar projects and associated infrastructure in the area could have cumulative negative and positive impacts for the local community. There is a concentration of solar facilities in the broader area around Vryburg. This is considered to be in line with Provincial and National Planning for solar energy development (in terms of the REDZ). The Woodhouse Solar 1 PV Facility falls within the identified geographical area most suitable for the rollout of the development of solar energy projects within the REDZ. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. The potential for significant cumulative impacts is however likely to be high. This could result in positive permanent impacts on the economy, business development, employment and education in the area and the Province. It may also result in some negative impacts such as an influx of jobseekers and change to the landscape and areas sense of place. However the cumulative impacts for the proposed Woodhouse Solar 1 PV Facility have been assessed to be acceptable (as detailed below).

Cumulative impacts from employment, skills and business opportunities

The proposed PV facility and the establishment of other solar energy facilities has the potential to result in significant positive cumulative impacts; specifically with the creation of a number of socio-economic opportunities for the Province, 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 centralise and expand their activities towards education and training more closely to the projects. Cumulative impacts on local entrepreneurs will be positive and assist in developing their businesses further. Also renewable energy projects under the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme are obliged to make a real contribution to local economic development in the area. Awarded projects are required to spend a certain amount of their generated revenue on Socio-Economic Development (SED) and Enterprise Development (ED) and share ownership in the project company with local communities. The cumulative impacts are likely to have significant positive impact on the local economy.

Nature: An increase in employment opportunities, skills development, SED and business opportunities with the establishment of more than one solar energy facility		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local- Regional (3)	Local- Regional (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Probable (3)	Probable (3)
Low (27)	**Low (27)**	**Medium (39)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	Yes
Confidence in findings	High	High
Mitigation: The establishment of a number of solar energy facilities in the area has the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development, business opportunities and SED/ED. 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.		

Cumulative impacts with large scale in-migration of people

The development of large-scale solar projects in the local area will likely draw a large number of labour, businesses and jobseekers to the area. If the local labour force cannot be sourced locally or the local labour pool is inadequate for the solar energy project, outside labour will likely move to the area to fill the gap. The area may experience an influx of new residents who may move to the area looking for job opportunities; which will have effects on the existing population during the construction periods that could entail problems of housing, sanitation, water usage and solid waste disposal. Employment for a solar energy facility peaks during construction and significantly declines during operation; since solar energy facilities need relatively few workers while in operation, solar facilities will not create long-term boomtowns. Though there may be an influx of workers during construction, these workers are largely temporary. Rapid population growth is a common experience in rural towns near new large development projects. Towns with larger populations (greater than 1 000 individuals) and with developed services will likely experience greater rates of population growth than areas without developed services. In relation to the area, the towns that are sensitive receptors will be Vryburg (population of 21 182 people) and the smaller settlements nearby. With the influx of new individuals, secondary industries in the town may also begin to grow, more individuals will move to the area to fill these secondary positions. The impact of this on services and resources is likely to impact the current communities and increase the pressure on local municipalities to meet the basic needs of these potential new communities. The poor communities are likely to be the most vulnerable to loss of service provision and suffer the negative impact of large scale in-migration. There is potential for the influx of migrants to significantly change the local receiving environment and this is likely to have a permanent impact in the region. If more than one solar energy facility is under construction at any one time, then the impacts from in-migration of people is likely to have more of a negative impact on the local area. It is very difficult to control an influx of people into an area, especially in a country where unemployment rates are high.

Nature: Negative impacts and change to the local economy with an in-migration of labourers, businesses and jobseekers to the area (construction and operation phase)		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (3)	Local (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Low (27)	**Low (18)**	**Medium (39)**
Status	Negative	Negative

Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Confidence in findings	Medium	Medium
Mitigation: » Develop a recruitment policy/ process (to be implemented by contractors), which will source labour locally, where feasible. » Working together with government agencies to ensure service provision is in line with the development needs of the local area. » Forming joint ventures with community organisations, through Trusts, which can provide local communities with benefits, such as employment opportunities and services.		

7.4 Cumulative impacts of two PV facilities located within the Remaining Extent of the farm Woodhouse 729

The potential for cumulative impacts on the Remaining Extent of the farm Woodhouse 729, should the development of two a PV facilities be realised (Woodhouse Solar 1 located in the northern portion and Woodhouse Solar 2 located in the southern portion of the property; refer to **Figure 7.2**) are likely to be largely contained within the boundaries of the Remaining Extent of the farm Woodhouse 729, and with the application of the necessary mitigation measures, contained within each of the respective development areas. This is deduced based on the following:

» The development footprints of the two proposed 100MW PV facilities are aligned with areas of medium-low ecological sensitivity and are located outside of the identified high to very high sensitive areas (which are in limited extent on the site) and the recommended buffers for the protection of these sensitive features.
» Visual impacts of associated with the development of the two 100MW PV facilities are considered as acceptable.
» Social – benefit to people in the area and increased opportunities for employment and spin-offs may occur. This is favourable.

The potential for cumulative impacts are discussed in further detail in Section 7.3 above. The cumulative impacts associated with the construction and operation of the two PV facilities (i.e. Woodhouse Solar 1 and Woodhouse 2) on the Remaining Extent of the farm Woodhouse 729 are considered to be acceptable provided that environmental impacts are mitigated to suitable standards by strict control and implementation of EMPrs for each project.

7.5 Contribution of the Woodhouse Solar 1 PV Facility to Climate Change mitigation

South Africa is a country with an economy dependent on coal for the majority of its electricity, an energy-intensive industrial sector and an energy sector responsible for 82% of total GHG emissions, making it the 12th highest world emitter of GHG[22].

It has been reported internationally that the move towards renewable energy for electricity generation needs has resulted in decreased greenhouse gas emissions. The International Energy Agency announced in March 2015 that 2014 carbon dioxide emissions from the energy sector levelled off for the first time in 40 years this has happened without being linked to an economic downturn. This was attributed to the increase in the use of renewable energy sources by China and OECD countries[23]. As GHG emissions associated with the provision of energy services are a major cause of climate change, this move to renewable energy and subsequent reduction in CO_2 emissions is considered as a positive contribution towards climate change mitigation.

The South African Government recognises the need to diversify the mix of energy generation technologies within the country and to reduce the country's reliance on fossil fuels which contribute towards climate change and are therefore not environmentally friendly. This is in accordance with the prescriptions of the United Nations Convention on Climate Change 1994 (UNFCCC) and its associated Kyoto protocol of 1997.

Consequently, the South African Government has recognised the need to move towards cleaner energy and has therefore set targets for cleaner energy technologies (including of 17GW renewable energy contribution to new power generation capacity) by 2030 (IRP, 2011). This is to be produced from wind, solar, biomass, gas and small-scale hydro facilities. Renewable energy plays a key role in mitigating global greenhouse gas emissions by radically lowering the emissions profile of the global energy system (International Renewable Energy Agency (IRENA), 2015). The proposed PV facility will assist in reducing the country's CO_2 emissions associated with energy supply relative to fossil fuels (e.g. coal). Development of numerous such facilities will have a cumulative positive impact on CO_2 emissions as this will reduce reliance on power generation from fossil fuels. This will aid the country in meeting the commitments made under the COP 21 Agreement, to which the Government has committed to become a signatory.

This is considered to be a significant positive impact for the environment and society at an international level.

[22] Greenhouse Gas Inventory for South Africa: 2000-2010

[23] http://ecowatch.com/2015/03/23/renewables-mitigate-climate-change/

7.6 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study. The current study assesses the cumulative impacts associated with the Woodhouse Solar 1 PV facility together with similar facilities within the region on the basis of current and best available information, with precautionary assumptions taken into account.

The alignment of renewable energy developments with the IRP 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.

There is a need for strategic planning and co-operation to better understand the cumulative impacts that may result from promoting renewable energy. In this regard the Department Environmental Affairs has initiated a Strategic Environmental Assessment to identify Renewable Energy Development Zones (REDZ). In the Cabinet Meeting of 17 February 2016, Cabinet approved the gazetting of Renewable Energy Development Zones (REDZ). The aims of the zones are to identify geographical areas where wind and solar PV technologies can be incentivised and where intense grid expansion can be directed, and to streamline the regulatory process for applications in these zones. These REDZ will ensure a transition to a low carbon economy, accelerating infrastructure development and contributing to a more coherent and predictable regulatory framework. The Woodhouse Solar 1 PV facility development site is located within the REDZ Vryburg Focus Area which was selected as an area highly suitable for solar facilities given a range of factors considered. The REDZs also provide priority areas for investment into the electricity grid. Currently one of the greatest challenges to renewable energy development in South Africa is the saturation of existing grid infrastructure and the difficulties in expanding the grid. With regards to cumulative impacts the REDZs implies that projects of the same nature will be consolidated in one area creating a node, ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. It is also important to reiterate that it is unlikely that all proposed solar facilities located within a 10km radius of the Woodhouse Solar 1 project site will be built due to various reasons. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Woodhouse Solar 1 PV facility will be acceptable, without any unacceptable loss or risks and the majority are rated as being of **moderate-low** significance with mitigation.

Table 7.2 provides a summary of the expected cumulative impacts associated with the proposed PV facility on the identified project site.

Table 7.2: Summary of the cumulative impact significance for the Woodhouse Solar 1 PV Facility.

Specialist assessment	Cumulative Impact Significance (Pre-Mitigation)	Cumulative Impact Significance (Post Mitigation)
Ecology	Low	Low
Avifauna	Low	Low
Archaeology	Low	Low
Palaeontology	Low	Low
Visual	Low - Medium	Low - Medium
Socio-Economic	Low - Medium	Low - Medium

The role of the cumulative assessment is to test if such impacts are relevant to the Woodhouse Solar 1 PV facility project in the proposed location. In regards to the above cumulative assessments undertaken for ecology, avifauna, archaeology, palaeontology, visual and avifauna it can be concluded that the development of the Woodhouse Solar 1 PV and other proposed renewable energy facilities in the region (with specific reference to the preferred bidder project, i.e. Waterloo Solar Park) are acceptable and will not result in an unacceptable loss or risk or an increase of the impacts. The following can be concluded considering the Woodhouse Solar 1PV Facility:

» The construction of the PV Facility will not result in the unacceptable clearing of threatened or protected plant species. The proposed development is acceptable from an ecological perspective.
» The proposed development is considered acceptable from an avifaunal perspective, as there are no unique habitats associated with the development.
» The development will not significantly increase the negative impact on the social environment. However, an increase in positive impacts, specifically as a result of job creation and socio-economic benefits, can be expected.
» The development of the Woodhouse Solar 1Pv Facility will contribute towards a reduction in greenhouse gas emissions from energy generation and will aid the country in meeting the commitments made under the COP 21 Agreement, to which the Government has committed to become a signatory.

Based on a detailed evaluation, the cumulative impacts associated with the construction and operation of the Woodhouse Solar 1 PV Facility and other proposed renewable energy facilities in the region (with specific reference to the preferred bidder project, i.e. Waterloo Solar Park) are considered to be acceptable. The low potential for cumulative impacts and risks makes the location of this project within the REDZ a desirable location for further consideration provided that environmental impacts are mitigated to suitable standards by strict control and implementation of EMPr's for each project as recommended within this EIA Report.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 8

8.1 Legal Requirements as per the EIA Regulations for the undertaking of an Environmental Impact Assessment Report, 2014

This chapter of the EIA report includes the following information required in terms of Appendix 3: Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	A summary of the findings of the specialist reports are included within section 8.4. The recommendations made by the specialists are included in chapter 6. An summary of the recommendations for the Woodhouse Solar 1 PV Facility is included in section 8.9.
3(l) an environmental impact statement which contains (i) a summary of the key findings of the environmental impact assessment, (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	An environmental impact statement (overall conclusion) is included in section 8.8. A summary of the key findings of the environmental impact assessment is included in sections 8.4.1 – 8.4.6. A map superimposing the proposed activities and its associated infrastructure on the environmental sensitivities of the preferred development area indicating the area that should be avoided, including buffers are included in section 8.5 and Figure 8.2. A summary of the costs (negative) and benefits (positive) impacts and risks of the proposed Woodhouse Solar 1 PV Facility is included in section 8.7.
3(n) the final proposed alternatives which respond to the impact management measures, avoidance and mitigation measures identified through the assessment.	The final proposed alternatives for the Woodhouse Solar 1 PV Facility which responds to the impact management measures, avoidance and mitigation are included as a mitigation strategy to ensure that the development will not have a detrimental effect on the environment. This is included in section 8.5.1.
3(o) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	Conditions to be included in the authorisation of the Woodhouse Solar 1Pv Facility are included in section 8.9.
3(q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be	A reasoned opinion as to whether the Woodhouse Solar 1 PV Facility should receive authorisation and the conditions

authorised, any conditions that should be made in respect of that authorisation.	that should form part of the authorisation is included in section 8.9.

8.2 Assessment process

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), Genesis Woodhouse Solar 1 (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) for the construction of the Woodhouse Solar 1 PV Facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of R982, R983, R984 and R985, a Scoping and an EIA Phase have been undertaken for the proposed PV facility. 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 in the EIA Process.

- *Notification Phase* - organs of state, stakeholders, and interested and affected parties (I&APs) were notified of the proposed PV facility 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 PV facility and environmental sensitivities (i.e. over the broader project site - entire extent of the Remaining Extent of the farm Woodhouse 729), as well as the extent of studies required within the EIA Phase were defined.
- *EIA Phase* – potentially significant biophysical and social impacts[24] and identified feasible alternatives have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to **Appendix J**).

The Conclusions and Recommendations of this EIA for the Woodhouse Solar 1 PV 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 broader study area. A summary of the recommendations and conclusions for the proposed PV facility is provided in this Chapter.

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

8.3 Summary of key considerations for the Woodhouse Solar 1 PV Facility

Genesis Woodhouse Solar 1 (Pty) Ltd propose the development of a commercial photovoltaic (PV) solar energy facility (known as the Woodhouse Solar 1 PV Facility) on the Remaining Extent of the farm Woodhouse 729. The proposed project site is located approximately 10km south east of the town of Vryburg and falls under the jurisdiction of the Naledi Local Municipality and within the greater Dr Ruth Segomotsi Mompati District Municipality in the North West Province.

The Woodhouse Solar 1 PV Facility will have a contracted capacity of up to 100MW which will accommodate several arrays of photovoltaic (PV) panels and associated infrastructure. The project will comprise of the following infrastructure which has been included in the scope of this EIA:

- Arrays of single axis PV tracking or fixed tilt PV panels with a generating capacity of up to 100MW.
- Mounting structures to support the PV panels.
- On-site inverters to convert the power from a direct current to an alternating current the power and a substation to facilitate the connection between the solar energy PV facility and the Eskom electricity grid.
- A new 132kV power line between the on-site substation and the Eskom grid connection point.
- Cabling between the project components, to be laid underground where practical.
- Offices and workshop areas for maintenance and storage.
- Temporary laydown areas.
- Internal access roads and fencing around the development area.

The purpose of the proposed PV facility is to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE). In response to the need, Genesis Woodhouse Solar 1 (Pty) Ltd, as an Independent Power Producer, is proposing the construction and operation of this PV facility.

Need and desirability: Solar PV is one of the most cost-effective, reliable and proven approaches for generating solar power. These systems have no moving parts, 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. In locations such as

Vryburg, there is a significant positive ecological and practical advantage to utilising a power generation technology that does not require large amount of water resources. From a social perspective and in consideration with the REIPPP Programme various social benefits can be associated with the development. As there is a need for employment opportunities within the Naledi Local Municipality, with an unemployment rate of ~26.4%, the development of the Woodhouse Solar 1 PV facility is a welcomed opportunity to the area which will create positive spin-offs within the surrounding communities ensuring growth and development within an area where it is considered as a necessity.

The North West Province has been identified as an area with the potential for the development of solar renewable energy generation, with suitable solar radiation levels and available tracts of land. The greater Vryburg area has been identified by the National Department of Environmental Affairs as one of the areas best suited for the roll-out of solar photovoltaic (PV) and wind energy projects in South Africa. These focus areas for the development of renewable energy are known as Renewable Energy Development Zones (REDZ), with the Vryburg area classified as REDZ zone 6. The project site is therefore situated within an area which is considered as a preferred location where renewable energy developments should take place and will therefore become a node for the development of renewable energy projects, with the gazetting of the REDZ.

The suitability of the project site for the development of a solar energy facility is also measured in terms of other energy facilities in the surrounding areas. Within a 10km radius from the site there are at least 5 other facilities located, one of which is a preferred bidder project. The fact that a preferred bidder project is located in close proximity (i.e. directly adjacent/west of the Remaining Extent of the farm Woodhouse 729) to the project site proposed for the Woodhouse Solar 1 PV Facility gives a definite indication of the suitability of the project site as well as the greater Vryburg area in terms of the need for the development of solar energy facilities throughout the area.

Project Site selection: The selection of the project site, development area and development footprint for the Woodhouse Solar 1 PV Facility was undertaken on the basis of a 'funnel down' approach, discussed below.

The PV facility is proposed to be situated on the Remaining Extent of the farm Woodhouse 729 (~2264ha in extent) which was identified by the developer and with the consent of the landowner as being suitable project site from an environmental and technical perspective for a project of this nature. This selection process was undertaken by the developer who considered various properties for the development of the solar energy facility. The project site was identified by the developer as suited to the development of the project due to the availability of the solar resource, close proximity to a viable grid connection, accessibility to the site, and support from the local municipality and landowner. Environmental constraints were also taken into

consideration. Based on the outcomes of the Scoping Phase and the considerations of the landowner, some areas within the broader project site were excluded (as potential no-go areas and/or inappropriate areas for the development) and a potentially suitable area (i.e. the development area) was selected for further investigation during the EIA Phase.

For the location of the PV facility within the project site, a preferred development area of approximately 287ha was recommended for the development within the northern portion of the Remaining Extent of the farm Woodhouse 729. This development area was identified on the basis of the environmental suitability of the area, direct grid connection options and technical constraints. The area represents the portion of the farm with the greatest potential for development of a PV facility after taking into consideration the sensitivities identified on the larger site. This area excludes areas of high biodiversity sensitivity and do not contain any areas considered to be no-go areas. Therefore, the funnel-down approach to site identification followed allowed for environmental sensitivity to inform the siting and preliminary layout design of the proposed project. This was further informed during the EIA by way of the specialist field investigations. Therefore, the approach adopted during site selection allowed for the avoidance of site sensitivities (following the mitigation hierarchy) by the project development footprint. The project site falls within the identified geographical areas / focus area most suitable for the rollout of the development of solar energy projects (i.e. Vryburg Solar priority area or REDZ 6). The site is also directly adjacent to preferred bidder projects.

Development area: In order to reduce the potential for on-site environmental impacts associated with the facility, the identified sensitive areas have been avoided as far as reasonably possible through the selection of a 287ha focus area. The extent of the demarcated area far exceeds the required development footprint for a PV facility (240ha required) and therefore it is possible to accommodate the PV development at the site with low impact on sensitive features. The developer provided a preliminary layout/development footprint for the PV facility, to be located within the development area, which was designed in line with the sensitivities identified within the development area within the Scoping Phase as well as the approval from the landowner. The aim of the design was to avoid all of the high sensitive areas (identified at scoping) located within the development footprint.

During the field-surveys and assessments undertaken by the specialists within this EIA Phase, sensitivities and appropriate buffers were identified and recommended within the development area (~287ha) which are considered as sensitive and requires avoidance of any disturbance. Limited areas were identified where the preliminary layout infringed on demarcated buffer areas. This was readily remedied. In order to avoid all areas of high sensitivity, including the associated buffers, an optimised layout/development footprint was produced. This optimised layout avoids the high sensitivity areas and the associated buffers, as recommended by the specialists, and is therefore considered as a mitigation strategy in order to ensure that the environmental impacts of the PV facility are

acceptable (refer to Section 8.5). The optimised layout is considered as the most environmentally and technically suitable layout for the development of the Woodhouse Solar 1 PV Facility within the identified development area and is considered as the preferred layout for the PV facility. As such, no alternative development area was required to be assessed through the EIA.

8.4 Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within **Appendices D-I** provide a detailed assessment of the potential impacts that may result from the proposed PV facility. This chapter concludes the EIA Report of the Woodhouse Solar 1 PV Facility by providing a summary of the conclusions of the assessment of the proposed development area for the development of the solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, sensitive areas and associated buffers within the development area were identified and flagged for consideration and avoidance by the development footprint (refer to **Figure 8.1**). An alternative project development footprint (i.e. an optimised layout) has been considered for the development in order to avoid all features of high sensitivity, as well as their associated buffers. Four grid connection alternatives for the connection of the PV facility to the national grid have been assessed.

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

» Impacts on ecology, flora, fauna, water resources and ecosystems.
» Impacts on avifauna.
» Impacts on heritage resources which includes archaeological and palaeontological resources.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line etc.).
» Social and economic impacts.

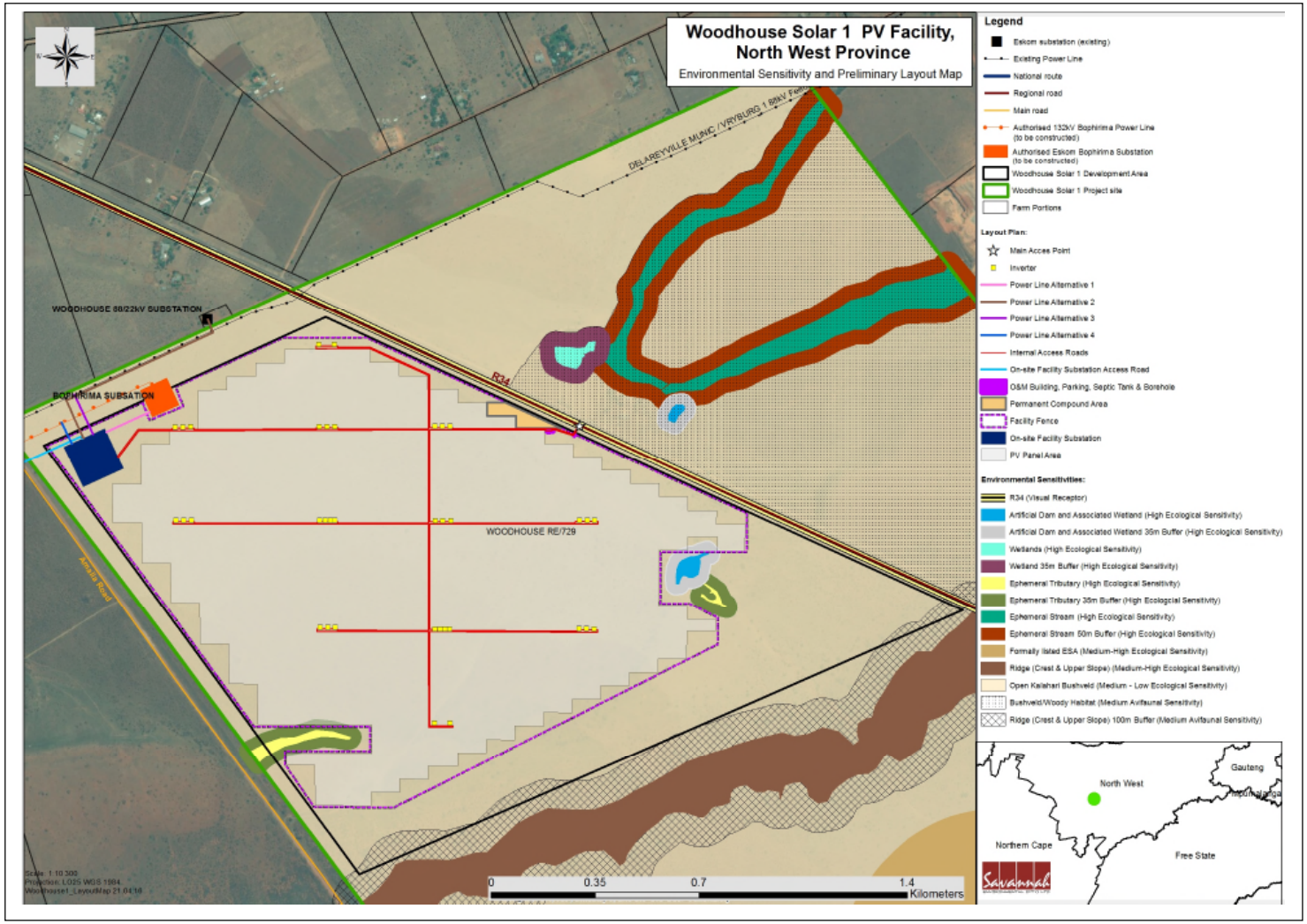


Figure 8.1: Woodhouse Solar 1 PV Facility preliminary layout considered through the EIA overlain on the identified environmental sensitivity map (refer to **Appendix K** for A3 map).

In summary, the environmental impacts associated with the proposed project, as identified through the EIA are as follows:

8.4.1 Impacts on Ecology

There are no highly sensitive features impacted by the development footprint, however, the facility layout infringes on buffers associated with sensitive features in the development area. Any impact to these areas of high sensitivity can be mitigated through the micro-siting of the facility layout in these areas. The abundance of species of concern within the development area is low and while there are some protected species present, such as *Acacaia erioloba*, there are no species of high conservation concern present and no significant impacts on the local populations of the protected species present can be expected. The CBA corridor areas within the development area are, as a result of historical and current anthropogenic activities and disturbance, no longer considered to be significant for ecological functioning. The site is considered appropriate for the development of a PV facility, which does not warrant whole-scale clearing of the development footprint and still allows for the functioning of areas as movement corridors. Therefore, the development of the facility within the transformed CBAs which overlap with the project development footprint is considered acceptable in terms of the loss of the area to development. Overall and with the suggested mitigation measures implemented, the **ecological** impacts of the development are likely to be of **moderate to low significance** and no impacts of high significance are likely. As a result, there are no ecological fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

8.4.2 Impacts on Avifauna

The development of the PV facility is likely to have little, if any, significant long-term impact on the avifauna of the wider area, especially after mitigation, and is considered to have acceptable levels of impact overall. The location of the project site and more specifically the development area are not considered unique habitats in the landscape and are already subject to varying degrees of transformation and degradation. Although two threatened and/or priority species were recorded within the broader study area – White-backed Vulture and Greater Flamingo respectively – these are widespread species, the area is not considered critical for their conservation and the extent of habitat loss for these species would be considered low. In terms of the direct impacts of the development in isolation, the development area is considered optimal for the development due to the homogenous nature of the vegetation, the level of degradation already present and the lower bird species diversity and abundance recorded in this area. The impacts of the development on avifauna are likely to be of **moderate to low significance** and no impacts of high significance are expected, with the implementation of mitigation measures.

8.4.3 Impacts on Heritage and Palaeontological Resources

No significant cultural landscape elements were recorded within the development area. Building ruins, Middle Stone Age (MSA) and Later Stone Age (LSA) artefacts were recorded scattered in varying densities across the proposed development area. Most of these artefacts are scattered too sparsely to be of any significance apart from noting their presence, which has been done in the specialist report. However discreet knapping sites were recorded at an existing quarry in the north eastern portion of the proposed footprint. Graves can be expected anywhere on the landscape, and may specifically be associated with stone cairns noted close to the farm labourer ruins. The impact of the development of the Woodhouse Solar 1 PV Facility on these recorded sites, with the implementation of the appropriate and recommended and appropriate mitigation measures is considered to be of a **low significance**.

The development area is underlain by the Vryburg Formation of the Ghaap Group, and the Dwyka Group of the Karoo Supergroup. The Dwyka Group (Karoo Supergroup) is represented by small outcrops in the north of the development area. Although trace fossils and plants could be present in the Dwyka Group the likelihood of significant fossil heritage in the Vryburg area is considered to be low. The southern portion of the development area consists of the Vryburg Formation, which is considered as unfossiliferous in the Vryburg area. Therefore, there are no areas located within the development area considered as sensitive, and as such the impact of the development with the implementation of appropriate mitigation measures is considered as being of a **low significance**.

8.4.4 Impacts on Visual Quality of the area

The area that is likely to be affected by visual impacts associated with the proposed Woodhouse Solar 1 PV Facility will be limited to the area immediately to the south of the urban area of Vryburg. This area is largely impacted by urban and urban fringe development. Due to the ridgeline to the south of the proposed development area, it will not impact on areas to the south that are more natural in character and where the landscape character is not influenced by development. As a result of this development mainly visually impacting on an area where there already is a strong visual influence from urban and urban fringe development, changes to the landscape quality are not likely to be problematic. The presence of receptors within the area and in close proximity to the development are likely to be sensitive to change in the outlook associated with the development. These sensitive receptors are however limited to residential homesteads and a guesthouse.

Impact **significance** was assessed and it was found that the visual significance is likely to be **medium- low** with the implementation of appropriate mitigation measures.

8.4.5 Social and Economic Impacts

The overall **social** impact is likely to be of a **medium significance** in terms of positive impacts, and a **low significance** in terms of the negative impacts (with the implementation of mitigation measures). From a social perspective it is concluded that the project is supported, but that mitigation measures should be implemented and adhered to. Positive and negative social impacts have been identified. The assessment of the key issues indicated that there are no negative impacts that can be classified as fatal flaws and which are of such significance that they cannot be successfully mitigated. Positive impacts could be enhanced by implementing appropriate enhancement measures and through careful planning.

Based on the social assessment the potential negative social impacts associated with the construction phase are temporary and typical of construction related projects and not just focussed on the construction of the proposed PV facility (these relate to influx of non-local workforce and jobseekers, intrusion and disturbance impacts, safety and security) and could be reduced with the implementation of the mitigation measures proposed. The potential negative social impacts associated with the construction phase are temporary and typical of construction related projects and not just focussed on the construction of the proposed PV facility (these relate to influx of non-local workforce and jobseekers, intrusion and disturbance impacts, safety and security) and could be reduced with the implementation of the mitigation measures proposed. Employment opportunities will be created in the construction and operation phase and the impact is rated as positive even if only a small number of individuals benefit in this regard. The proposed project could assist the local economy in creating entrepreneurial development, especially if local business could be involved in the provision of general material and services during the construction and operational phases. Capacity building and skills training among employees are critical and would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other sectors.

The proposed PV facility also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the increased awareness of climate change, represents a positive social benefit for society as a whole.

8.4.6 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. 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 Woodhouse Solar 1 PV Facility falls within the identified geographical area most suitable for the rollout of the development of solar energy projects within the North West Province, that is Renewable Energy Development Zone 6, or the Vryburg Focus Area). This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. It is also important to note that it is unlikely that all proposed renewable energy facilities located in the region will be built due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets. The site is located in close proximity to the Waterloo Solar Park, which has received a Preferred Bidder status, as well as four other PV facilities, three of which have received environmental authorisation. The cumulative impacts for the proposed Solar Facility have been assessed to be acceptable, with no unacceptable loss or risk expected.

The potential for cumulative impacts are detailed in Chapter 7, and the assessment includes the potential for:

» visual intrusion and change of character of the area;
» positive social benefits and spin-off effects associated with the REIPPP Programme;
» loss of vegetation and habitat loss (for fauna and avifauna).

Considering the findings of the specialist assessments undertaken for the project, **cumulative impacts** range from a **low to moderate significance** (on a landscape level in this region of the Vryburg area) and can be considered as both **positive and negative**. The use of the EMPr and mitigation measures would assist in mitigating these negative impacts to an acceptable level as well as enhance the positive impacts to a beneficial level.

8.5 Environmental Sensitivity Mapping

From the specialist investigations undertaken for the proposed Woodhouse Solar 1 PV Facility, a number of sensitive areas were identified (refer to **Figure 8.2** and **Appendix K**).

The following sensitive areas/environmental features have been identified to be associated with the 287ha development area of the Woodhouse Solar 1 PV Facility:

» The areas of high ecological sensitivity (to be avoided) include:
  * areas containing riparian vegetation on ephemeral tributaries and an associated 35m buffer
  * an artificial dam and its associated wetland area and an associated 35m buffer.

Buffers were recommended by the ecologist in order to ensure no encroachment on these high sensitivity ecological features (i.e. avoidance). .

The facility layout infringes on these buffer areas. These features and buffers are to be avoided by the appropriate placement of infrastructure or the construction footprint. It is recommended that the facility layout/development footprint is micro adjusted to avoid these areas.

The following sensitive areas/environmental features have been identified outside of the development area of the Woodhouse Solar 1 PV Facility:

» areas containing riparian vegetation on ephemeral streams and an associated 50m buffer
» wetland and an associated 35m buffer
» ridgeline and associated 100m buffer of moderate sensitivity to avifauna
» woody habitat providing habitat for birds

These areas or features of sensitivity are all located well away from the development footprint and any PV facility infrastructure and will not be impacted on by the proposed PV development.

8.5.1. Mitigation Strategy: development of an optimised layout

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 commitment of the project to adhere to recommended mitigation measures, the project developer has developed a best practice mitigation strategy with regards to the facility layout.

The EIA recommendations have been taken into account by the project developer, and the facility layout has been refined to avoid the areas identified as being of high sensitivity (or no-go areas to be avoided). This refinement of the layout has resulted in the repositioning of the PV panels as well as the facility fence outside of the identified high sensitivity areas and the associated buffers in the south west and south east corners of the development footprint. The ephemeral tributaries and the associated 35m buffer have been avoided by the optimised layout/development footprint in order to ensure that the features will not be impacted on by the development. The artificial dam and associated wetland and the associated 35m buffer is avoided by the optimised layout/development footprint.

This optimised layout considering the implemented mitigation measures is illustrated in **Figure 8.2** and represents a positive outcome in terms of impact reduction and mitigation and the optimal layout for the facility.

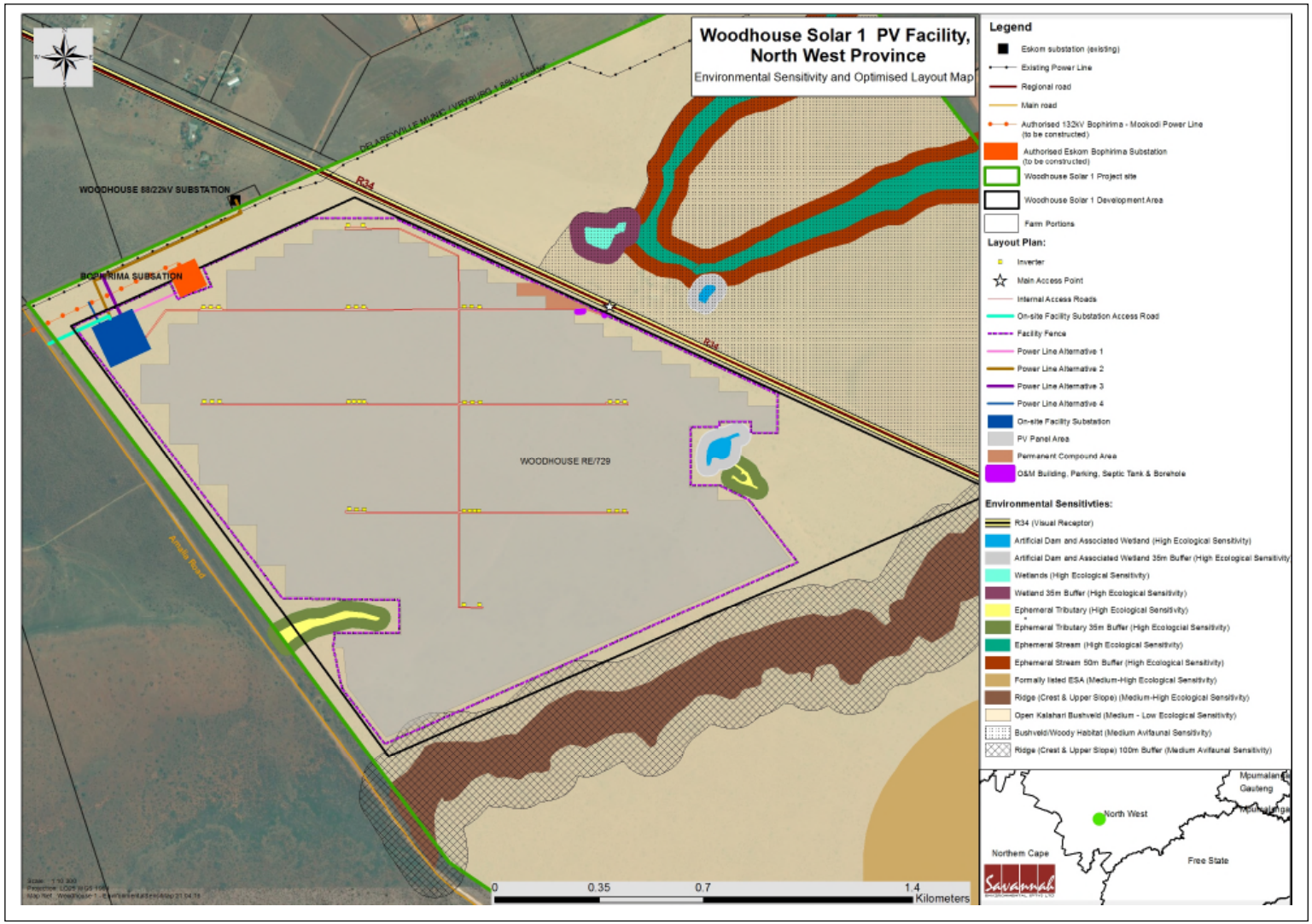


Figure 8.2: Woodhouse Solar 1 PV Facility optimised layout and environmental sensitivity map (refer to **Appendix K** for A3 map).

8.6 Comparison of Grid Connection Alternatives

For the Woodhouse Solar 1 PV Facility to connect into the national grid four grid connection alternatives area being considered. These grid connection alternatives include:

- Alternative 1: A direct connection to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the affected property (i.e. on the Remaining Extent of the farm Woodhouse 729);
- Alternative 2: A direct connection to the existing Woodhouse 88/22kV Substation located north of the boundary of the affected property; and
- Alternative 3: A turn-in turn-out connection to the existing Delareyville Munic/Vryburg 1 88kV Feeder located along the northern boundary of the affected property; and
- Alternative 4: A turn-in turn-out connection to the authorised 132kV Eskom Bophirima–Mookodi power line, to be constructed by Eskom

The details of the alternative power line routes considered are:

- *Alternative 1:* A 132kV power line between the on-site facility substation and the authorised Eskom Bophirima Substation to be constructed in the northern portion of the project site. The length of the power line required to be constructed for this connection will be ~160m.
- *Alternative 2:* A 132kV power line between the on-site substation and the existing Woodhouse 88/22kV Substation. The length of power line to be constructed is approximately 747m, and is the longest power line route alternative considered for the Woodhouse Solar 1 PV Facility.
- *Alternative 3:* A 132kV power line between the on-site facility substation and the existing Delareyville Munic-Vryburg 1 88kV Feeder line located on the northern boundary of the project site. The length of the power line required to establish the connection is approximately 146m, and would be required to be a double circuit line.
- *Alternative 4:* A 132kV power line between the on-site substation and the authorised 132kV Eskom Bophirima–Mookodi power line (to be constructed). The length of power line is approximately 80m, and would be required to be a double circuit line, and is the shortest power line route alternative considered for the Woodhouse Solar 1 PV Facility.

In terms of the specialist studies undertaken, the following conclusions were made regarding the four grid connection route alternatives (refer to the table below):

Aspect	Alternative 1 (~160m in length)	Alternative 2 (~747m in length)	Alternative 3 (~146m in length)	Alternative 4 (~80m in length)
Ecology	Acceptable – » Located within a medium-low ecological sensitive area. » Does not impact on sensitive ecological features.	Acceptable – » Located within a medium-low ecological sensitive area. » Does not impact on sensitive ecological features.	Acceptable – » Located within a medium-low ecological sensitive area. » Does not impact on sensitive ecological features.	Acceptable – » Located within a medium-low ecological sensitive area. » Does not impact on sensitive ecological features.
Avifauna	Acceptable – » No unique habitats affected » Located within a low sensitive area	Acceptable – Least preferred » No unique habitats affected » Located within a low sensitive area » Longest power line increasing potential for collision (although parallel to an existing line)	Acceptable – » No unique habitats affected » Located within a low sensitive area	Acceptable – » No unique habitats affected » Located within a low sensitive area
Heritage and Palaeontology	Acceptable – » Artefacts identified are scattered too sparsely to be of any significance. » No significant heritage finds » Fossil potential low	Acceptable – » Artefacts identified are scattered too sparsely to be of any significance. » No significant heritage finds » Fossil potential low	Acceptable – » Artefacts identified are scattered too sparsely to be of any significance. » No significant heritage finds » Fossil potential low	Acceptable – » Artefacts identified are scattered too sparsely to be of any significance. » No significant heritage finds » Fossil potential low.

Visual impacts	Acceptable – » located in close proximity to existing power infrastructure (Woodhouse Substation and Delareyville Munic/Vryburg 1 88kV Feeder) and infrastructure to be constructed in the near future (authorised Eskom Bophirima Substation and authorised 132kV Eskom Bophirima–Mookodi power line).	Acceptable – Least preferred » located in close proximity to existing power infrastructure (Woodhouse Substation and Delareyville Munic/Vryburg 1 88kV Feeder) and infrastructure to be constructed in the near future (authorised Eskom Bophirima Substation and authorised 132kV Eskom Bophirima–Mookodi power line). » Length of the power line: ~747m (longest power line alternative)	Acceptable – » located in close proximity to existing power infrastructure (Woodhouse Substation and Delareyville Munic/Vryburg 1 88kV Feeder) and infrastructure to be constructed in the near future (authorised Eskom Bophirima Substation and authorised 132kV Eskom Bophirima–Mookodi power line).	Acceptable – **Preferred Alternative** » located in close proximity to existing power infrastructure (Woodhouse Substation and Delareyville Munic/Vryburg 1 88kV Feeder) and infrastructure to be constructed in the near future (authorised Eskom Bophirima Substation and authorised 132kV Eskom Bophirima–Mookodi power line). » shortest power line alternative (~80m), therefore least visual impact
Social	Acceptable– » Development to take place on Woodhouse RE/729.	Acceptable - Least preferred » Longest power line route (747m) » Development to take place on Woodhouse RE/729. » Located parallel to an existing Eskom power line.	Acceptable– » Development to take place on Woodhouse RE/729.	Acceptable – **Preferred Alternative** » Shortest power line route (80m) » » Development to take place on Woodhouse RE/729.

There are no impacts of unacceptably high significance associated with any of the four grid connection alternatives assessed. There are no significant differences between the power line alternatives due to the homogeneous nature of the area in which they are proposed and the marginal difference in the length of the power line. Alternative 2 is the longest length of all the alternatives presented. As such it is the least preferred alternative from an environmental perspective, but at under 1km is still considered more than acceptable. In addition, this route follows an existing Eskom power line for the majority of its length.

As all four power line alternatives are considered to be acceptable for implementation from an environmental perspective, the preferred power line alternative and grid connection point is based on technical suitability. The developer has indicated that Alternative 1, a direct connection to the authorised Eskom Bophirima Substation (to be constructed within the northern portion of the affected property) via a new 132kV power line is the preferred technical alternative. Therefore, from an environmental perspective and technical preference, the grid connection Alternative 1 is nominated as the preferred alternative for development.

8.7 Environmental Costs of the Project versus Benefits of the Project

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

» Direct loss of biodiversity, flora and fauna due to the clearing of land for the construction and utilisation of land for the PV facility (which is limited to the development footprint of 240ha). The cost of loss of biodiversity has been minimised on the PV facility through the careful location of the development to avoid key areas supporting biodiversity of particularly high conservation importance.
» Visual impacts associated with the PV panels and power line. The cost of loss of visual quality to the area is reduced due to the area already been visually impacted by urban development and other power infrastructure in close proximity to this project.
» Change in land-use and loss of land available for grazing on the development footprint, although the grazing potential within the project site is restricted.

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 PV facility 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 operation phases.

» The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix.
» South Africa's per capita greenhouse gas emissions being amongst the highest in the world due to reliance on fossil fuels, the proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW PV project, on a like for like basis.
» New business sales that will be stimulated as a result of the establishment of the project, albeit for a temporary period, will be lost. 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, such as Vryburg and Huhundi. 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.
» The establishment of the PV facility will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. Various PV facilities are proposed within the area, which means that the transfer of skills from foreign experts to the local engineers and construction workers already takes place.
» The LED goals of the Dr Ruth Segomatsi Momopati District Municipality (in terms of energy development, manufacturing growth through energy development and techno-tourism) will not be met to the extent possible should the project not be constructed.

The benefits of the Woodhouse Solar 1 PV Facility are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project.

8.8 Overall Conclusion (Impact Statement)

The technical viability of establishing a solar energy facility with a net generating capacity of up to 100MW on a site located on the Remaining Extent of the farm Woodhosue 729 has been established by Genesis Woodhouse Solar 1 (Pty) Ltd. The positive implications of establishing the PV facility on the identified site include the following:

» The potential to harness and utilise solar energy resources within the North West Province.
» The PV facility will assist the South African government in reaching their set targets for renewable energy.
» The PV facility will assist the South African government in the implementation of its green growth strategy and job creation targets.

» The PV facility will assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business.
» The National electricity grid in the North West Province will benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed Woodhouse Solar 1 PV Facility from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts have been reduced by implementing the mitigation measures recommended by the specialist team during the EIA process, and this specifically included the consideration of the development footprint/preliminary layout in relation to sensitivities identified. The avoidance of areas of sensitivity is illustrated by the optimised layout included as **Figure 8.3**. The PV facility has considered constraints, and is considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) for the PV facility is included within **Appendix J**.

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

8.9 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.

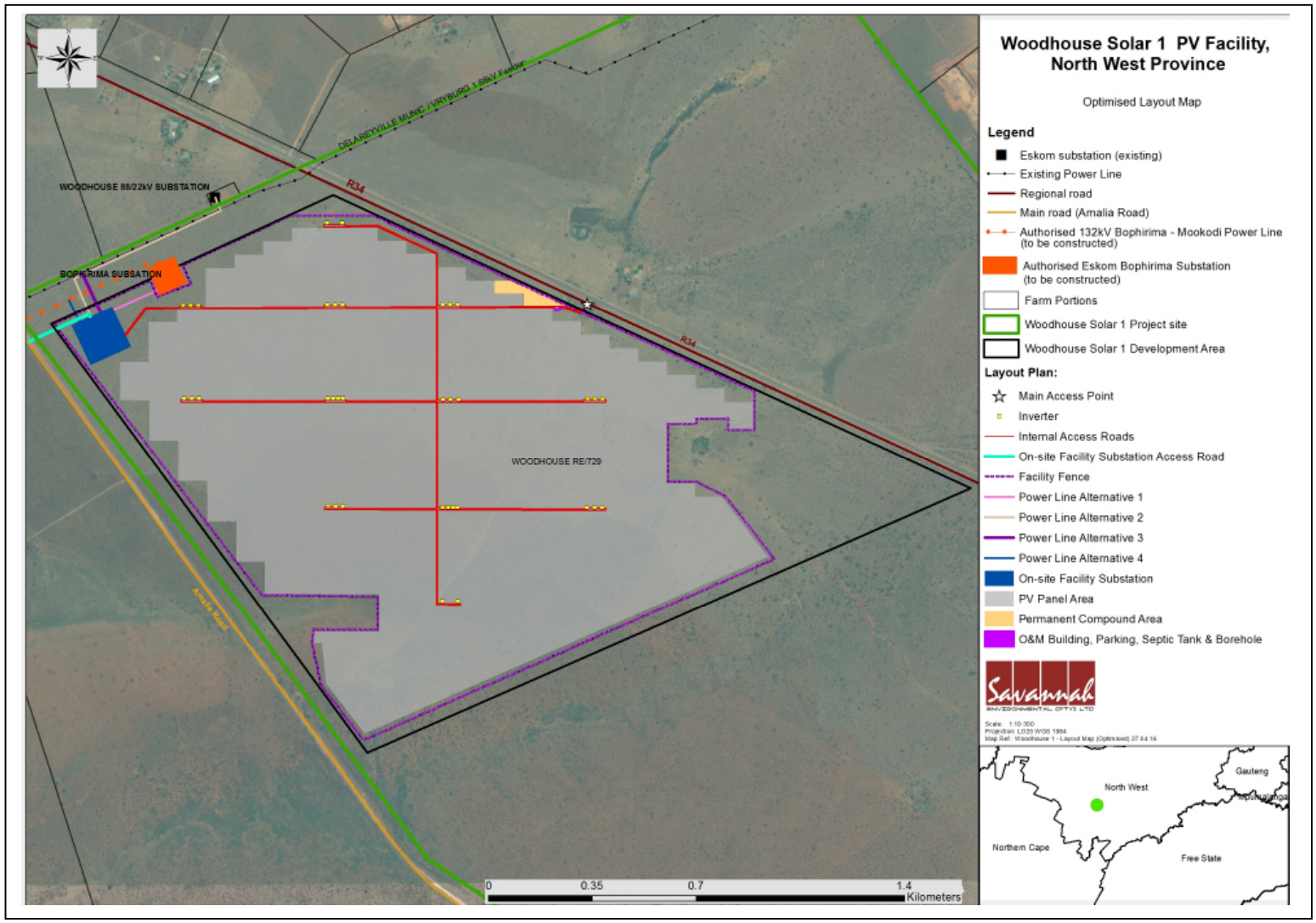


Figure 8.3: Optimised layout for the Woodhouse Solar 1 PV Facility (A3 map included in **Appendix K**).

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 PV facility, 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 Woodhouse Solar 1 PV Facility can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

The optimised layout/development footprint as presented in **Figure 8.2** avoid the high sensitivities identified on the site, and are nominated as the preferred alternatives following the full assessment through this EIA process. The reasons for this are below:

» Optimised layout/development footprint: This layout avoids the major sensitive features of the site such as tributaries and wetlands and there are no features or buffers of high sensitivity within the development footprint. The abundance of species of concern within the development area is also low and while there are some protected species present, such as *Acacaia erioloba*, there are no species of high conservation concern present.
» Preferred grid connection: the preferred power line route for the connection to the national grid is Alternative 1, a connection from the on-site facility substation to the to the authorised Eskom Bophirima Substation to be constructed within the northern portion of the Remaining Extent of the farm Woodhouse 729.

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

» Disturbed areas should be rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» All mitigation measures detailed within this report as well as the specialist reports contained within **Appendices D to I** are to be implemented.
» The draft Environmental Management Programme (EMPr) as contained within **Appendix J** of this report should form part of the contract with the Contractors

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

» A comprehensive stormwater management plan should be compiled for the developmental footprint prior to construction.
» An ecological walk through survey for the PV plant and associated infrastructure (including the grid connection power line route) must be undertaken prior to construction.
» A permit to be obtained for removal of protected trees and provincially protected flora that are affected.
» A post construction (once operational) site walk over the facility footprint be conducted by an avifaunal specialist to determine whether a long-term avifaunal mortality monitoring programme is required for the site.
» The relevant Water Use License for water uses to be obtained from DWS.
» Applications for all other relevant and required permits required to be obtained by Genesis Woodhouse Solar 1 (Pty) Ltd must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to any heritage sites, disturbance of protected vegetation and protected trees, and water uses.

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