240MW HIGHVELD SOLAR PHOTOVOLTAIC (PV) FACILITY NORTH WEST PROVINCE

Final Basic Assessment Report

January 2023

savannah environmental

t +27 (0)11 656 3237
f +27 (0)86 684 0547
e info@savannahsa.com
w www.savannahsa.com

Prepared for:

WKN Windcurrent SA (Pty) Ltd

301 Sunclare Building
21 Dreyer Street
Claremont
Cape Town
7708

Prepared by:

savannah environmental

t +27 (0)11 656 3237 f +27 (0)86 684 0547 e info@savannahsa.com w www.savannahsa.com
First Floor, Block 2, 5 Woodlands Drive Office Park, Cnr Woodlands Drive & Western Service Road, Woodmead, 2191

PROJECT DETAILS

DFFE Reference	:	14/12/16/3/3/1/2671
Title	:	Basic Assessment Process: Highveld Solar PV Facility, North West Province
Authors	:	Savannah Environmental Chantelle Geyer Karen Jodas Nicolene Venter
Specialists	:	The Biodiversity Company Pachnoda Consulting Terra Africa Environmental Consultants CTS Heritage Eco Thunder Consulting LoGIS
Applicant	:	WKN Windcurrent SA (Pty) Ltd
Report Status	:	Final Basic Assessment Report
Date	:	January 2023

When used as a reference this report should be cited as: Savannah Environmental (2022) Final Basic Assessment Report for the Highveld Solar PV Facility, North West Province.

PURPOSE OF THE BA REPORT AND INVITATION TO COMMENT

WKN Windcurrent SA (Pty) Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Basic Assessment (BA) process for the Highveld Solar PV Facility, North West Province. The BA process is being undertaken in accordance with the requirements of the 2014 EIA Regulations promulgated in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA).

This BA Report consists of ten chapters, as follows:

- **Chapter 1** provides background to the Highveld Solar PV Facility and the basic assessment process.
- **Chapter 2** provides a project description of the Highveld Solar PV Facility.
- **Chapter 3** outlines strategic regulatory and legal context for energy planning in South Africa and specifically relating to the project.
- **Chapter 4** describes the need for, and alternatives considered for the Highveld Solar PV Facility.
- **Chapter 5** outlines the approach to undertaking the basic assessment process.
- **Chapter 6** describes the existing biophysical and social environment within and surrounding the study and development area.
- **Chapter 7** provides an assessment of the potential issues associated with the Solar PV facility and associated infrastructure.
- **Chapter 8** presents the assessment of cumulative impacts of the Solar PV Facility.
- **Chapter 9** presents the conclusions and recommendations based on the findings of the BA Report.
- **Chapter 10** provides references used in the compilation of the BA Report.

The Basic Assessment Report was made available for a 30-day review and comment period from 11 November 2022 to 12 December 2022 on the Savannah Environmental website (https://savannahsa.com/public-documents/energy-generation/). All comments received and recorded during the 30-day review and comment period have been included, considered, and addressed within this Final BA Report for consideration by the DFFE.

EXECUTIVE SUMMARY

The development of a solar photovoltaic (PV) facility and associated infrastructure with a generating capacity of up to 240MW is proposed by WKN Windcurrent SA (Pty) Ltd on a site located approximately 15km north east of the town of Stilfontein, in the North West Province (refer to **Figure 1**). The site is located in the JB Marks Local Municipality, which falls within jurisdiction of the Dr Kenneth Kaunda District Municipality. The entire extent of the site which falls within the solar PV development will be known as the Highveld Solar PV Facility.

From a regional perspective, the Stilfontein area is considered favourable for the development of a solar energy facility by virtue of prevailing climatic conditions, relief, aspect, the extent of the affected properties, the availability of a direct grid connection (i.e. a point of connection to the national grid) and the availability of land on which the development can take place. The complete extent of the study area, inclusive of the development area is located within the Klerksdorp Renewable Energy Development Zone (REDZ)[1] as well as the Central Corridor of the Strategic Transmission Corridors[2]. Furthermore, six (6) authorised solar PV facilities are located to the South and East of the development area for the Highveld Solar PV Facility.

The solar facility is proposed in response to identified objectives of the national and provincial government, and local and district municipalities to develop renewable energy facilities for power generation purposes. Highveld Solar PV Facility is planned to be bid into the Department of Mineral Resource and Energy's (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply with Highveld Solar PV Facility set to inject up to 240MW_{AC} into the national grid. The development will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP).

In order to connect the Highveld Solar PV Facility to the national grid, a grid connection (known as Highveld PV Grid Connection) will need to be implemented. The grid connection will include the development of 132kV switching substation/s and a 132k power line(s) within a 300m wide corridor to a point of connection on the Hermes DS - Potchefstroom DS 1 and Buffels East 1 - Potchefstroom 132kV Feeder lines located east of Khuma and the R502. This infrastructure will be assessed within a separate BA process.

A preferred project site[3] with an extent of ~1400ha has been identified by WKN Windcurrent SA (Pty) Ltd as a technically suitable area for the development of the Highveld Solar PV Facility. The project site consists of four (4) affected properties:

[1] The REDZ are zones identified by the Department of Forestry Fisheries and the Environment (DFFE) as geographical areas of strategic importance for the development of large-scale solar PV and wind energy development activities and which have been earmarked for the development of renewable energy facilities within South Africa as per GNR114 of February 2018 and GNR142 of February 2021.
[2] The Strategic Environmental Assessment for Electricity Grid Infrastructure (EGI) in South Africa has identified five Strategic Transmission Corridors that are of strategic importance for the rollout of the supporting large scale electricity transmission and distribution infrastructure in terms of Strategic Integrated Project 10: Electricity Transmission and Distribution. The Central Corridor is one of these five Strategic Transmission Corridors as per GNR113 of February 2018.
[3] The project site is that identified area within which the development area and development footprint are located. It is the broader geographic area assessed as part of the BA process, within which indirect and direct effects of the project may occur. The project site is ~1400ha in extent.

- Remainder of Portion 10 of Farm Rietfontein 388;
- Portion 76 of Farm Rietfontein 388;
- Portion 56 of Farm Rietfontein 388; and
- Remaining Extent of Farm Rietfontein 3.

Additional properties affected by the existing access road (which will be upgraded) includes Portion 62 of Farm Rietfontein 388 and the Remaining Extent of Farm Rietfontein 566.

The full extent of the project site has been considered within the BA process with the aim of determining the suitability from an environmental and social perspective and identifying areas that should be avoided in development planning. Within this identified project site, a development area and a development footprint have been defined for assessment. The project site is larger than the area required for the development footprint of a 240MW Solar Energy Facility and therefore provides the opportunity for the optimal placement of infrastructure, ensuring avoidance of major identified environmental sensitivities or constraints identified through this BA process.

A development area[4] for the placement of the solar facility infrastructure (i.e. development footprint[5]) has been identified within the project site and assessed as part of the BA process. The development area is ~1300ha in extent and the much smaller development footprint of ~433ha will be placed and sited within the development area. The infrastructure within the development footprint associated with the 240MW solar PV facility will include:

- Solar PV arrays, modules and mounting structures.
- Inverters and transformers.
- A Battery Energy Storage System (BESS)
- On-site facility substation
- Cabling between the project components
- Site and internal access roads up to 6m in width, where required
- Temporary and permanent laydown areas and O&M buildings and fencing around the development area.

[4] The development area is that identified area where the 240MW PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~1300ha in extent.

[5] The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for the Highveld Solar PV facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

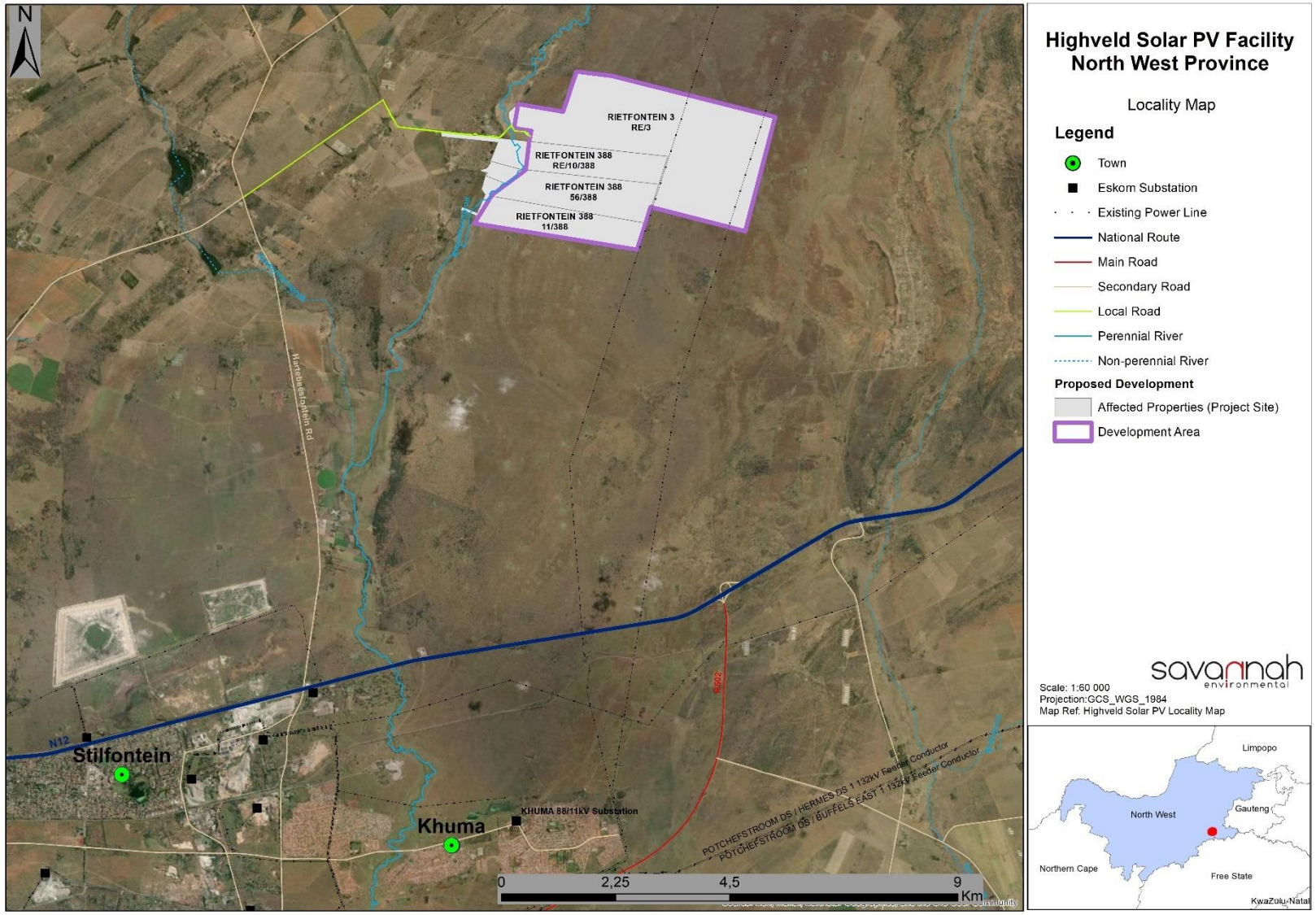


Figure 1: Locality map of the project site showing the location of the site in relation to the closest towns of the area (refer to **Appendix L** for A3 map)

2. Evaluation of the Highveld Solar PV Facility

The BA Report, together with the specialist studies contained within **Appendices D-I** provide a detailed assessment of the potential impacts that may result from the development of the Highveld Solar PV Facility.

No environmental fatal flaws were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of no-go features or buffers within the project development area by the development footprint and the undertaking of monitoring, as specified by the specialists.

The potential environmental impacts associated with the Highveld Solar PV Facility identified and assessed through the BA process include:

» Impacts on ecology, including flora, fauna and wetlands
» Impacts on avifauna
» Impacts to soils and agricultural potential
» Impacts on heritage resources, including archaeology and palaeontology
» Visual impacts on the area imposed by the components of the facility
» Social impacts.

The development footprint, as assessed in the BA Report is presented in **Figure 2**.

2.1. Impacts on Ecology (including flora, fauna and wetlands)

The Terrestrial Biodiversity and Wetlands Assessment (**Appendix D**) undertaken determined that there are no impacts associated with the Highveld Solar PV Facility and associated infrastructure (including access road upgrade) that cannot be mitigated to an acceptable level and as such, the assessed layout was considered acceptable. The findings indicate that the bulk of the project site is located within the Carletonville Dolomite Grassland vegetation type, which is listed as Least Threatened.

A majority of the development area for the project is located within an ESA1 (Corridor/Linkage). Ecological Support Areas (ESAs) are terrestrial and aquatic areas that are not essential for meeting biodiversity representation targets (thresholds), but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development. Due to the extent of this ESA1, and the availability of ample natural to near natural areas still available in the area, the development will not have a significant impact on this ESA, and its ability to function as an important corridor. CBA1 areas should be avoided as far as possible, and the proposed development footprint does achieve this.

The Terrestrial Fauna survey of the site was conducted by means of active searching and recording any tracks or signs of mammals and actual observations of mammals. From the survey the following actual observations were recorded:

» No reptile or amphibian species were recorded during the site assessment.
» Five (5) mammal species were observed that could naturally occur outside of protected areas. This species include *Canis mesomelas, Cryptomys hottentotus,Hystrix africaeaustralis, Pedetes capensis* and *Raphicerus campestris*.

.

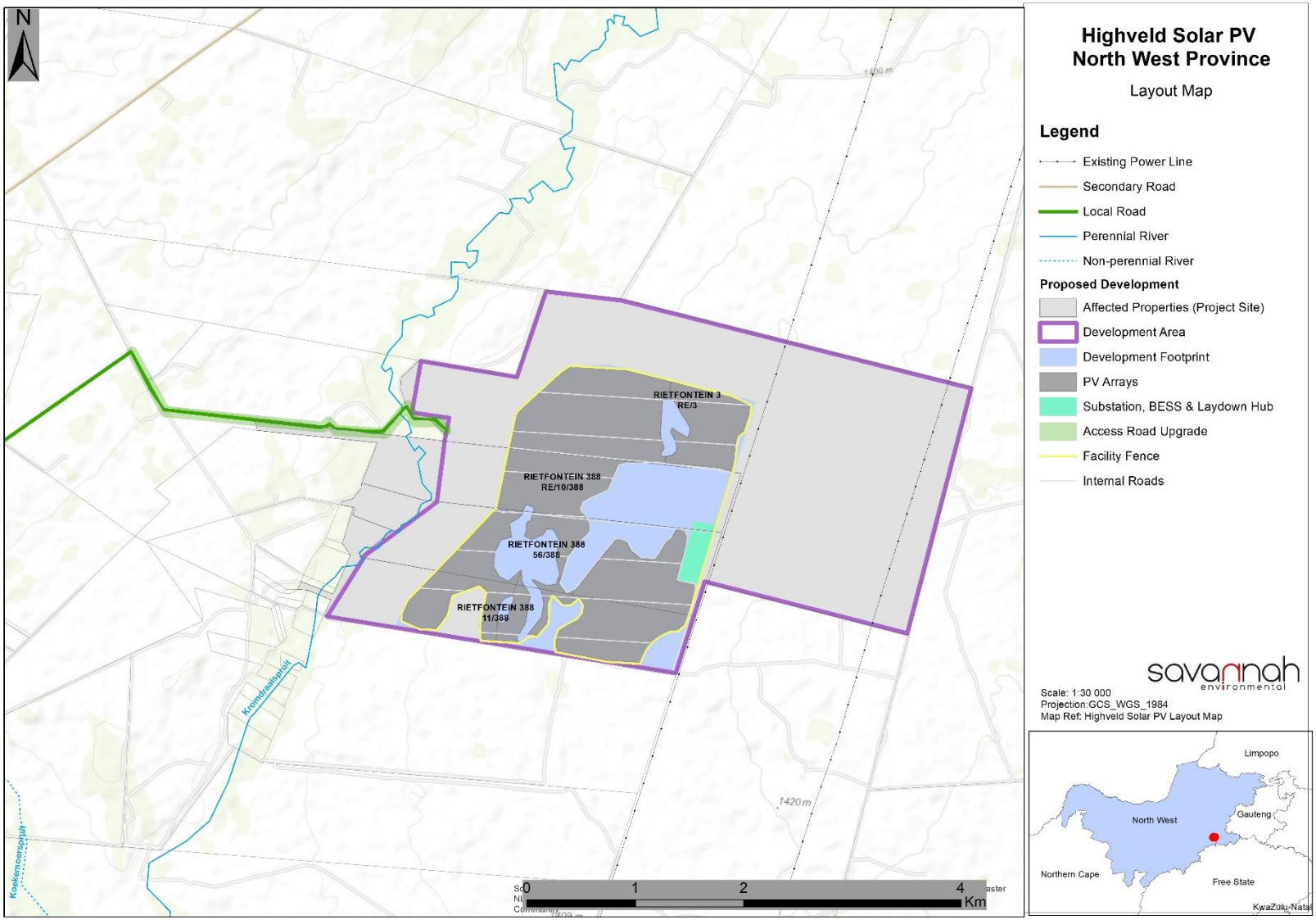


Figure 2: The entire extent of the development footprint (~522ha) and internal layout as assessed within this BA Report for the Highveld Solar PV Facility

An optimised facility layout (as indicated in Chapter 9 and Figure 9.1) achieves this mitigation, as required. Thus, according to this optimized layout, all of the highly sensitive areas will be avoided, and the Highveld Solar PV Facility will not significantly impact sensitive areas or impact conservation targets set out by the province.

Wetland and freshwater features include the Kromdraaispruit, an unclassified NFEPA river located on the western boundary of the project area. The wetland habitat, including the 500m buffer, has been completely excluded from the development footprint (avoidance in terms of the mitigation hierarchy).

Construction could result in the encroachment into water resources and result in the loss or degradation of these system, most of which are functional and provide ecological services. These disturbances could also result in the infestation and establishment of alien vegetation which would affect the functioning of the systems. Leaks and/or spillages could result in contamination of the receiving water resources. Contaminated water resources are likely to have an effect on the associated biota. An increase in stormwater runoff could result in physical changes to the receiving systems caused by erosion, run-off and also sedimentation, and the functional changes could result in changes to the vegetative structure of the systems.

Overall, there are no specific long-term impacts likely to be associated with the development of the Highveld Solar PV Facility that cannot be reduced to a low significance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

2.2. Impacts on Avifauna

The Avifauna Impact Assessment (**Appendix E**), which considered the results of two seasons of pre-construction bird monitoring, determined the significance of potential avifauna impact to be moderate to low after mitigation (depending on the type of impact). However, the risk for certain waterbirds (mainly large-bodied waterfowl such as the South African Shelduck *Tadorna cana*, Egyptian Goose *Alopochen aegyptiacus* and members of the *genus Anas*) colliding with the PV infrastructure remained eminent due to the presence of the nearby Kromdraaispruit.

The critically endangered White-backed Vulture (*Gyps africanus*) and endangered Cape Vulture (*G. coprotheres*) were observed as foraging individuals soaring overhead. In addition, a pair of vulnerable Lanner Falcons (*Falco biarmicus*) occurred within the study area. The nearby Kromdraaispruit floodplain west of development area provided potential suitable foraging habitat for the regionally endangered African Marsh Harrier (*Circus ranivorus*), although this species was not observed during the respective surveys. Although the African Marsh Harrier was not recorded on the study area during the survey period, it was recommended that all potential habitats be conserved (as a precautionary principle) by applying a 500m buffer to the edge of the Kromdraaispruit floodplain.

No fatal-flaws were identified during the assessment, although it was strongly recommended that the proposed mitigation measures and monitoring protocols (e.g. post construction monitoring) be implemented during the construction and operational phase of the project.

2.3. Impacts on Soil and Agricultural Potential

The soil forms present within the development footprint, are shallow to very shallow soils that range in depth between 0.05 and 0.45m. Rock outcrops are present on the surface in several areas within the proposed development footprint. The area has not historically been used for crop production and also not recently, as confirmed by the field crop boundary data of DALRRD (2019). No irrigation infrastructure is present within the project area and irrigated agricultural is currently not practiced in the area. Considering the soil properties, land capability and agricultural potential of the development area, the entire area has Low Agricultural Sensitivity.

It is anticipated that the construction and operation of the Highveld Solar PV Facility and associated infrastructure will have impacts that range from medium to low. Through the consistent implementation of the recommendation mitigation measures, most of impacts can all be reduced to low. It is therefore the specialist's opinion that the proposed development is considered favourably, permitting that the mitigation measures are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be affected. The project infrastructure should also remain within the proposed project area that will be fenced off.

2.4. Impacts on Heritage Resources (archaeology, palaeontology and cultural landscape)

None of the heritage resources identified fall within the PV layout area provided and as such, no direct impact to any heritage resources is anticipated. The heritage resources that were identified fall within close proximity to the layout provided and as such, it is important that impact to the significant sites is avoided. It is recommended that the sensitive heritage areas identified in this report are avoided by any proposed development of new infrastructure.

All the graves are highly significant, and a 100m buffer zone with a fence is recommended.

The geological structures suggest that the rocks are the correct age and type to preserve fossils. The site visit and walk through confirmed that there were, however, no fossils in the project footprint.

The heritage specialists have no objection to the proposed development of the Highveld Solar PV facility. A Conservation Management Plan is recommended to be drafted for the ongoing management and conservation of the identified burials and other heritage resources. The road proposed for upgrade falls within the recommended 100m no development buffer for site 117, however, no direct impact to the site is anticipated as long as the alignment of the existing road is followed and any widening of the road takes place to the south, away from the identified burial.

2.5. Visual Impacts

The anticipated visual impacts associated with the construction and operation phases of the Highveld Solar PV facility and associated infrastructure range from moderate to low significance as a result of the generally industrial and developed character of the landscape. There are a very limited number of potential sensitive visual receptors within a 3km radius of the proposed structures. These anticipated visual impacts on sensitive visual receptors, if and where present, in close proximity to the proposed facility (resident at Rietfontein East homesteads, and observers travelling along the along the secondary road to the west of the facility) are not considered to be fatal flaws.

In the specialist's opinion, considering all factors, it is recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures and management programme.

2.6. Socio-Economic Impacts

The social impacts identified (including all positive and negative impacts) will be either of a low or medium significance. No negative impacts with a high significance rating have been identified to be associated with the development of the Highveld Solar PV Facility and associated infrastructure. All negative social impacts are within acceptable limits with no impacts considered as unacceptable from a social perspective. The recommendations proposed for the project are appropriate and suitable for the mitigation of the negative impacts and the enhancement of the positive impacts. Highveld Solar PV Facility is supported at a national, provincial, and local level, and that the proposed project will contribute positively towards a number of targets and policy aims.

Based on the findings of the SIA the proposed establishment of the Highveld Solar PV is supported.

2.7 Assessment of 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 and within the surrounding areas of the development area. 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.

Based on the specialist cumulative assessment and findings (**Appendix D** to **Appendix I** and Chapter 8 of the BA), the development of the Highveld Solar PV facility, and its contribution to the overall impact of all existing and proposed solar energy facilities within a 30km radius, it can be concluded that cumulative impacts will be of a low to moderate significance, with impacts of a high significance mainly relating to impacts on habitat. There are however no impacts or risks identified to be considered as unacceptable with the development of Highveld Solar PV and other solar energy facilities within the surrounding area. In addition, no impacts which will result in whole-scale change are expected.

A summary of the cumulative impacts is included in **Table 1** below.

Table 1: Summary of the cumulative impact significance for the Highveld Solar PV Facility.

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Terrestrial Ecology	High	Medium
Wetlands	High	Low
Avifauna	Medium	Medium
Soils and Agricultural Potential	Low to Medium (depending on the impact being considered)	Low to Medium (depending on the impact being considered)

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Heritage (including archaeology, palaeontology and sense of place)	Negligible	Negligible
Visual	Medium	Medium
Socio-Economic	Low to Medium (depending on the impact being considered)	Low to Medium (depending on the impact being considered)

Based on the specialist cumulative assessment and findings, the development of the Highveld Solar PV Facility and its contribution to the overall impact of all renewable energy facilities to be developed within a 30km radius, it can be concluded that the Highveld Solar PV Facility cumulative impacts will be of a medium to low significance. It was concluded that the development of the Highveld Solar PV Facility will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment.

3. Environmental Costs of the Solar PV Facility versus Benefits of the Solar PV Facility

Environmental costs (including those to the natural environment, economic and social environment) can be anticipated at a local and site-specific level and are considered acceptable provided the mitigation measures as outlined in the Basic Assessment Report and the EMPr are implemented and adhered to. No fatal flaws have been identified.

These environmental costs could include:

» A loss of biodiversity, flora and fauna due to the clearing of land for the construction and utilisation of land for the PV facility. The cost of loss of biodiversity has been minimised/avoided through the implementation of recommendations provided by the specialist. All wetland features are avoided. All CBA1 areas are avoided. The resulting impact is considered to be acceptable.
» Impacts on birds. The development will result in a loss of habitat. The impact is however considered to be acceptable without any impact of high significance.
» Heritage impacts associated with the PV facility and upgrade to the access road may occur. The heritage resources are outside of the facility development footprint and have a 100m no-go buffer which is required to be adhered to. Mitigation measures that have been recommended will reduce the anticipated impacts.
» Loss of land for agriculture. The development will remove areas available for agricultural activities. However, based on the low sensitivity of the soils within the development footprint of the PV Facility, this will not be significant.
» Visual impacts associated with the PV facility. It is envisaged that the structures where visible from shorter distances, and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence. General mitigations have been recommended to minimise the impact.
» Impacts on the social environment. Socio-economic impacts include impacts on the sense of place and property and business values that could occur during both construction and operation, the effect on social and economic infrastructure, and crime and social conflicts in the area that could be created during only the construction phase. These impacts though will only affect local communities either temporarily or over the long term. These impacts are not highly significant and can be traded off for the net positive impact created by the project in terms of production, employment, government revenue, community benefits and households' earnings.

Benefits of the Highveld Solar PV Facility include the following:

» The project will result in important economic benefits at the local and regional scale through job creation, income and other associated downstream economic development. These will persist during the preconstruction, construction, operation and decommissioning phases of the project.
» The project provides an opportunity for a new land use on the affected properties which is considered as a more efficient use of the land and provides an opportunity for financial benefits to the current land use.
» The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective IDPs.
» The project serves to diversify the economy and electricity generation mix of South Africa through the addition of solar energy.
» The water requirement for a solar facility is negligible compared to the levels of water used by coal-based technologies. This generation technology is therefore supported in dry climatic areas.
» South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to the reliance on fossil fuels. The Highveld Solar PV Facility will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.

The benefits of the Highveld Solar PV Facility are expected to occur at a national, regional, and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility.

4. Overall Conclusion (Impact Statement)

The preferred activity was determined by the developer to be the development of a renewable energy facility on site using solar irradiation as the preferred technology, due to the availability of a suitable solar resource. Independent specialists appointed to undertake the assessment of potential impacts associated with the project assessed a larger area in order to inform the best location for the solar facility infrastructure. The Specialists considered desktop data, results from field work, existing literature and the National Web-based Environmental Screening Tool to inform the identification of sensitivities. A proposed layout was designed after provision of sensitivity data by the specialists with the aim of avoiding the identified sensitive areas.

Based on the specialist investigations of the larger area, a technically viable development footprint was proposed by the developer and assessed as part of the BA process. The findings of the assessment of the development footprint undertaken by independent specialists have informed the results of this report. The specialist findings have indicated that there are no identified fatal flaws associated with the implementation of the project within the project site.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen from a policy perspective at a local, provincial and National level. The project development area is located outside of any protected area, outside of any Critical Biodiversity Areas (CBAs) as defined in the Provincial Conservation Plan, and away from any freshwater resource features. When considering biodiversity and socio-economic benefits and impacts on the affected and surrounding areas, the following is concluded from the specialist studies undertaken within this BA process.

From a biodiversity perspective, the site is not located within a protected area. The site is located within an extensive ESA. However, overall, there are no specific long-term impacts likely to be associated with the development of the Highveld Solar PV Facility that cannot be reduced to a moderate or low significance. There are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Identified avifauna sensitivities were identified and avoided by the development footprint, and the layout proposed ensures that all heritage sensitivities identified are avoided and recommended buffer areas are honoured. This approach is in line with the application of the mitigation hierarchy, where all the sensitive areas which could be impacted by the development have been avoided (i.e. tier 1 of the mitigation hierarchy). Where impacts could not be avoided, appropriate mitigation has been proposed to minimise impacts. It follows therefore that the project does not adversely impact on the ecological integrity of the area.

The Social Impact Assessment has identified short-term (construction related) impact indicators and operational related socio-economic impact indicators. The assessment of the proposed facility, and its net effect from a socio-economic perspective, indicates that the project would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of its establishment.

As detailed in the cost-benefit analysis, the benefits of the Highveld Solar PV Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility. From an economic perspective, both positive and negative impacts are expected.

Based on the conclusions of the specialist studies undertaken, it can be concluded that the development of the Highveld Solar PV Facility based on the current layout as provided by the Applicant will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures).

5. Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the optimised development footprint proposed by the developer within the development site, the avoidance of the sensitive environmental features within the project development area, as well as the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the Highveld Solar PV Facility is acceptable within the landscape and can reasonably be authorised subject to implementation of the optimised facility layout and the mitigation and enhancement measures recommended by the specialists. The optimised facility layout as provided by the Applicant (**Figure 2**) is considered to be appropriate from an environmental perspective, with micro-siting of panels and roads required to ensure that the layout avoids all identified sensitivities and recommended buffer areas.

The following infrastructure would be included within an authorisation issued for the project:

240MW Solar PV facility: Highveld Solar PV Facility located within Portions 79 and 56 and the Remainder of Portion 10 of Farm Rietfontein 388; and Remainder of Farm Rietfontein 3, including:

- Solar PV arrays, modules and mounting structures.
- Inverters and transformers.
- A Battery Energy Storage System (BESS)
- On-site facility substation
- Cabling between the project components
- Site and internal access roads up to 6m in width, where required
- Temporary and permanent laydown areas and O&M buildings and fencing around the development area.

The following key conditions would be required to be included within an authorisation issued for the Highveld Solar PV Facility:

- All mitigation measures detailed within this BA report, as well as the specialist reports contained within **Appendices D to I** are to be implemented.
- The EMPr as contained within **Appendix J** of this BA report should form part of the contract with the Contractors appointed to construct and maintain the solar facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the Highveld Solar PV Facility is considered key in achieving the appropriate environmental management standards as detailed for this project.
- Exclude all areas of Very High Ecological Sensitivity (the Red listed plant community) from the development footprint.
- Following the final design of the Highveld Solar PV Facility, a revised layout must be submitted to DFFE for review and approval prior to commencing with construction. No development is permitted within the identified no-go areas as detailed in **Figure 3**
- A pre-construction walk-through of the final layout, including roads and underground cables, should be undertaken before construction commences and adjusted where required to reduce impacts on species of conservation concern and habitats of concern.
- Before construction commences individuals of listed species within the development footprint that would be affected, must be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey. Permits from the relevant national and provincial authorities, must be obtained before the individuals are disturbed.
- A detailed site-specific eradication and management programme for alien invasive plants must be developed and implemented.
- Implement a Conservation Management Plan for the ongoing management and conservation of the identified burials and other heritage resources.
- Implement a chance finds procedure for the rescuing of any fossils or heritage resources discovered during construction.
- If any archaeological material or human burials are uncovered during construction activities, work in the immediate area should be halted, the find reported to the heritage authorities and inspected by an archaeologist. Such heritage is the property of the State and may require excavation and curation in an approved institution.
- Maintain vegetation cover (i.e. either natural or cultivated) immediately adjacent to the actual development footprint, both during construction and operation of the proposed facility.
- Monitor all rehabilitated areas for one year following decommissioning and implement remedial actions as and when required.

A validity period of 10 years of the Environmental Authorisation is requested, should the project obtain approval from DFFE.

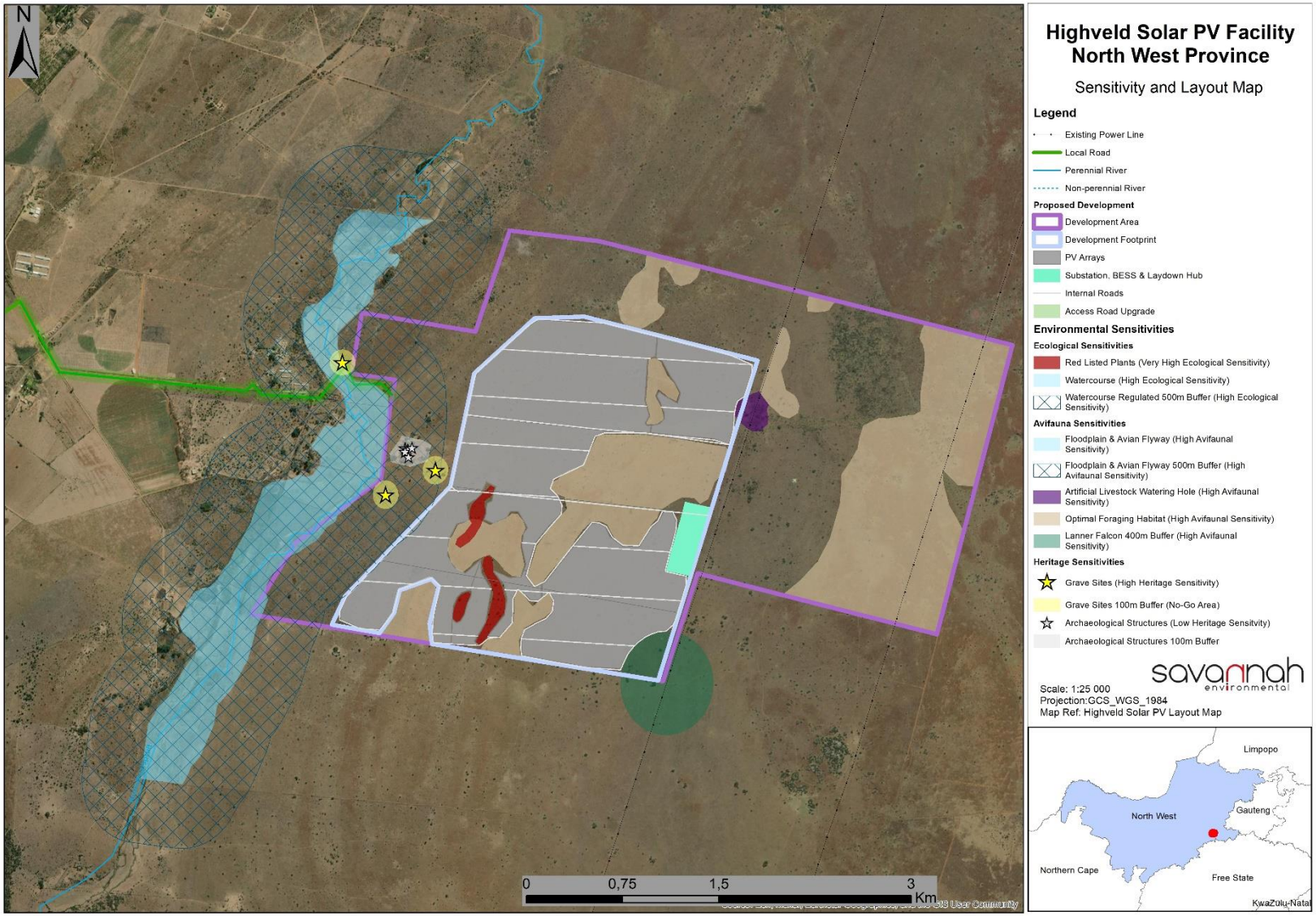


Figure 3: Environmental sensitivity map from the results of the Basic Assessment for the Highveld Solar Facility

DEFINITIONS AND TERMINOLOGY[6]

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.

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Commercial Operation date: The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

Commissioning: Commissioning commences once construction is completed.

Construction: Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

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

Decommissioning: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

Development area: The development area is that identified area (located within the project site) where the Highveld Solar PV Facility is planned to be located. The development area is still to be determined.

Development footprint: The development footprint is the defined area (located within the development area) where the PV array and other associated infrastructure for the Highveld Solar PV Facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

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.

[6] Where relevant, definitions are aligned with those definitions as per the EIA Regulations (2014, as amended).

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

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

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.

Emergency: An undesired/ unplanned event that results in a significant environmental impact and requires the notification of the relevant statutory body, such as a local authority.

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

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

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

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 because 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 because 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 public.

Method statement: A written submission to the ECO and the site manager (or engineer) by the EPC Contractor in collaboration with his/her EO.

Mitigation hierarchy: The mitigation hierarchy is a framework for managing risks and potential impacts related to biodiversity and ecosystem services. The mitigation hierarchy is used when planning and implementing development projects, to provide a logical and effective approach to protecting and conserving biodiversity and maintaining important ecosystem services. It is a tool to aid in the sustainable management of living, natural resources, which provides a mechanism for making explicit decisions that balance conservation needs with development priorities

No-go areas: Areas of environmental sensitivity that should not be impacted on or utilised during the development of a project as identified in any environmental reports.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

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

Pre-construction: The period prior to the commencement of construction, this may include activities which do not require Environmental Authorisation (e.g., geotechnical surveys).

Project site: The project site is the area with an extent of 1400ha, within which the Highveld Solar PV Facility development footprint will be located.

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.

TABLE OF CONTENTS

APPENDICES LIST

Appendix A: EIA Project Consulting Team CVs
Appendix B: Authority Correspondence
Appendix C: Public Participation Process
Appendix C1: I&AP Database
Appendix C2: Site Notices and Newspaper Advertisements
Appendix C3: Background Information Document
Appendix C4: Organs of State Correspondence
Appendix C5: Stakeholder Correspondence
Appendix C6: Minutes of Meetings
Appendix C7: Comments Received
Appendix C8: Comments and Responses Report
Appendix D: Terrestrial Ecology Impact Assessment
Appendix E: Avifauna Impact Assessment
Appendix F: Soils and Agricultural Impact Assessment
Appendix G: Heritage Impact Assessment
Appendix H: Visual Impact Assessment
Appendix I: Socio-Economic Impact Assessment
Appendix J: Environmental Management Programmes
Appendix K: DFFE Screening Report
Appendix L: Maps (A3)
Appendix M: EAP Declaration of Independence and Affirmation
Appendix N: Specialist Declarations
Appendix O: Site Verification Report

CHAPTER 1: INTRODUCTION

The development of a solar photovoltaic (PV) facility and associated infrastructure with a generating capacity of up to 240MW is proposed by WKN Windcurrent SA (Pty) Ltd on a site located approximately 15km north east of the town of Stilfontein, in the North West Province (**Figure 1.1**). The site is located in the JB Marks Local Municipality, which falls within jurisdiction of the Dr Kenneth Kaunda District Municipality. The entire extent of the site falls within the solar PV development will be known as the Highveld Solar PV Facility.

A development area[7] of approximately 1300ha has been identified within the study area by the Applicant. Within this identified development area, a development footprint[8] or facility layout has been defined. This development footprint/facility layout of approximately ~433ha has been fully considered within this Basic Assessment (BA) process and assessed in terms of its suitability from an environmental and social perspective. The development area is larger than the area needed for the construction of a 240MW PV facility and provided the opportunity for the optimal placement of the infrastructure, ensuring avoidance of major identified environmental sensitivities by the development footprint.

From a regional perspective, the Stilfontein area is considered favourable for the development of a solar energy facility by virtue of prevailing climatic conditions, relief, aspect, the extent of the affected properties, the availability of a direct grid connection (i.e. a point of connection to the national grid) and the availability of land on which the development can take place. The complete extent of the study area, inclusive of the development area is located within the Klerksdorp Renewable Energy Development Zone (REDZ)[9] as well as the Central Corridor of the Strategic Transmission Corridors[10]. Furthermore, six (6) authorised solar PV facilities are located to the South and East of the development area for the Highveld Solar PV Facility.

The solar facility is proposed in response to identified objectives of the national and provincial government, and local and district municipalities to develop renewable energy facilities for power generation purposes. Highveld Solar PV Facility is planned to be bid into the Department of Mineral Resource and Energy's (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply with Highveld Solar PV Facility set to inject up to 240MW_{AC} into the national grid. The development will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP).

In order to connect the Highveld Solar PV Facility to the national grid, a grid connection (known as Highveld PV Grid Connection) will need to be implemented. The grid connection will include the development of

[7] The development area is that identified area where the 240MW PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~1300ha in extent.
[8] The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for the Highveld Solar PV facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.
[9] The REDZ are zones identified by the Department of Forestry Fisheries and the Environment (DFFE) as geographical areas of strategic importance for the development of large-scale solar PV and wind energy development activities and which have been earmarked for the development of renewable energy facilities within South Africa as per GNR114 of February 2018 and GNR142 of February 2021.
[10] The Strategic Environmental Assessment for Electricity Grid Infrastructure (EGI) in South Africa has identified five Strategic Transmission Corridors that are of strategic importance for the rollout of the supporting large scale electricity transmission and distribution infrastructure in terms of Strategic Integrated Project 10: Electricity Transmission and Distribution. The Central Corridor is one of these five Strategic Transmission Corridors as per GNR113 of February 2018.

132kV switching substation/s and a 132k power line(s) within a 300m wide corridor to a point of connection on the Hermes DS - Potchefstroom DS 1 and Buffels East 1 - Potchefstroom 132kV Feeder lines located east of Khuma and the R502. This infrastructure will be assessed within a separate BA process.

1.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of a Basic Assessment Report

The National Environmental Management Act (NEMA, Act No. 107 of 1998) 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 the NEMA with the granting of the relevant environmental authorisation being applied for through this BA process.

The development (i.e. construction and operation) of Highveld Solar PV Facility is subject to the requirements of the EIA Regulations of 2014 (as amended), published in terms of Section 24(5) of NEMA. Therefore, in terms of the EIA Regulations of 2014, promulgated under Section 24 and 24D of NEMA, various aspects of the project are listed as activities that may have a detrimental impact on the environment. The primary listed activity triggered is Activity 1 of Listing Notice 2 (GN R325) which relates to the development of facilities or infrastructure for the generation of electricity from a renewable resource where the generating capacity is 20MW or more. Highveld Solar PV Facility will have a contracted capacity of up to 240MW$_{AC}$.

As the project has the potential to impact on the environment, an Environmental Impact Assessment process is required to be completed in support of an application for Environmental Authorisation prior to the commencement of construction of the project. As the project falls within the designated Klerksdorp REDZ[11], a Basic Assessment (BA) process is applicable as per GNR114 of February 2018.

This BA Report has been prepared in accordance with the requirements of the EIA Regulations published on 08 December 2014 (as amended) promulgated in terms of Chapter 5 of the National Environmental Management Act (Act No 107 of 1998). This chapter of the BA Report includes the following information required in terms of Appendix 1: Content of Basic Assessment reports:

Requirement	Relevant Section
3(a) the details of the (i) EAP who prepared the report and (ii) the expertise of the EAP, including a curriculum vitae.	The details of the EAP who prepared the report and the expertise of the EAP are included in section 1.3. The curriculum vitae of the EAP and project team is included in **Appendix A**.
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 Highveld Solar PV Facility is included in section 1.2, **Table 1.1** and **Figure 1.1**. The information provided includes the 21-digit Surveyor General code of the affected property and the farm name. 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.

[11] Based on the location of the study area within the Klerksdorp REDZ, the project is subject to a BA process and not a full Scoping and Environmental Impact Reporting (SEIR) process. A shortened timeframe of 57 days for the processing of an application for environmental authorisation will also be applicable.

The BA Report is structured according to the following chapters:

- **Chapter 1** provides background to the Highveld Solar PV Facility and the basic assessment process.
- **Chapter 2** provides a project description of the Highveld Solar PV Facility.
- **Chapter 3** outlines strategic regulatory and legal context for energy planning in South Africa and specifically relating to the project.
- **Chapter 4** describes the need for, and alternatives considered for the Highveld Solar PV Facility.
- **Chapter 5** outlines the approach to undertaking the basic assessment process.
- **Chapter 6** describes the existing biophysical and social environment within and surrounding the study and development area.
- **Chapter 7** provides an assessment of the potential issues associated with the Solar PV facility and associated infrastructure.
- **Chapter 8** presents the assessment of cumulative impacts of the Solar PV Facility.
- **Chapter 9** presents the conclusions and recommendations based on the findings of the BA Report.
- **Chapter 10** provides references used in the compilation of the BA Report.

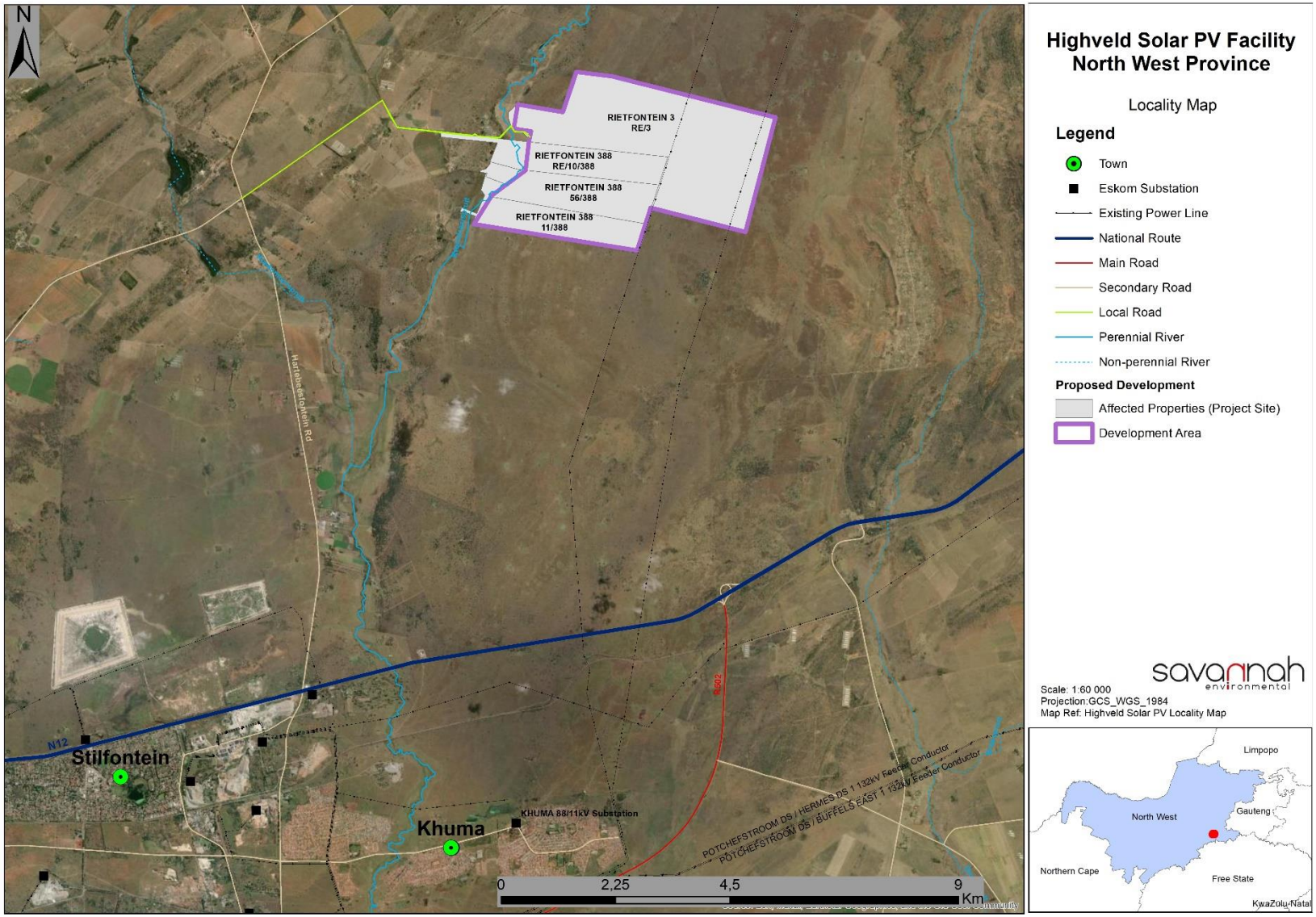


Figure 1.1: Locality map of the project site showing the location of the site in relation to the closest towns of the area. (refer to **Appendix L** for A3 map)

1.2 Project Overview

A preferred project site[12] with an extent of ~1400ha has been identified by WKN Windcurrent SA (Pty) Ltd as a technically suitable area for the development of the Highveld Solar PV Facility. The project site consists of four (4) affected properties:

- Remainder of Portion 10 of Farm Rietfontein 388;
- Portion 76 of Farm Rietfontein 388;
- Portion 56 of Farm Rietfontein 388; and
- Remaining Extent of Farm Rietfontein 3.

Additional properties affected by the existing access road (which will be upgraded) includes Portion 62 of Farm Rietfontein 388 and the Remaining Extent of Farm Rietfontein 566.

A development area[13] for the placement of the solar facility infrastructure (i.e. development footprint[14]) has been identified within the project site and assessed as part of the BA process. The development area is ~1300ha in extent and the much smaller development footprint of ~433ha will be placed and sited within the development area. The infrastructure within the development footprint associated with the 240MW solar PV facility will include:

- Solar PV arrays, modules and mounting structures.
- Inverters and transformers.
- A Battery Energy Storage System (BESS)
- On-site facility substation
- Cabling between the project components
- Site and internal access roads up to 6m in width, where required
- Temporary and permanent laydown areas and O&M buildings and fencing around the development area.

The key infrastructure components that form part of the facility are described in greater detail in Chapter 2 of this BA Report.

WKN Windcurrent SA (Pty) Ltd has confirmed that the project site is particularly suitable for solar energy development from a technical perspective due to the solar resources, access to the electricity grid, compatibility with the current land use and land availability.

The details of the location of the development footprint considered for the development of the project are included in **Table 1.1** below.

[12] The project site is that identified area within which the development area and development footprint are located. It is the broader geographic area assessed as part of the BA process, within which indirect and direct effects of the project may occur. The project site is ~1400ha in extent.

[13] The development area is that identified area where the 240MW PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~1300ha in extent.

[14] The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for the Highveld Solar PV facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

Table 1.1: Detailed description of the Highveld Solar PV Facility project site

Component	Description / Dimensions		
District Municipality	Dr Kenneth Kaunda District Municipality		
Local Municipality	JB Marks Local Municipality		
Ward Number (s)	Ward 27		
Nearest town(s)	Stilfontein (15km south west)		
Farm name(s) and number(s) of properties affected by the PV Facility	Properties affected by the PV facility: » Remainder of Portion 10 of Farm Rietfontein 388 (T0IP00000000038800010) » Portion 79 of Farm Rietfontein 388 (T0IP00000000038800079) » Portion 56 of Farm Rietfontein 388 (T0IP00000000038800056) » Remaining Extent of Farm Rietfontein 3 (T0IP00000000000300000) Additional properties affected by the upgrade of the existing road: » Portion 62 of Farm Rietfontein 388 (T0IP00000000038800062) » Remaining Extent of Farm Rietfontein 566 (T0IP00000000056600000)		
Portion number(s) of properties affected by the Solar Facility			
SG 21 Digit Code (s)			
Current zoning	Agriculture		
Current land use	Grazing (mainly cattle)		
Site Extent (Study Area)	~1400ha		
PV Development Area	~1300ha		
PV Development Footprint (Including environmentally constrained areas[15])	~552ha		
PV Development Footprint (Excluding environmentally constrained areas)[16]	~433ha		
Site Coordinates (project site)		**Latitude:**	**Longitude:**
	Northern point	26°42'49.18"S	26°51'39.58"E
	Eastern point	26°43'10.13"S	26°54'2.10"E
	Southern point	26°44'38.63"S	26°52'29.96"E
	Western point	26°44'28.44"S	26°50'34.37"E
	Centre point	26°43'45.10"S	26°52'26.31"E
Existing access road (to be upgraded)		**Latitude:**	**Longitude:**
	Starting point	26°43'13.60"S	26°49'23.66"E
	Centre point	26°43'31.68"S	26°50'12.83"E
	End point	26°43'31.18"S	26°51'9.53"E
Low-level crossing (bridge)		**Latitude:**	**Longitude:**

[15] These areas were identified during the screening phase as high sensitivity, and it was recommended by the specialist that these areas should be avoided by the development footprint.
[16] This is the development footprint that was assessed by the independent specialists.

	Centre point	26°43'24.85"S	26°50'55.64"E

The overarching objective for the planning process 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. These aspects must now be considered within site-specific specialist studies and assessments through the BA process in order to delineate areas of sensitivity within the surrounding area, project site and development area and ultimately inform the placement of the solar facility and associated infrastructure within the areas considered suitable for development.

1.3 Details of the Environmental Assessment Practitioner and Expertise to conduct the BA process

In accordance with Regulation 12 of the 2014 EIA Regulations (GNR 326), WKN Windcurrent SA (Pty) Ltd has appointed Savannah Environmental (Pty) Ltd as the independent environmental assessment consultant to undertake the Basic Assessment and prepare the BA Report for the Highveld Solar PV Facility. Neither Savannah Environmental nor any of its specialists are subsidiaries of, or are affiliated to WKN Windcurrent SA (Pty) Ltd. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

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

The Savannah Environmental team have considerable experience in basic 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. Strong competencies have been developed in project management of environmental processes, as well as strategic environmental assessment and compliance advice, and the assessment of environmental impacts, the identification of environmental management solutions and mitigation/risk minimising measures.

The Savannah Environmental team includes:

- **Chantelle Geyer** is the junior EAP on this project and the GIS Practitioner, she holds a BSc degree in Environmental Science, and a BSc Honours degree in Environmental Geology degree from the North-West University in Potchefstroom, South Africa. She is an Environmental Consultant and specialises in basic assessments, environmental impact assessments, GIS-mapping, public participation administration, and environmental management programmes.
- **Karen Jodas** is a Director at Savannah Environmental (Pty) Ltd and the project manager for the Highveld PV and Grid Connection projects, she holds a Master of Science Degree and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP) and a registered EAP with EAPASA. She has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation and transmission projects through her involvement in related EIA processes over the past 25 years. She has successfully managed and undertaken EIA processes for infrastructure development projects throughout South Africa. Responsibilities for environmental studies include project management (including client and authority liaison and management of specialist teams); review and manipulation of data; identification and assessment of

potential negative environmental impacts and benefits; review of specialist studies; and the identification of mitigation measures.

» **Nicolene Venter,** is a Board Member of IAPSA (International Association for Public Participation South Africa). She holds a Higher Secretarial Diploma and has over 21 years of experience in public participation, stakeholder engagement, awareness creation processes and facilitation of various meetings (focus group, public meetings, workshops, etc.). She is responsible for project management of public participation processes for a wide range of environmental projects across South Africa and neighbouring countries.

In order to adequately identify and assess potential impacts associated with the project, a number of specialists have been appointed as part of the project team and have provided specialist input into this BA Report (refer to **Table 1.2**).

Table 1.2: Independent Specialists that contribute to the BA Report

Company	Specialist Area of Expertise	Specialist Name
The Biodiversity Company	Terrestrial and Wetland Ecology	Daniel Meintjes Andrew Husted
Pachnoda Consulting CC	Avifauna	Lukas Niemand
Terra Africa Environmental Consultants	Soils and Agricultural Potential	Marinè Pienaar
CTS Heritage	Heritage and Palaeontology	Jenna Lavin
LoGIS	Visual	Lourens du Plessis
Eco-Thunder Consulting (Pty) Ltd	Social Environment	Brogan Geldenhuys

Curricula Vitae (CVs) detailing Savannah Environmental team's expertise and relevant experience are included in **Appendix A** of the BA Report.

CHAPTER 2: PROJECT DESCRIPTION

This chapter provides an overview of the Highveld Solar PV Facility and details the project scope, which includes the planning/design, construction, operation, and decommissioning activities required for the development.

2.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of a Basic Assessment Report

This chapter of the BA Report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 1: Content of Basic Assessment Reports:

Requirement	Relevant Section
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 coordinates of the boundary of the property or properties.	The location of the proposed project is detailed in Chapter 1, **Table 1.1**, as well as section 2.2.1 below.
3(c)(i)(ii) 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; or on land where the property has not been defined, the coordinates within which the activity is to be undertaken	A layout map illustrating the development footprint of the Highveld Solar PV Facility, including associated infrastructure is included as **Figure 2.3**. This development footprint has been assessed within this BA Report and the independent specialist studies.
3(d)(ii) a description of the scope of the proposed activity, including a description of the activities to be undertaken including associated structures and infrastructure	A description of the activities to be undertaken with the development of project is included in **Table 2.1** and **Table 2.2**.

2.2 Nature and extent of the Highveld Solar PV Facility

From a technical perspective, the Stilfontein area is considered favourable for the development of commercial solar energy facilities by virtue of the prevailing climatic conditions, relief and aspect, the extent of the project site and development area, the availability of a direct grid connection (i.e. point of connection to the national Eskom grid), and the availability of land on which development can take place.

The Highveld Solar PV facility will comprise the installation and operation of solar PV technology with a total contracted capacity of up to 240MW. The project will make use of bifacial tracking PV technology. The solar panels which, once installed, will reach a height of up to 5.5m above ground level. The solar panels will be connected to centralised inverter power stations or utilize string inverters mounted above ground.

2.2.1 Overview of the Project Site and Development Area

The project site is located within the JB Marks Local Municipality and the Dr Kenneth Kaunda District Municipality, with the entire extent of the site located within the Klerksdorp REDZ and the Central Corridor of the Strategic Transmission Corridors. The preferred PV project site (with an extent of ~1400ha) consists of four (4) affected properties as follows:

- Remainder of Portion 10 of Farm Rietfontein 388;
- Portion 79 of Farm Rietfontein 388;
- Portion 56 of Farm Rietfontein 388; and
- Remaining Extent of Farm Rietfontein 3.

Additional properties affected by the upgrade of the existing road:
- Portion 62 of Farm Rietfontein 388 (T0IP00000000038800062)
- Remaining Extent of Farm Rietfontein 566 (T0IP00000000056600000)

The development area is ~1300ha in extent. The development footprint (~433ha) of Highveld Solar PV facility is sited within the development area and has a much smaller extent (i.e. ~35% of the development area). The development footprint will house the PV Panels and other associated infrastructure. Only the upgrade to the existing site access road will be constructed outside the development footprint.

The development area is located to the north of the N12. Access to the project site is via national and secondary roads, as well as local roads (**Figure 2.1**): via the N12, located to the south of the development area; the Hartebeesfontein Road; and Rietfontein Road which are located to the west of the development area. The existing access road turning off from the Rietfontein Road towards the PV facility will be upgraded for safe access to the facility during the construction and operation phases. The upgrades will include widening to 6m and reinforcement of the low-level crossing. This route will be utilised for accessing the project site area and development footprint.

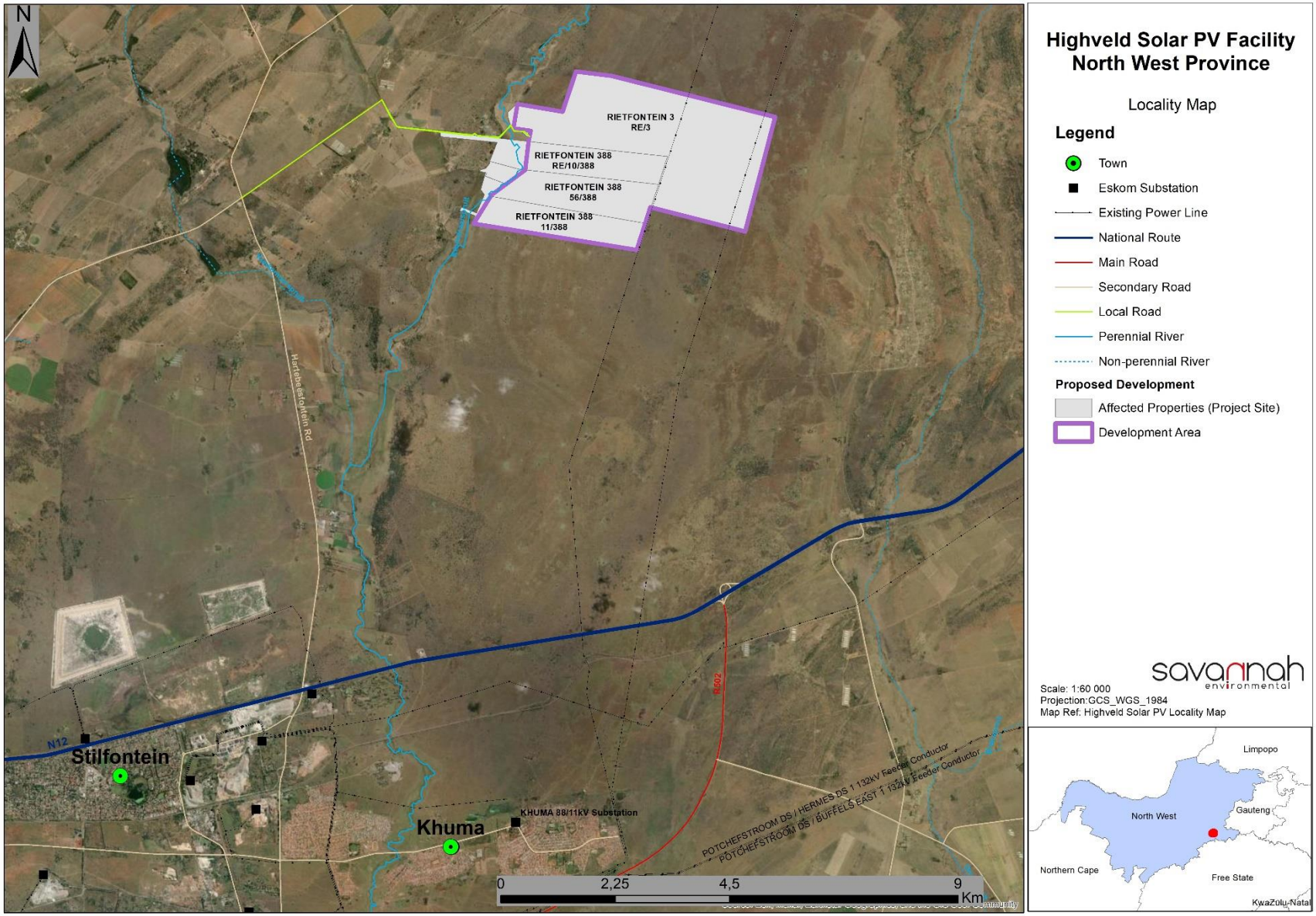


Figure 2.1: Location of the N12 national road in relation to the Highveld Solar PV Facility project site.

Prior to the initiation of the BA process, the project site was subject to a screening and fatal flaw assessment, which included field surveys by specialist consultants. The assessment was undertaken to identify potential environmental constraints and sensitivities within the project site. This was then used to inform the location of the development area, while ensuring that potential negative environmental impacts were minimised as far as possible. The development area was then subject to more detailed specialist studies to assess and determine the location of the Highveld Solar PV Facility development footprint, which will include the PV panels, an on-site facility substation, inverters, buildings and access roads (**Figure 2.2).**

2.2.2 Components of the Highveld Solar PV Facility

The project site is proposed to accommodate both the PV facility as well as most of the associated infrastructure which is required for such a facility (with portions of the power line route located on properties outside of the project site), and will include:

- Solar PV arrays, modules and mounting structures.
- Inverters and transformers.
- A Battery Energy Storage System (BESS)
- On-site facility substation
- Cabling between the project components
- Site and internal access roads up to 6m in width, where required
- Temporary and permanent laydown areas and O&M buildings and fencing around the development area.

In order to connect the Highveld Solar PV Facility to the national grid, a grid connection (known as Highveld Grid Connection) will need to be developed and implemented, which will be assessed within a separate BA process. The grid connection will include the development of specific infrastructure components which include a switching substation and a 132kV power line. The power line will connect the switching substation, located on either the Highveld Solar PV Facility or at the point of connection, and a point of connection on the Hermes DS - Potchefstroom DS 1 and Buffels East 1 - Potchefstroom 132kV Feeder lines located east of Khuma and the R502.

A summary of the details and dimensions of the planned infrastructure associated with the project is provided in **Table 2.1.** The details and dimensions of the facility development footprint were assessed as part of the independent specialist studies undertaken as part of the Basic Assessment process. **Figure 2.2** illustrates the development footprint of the Highveld Solar PV Facility assessed as part of this BA report.

Table 2.1: Details the Highveld Solar PV Facility and associated infrastructure

Component	Description / Dimensions
Contracted capacity of the facility	Up to 240MW
Total extent of the Affected Properties, also referred to as the project site[17]	~1400ha
Total extent of the Development area[18]	Up to ~1300ha
Total extent of the Development footprint[19] (Including environmentally constrained areas[20])	Up to ~552ha
Total extent of the Development footprint(Excluding environmentally constrained areas)[21]	Up to ~433ha
PV panels	» Height: up to 5.5m from ground level (installed)
On-site Facility Substation	» Located within the development footprint. » Approximately 1ha in extent.
Access gravel roads and internal roads	» Existing roads will be used, wherever possible, to access the project site and development area. » Access to the PV development area is provided via: the N12, located to the south of the development area; the Hartebeesfontein Road; and Rietfontein Road which are located to the west of the development area. » The existing access road turning off from the Rietfontein Road towards the PV facility will be upgraded for safe access to the facility during the construction and operation phases. The upgrades will include widening to 6m and reinforcement of the low level crossing. » Internal roads up to 6m in width will be required to access the PV panels and on-site substation.

[17] The project site is that identified area within which the development area and development footprint are located. It is the broader geographic area assessed as part of the BA process, within which indirect and direct effects of the project may occur. The project site is ~1400ha in extent.

[18] The development area is that identified area where the 240MW PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~1300ha in extent.

[19] The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for the Highveld Solar PV facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

[20] These areas were identified during the screening phase as highly sensitive and it was recommended by the specialist that these areas should be avoided by the development footprint.

[21] This is the development footprint that was assessed by the independent specialists.

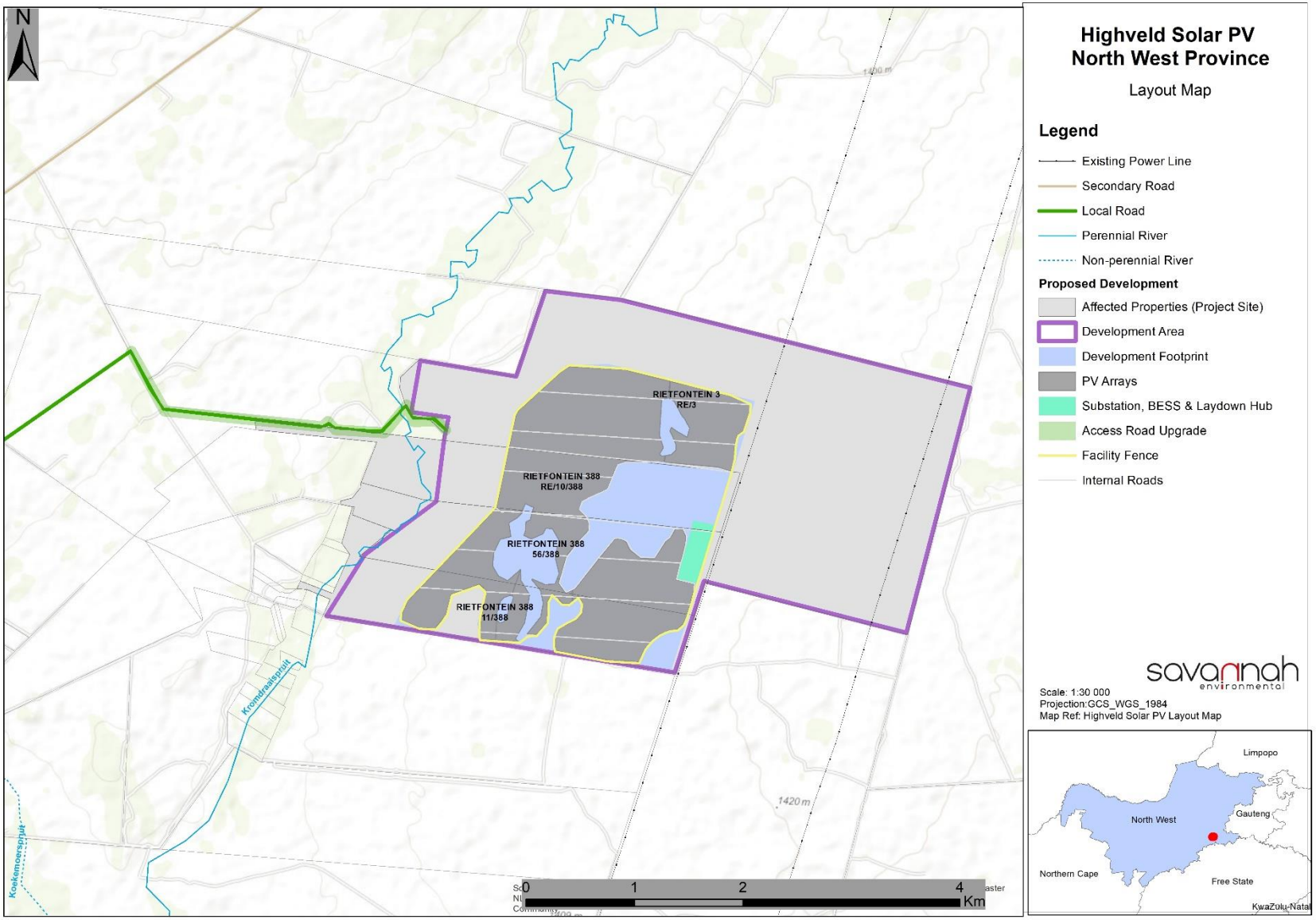


Figure 2.2: The entire extent of the entire development footprint (~522ha) and internal layout as assessed within this BA Report for the Highveld Solar PV Facility.

2.3 Summary of the Site Selection Process and Pre-Feasibility Analysis

As a precursor to initiating the BA process, WKN Windcurrent (Pty) Ltd undertook a solar resource assessment, as well as a site identification and selection process to determine areas suitable for the development of a solar PV facility from an environmental and technical perspective in the North West Province.

Through this process, the project area was identified as having the potential for the installation of a PV facility on the basis of key technical criteria such as:

- favourable climatic conditions (solar renewable energy facilities are directly reliant on average solar irradiation values for a particular area);
- access and capacity of the electricity grid and connection cost;
- accessibility of the affected property;
- compatibility of current land use; and
- local site topography.

In addition, the study area is located within the Klerksdorp Renewable Energy Development Zone and the Central Strategic Transmission Corridor, both of which have been designated by Government for the development of large-scale solar PV facilities and grid infrastructure.

From the initial pre-feasibility analysis, the developer excluded the following:

a) Areas where the current land use was not considered compatible with the proposed land use. This relates to current and future land use activities being undertaken within the areas that would be affected by the development of Highveld Solar PV Facility;
b) Areas that present greater environmental constraints which would have a higher environmental impact and reduce the chances of success for the project (i.e. environmentally constrained); and
c) Areas where there were greater technical constraints (i.e. solar energy availability), as this would influence the cost effectiveness of the facility and therefore the economic feasibility of the development.

The detail regarding site-specific characteristics, and how these provide further motivation for the selection of the specific study area for Highveld Solar PV Facility is provided below:

Study Area Extent, Conditions and Land Availability: Availability of level land of sufficient extent can be a restraining factor for the development of a solar PV facility.

Highveld Solar PV Facility would require sufficient space for the placement of infrastructure in order to generate the envisaged contracted capacity of up to 240MW_{AC}. The development area proposed for Highveld Solar PV Facility provides sufficient space for the solar PV facility, while allowing for the avoidance of any potential environmental sensitivities.

The following are key considerations in terms of land availability:

- The project site and development area terrain conditions are suitable for a development of this nature, with the site being of a suitable gradient for the development of a solar PV facility.
- The region can be described as slightly undulating plains dissected by prominent rocky chert ridges.
- The development footprint would comprise less than 40% of the total extent of the project site.

» Specialist surveys considering avifauna, ecology and freshwater features defined preliminary areas to be avoided.

The project site, including the development area is, therefore, considered suitable and appropriate from a technical perspective.

Site access: Access to the development area is considered as an important characteristic as easy access is required for the transportation of project related infrastructure and heavy machinery during construction. The proximity of the study area to viable access routes decreases the impact on secondary roads in terms of traffic during the construction and operation phases. The area can be readily accessed via the N12, located to the south of the development area; the Hartebeesfontein Road; and Rietfontein Road which are located to the west of the development area. The existing access road turning off from the Rietfontein Road towards the PV facility will be required to be upgraded for safe access to the facility during the construction and operation phases. The upgrades will include widening to 6m and reinforcement of the low-level crossing.

Considering the readily available site access to the study area and development area, the location of Highveld Solar PV Facility is considered to be suitable and appropriate.

Land use considerations: The current land use of the site is an important consideration in the site selection in terms of limiting disruption to existing land use practices. There is no cultivated agricultural land within the development footprint which could be impacted upon by the development of the PV facility. The affected property is currently used for livestock grazing. Furthermore, the landowner is currently considering options for the alternative use of their land other than for grazing. Other activities present within the study area and within the surrounding areas include power line servitudes associated with the existing and approved grid infrastructure, and the future development of other solar PV facilities which have been authorised. It is considered that the development of Highveld Solar PV Facility is compatible with the study area and will not present a conflicting land use. The location of the development area is also considered to be acceptable within the study area as it avoids all conflicting land uses and will rather add to the current activities being undertaken in the area.

Grid connection considerations: Ease of access into the Eskom national electricity grid is vital to the viability of a solar PV facility and addresses Eskom's concerns for lower cost connection alternatives given current funding constraints. Solar PV facilities that are located near a grid connection point and/or demand centre are favourable and reduce the losses associated with power transmission. Various existing grid connection infrastructure is located within the area. The grid connection point for Highveld Solar PV Facility will be south of the project development area. The grid connection solution will be assessed within a separate BA process and will include a switching substation and a new 132kV power line.

2.4 PV Technology considered for Highveld Solar PV Facility and the Generation of Electricity

Solar PV energy facilities 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 placing them into a higher state of energy to create electricity.

A PV cell is made of silicon acting as a semi-conductor and 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 convert direct current (DC[22]) to alternating current (AC[23]). The electricity is then stepped up to a higher voltage via a transformer before being evacuated into the national grid via a power line.

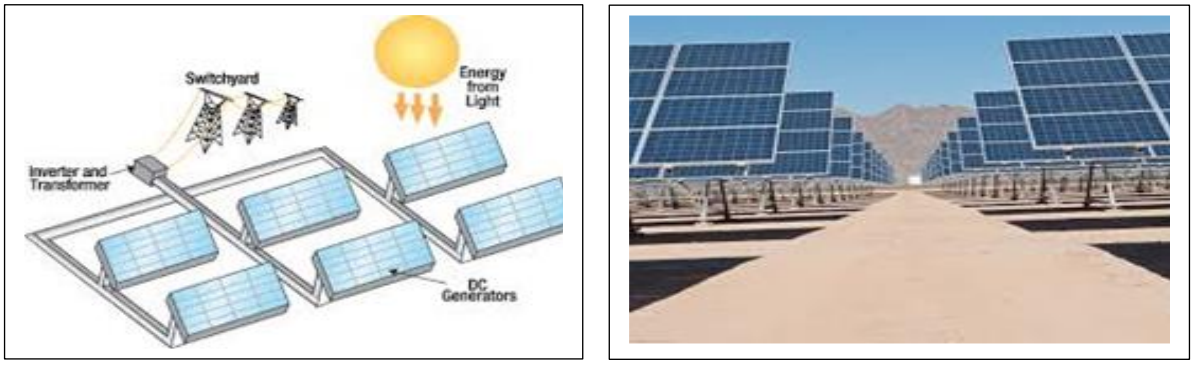


Figure 2.3: Overview of a PV cell, module, and array / panel (Source: pveducation.com)

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

Photovoltaic Cells

A PV cell is made of silicon 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 240MW_{AC} of power, the solar PV 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 and negatively charged on each 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 (DC).

Monofacial and Bifacial Cells

In monofacial solar cells, the front surface is transparent with glass lamination and the back surface is opaque. In contrast, bifacial cells capture the diffuse reflected light from the ground and other reflective surfaces that

[22] DC (direct current) is the unidirectional flow or movement of electric charge carriers (which are usually electrons). The intensity of the current can vary with time, but the general direction of movement stays the same at all times. As an adjective, the term DC is used in reference to voltage whose polarity never reverses. In a DC circuit, electrons emerge from the negative, or minus, pole and move towards the positive, or plus, pole. Nevertheless, physicists define DC as traveling from plus to minus. (sourced from https://whatis.techtarget.com/definition/DC-direct-current).

[23] An alternating current (AC) occurs when charge carriers in a conductor or semiconductor and periodically reverse their direction of movement. The voltage of an AC power source can be easily changed by means of a power transformer. This allows the voltage to be stepped up (increased) for transmission and distribution (sourced from https://whatis.techtarget.com/definition/alternating-current-AC).

surround the panel. A bifacial cell has identical metallic grid as a monofacial cell, just on both front and back surfaces.

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 PV facility to the national grid, numerous inverters will be arranged in several arrays to collect and convert the produced power.

The Support Structure

PV panels will be fixed to a support structure. PV panels can either utilise fixed / static support structures, or single or double axis tracking support structures (refer to **Figure 2.4**). PV panels which utilise fixed / static support structures are set at an angle (fixed-tilt PV system) so as to optimise the amount of solar irradiation. With fixed / static support structures the angle of the PV panel is dependent on the latitude of the proposed development and may be adjusted to optimise for summer and winter solar radiation characteristics. PV panels which utilise tracking support structures track the movement of the sun throughout the day so as to receive the maximum amount of solar irradiation.

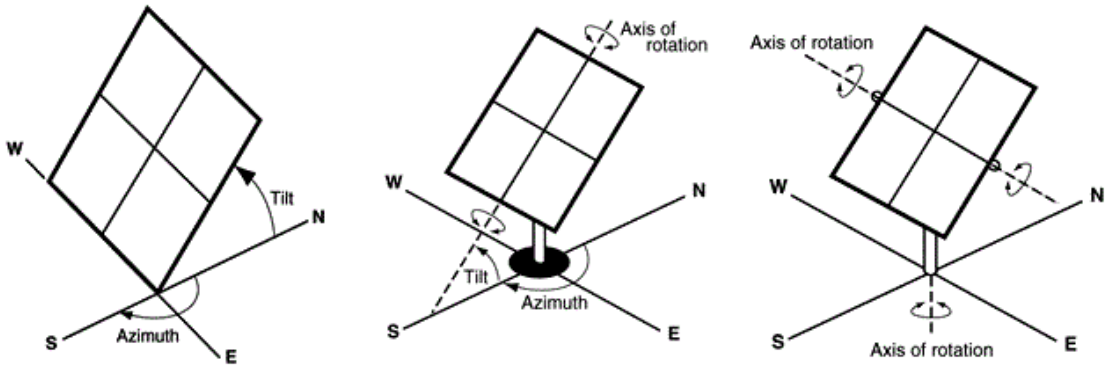


Figure 2.4: Overview of different PV tracking systems (from left to right: fixed-tilt, single-axis tracking, and double-axis tracking (Source: pveducation.com))

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

2.4.1. Bifacial Solar Panel Technology

WKN Windcurrent SA (Pty) Ltd is proposing to use bifacial tracking technology. Bifacial ("two-faced") modules produce solar power from both sides of the panel. Traditional solar panels capture sunlight on one light-absorbing side. The light energy that cannot be captured is simply reflected away. Bifacial solar panels have solar cells on both sides, which enables the panels to absorb light from the back and the front (refer to **Figure 2.5**). Practically speaking, this means that a bifacial solar panel can absorb light reflected off the ground or another material. In general, more power can be generated from bifacial modules for the same area, without having to increase the development footprint.

The optimum tilt for a bifacial module has to be designed so as to capture a big fraction of the reflected irradiation. Use of trackers is recommended so the modules can track the sun's movement across the sky, enabling them to stay directed to receive the maximum possible sunlight to generate power.

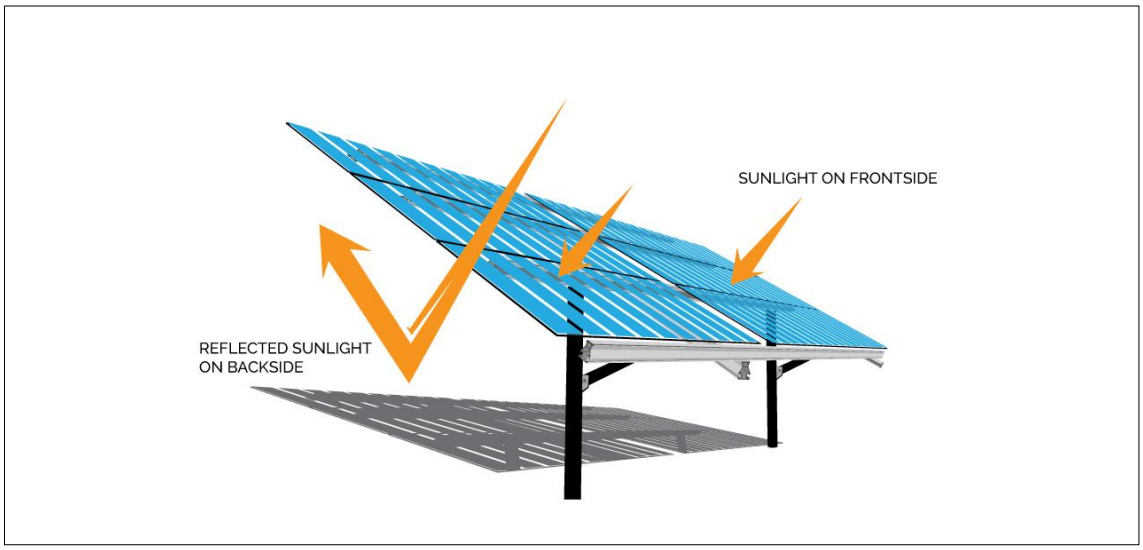


Figure 2.5: Diagram showing how bifacial Solar PV panels work (Source: https://sinovoltaics.com/learning-center/solar-cells/bifacial-solar-modules/)

2.5 Activities during the Project Development Stages

In order to construct the Highveld Solar 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.

2.5.1 Design and Pre-Construction Phase

Requirements	» Planning and design of facility
Activities to be undertaken	
Site preparation	» Confirming the integrity of site access to accommodate the required equipment. » Preparation of the site (e.g., laydown area). » Mobilisation of construction equipment.
Conduct surveys prior to construction	» Including, but not limited to a detailed geotechnical survey, site survey and confirmation of the infrastructure micro-siting footprint, survey of the security booth, O&M building, workshop, storage and site office areas to determine and confirm the locations of all associated infrastructure.

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 and/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 BA Report therefore describes the project in terms of the best available knowledge at the time. The final facility design will be required to be approved by the DFFE.

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, on-site facility substation and the facility'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 development area. The purpose is to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.

2.5.2 Construction Phase

The construction phase will entail a series of activities including:

Construction Phase	
Requirements	» Project requires Environmental Authorisation from Department of Forestry, Fisheries and the Environment (DFFE). » Duration expected to be between 9 – 12 months for the Highveld Solar PV Facility. » Create direct construction employment opportunities: Up to 150 jobs (at peak of construction) created and maintained for approximately 9 – 12 months. » No on-site labour camps will be established. Employees to be accommodated in the nearby towns such as Stilfontein and transported to and from site on a daily basis. » Overnight on-site worker presence would be mostly limited to security staff. » Security staff will also be present during the night-time of the construction phase. » *Waste* - waste will be minimised, re-used, and recycled as far as practically possible. Where re-use and recycling is not possible, waste will be removed by a sub-contractor or the municipality, where possible, for disposal at a registered facility. Waste containers, including containers for hazardous waste, will be located at easily accessible locations on site when construction activities are undertaken. » *Sanitation* – during the construction phase, mobile chemical toilets or a conservancy tank will be placed within the development area for use by contractors. Alternatively, employees may be requested to utilise existing ablution facilities in close proximity to the PV Facility. » *Electricity supply* - electricity required for construction activities will be available from Eskom distribution networks or the Client facilities in the area, back-up generators will be available on site as well. » *Water supply* – water will be required for the construction phase, which will be approximately 150Ml for construction and 300Ml for operation, washing of equipment, earthworks/dust suppression and civil works. Water will be sourced directly from a registered water services provider such as the municipality.
Activities to be undertaken	
Establishment of access roads to the site	» Existing access roads will be utilised where possible to minimise impact and upgraded where required. » Internal access roads up to 6m wide will be established within the site at the commencement of construction.
Undertake site preparation	» Including the clearance of vegetation at the footprint of each support structure, establishment of the laydown areas, the establishment of internal access roads and excavations for foundations. » Stripping of topsoil to be stockpiled, backfilled, removed from site and/or spread on site. » To be undertaken in a systematic manner to reduce the risk of exposed ground being subjected to erosion. » Include search and rescue of floral Species of Conservation Concern (where required) and the identification and excavation of any sites of cultural/heritage value (where required).
Establishment of laydown areas	» A laydown area for the storage of project components, including the PV panels and civil engineering construction equipment. » The laydown area will also accommodate building materials and equipment associated with the construction of buildings. » No onsite borrow pits will be required. Infilling or depositing materials will be sourced from licenced borrow pits within the surrounding areas.

Transport of components and equipment to and within the site	» Transportation will take place via appropriate National and Provincial roads, and the dedicated access/haul road to the site. » 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) 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.
Erect PV Panels	» Installation of the solar PV panels and the structural and electrical infrastructure to make the plant operational. » For array installation, typically vertical support posts/piles are driven into the ground. Depending on the results of the geotechnical investigation a different foundation method may be required. Different options include a screw pile, helical pile, micro-pile or drilled post/pile which may or may not need to be cast in concrete underground at an appropriate depth as determined by the Geotechnical investigation. 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. » Wire harnesses connect the PV modules to the electrical collection systems.
Connection of PV facility to the onsite substation	» Underground cables and overhead circuits connect the string inverters to the on-site AC electrical infrastructure (central inverter) and ultimately the project's on-site substation. » Excavation of trenches are required for the installation of the cables. Trenches will be approximately 1.2m deep. » Underground cables are planned to follow the internal access roads, as far as possible.
Connect substation to the power grid substation to the power grid	» The grid connection corridor extends between the switching substation located on the Highveld Solar PV Facility and a point of connection on the Hermes DS - Potchefstroom DS 1 and Buffels East 1 - Potchefstroom 132kV Feeder lines located east of Khuma and the R502. This switching substation may be located at the point of connection, if required by Eskom.
Undertake site rehabilitation	» Commence with rehabilitation efforts once construction is completed in an area, and all construction equipment is removed. » On commissioning, access points to the site that will not be required for the operation phase will be closed and prepared for rehabilitation.

Procurement and employment

Highveld Solar PV Facility is likely to create approximately ~150 (at its peak) employment opportunities (temporary) for a period of ~9 to 12 months, depending on the final design, during the construction phase. Of this approximately 60% of the opportunities will be available to low skilled workers (construction labourers, security staff, drivers, equipment operators etc.), 25% will be available to semi-skilled personnel (electricians, site managers etc.) and 15% of employment opportunities will be for skilled individuals (engineers, project managers, site managers etc.). Solar PV facilities make use of high numbers of low skilled and semi-skilled labour so there will be good opportunity to use local labour. Employment opportunities for Highveld Solar PV Facility will peak during the construction phase and significantly decline during the operation phase.

Establishment of an Access Road to the Study Area and Internal Access Roads within the Development Area

Access to the project site is via national and secondary roads, as well as local roads (**Figure 2.1**): via the N12, located to the south of the development area; the Hartebeesfontein Road; and Rietfontein Road which are located to the west of the development area. The existing access road turning off from the Rietfontein Road towards the PV facility will be upgraded for safe access to the facility during the construction and operation

phases. The upgrades will include widening to 6m and reinforcement of the low-level crossing. This route will be utilised for accessing the project site, area and development footprint. Within the development area itself, access will be required from new/existing roads for construction purposes (and limited access for maintenance during operation). A network of up to 6m wide internal access roads will be developed to provide access to the development area and to the various project components within the development footprint of Highveld Solar PV Facility.

Undertake Site Preparation

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

Services Required

- *Waste* - waste will be minimised, re-used, and recycled as far as practically possible. Where re-use and recycling is not possible, waste will be removed by a sub-contractor or the municipality, where possible, for disposal at a registered facility. Waste containers, including containers for hazardous waste, will be located at easily accessible locations on site when construction activities are undertaken. Excess waste material will be removed once the construction phase is complete and will be disposed of at registered landfill site/waste facility. The handling, storage and disposal of the hazardous waste components, i.e. oils and other lubricants, will be done in accordance with the relevant legislation.
- *Sanitation* – during the construction phase, mobile chemical toilets or a conservancy tank will be placed within the development area for use by contractors. Alternatively, employees may be requested to utilise existing ablution facilities in close proximity to the PV Facility.
- *Electricity supply* - electricity required for construction activities will be available from Eskom distribution networks or the Client facilities in the area, back-up generators will be available on site as well.
- *Water supply* – water will be required for the construction phase, which will be approximately 150Ml for construction and 300Ml for operation, washing of equipment, earthworks/dust suppression and civil works. Water will be sourced directly from a registered water services provider such as the municipality.

Transport of Components and Equipment to Site

The components for the solar PV facility will be transported to site by road, via the N12. Some of the components (i.e. on-site facility substation transformers) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[24] by virtue of the dimensional limitations. Typical civil engineering construction equipment (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) will need to be brought to the site as well as components required for the mounting of the PV support structures, construction of the on-site facility substation and site preparation.

Establishment of Laydown Areas on Site

A temporary laydown and storage area will be required for the typical construction equipment. Once the required equipment has been transported to site, a dedicated equipment laydown area will be established. The laydown area 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 storage of the PV panels and the general placement/storage of construction equipment and other components required for the operations of the facility.

Erect PV Cells and Construct On-Site Facility Substation and Invertors

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

The construction phase involves installation of the solar PV panels, including 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, micro-pile 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 Power Conversion Stations (PCS) to the on-site AC electrical infrastructure and ultimately the project's on-site facility substation.

Figure 2.6: Frame structural details

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

Establishment of Ancillary Infrastructure

Ancillary infrastructure will include cabling for the connection to the Eskom national grid, workshops and maintenance buildings, storage and laydown areas, gatehouse, security offices, and other storage areas under roof. The establishment of these facilities/buildings will require the localised clearing of vegetation and levelling of the development footprint and the excavation of foundations prior to construction.

Undertake Site Remediation

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

Figure 2.7: Photographs of the construction phase of a solar facility similar to the Highveld Solar PV Facility (Source:https://medium.com/@solar.dao/how-to-build-pv-solar-plant-6c9f6a01020f; https://www.shutterstock.com/video/clip-1028794-workers-mounting-panels-on-solar-power-plant-construction; https://www.esi-africa.com/renewable-energy/kenya-construction-solar-farm-gets-green-light/)

2.5.3 Operation Phase

Highveld Solar PV Facility is expected to be operational for 20 to 25 years. The facility will, under normal operating conditions, operate continuously, 7 days a week.

Operation Phase	
Requirements	» Duration will be 20-25 years, or longer depending on the need for the project. » Requirements for security and maintenance of the facility. » Employment opportunities relating mainly to operation activities and maintenance. Up to 10 (full-time and temporary) employment opportunities will be available. » *Waste* - waste will be minimised, re-used, and recycled as far as practically possible. Where re-use and recycling is not possible, waste will be removed by a sub-contractor or the municipality, where possible, for disposal at a registered facility. Waste containers, including containers for hazardous waste, will be located at easily accessible locations on site when construction activities are undertaken. » *Sanitation* – during the construction phase, mobile chemical toilets or a conservancy tank will be placed within the development area for use by contractors. Alternatively, employees may be requested to utilise existing ablution facilities in close proximity to the PV Facility. » *Electricity supply* - electricity required for construction activities will be available from Eskom distribution networks or the Client facilities in the area, back-up generators will be available on site as well. » *Water supply* – water requirements will be approximately 300 000m^3 for the entire operational phase, washing of equipment. Water will be sourced directly from a registered water services provider such as the municipality.
Activities to be undertaken	
Operation and maintenance	» Full time security, maintenance, and control room staff. » PV facility will be operational except under circumstances of mechanical breakdown, inclement weather conditions, or maintenance activities. » PV facility to be subject to periodic maintenance and inspection. » Disposal of waste products (e.g., oil and other lubricants, etc) in accordance with relevant waste management legislation. » Areas which were disturbed during the construction phase to be utilised should a laydown area be required during operation. » PV panels will be washed during operation utilising clean water or non-hazardous biodegradable cleaning products. Wastewater generated by washing can be allowed to run-off under the panels.

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 solar PV facility will create approximately 30 direct and 70 indirect full-time employment opportunities. The number of skilled and semi-skilled personnel will comprise 30% and unskilled will comprise 70% of the workforce during the operation phase. Employees that can be sourced from the local municipal pool include the less skilled and semi-skilled such as safety and security staff and certain maintenance crew. Highly skilled personnel may need to be recruited from outside the local area.

Water will be required for the operation phase. Approximately 12 000m^3 of water per annum will be required for the operation of the solar PV facility. The water required will be sourced directly from the Local Municipality following a Service Level Agreement (SLA) with the municipality. Alternatively, water will be transported to site by water tanker.

Other services required for the operation phase include refuse material disposal and sanitation. No effluent is anticipated to be produced during the operation phase, except for normal sewage due to the presence of the operations and maintenance staff. The sewage generated over this period will be collected and treated as per normal standards.

2.5.4 Decommissioning Phase

Depending on the continued economic viability of Highveld Solar PV Facility following the initial 20–25-year operation period, the solar 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 disassembled and replaced with new, more efficient technology/infrastructure available at that time. However, if the decision is made to decommission the solar PV facility, the following activities will form part of the project scope.

Decommissioning Phase	
Requirements	» Decommissioning of the Highveld Solar PV Facility infrastructure at the end of its economic life. » Potential for repowering of the facility, depending on the condition of the facility at the time. » Expected lifespan of approximately 20-25 years (with maintenance) before decommissioning is required. » Decommissioning activities to comply with legislation relevant at the time.
Activities to be undertaken	
Site preparation	» Confirming the integrity of site access to accommodate the required equipment. » Preparation of the site (e.g., laydown area and construction platform). » Mobilisation of equipment required for decommissioning.
Disconnect, disassemble, and remove solar facility components	» Disconnect the facility from the grid. » Dismantle all panels, mounting structures and foundations in line with all relevant legislation. » Recycle, repurpose and re-use as much of the decommissioned project components as possible in accordance with regulatory requirements. » Concrete foundations will be removed to a depth as defined by an agricultural specialist. » Backfill the mounting structure holes and rehabilitate the area appropriately. » Visible cables will be removed. » A final site walkthrough will be conducted to remove debris and/or waste generated within the site during the decommissioning process. » Rehabilitation may include top soiling, raking, and/or re-seeding (whichever is appropriate).

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 solar PV facility 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. 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 returned to a beneficial land use.

Future plans for the site and infrastructure after decommissioning

The capacity of Highveld Solar PV Facility would have degraded by ~15% over 20 years. The expectation is that the development area will be used for future renewable energy procurement as the operation phase approaches the termination date of the 20-year Power Purchase Agreement (PPA). If decommissioning were to occur, it would be 20 years (or the stated years) after the commencement of the PPA. Another option for the site after decommissioning is for grazing to resume.

CHAPTER 3: POLICY AND LEGISLATIVE CONTEXT

This Chapter provides an overview of the policy and legislative context within which the development of a solar energy facility such as the Highveld Solar PV Facility and its associated infrastructure is proposed. It identifies environmental legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process which may be applicable to or have bearing on the proposed project.

3.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of a Basic Assessment Report

This chapter of the BA Report includes the following information required in terms of Appendix 1: Content of Basic Assessment Reports:

Requirement	Relevant Section
(e) a description of the policy and legislative context within which the development is proposed including- (i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report. (ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments.	A description of the policy and legislative context within which the Highveld Solar PV Facility is proposed is included and considered within this chapter.

3.2 Strategic Electricity Planning in South Africa

The energy sector in South Africa has been, and continues to be, at the centre of the economic and social development. The industry directly affects the economy by using labour and capital to produce energy. As the country`s economy continues to grow, the Department of Mineral Resources and Energy (DMRE) is mandated to ensure that energy resources are available, and that there is access to energy services in an affordable, reliable and sustainable manner, while minimizing the associated adverse environmental impacts (Department of Energy, 2019).

The need to expand electricity generation capacity in South Africa is based on national policy and informed by on-going strategic planning undertaken by the DMRE. The hierarchy of policy and planning documentation that supports 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 and plans that have relevance to the development of the Highveld Solar PV Facility.

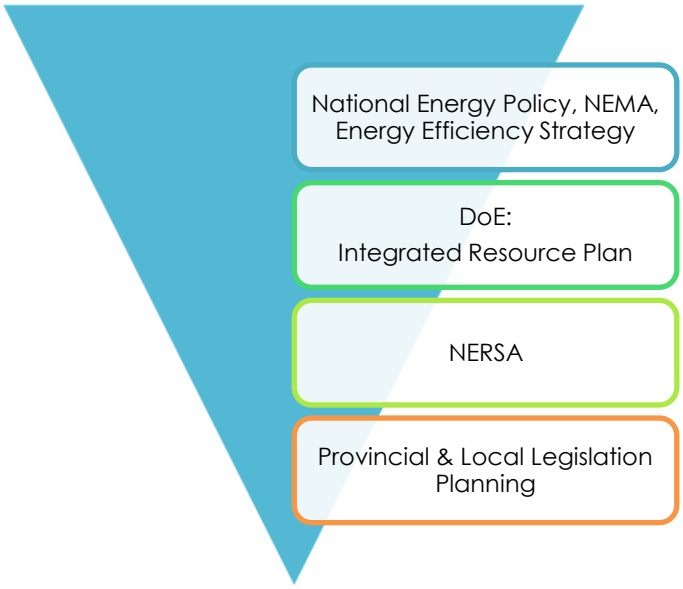


Figure 3.1: Hierarchy of electricity and planning documents

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 of a solar energy project and the related statutory environmental assessment process.

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

- **Department of Mineral Resources and Energy (DMRE):** This Department is responsible for policy relating to all energy forms and for compiling and approving the Integrated Resource Plan (IRP) for electricity and since merging with the Department of Mineral Resources (DMR) is also responsible for granting approvals for the use of land which is contrary to the objects of the Mineral and Petroleum Resource Development Act (No. 28 of 2002) (MPRDA) in terms of Section 53 of the MPRDA. Therefore, in terms of the Act, approval from the Minister is required to ensure that the proposed activities do not sterilise mineral resources that may occur within the broader study area.
- **National Energy Regulator of South Africa (NERSA):** NERSA is responsible for regulating all aspects of the electricity sector and will ultimately issue licenses for IPP projects to generate electricity.
- **Department of Forestry, Fisheries and the Environment (DFFE):** This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the 2014 EIA Regulations (GN R326) as amended. DFFE is the competent authority for this project (as per GNR 779 of 01 July 2016) and is charged with considering whether to grant an EA for the project under consideration. Furthermore, the Department is also responsible for issuing permits for the disturbance or destruction of protected tree species listed under Section 15 (1) of the National Forest Act (No. 84 of 1998) (NFA). The Department is also responsible for permits for Threatened or Protected Species (TOPS) under the National Environmental Management: Biodiversity Act (No. 10 of 2004).
- **The South African Heritage Resources Agency (SAHRA):** SAHRA is a statutory organisation established under the National Heritage Resources Act (No. 25 of 1999) (NHRA), as the national administrative body responsible for the protection of South Africa's cultural heritage.

- **South African National Roads Agency Limited (SANRAL):** This Agency is responsible for the regulation and maintenance of all national road routes.
- **Department of Human Settlements, Water and Sanitation (DHSWS):** This Department is responsible for effective and efficient water resource management to ensure sustainable economic and social development. This Department is also responsible for evaluating applications and issuing licenses pertaining to water use (i.e. Water Use Licenses (WUL) and General Authorisation).
- **The Department of Agriculture, Rural Development and Land Reform (DARDLD):** This Department is the custodian of South Africa's agricultural resources and is responsible for the formulation and implementation of policies governing the agricultural sector and the initiation, facilitation, coordination and implementation of integrated rural development programmes.

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

- **North West Department of Economic Development, Environment, Conservation and Tourism (DEDECT):** This Department is the commenting authority for the BA process for the project and is responsible for the issuing of other biodiversity and conservation-related permits. DEDECT's involvement relates specifically to sustainable resource management, conservation of protected species and land care.
- **North West Department of Public Works and Roads (DPWR):** DPWR is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
- **North West Department of Community Safety and Transport Management (DCSTM):** 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 Authority (PHRA):** PHRA is responsible for the identification, conservation and management of heritage resources, as well as commenting on heritage related issues within the 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 affected local municipality is the **JB Marks Local Municipality** which forms part of the **Dr Kenneth Kaunda District Municipality**. In terms of the Municipal Systems 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.

The relevant legislation and policies listed and discussed below are relevant to the Highveld Solar PV Facility development.

3.3 Policy and Planning Considerations on International, National, Provincial and Local Levels

3.3.1 Policy and planning on an International Level

South Africa has committed to various international policies which relate to environmental concerns, specifically that of climate change and global warming. **Table 3.1** below provides a summary of the international policies and plans that South Africa has made commitments towards, and how the proposed development of the Highveld Solar PV Facility aligns with the thinking or commitments of these agreements.

Table 3.1: International policies relevant to the Highveld Solar PV Facility

Relevant policy	Relevance to the Highveld Solar PV Facility
The Kyoto Protocol, 1997	The protocol calls for the reduction of South Africa's greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. The development of Highveld Solar PV Facility will enable the evacuation of additional capacity to the renewable energy sector of the country and strengthen the commitment and action plan to achieve the requirements as set out in the protocol.
United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP)	The Conference of the Parties (COP), established by Article 7 of the UNFCCC, is the supreme body and highest decision-making organ of the Convention. It reviews the implementation of the Convention and any related legal instruments and takes decisions to promote the effective implementation of the Convention. The Conference of the Parties (COP) 21 was held in Paris from 30 November to 12 December 2015. From this conference, an agreement to tackle global warming was reached between 195 countries. South Africa signed the Agreement in April 2016 and ratified the agreement on 01 November 2016. The Agreement was assented to by the National Council of Provinces on 27 October 2016, and the National Assembly on 1 November 2016. South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD) GHG emissions trajectory whereby South Africa's emissions should peak between 2020 and 2025, plateau for approximately a decade, and then decline in absolute terms thereafter, and based on this the country has pledged to reduce emissions by 34% and 42% below Business As Usual (BAU) emissions in 2020 and 2025, respectively. The policy provides support for the Highveld Solar PV Facility which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.
The Equator Principles 4 (October 2020)	The Equator Principles 4 constitute a financial industry benchmark used for determining, assessing, and managing a project's environmental and social risks. The Equator Principles (Eps) are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The EPs are applicable to large infrastructure projects and apply globally to all industry sectors. In terms of the EPs, South Africa is a non-designated country, and as such the assessment process for projects located in South Africa evaluates compliance with the applicable IFC Performance Standards on Environmental and Social Sustainability and Environmental Health and Safety (EHS) Guidelines. The Highveld Solar PV Facility is currently being assessed in accordance with the requirements of the 2014 EIA Regulations, as amended (GNR 326), published in terms of Section 24(5) of the National Environmental Management Act (No. 107 of 1998) (NEMA), which is South Africa's national legislation providing for the authorisation of certain controlled activities. Through this assessment, all potential social and environmental risks are identified and assessed, and appropriate mitigation measures proposed.

Relevant policy	Relevance to the Highveld Solar PV Facility
International Finance Corporation (IFC) Performance Standards and Environmental and Social Sustainability (January 2012)	The International Finance Corporation's (IFC) Performance Standards (PSs) on Environmental and Social Sustainability were developed by the IFC and were last updated on 1 January 2012. Performance Standard 1 requires that a process of environmental and social assessment be conducted, and an Environmental and Social Management System (ESMS) appropriate to the nature and scale of the project, and commensurate with the level of its environmental and social risks and impacts be established and maintained. The above-mentioned standard is the overarching standard to which all the other standards relate. Performance Standards 2 through 8 establish specific requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment, the standards 2 and 8 describe potential social and environmental impacts that require particular attention specifically within emerging markets. Where social or environmental impacts are anticipated, the developer is required to manage them through its ESMS consistent with Performance Standard 1. Given the nature of the Highveld Solar PV Facility, it is anticipated (at this stage of the process) that Performance Standards 1, 2, 3, 4, 6, and 8 may be applicable to the project (see box 1 below). • Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts • Performance Standard 2: Labour and Working Conditions • Performance Standard 3: Resource Efficiency and Pollution Prevention • Performance Standard 4: Community Health, Safety and Security • ~~Performance Standard 5: Land Acquisition and Involuntary Resettlement~~ – N/A • Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources • ~~Performance Standard 7: Indigenous Peoples~~ – N/A • Performance Standard 8: Cultural Heritage

3.3.2 Policy and planning on a National Level

Further to the South African government's commitment in August 2011 to support the development of renewable energy capacity, the DMRE initiated the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) to procure renewable energy from the private sector in a series of rounds. To date, the Department has procured 6 422MW of renewable energy capacity from 112 independent power producers (IPPs), with 4 742MW operational and made available to the grid[25]. National policies have to be considered for the construction and operation of the solar PV facility to ensure that the development is in line with the planning of the country.

A brief review of the most relevant national policies is provided below in **Table 3.2**. The development of Highveld Solar PV Facility is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

[25]http://www.nersa.org.za/wp-content/uploads/2021/05/Monitoring-of-Renewable-Energy-Performance-of-Power-Plants-%E2%80%93-Performance-of-Power-Plants-in-2020

Table 3.2: Relevant national legislation and policies relevant to the Highveld Solar PV Facility

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
Constitution of the Republic of South Africa, 1996	Section 24 of the Constitution pertains specifically to the environment. It states that everyone has the right to an environment that is not harmful to their health or well-being, and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Constitution outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires that development be conducted in such a manner that it does not infringe on an individual's environmental rights, health, or well-being. This is especially significant for previously disadvantaged individuals who are most at risk to environmental impacts.
National Environmental Management Act (No. 107 of 1998) (NEMA)	This piece of legislation is South Africa's key piece of environmental legislation and sets the framework for environmental management in South Africa. NEMA is founded on the principle that everyone has the right to an environment that is not harmful to their health or well-being as contained within the Bill of Rights. The national environmental management principles state that the social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment. The need for responsible and informed decision-making by government on the acceptability of environmental impacts is therefore enshrined within NEMA.
White Paper on the Energy Policy of the Republic of South Africa (1998)	The South African Energy Policy, published by the then Department of Minerals Resources and Energy (DMRE) in December 1998 identifies five key objectives, namely: » Increasing access to affordable energy services. » Improving energy sector governance. » Stimulating economic development. » Managing energy-related environmental impacts. » Securing supply through diversity. In order to meet these objectives and the developmental and socio-economic objectives of South Africa, the country needs to optimally use available energy resources. The South African Government is required to address what can be done to meet these electricity needs both in the short and long-term. The Energy Policy identifies key objectives for energy supply, such as increasing access to affordable energy services, managing energy-related environmental impacts and securing energy supply through diversifying South Africa's electricity mix. 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 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*".

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	The support for the Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly wind and solar, 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. » Addressing constraints on the development of the renewable industry.
White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)	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), which pledges *'Government support for the development, demonstration and implementation of renewable energy sources for both small and large-scale applications'*. This White Paper on Renewable Energy sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. 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: Article I: Ensuring that equitable resources are invested in renewable technologies. Article II: Directing public resources for implementation of renewable energy technologies. Article III: Introducing suitable fiscal incentives for renewable energy. Article IV: Creating an investment climate for the development of renewable energy sector.

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	The objectives of the White Paper on Renewable Energy are considered in six focal areas, namely: i) Financial instruments. ii) Legal instruments. iii) Technology development. iv) Awareness raising. v) Capacity building and education. vi) Market based instruments and regulatory instruments. This policy supports the investment in renewable energy facilities as they contribute towards ensuring energy security through the diversification of energy supply, reducing Greenhouse Gas (GHG) emissions and the promotion of renewable energy sources.
National Energy Act (No. 34 of 2008)	The purpose of the National Energy Act (No. 34 of 2008) is 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, while taking environmental management requirements into account. In addition, the Act also provides for energy planning, and increased generation and consumption of Renewable Energies (REs). The Act provides the legal framework which supports the development of RE facilities for the greater environmental and social good and provides the backdrop against which South Africa's strategic planning regarding future electricity provision and supply takes place.
The Electricity Regulation Act (No. of 2006)	The Electricity Regulation Act (ERA) (No. 04 of 2006) as amended by the Electricity Regulation Act (No. 28 of 2007), replaced the Electricity Act (No. 41 of 1987), as amended, with the exception of Section 5B, which provides funds for the energy regulator for the purpose of regulating the electricity industry. The ERA establishes a national regulatory framework for the electricity supply industry and made NERSA custodian and enforcer of the National Electricity Regulatory Framework. The ERA also provides for licences and registration as the manner in which the generation, transmission, distribution, reticulation, trading, and import and export of electricity is regulated.
Integrated Energy Plan (IEP), November 2016	The purpose and objectives of the Integrated Energy Plan (IEP) are derived from the National Energy Act (No. 34 of 2008). The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include: » To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector. » To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels). » To guide investment in and the development of energy infrastructure in South Africa. » To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	A draft version of the IEP was released for comment on 25 November 2016. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. The development of the IEP is an ongoing continuous process. It is reviewed periodically to take into account changes in the macroeconomic environment, developments in new technologies and changes in national priorities and imperatives, amongst others. The 8 key objectives of the integrated energy planning process are as follows: » Objective 1: Ensure security of supply. » Objective 2: Minimise the cost of energy. » Objective 3: Promote the creation of jobs and localisation. » Objective 4: Minimise negative environmental impacts from the energy sector. » Objective 5: Promote the conservation of water. » Objective 6: Diversify supply sources and primary sources of energy. » Objective 7: Promote energy efficiency in the economy. » Objective 8: Increase access to modern energy.
Integrated Resource Plan for Electricity (IRP) 2010-2030	The Integrated Resource Plan (IRP) for Electricity is a subset of the IEP and constitutes South Africa's National electricity plan. The IRP is an electricity infrastructure development plan based on least-cost electricity supply and demand balance, taking into account security of supply and the environment. The primary objective of the IRP 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. The IRP also serves as input to other planning functions, including amongst others, economic development and funding, and environmental and social policy formulation. The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development. Following the promulgation of the IRP 2010–2030, implementation followed in line with Ministerial Determinations issued under Section 34 of the Electricity Regulation Act (Act No. 4 of 2006). The Ministerial Determinations give effect to planned infrastructure by facilitating the procurement of the required electricity capacity. Since the promulgated IRP 2010–2030, the following capacity developments have taken place: » A total 6 422MW under the Renewable Energy Independent Power Producers Programme (REIPPP) has been procured, with 3 876MW operational and made available to the grid. » IPPs have commissioned 1 005MW from two Open Cycle Gas Turbine (OCGT) peaking plants. » Under the Eskom build programme, the following capacity has been commissioned: * 1 332MW of Ingula pumped storage, 1 588MW of Medupi, 800MW of Kusile and * 100MW of Sere Wind Farm. » 18 000MW of new generation capacity has been committed to.

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	Besides capacity additions, a number of assumptions have changed since the promulgation of IRP 2010–2030. Key assumptions that changed include the electricity demand projection, Eskom's existing plant performance, as well as new technology costs. In addition, environmental considerations such as South Africa's contribution to Greenhouse gases which contribute to climate change, local air quality and water availability have come to the fore. These considerations necessitated the review and update of the IRP and ultimately the promulgation of a revised plan in October 2019. In terms of the IRP 2019, South Africa continues to pursue a diversified energy mix that reduces reliance on a single or a few primary energy sources. In the period prior to 2030, the system requirements are largely for incremental capacity addition (modular) and flexible technology, to complement the existing installed inflexible capacity. South Africa is a signatory to the Paris Agreement on Climate Change and has ratified the agreement. In line with INDCs (submitted to the UNFCCC in November 2016), South Africa's emissions are expected to peak, plateau and from year 2025 decline. Following consideration of all these factors, the following Plan was promulgated.

	Coal	Coal (Decommis-sioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	37,149		1 860	2,100	2 912	1 474	1 980	300	3 830	499
2019	2,155	-2,373					244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1,433	-557				114	300			
2021	1,433	-1403				300	818			
2022	711	-844			513	400 1,000	1,600			
2023	750	-555				1000	1,600			500
2024			1,860				1,600		1000	500
2025						1000	1,600			500
2026		-1,219					1,600			500
2027	750	-847					1,600		2000	500
2028		-475				1000	1,600			500
2029		-1,694			1575	1000	1,600			500
2030		-1,050		2,500		1000	1,600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	33,364		1,860	4,600	5,000	8,288	17,742	600	6,380	
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	
% Annual Energy Contribution (% of MWh)	58.8		4.5	8.4	1.2*	6.3	17.8	0.6	1.3	

Installed Capacity
Committed/Already Contracted Capacity
Capacity Decommissioned
New Additional Capacity
Extension of Koeberg Plant Design Life
Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030.
- Koeberg power station rated/installed capacity will revert to 1,926MW (original design capacity) following design life extension work.
- Other/ Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility.
- Short term capacity gap is estimated at 2,000MW.

IRP 2019 as promulgated in October 2019[26]

This plan provides for the development of 6000MW of new capacity from large scale PV. The Highveld Solar PV Facility project would contribute towards this goal through the generation of 240MW.

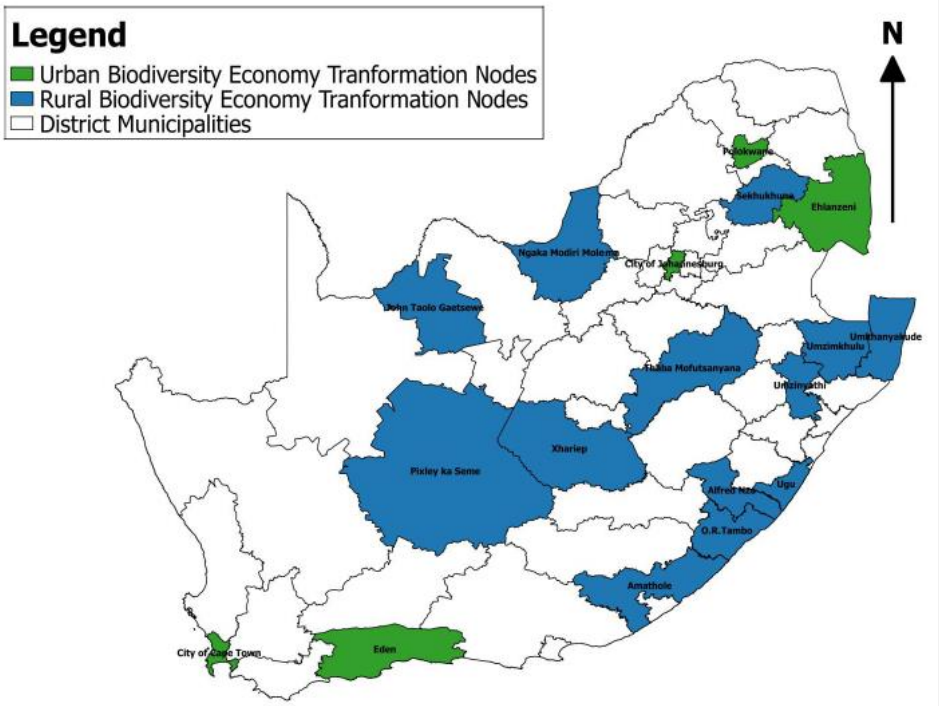
Renewable Energy Policy in South Africa	Yes. Support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable energy resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases 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

[26] source: https://www.cliffedekkerhofmeyr.com/en/news/publications/2019/Corporate/energy-alert-22-october-The-Integrated-Resource-Plan-2019-A-promising-future-roadmap-for-generation-capacity-in-South-Africa.html

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	account. However, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been largely neglected in South Africa. Challenges regarding the implementation of renewable energy have been identified. Through the development of renewable energy projects (including the Highveld Solar PV Facility), additional renewable energy will be made available which will assist with the further growth and development of the renewable energy sector.
National Development Plan 2030	The National Development Plan (NDP) 2030 offers a long-term plan for the country. It defines desired destinations where inequality and unemployment are reduced, and poverty is eliminated so that all South Africans can attain a decent standard of living. Electricity is one of the core elements of a decent standard of living. While the achievement of the objectives of the NDP requires progress on a broad front, three priorities stand out, namely: » Raising employment through faster economic growth » Improving the quality of education, skills development and innovation » Building the capability of the state to play a developmental, transformative role In terms of the Energy Sector's role in empowering South Africa, the NDP envisages that, by 2030, South Africa will have an energy sector that promotes: » Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. » Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households. » Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change. In formulating its vision for the energy sector, the NDP took the IRP 2010 as its point of departure. Therefore, although electricity generation from coal is still seen as part of the energy mix within the NDP, the plan sets out steps that aim to ensure that, by 2030, South Africa's energy system will look very different to the current situation: coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources – especially wind, solar, and imported hydroelectricity – will play a much larger role.
Strategic Integrated Projects (SIPs)	The Presidential Infrastructure Coordinating Committee (PICC) is integrating and phasing investment plans across 36 Strategic Infrastructure Projects (SIPs) which have five core functions: to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the integration of African economies. A balanced approach is being fostered through greening of the economy, boosting energy security, promoting integrated municipal infrastructure investment, facilitating integrated urban development, accelerating skills development, investing in rural development and enabling regional integration. SIP 8 and 9 of the energy SIPs supports the development of the solar energy facility: » SIP 8: Green energy in support of the South African economy: Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010 – 2030) and supports bio-fuel production facilities.

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	» SIP 9: Electricity generation to support socio-economic development: The proposed Highveld Solar 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 Mineral Resources and 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. » SIP 20: Energy (gazetted in GG 43547 on 24 July 2020). Includes 3 sub-projects; a. Emergency/Risk Mitigation Power Purchase Procurement Programme (2000MW): National b. Small IPP Power Purchase Procurement Programme (100MW): National c. Embedded Generation Investment Programme (EGIP)-400MW: National The Highveld Solar PV Facility could be registered as a SIP project once it is under development. The project would then contribute to the above-mentioned SIPs.
Renewable Energy Development Zones (REDZ) (GNR 114 of February 2018)	The Strategic Environmental Assessment (SEA) for Wind and Solar Photovoltaic Energy in South Africa, 2015, has identified 11 Renewable Energy Development Zones (REDZs) that are of strategic importance for large-scale wind and solar photovoltaic energy development, including the roll-out of its supporting transmission and distribution infrastructure, in terms of Strategic Integrated Project (SIP) 8: Green Energy in support of the South African Economy. The Highveld Solar PV Facility is located within the Klerksdorp REDZ.
National Biodiversity Economy Strategy (NBES) (March 2016)	The biodiversity economy of South Africa encompasses the businesses and economic activities that either directly depend on biodiversity for their core business or that contribute to conservation of biodiversity through their activities. The commercial wildlife and the bioprospecting industries of South Africa provide cornerstones for the biodiversity economy and are the focus of this strategy. Both the wildlife and bioprospecting sub-sectors of the biodiversity economy have already demonstrated the potential for significant future development and growth. In the study commissioned on the situational analysis of the biodiversity economy, the contribution of the biodiversity economy to the national economy can be measured in terms of Gross Domestic Product (GDP), with the wildlife and bioprospecting industries contributing approximately R3 billion to GDP in 2013. Growth in the wildlife and bioprospecting industries can make a significant impact on the national economy, while contributing to national imperatives such as job creation, rural development and conservation of our natural resources. The Wildlife Industry value chain is centred on game and wildlife farming/ranching activities that relate to the stocking, trading, breeding, and hunting of game, and all the services and goods required to support this value chain. The key drivers of this value chain include domestic hunters, international hunters and a growing retail market demand for wildlife products such as game meat and taxidermy products. This sector is therefore characterised by an interesting combination of agriculture, eco-tourism and conservation characteristics. Over the period 2008-2013, the total Wildlife Industry market grew by more than 14% per year. This growth comprised an average annual growth exceeding 6% in domestic hunting, a decrease in international hunting, and an exponential growth in live auction sales. It is considered likely that the consolidated Wildlife Industry has the potential to

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	experience a weighted average annual growth rate of between 4 %-14 % per year up to 2030. In order for the wildlife and bioprospecting sub-sectors of the biodiversity economy to achieve its full potential, a strategic partnership between the state, private sector and communities is required. To this end, a National Biodiversity Economy Strategy (NBES) is required to guide the sustainable growth of the wildlife and bioprospecting industries and to provide a basis for addressing constraints to growth, ensuring sustainability, identifying clear stakeholder's responsibilities and monitoring progress of the Enabling Actions. The Vision of NBES is to optimise the total economic benefits of the wildlife and bioprospecting industries through its sustainable use, in line with the Vision of the Department of Environmental Affairs. The purpose of NBES is to provide a 14-year national coordination, leadership and guidance to the development and growth of the biodiversity economy. NBES has set an industry growth goal stating that by 2030, the South African biodiversity economy will achieve an average annualised GDP growth rate of 10% per annum. This envisioned growth curve extends into the year 2030 and is aligned to the efforts of the country's National Development Plan, Vision 2030. The NBES seeks to contribute to the transformation of the biodiversity economy in South Africa through inclusive economic opportunities, reflected by a sector which is equitable - equitable access to resources, equitable and fair processes and procedures and equitable in distribution of resources (i.e. business, human, financial, indigenous species, land, water) in the market. To address these transformation NBES imperatives, NBES has the principles of: » Conservation of biodiversity and ecological infrastructure » Sustainable use of indigenous resources » Fair and equitable beneficiation » Socio-economic sustainability » Incentive driven compliance to regulation » Ethical practices » Improving quality and standards of products. The NBES provides the opportunity to redistribute South Africa's indigenous biological/ genetic resources in an equitable manner, across various income categories and settlement areas of the country. The NBES has prioritised nodes in the country for biodiversity economy transformation, referred to as BET nodes. NBES prioritises 18 BET nodes, 13 rural and 5 urban districts across the nine provinces of the country (refer to **Figure 3.2**), with communities having been prioritised for development of small and medium size enterprises and community-based initiatives which sustainably use of indigenous biological and/or genetic resources. The Dr Kenneth Kaunda District Municipality within which the Highveld Solar PV Facility is proposed is not included as one of these nodes.

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	 **Figure 3.2:** Map of the Biodiversity Economy Transformation (BET) nodes which are the transformation priorities of the NBES
New Growth Path (NGP) Framework, 2010	The purpose of the New Growth Path (NGP) Framework is to provide effective strategies towards accelerated job-creation through the development of an equitable economy and sustained growth. The target of the NGP is to create 5 million jobs through the green economy. With economic growth and employment creation as the key indicators identified in the NGP. To achieve this, government will seek to, amongst other things, identify key areas for large-scale employment creation, as a result of changes in conditions in South Africa and globally, and to develop a policy package to facilitate employment creation in these areas. The Highveld Solar PV Facility will assist with the creation of both temporary and permanent employment opportunities during the construction and operation phases, which will contribute, albeit to a limited extent, to the economy and sustainable growth.
National Climate Change Response Strategy for South Africa, 2004	The need for a national climate change policy for South Africa was identified as an urgent requirement during the preparations for the ratification of the UNFCCC in 1997. A process to develop such a policy was thus instituted under the auspices of the National Committee for Climate Change (NCCC), a non-statutory stakeholder body set up in 1994 to advise the Minister on climate change issues and chaired by the then Department of Environmental Affairs and Tourism (DEAT). It was determined that a national climate change response strategy will promote integration between the programmes of the various government departments involved to maximise the benefits to the country as a whole, while minimising negative impacts. Further, as climate change response actions can potentially act as a significant factor in boosting sustainable economic and social development, a national strategy specifically designed to bring this about is clearly in the national interest, supporting the major objectives of the government including poverty alleviation and the creation of jobs. A number of principles and factors guided the conception of the strategy and is required to be implemented. These are: » Ensuring that the strategy is consistent with national priorities, including poverty alleviation, access to basic amenities including infrastructure development, job

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	creation, rural development, foreign investment, human resource development and improved health, leading to sustainable economic growth; » Ensuring alignment with the need to consistently use locally available resources; » Ensuring compliance with international obligations; » Recognizing that climate change is a cross cutting issue that demands integration across the work programmes of other departments and stakeholders, and across many sectors of industry, business and the community; » Focussing on those areas that promote sustainable development; » Promoting programmes that will build capacity, raise awareness and improve education in climate change issues; » Encouraging programmes that will harness existing national technological competencies; » Reviewing the strategy constantly in the light of national priorities and international trends; » Recognizing that South Africa's emissions will continue to increase as development is realised. The strategy was devised through an integrated approach and considers policies and programmes of other government departments and the fact that South Africa is a developing country. This will ensure that the principles of sustainable development are adequately served and do not conflict with existing development policies.
National Climate Change Response Policy, 2011	The Conference of the Parties (COP) 21 was held in Paris from 30 November to 12 December 2015. From this conference, an agreement to tackle global warming was reached between 195 countries. This Agreement is open for signature and subject to ratification, acceptance or approval by States and regional economic integration organisations that are Parties to the Convention from 22 April 2016 to 21 April 2017. Thereafter, this Agreement shall be open for accession from the day following the date on which it is closed for signature. The agreement can only be sanctioned once it has been ratified by 55 countries, representing at least 55% of emissions. South Africa signed the Agreement in April 2016 and ratified the agreement on 01 November 2016. The Agreement was assented to by the National Council of Provinces on 27 October 2016, and the National Assembly on 1 November 2016. The Agreement was promulgated on 04 November 2016, thirty days after the date on which at least 55 Parties to the Convention, which account for at least 55% of the total global greenhouse gas emissions have deposited their instruments of ratification, acceptance, approval or accession with the Depositary. South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD) GHG emissions trajectory whereby South Africa's emissions should peak between 2020 and 2025, plateau for approximately a decade, and then decline in absolute terms thereafter, and based on this the country has pledged to reduce emissions by 34% and 42% below Business As Usual (BAU) emissions in 2020 and 2025, respectively. The policy provides support for the Highveld Solar PV Facility, which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.
Climate Change Bill, 2018	On 08 June 2018 the Minister of Environmental Affairs published the National Climate Change Bill ("the Bill") for public comment. The purpose of the Bill is to build an effective

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	climate change response and ensure the long-term, just transition to a climate resilient and lower carbon economy and society. This will be done within the context of sustainable development for South Africa, and will provide for all matters related to climate change. The National Climate Change Bill addresses issues related to institutional and coordination arrangement across the three spheres of government namely national, provincial and local. It further highlights the need for the spheres of government and entities, sectors as well business to respond to challenges of climate change. The Bill further addresses the matters relating to, the national adaptation to impacts of climate change, greenhouse gas emissions and removals, and policy alignment and institutional arrangements. The Bill provides a procedural outline that will be developed through the creation of frameworks and plans. The following objectives are set within the Bill: a) Provide for the coordinated and integrated response to climate change and its impacts by all spheres of government in accordance with the principles of cooperative governance; b) Provide for the effective management of inevitable climate change impacts through enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to building social, economic, and environmental resilience and an adequate national adaptation response in the context of the global climate change response; c) Make a fair contribution to the global effort to stabilise greenhouse gas concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe and in a manner that enables economic, employment, social and environmental development to proceed in a sustainable manner. The Highveld Solar PV Facility comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.
Independent Power Producers Procurement Programme (IPPPP)	In terms of renewable energy, 6 422 MW of electricity had been purchased in seven bid rounds from 112 RE Independent Power Producers (IPPs). The national grid has been connected to 3 162 MW of electricity generation capacity from 57 IPP projects. Since the first project went live, renewable energy sources procured through the REIPPPP have generated 16 991 GWh of energy (a 15% contribution to morning and evening system peak periods). According to the document, the REIPPPP has attracted significant investment in the development of REIPPs in the country. The total investment (total project costs) of projects under construction and in the process of closure is R201.8 billion (this includes total debt and equity of R200.4 billion, as well as early revenue and VAT facility of R1.4 billion). In the six bid windows, the REIPPPP attracted R48.8 billion in foreign investment and financing (BW1 – BW4, 1S2 and 1S2). This is more than double the amount of FDI brought into South Africa in 2015. (R22.6 billion). South Africans held 48% (R31.5 billion) of the total equity shareholding (R66.7 billion) across BW1 to BW4, BW1S2 and 1S2. This is significantly more than the required 40%. Foreign equity amounts to R35.8 billion, accounting for 52% of total equity.

Relevant legislation or policy	Relevance to Highveld Solar PV Facility
	The REIPPPP also contributes to broad-based black economic empowerment and the development of black industrialists. In this regard, Black South Africans own 31% of projects that have reached financial close, which is slightly higher than the 30% target. The REIPPPP has also ensured that black people in local communities have ownership in IPP projects that operate in or near their communities. On average, black local communities own 11% of projects that have reached financial close. This is far above the 5% target. Furthermore, an average of 18% shareholding by black people in engineering, procurement, and construction (EPC) contractors has been achieved in projects that have reached financial close under the REIPPPP. This is slightly less than the 20% target. For the 57 projects currently in operation, black people's shareholding in operating companies of IPPs has averaged 20% (versus a target of 20%). (i.e. in BW 1, 2 and 3). The target for black people in top management shareholding has been set at 40%, with an average of 61% achieved to date. As a result, the target has been significantly exceeded.

3.3.3 Policy and planning at a Provincial Level

A brief review of the most relevant provincial policies is provided below in **Table 3.3**. The proposed development is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

Table 3.3: Relevant provincial legislation and policies for Highveld Solar PV

Relevant policy	Relevance to Highveld Solar PV Facility
North West Provincial Development Plan (PDP), 2030	The North West Provincial Development Plan (PDP) 2030 is largely based on and intends to implement the objectives of the National Development Plan (NDP) 2030. The following are the overall objectives of the PDP: By 2030: » Eliminate income poverty: By 2030, the percentage of the population living in poverty will have fallen from 46% to 0%. » Reduce inequality by lowering the Gini coefficient from 0.61 to 0.53. » The targets for poverty reduction and the GINI coefficient supplement the national targets for poverty eradication and inequality reduction. » The unemployment rate is expected to fall from 24% in 2010 to 14% in 2020 and 6% in 2030. This necessitates the creation of an additional 815 000 jobs. Total employment is expected to increase from 748 000 to 1,563 000. » According to the NDP, total employment in South Africa will increase from 13 million to 24 million. The North West Province will be home to 7% of the new jobs that must be created. By 2030, the North West will account for 6.5% of all employment in South Africa. » In real terms, the provincial Gross Value Added (GVA) should increase by 2.9 times. Such expansion will necessitate annual GVA growth of 5.4% on average. The development of the Highveld Solar PV Facility has the potential to contribute to a number of PDP targets, including job creation and increased income, which would have a positive impact on the Province's current unemployment rate, standard of living, levels of inequality, and poverty levels; contribution to per capita income and labour force participation rates; and production of clean energy.

Relevant policy	Relevance to Highveld Solar PV Facility
North West Province Spatial Development Framework (SDF) (2016) – Published 2017	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. As per the North West Provincial Spatial Development Framework (PSDF) (2017) electricity within the province is primarily provided by Eskom to re-distributors – mainly municipalities (10%), commercial (5%), agriculture (5%), mining (30%), industrial (30%) and Residential (20%). According to the North West PSDF the proposed project site is located within the Mahikeng Distribution Area, which is characterised by minor developments, including Commercial, Industrial, and Major Electrification; and has a projected growth of 125MW (Eskom, 2015). Eskom's Transmission Development Plan 2015 – 2024 represents the transmission network infrastructure investment requirements over the 10-year period between 2015 and 2024. Projects proposed for the North West Province for the next 10 years include the introduction of 400kV power lines and transformation to support or relieve the existing networks. Five transmission power corridors have been identified as critical to providing a flexible and robust network that could respond to meet the needs of future IPPs and IRP requirements. The development of the proposed PV facility and its associated grid connection infrastructure 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.
Renewable Energy Strategy for the North West Province (2012)	The Renewable Energy Strategy for the North West Province was developed in 2012 by the North West Province's then Department of Economic Development, Environment, Conservation, and Tourism (DEDECT). The strategy was created in response to the North West Province's need to participate meaningfully in South Africa's RE sector. The North West Province's RE strategy aims to improve the environment, reduce its contribution to climate change, and alleviate energy poverty, all while promoting economic development and job creation and developing its green economy. The North West Province, according to the strategy, consumes approximately 12% of South Africa's available electricity and is ranked as the country's fourth largest electricity consuming province. This is primarily due to the high demand for electrical energy-intensive mining and related industrial sectors, which consume approximately 63% of the province's electricity supply. While the strategy acknowledges that South Africa has an abundance of RE resources, it is also aware that the applicability of these RE resources is dependent on a number of factors and, as a result, are not equally viable for the North West Province. Solar Energy (photovoltaic as well as solar water heaters), Municipal Solid Waste, hydrogen and fuel cell

Relevant policy	Relevance to Highveld Solar PV Facility
	technologies, biomass, and energy efficiency were identified as the RE sources with the greatest potential and competitiveness for the North West Province. The advantages and benefits associated with the implementation and use of RE technologies for the North West Province include: » Energy supply for rural communities, schools, and clinics that are not connected to the national power grid. » The creation of an environment in which access to electricity allows rural communities to build an economic base through agricultural and home-based industries, as well as Small, Medium, and Micro Enterprises (SMMEs) in order to increase their income-generating potential. » It would result in less time spent collecting wood and water, improving the quality of life in communities and, in particular, for women. » Reduced use of fuelwood as an energy source for cooking and heating, which causes respiratory and other hazards. Solar water heating for urban and rural households, reducing the need for either electricity (in urban settings) or fuelwood (in rural settings) to heat water, lowering our national peak demand and preserving woodlands in a sustainable manner. » Large-scale use of renewable energy will also reduce carbon dioxide emissions, contributing to a cleaner environment. Because RE and energy efficiency go hand in hand, there will be additional financial benefits and a need for smaller RE systems. » The development of a strong localised RE industry within the NWP holds significant potential for Black Economic Empowerment (BEE) and job creation within the Province. » The development of a strong renewable energy base in the North West Province, particularly in the manufacture of fuel cells, could stimulate the market for Platinum Group Metals (PGM), benefiting the local mining sector. This is because renewable energy sources have a significant potential for increasing supply security by diversifying the energy supply portfolio and are increasingly contributing to a long-term sustainable energy future. Regarding environmental impacts, RE emits fewer GHGs than fossil fuels, as well as fewer airborne particulates and other pollutants. Furthermore, when compared to coal-fired power plants, RE generation technologies use less water.
North West Provincial Growth and Development Strategy (PGDS) 2004-2014	The North West Provincial Growth and Development Strategy (PGDS) establishes a framework for the province's and its people's integrated and sustainable growth and economic development. The Province's challenges are summarized as follows: The Province is mostly rural in nature; it has a low population density and relatively inadequate infrastructure, particularly in remote rural areas; it inherited an enormous backlog in basic service delivery and maintenance that will take time to eliminate; the population is predominantly poor, with high levels of illiteracy and dependency affecting their productivity and ability to compete for jobs; and it is marked by great inequalities between the rich and the poor. From the foregoing, job creation and poverty eradication, as well as a lack of expertise and skills, stand out as the most pressing issues to be addressed in the Province. The PGDS's goals and objectives are to combat poverty and unemployment, improve low levels of expertise and skills, which are classified as both immediate and long-term goals, and to require primary goals for sustained growth and economic development. The

Relevant policy	Relevance to Highveld Solar PV Facility
	proposed solar farm will help to create jobs and develop skills, which is in line with the North West PGDS's goals and objectives. The North West PGDS seeks to create a sustainable economy in order to eliminate poverty and improve social development. The proposed solar farm will contribute to the local area's growth and development by broadening the economic base and creating job opportunities.

3.3.4 Policy and planning at a Local Level

The local tiers of government relevant to the Highveld Solar PV project are the JB Marks Municipality and the Dr Kenneth Kaunda District Municipality. Instruments and/or policies at both the district and local level contain objectives which align with the development of the Highveld Solar PV Facility. These include, economic growth, job creation, community upliftment and poverty alleviation.

Table 3.4: Relevant district and local legislation and policies for Highveld Solar PV Facility

Relevant policy	Relevance to Highveld Solar PV Facility
Dr Kenneth Kaunda District Municipality Draft Integrated Development Plan (IDP) 2022 – 2027	The following are the objectives of Dr Kenneth Kaunda DM's Spatial Development Framework (SDF): » Diversification of the economic base » Accelerating growth in agriculture, tourism, industries, and export sectors (metals, clothing, textiles, agro-processing, mineral beneficiation, and manufacturing » Manufacturing sector innovation and competitiveness is a critical component in the strategy to significantly increase the manufacturing sector's potential to contribute to the overall development of the district » Ensure sustainability by identifying potential conflict zones between proposed development and environmentally sensitive areas » Bringing marginalized communities into the economic mainstream » Strengthening and concentration of developments along N12 » Identification of available land and infrastructure to accommodate development along the corridor Dr Kenneth Kaunda District Municipality's (DKKDM) vision is to be a catalyst for economic development in the North West Province region, benefiting all communities within its jurisdiction. The goal is to help municipalities implement key local economic development projects by championing investment in or supporting business development for selected high-impact projects that will stimulate economic growth, job creation, and economic diversification in the district region. The proposed Highveld Solar PV facility is consistent with the SDF in the IDP. Through the field of renewable energy, the development will help the District Municipality achieve economic growth and build a sustainable economy.
JB Marks Local Municipality Draft Integrated Development Plan (IDP) 2022 – 2023	The JB Marks Local Municipality Strategic Agenda should be implemented in pursuance of the following six Key Performance Areas for Local Government as contained in the Municipal Planning and Performance Management Regulations (2006) as promulgated by National Government: » KPA 1: Municipal Transformation and Organizational Development - To improve organization stability and sustainability

Relevant policy	Relevance to Highveld Solar PV Facility
	» KPA 2: Basic Service Delivery and Infrastructure Development - To eradicate backlog in order to improve access and ensure proper operation and maintenance to services and infrastructure development » KPA 3: Local Economic Development - To create an environment that promotes developments of local economy and facilitate job creation » KPA 4: Municipal Financial Viability and Management - To improve overall financial management in the municipality by developing and implementing appropriate financial management policies, procedure and system » KPA 5: Good Governance and Public Participation - To promote a culture of participatory and good governance » KPA 6: Spatial Rationale - Improve the quantity and quality of basic services for all people in terms of water, sanitation, electricity, waste management, roads and disaster management (infrastructure investment & development) The development of the Highveld Solar PV facility means the Local Municipality will add an additional IPP project within its jurisdiction. This will lead to an economic multiplier effect for the municipality and its residents which will fulfil the socio-economic objectives of the IDP such as creation of employment opportunities and economic growth.

CHAPTER 4: NEED AND DESIRABILITY & ALTERNATIVES

One of the objectives of the BA process is to motivate for "*the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint*". The need and desirability of a development needs to consider whether it is the right time and right place for locating the type of land-use/activity being proposed. Need and desirability is therefore equated to the wise use of land and should be able to answer the question of what the most sustainable use of land may be.

This Chapter provides an overview of the suitability of the Highveld Solar PV Facility being developed at the preferred project location from an international, national, regional, and site-specific perspective. It provides an overview of the need and desirability, and perceived benefits of the project specifically. This Chapter provides an overview of the various alternatives considered for Highveld Solar PV Facility as part of the BA Process.

4.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of a Basic Assessment Report

This chapter of the BA Report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 1: Content of Basic Assessment Reports:

Requirement	Relevant Section
(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 of the Highveld Solar PV Facility is included and discussed as a whole within this chapter. The need and desirability for the development of the Highveld Solar PV Facility has been considered from an international, national, regional and site-specific perspective.
(h)(i) a full description of the process followed to reach the proposed development footprint within the approved site, including details of the development footprint alternatives considered	The details of all alternatives considered as part of the Highveld Solar PV Facility is included in **Section 4.7.**
(h)(ix) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such	The details of the alternatives considered as part of the Highveld Solar PV Facility have been included in **Section 4.7**. Where no alternatives are being considered a motivation has been included.

4.2 Need and Desirability from an International Perspective

The need and desirability of the Highveld Solar PV Facility, from an international perspective, can be described through the project's alignment with internationally recognised and adopted agreements, protocols, and conventions. South Africa is signatory to a number of international treaties and initiatives, including the United Nation's Development Programme's (UNDP's) Sustainable Development Goals (SDGs). The SDGs address social and economic development issues such as poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, urbanization, environment and social justice. The SDGs comprise 17 global goals set by the United Nations. The 17 SDGs are characterised by 169 targets, and 304 indicators.

Goal 7 of the SGDs relates to "Affordable and Clean Energy", with the aim of the goal being to ensure access to affordable, reliable, sustainable and modern energy for all. The following targets and indicators have been set for Goal 7:

Targets		Indicators	
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services.	7.1.1 7.1.2	Proportion of population with access to electricity. Proportion of population with primary reliance on clean fuels and technology.
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix.	7.2.1	Renewable energy share in the total final energy consumption.
7.3	By 2030, double the global rate of improvement in energy efficiency.	7.3.1	Energy intensity measured in terms of primary energy and GDP.
7.A	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.	7.A.1	Mobilised amount of United States dollars per year starting in 2020 accountable towards the $100 billion commitment.
7.B	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support.	7.B.1	Investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services.

The development of the Highveld Solar PV Facility would contribute positively towards achieving Goal 7 (and specifically 7.2.1) of the SGDs through the following means:

- By generating up to 240MW of affordable and clean energy.
  - A study published by the CSIR on 14 October 2016 ("Cost of new power generators in South Africa Comparative analysis based on recent IPP announcements", Dr Tobias Bischof-Niemz and Ruan Fourie) which took into consideration the results of the cost prices bid successfully under the DoE's REIPPP and Coal Baseload IPP Procurement (CBIPPP) Programmes found that solar PV and wind were 40% cheaper than new baseload coal (i.e. R0.62/kWh for PV and wind vs R1.03 for coal).
  - PV technology is one of the cleanest electricity generation technologies, as it is not a consumptive technology and does not result in the release of emissions during its operation.
- By contributing towards South Africa's total generation capacity, specifically through the utilisation of renewable energy resources.

4.3 Need and Desirability from a National Perspective

4.3.1 Policy and Planning

The National Development Plan (NDP) envisages that, by 2030, South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates; that is socially equitable through expanded access to energy at affordable tariffs; and that is environmentally sustainable through reduced emissions and pollution. Historically, coal has provided the primary fuel resource for baseload electricity generation in South Africa. Consequently, Eskom, who is the main electricity generating company in the

country, generates approximately 85% of the country's electricity from coal resources (Stats SA, 2016), resulting in a large carbon footprint. Taking into consideration the need to ensure adequate supply of electricity and meet international obligations in terms of addressing climate change, Government has identified the need to diversify the energy mix within the country.

The Highveld Solar PV Facility is proposed in specific response to the identified energy mix of South Africa as per the requirements set out in the IRP with regards to renewable energy targets. As a result, the need and desirability of the project from a national perspective can largely be assimilated from the project's alignment with national government policies, plans, and programmes which have relevance to energy planning and production (as discussed in detail in Chapter 3). The following key policies have been developed by Government to take into account South Africa's current energy production and projected future demands, and provides the necessary framework within which energy generation projects can be developed:

» Integrated Energy Plan (IEP)
» Integrated Resource Plan (IRP)

The abovementioned energy plans have been extensively researched and are updated on an ongoing basis to take into consideration changing scenarios, new information, developments in new technologies, and to reflect updated demands and requirements for energy production within the South African context. These plans form the basis of South Africa's energy generation sector and dictate national priorities for energy production.

The IEP is intended to provide a roadmap of South Africa's future energy landscape and guide future energy infrastructure investments and policy development. The Plan considered the three pillars of sustainable development, and list the following as the eight key energy planning objectives:

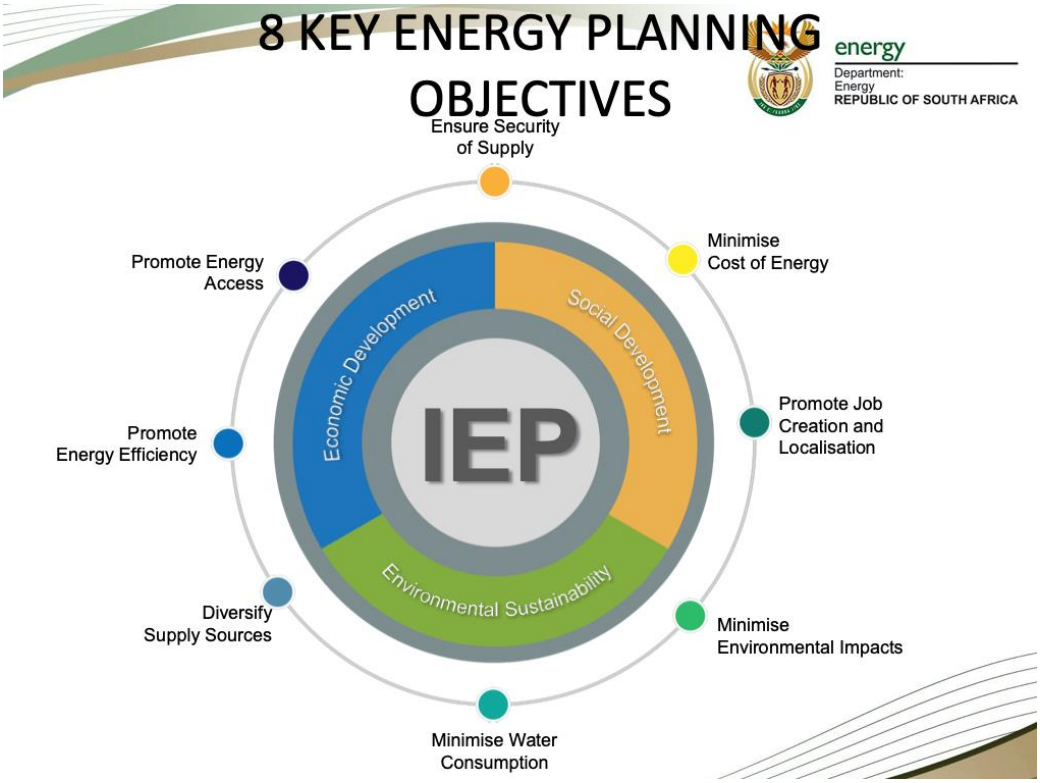


Figure 4.1: Eight key energy objectives as listed in the IEP, 2016 (extract from DOE presentation, December 2016)

The latest iteration of the IEP (25 November 2016) contained the following statement regarding solar power in South Africa:

"*South Africa experiences some of the highest levels of solar radiation in the world and this renewable resource holds great potential for the country. The daily solar radiation in South Africa varies between 4.5 and 6.5 kilowatt hours per square meter (kWh/m²) (16 and 23 megajoules per square meter [MJ/m²]) (Stassen, 1996), compared to about 3.6kWh/m² in parts of the United States and about 2.5kWh/m² in Europe and the United Kingdom. The total area of high radiation in South Africa amounts to approximately 194 000km². With electricity production per square kilometre of mirror surface in a solar thermal power station being 30.2MW, and just 1% of the high radiation area in the country being made available for solar power generation, the generation potential is approximately 64GW. Solar energy has the potential to contribute quite substantially to South Africa's future energy needs. This would, however, require large investments in transmission lines from the areas of high radiation to the main electricity consumer centres*."

In terms of electricity generation, the IEP states that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources, and includes the following statement regarding solar energy's contribution to the diversified energy mix:

- *Solar should play a much more significant role in the electricity generation mix than it has done historically, and constitutes the greatest share of primary energy (in terms of total installed capacity) by 2050. The contribution of solar in the energy mix comprises both CSP and solar PV. Solar PV includes large scale installations for power generation which supply to the grid and individual, off-grid solar home systems and rooftop panels.*
- *A thorough solar resource assessment for South Africa should continue to be undertaken in the North West Province and extended to other provinces deemed to have high solar radiation levels.*
- *Investments should be made to upgrade the grid in order to accommodate increasing solar and other renewable energy contributions.*

The Integrated Resource Plan 2019 is South Africa's current gazetted energy plan. The purpose of the plan is to ensure sustainable electricity development which takes into consideration technical, economic, and social constraints, and identifies investments in the electricity sector which are required to meet the country's forecasted electricity demands at minimum costs. The consideration of GHG emissions in the determination of the energy generation mix indicates government's commitment to international obligations under the Paris Agreement.

Besides capacity additions, a number of assumptions changed since the promulgation of IRP 2010–2030. Key assumptions that changed include the electricity demand projection, Eskom's existing plant performance, as well as new technology costs. In addition, environmental considerations such as South Africa's contribution to Greenhouse gases which contribute to climate change, local air quality and water availability have come to the fore. These considerations necessitated the review and update of the IRP and ultimately the promulgation of a revised plan in October 2019. In terms of the IRP 2019, South Africa continues to pursue a diversified energy mix that reduces reliance on a single or a few primary energy sources. In the period prior to 2030, the system requirements are largely for incremental capacity addition (modular) and flexible technology, to complement the existing installed inflexible capacity. South Africa is a signatory to the Paris Agreement on Climate Change and has ratified the agreement. In line with NDCs (submitted to the UNFCCC in November 2016), South Africa's emissions are expected to peak, plateau and from year 2025 decline. The IRP 2019 provides for the development of 6000MW of new capacity from large scale PV.

In addition to the policy considerations detailed above, Government has prioritised post COVID-19 turnaround plans in terms of renewable energies within the Just Energy Transition (JET), coupled with key development objectives of the various spheres of government. These policies share the same ideals, such as:

» The utilisation, application and investment in renewable energy resources in South Africa is considered to be an essential means of reducing the carbon footprint of the country,
» Diversifying the national economy,
» Reducing poverty, and
» Providing critical additional energy to that of Eskom.

Government has compiled an Economic Reconstruction and Recovery Plan which was presented to Parliament in October 2020. According to this plan, the economic survey will rely on a massive investment in infrastructure, including energy, telecommunications, ports and rail. The core elements of the Economic Reconstruction and Recovery Plan are as follows:

1. Priority interventions for economic recovery: the plan sets out eleven priority interventions that will ignite South Africa's recovery and reconstruction effort. These are the flagship initiatives that all of society will rally around to build a new economy (**Figure 4.2**).
2. Enabling conditions for growth: these are growth-enhancing reforms and other preconditions for an inclusive, competitive and growing economy.
3. Macroeconomic framework: economic reconstruction and recovery requires careful mobilisation of resources to ensure fiscal sustainability.
4. Institutional arrangements: the plan focuses on execution, and is supported by enhanced institutional arrangements to ensure implementation and accountability.

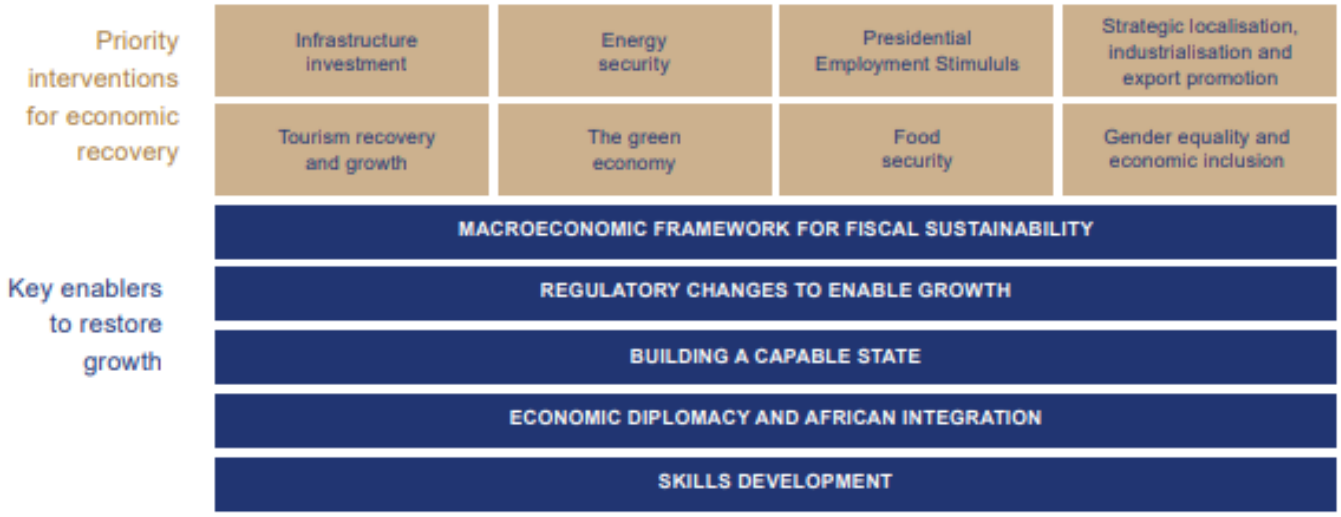


Figure 4.2: Core elements of the Economic Reconstruction and Recovery Plan (source: Building a new economy - Highlights of the Reconstruction and Recovery Plan, Presidency of the Republic of South Africa)

The plan recognises energy security as the most important prerequisite for the recovery agenda and states that renewed investment in a diversified energy mix can be achieved within a short time horizon, while alleviating a crippling energy crisis and facilitating a necessary transition to a less carbon-intensive economy.

One of the key commitments of the plan is, therefore, to implement the IRP 2019 without delay to provide a substantial increase in the contribution of renewable energy sources by 2030, alongside other sources including battery storage, gas and clean coal. The transition to green energy is recognised as contributing towards the realisation of the low-carbon, climate-resilient and inclusive economy envisaged by the National Development Plan. The development of the Highveld Solar PV Facility is identified as a mechanism for securing additional power generation capacity as part of the REIPPP programme or for private off-takers, reducing the reliance for electricity on Eskom.

The need for new power generation from solar PV facilities has been identified and assessed by government at a national scale considering the national energy requirements as well as international commitments under the Paris Agreement; therefore, provision has been made for the inclusion of new PV power generation capacity in South Africa's energy mix. The implementation of the Highveld Solar PV Facility has the potential to contribute positively towards the identified need, while simultaneously contributing to job creation and socio-economic development, identified as a need for the country within the National Development Plan (NDP).

The Highveld Solar PV Facility will make use of renewable energy technology and would contribute positively towards reducing South Africa's GHG emissions and ensure compliance with all applicable legislation and permitting requirements. In addition, by making use of PV technology, the Highveld Solar PV Facility would have reduced water requirements when compared with some other generation technologies in alignment with one of the vision 2030 themes of the then-Department of Water and Sanitation's (now the Department of Human Settlements, Water and Sanitation) National Water Resource Strategy 2 (2013) (i.e. transitioning to a low carbon economy through stimulating renewable energy and retrofitting buildings).

4.3.2 Renewable Energy Development Zones (REDZ)

The DFFE has committed to contribute to the implementation of the NDP, the National Infrastructure Plan (NIP) and 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 the DFFE in support of SIP 8, 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).

The procedure to be followed in applying for environmental authorisation for a large-scale project in a REDZ was formally gazetted on 16 February 2018 (GN R114). The aim of the zones is to streamline the regulatory process, identifying geographical areas where wind and solar PV technologies can be incentivised. These REDZ will ensure a transition to a low carbon economy, accelerating infrastructure development and contributing to a more coherent and predictable regulatory framework.

As illustrated in **Figure 4.3**, the complete extent of the development area of the Highveld Solar PV Facility falls within the Klerksdorp REDZ, which was selected by the DFFE as an area highly suitable for the development of solar energy facilities given a range of factors considered, including environmental sensitivities. This alignment with the REDZ area provides further support for the selection of the specific site chosen for this project

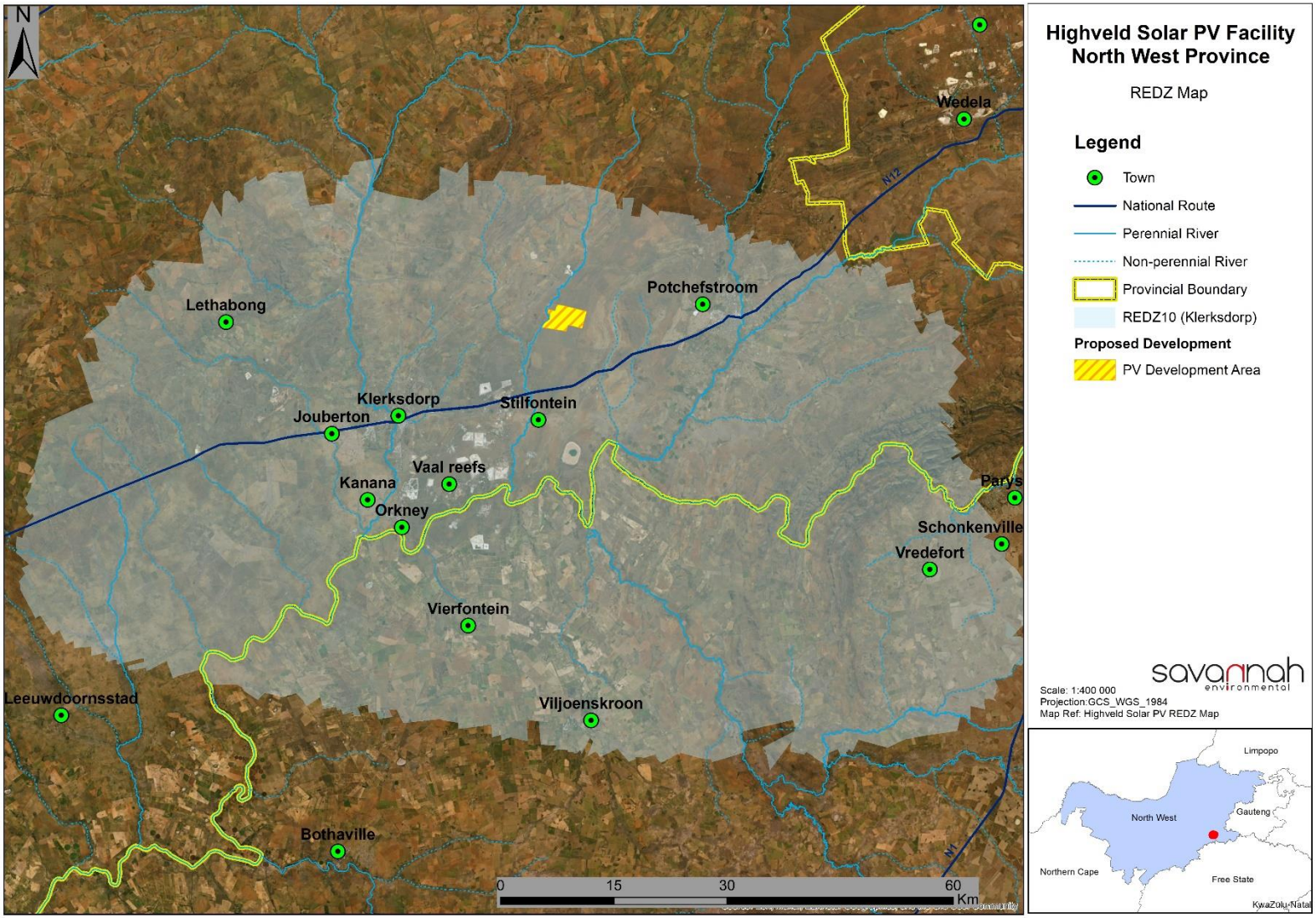


Figure 4.3: The Highveld Solar PV Facility is located within the Northern Section of the Klerksdorp REDZ area

From a planning perspective, the proposed Highveld PV Grid Connection[27] is also considered to be appropriately located within the Central Corridor of the Strategic Transmission Corridors (as gazetted on 16 February 2018, GN R113) (refer to **Figure 4.4**).

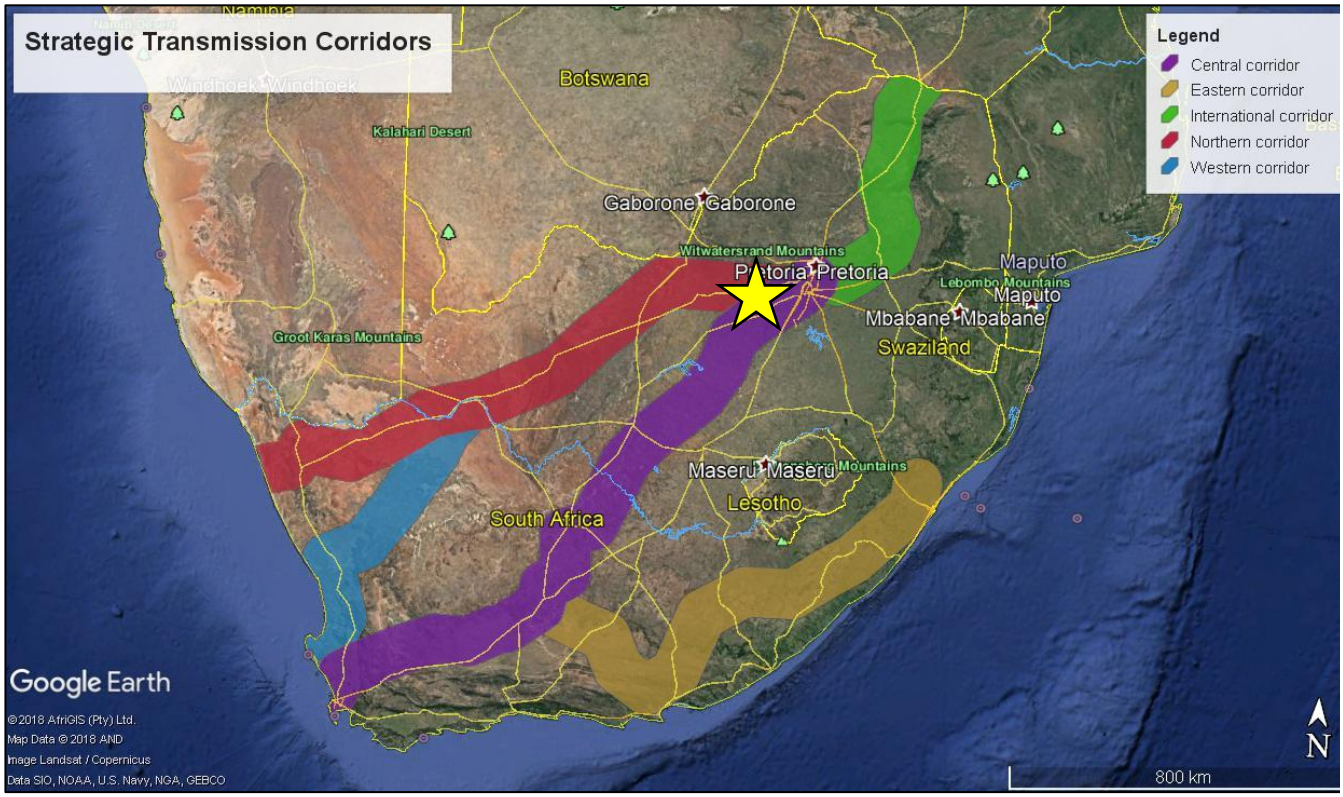


Figure 4.4: Strategic Power Corridors identified as the optimal locations where power infrastructure expansion is needed to enable the balancing of future demand and supply requirements, while minimising negative impacts to the environment. The location of the development area and study area for the Highveld Solar PV facility is indicated with a star.

4.4 Need and Desirability from a Regional Perspective

South Africa's electricity generation mix has historically been dominated by coal. However, up to 2030 a new capacity demand will be driven by the decommissioning of existing coal-fired power stations. A further 24 100MW (**Figure 4.5**) of coal power is expected to be decommissioned in the period 2030 to 2050. Therefore, additional capacity will be required from renewable energy sources, particularly solar with 6 000MW being allocated for the period up to 2030.

[27] The grid connection solution to connect Highveld Solar PV facility to a point of connection on the Hermes DS - Potchefstroom DS 1 and Buffels East 1 - Potchefstroom 132kV Feeder lines located east of Khuma and the R505, has been assessed within a separate BA process.

	Coal	Coal (Decommis-sioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	37,149		1 860	2,100	2 912	1 474	1 980	300	3 830	499
2019	2,155	-2,373					244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1,433	-557				114	300			
2021	1,433	-1403				300	818			
2022	711	-844			513	400 1,000	1,600			
2023	750	-555				1000	1,600			500
2024			1,860				1,600		1000	500
2025						1000	1,600			500
2026		-1,219					1,600			500
2027	750	-847					1,600		2000	500
2028		-475				1000	1,600			500
2029		-1,694			1575	1000	1,600			500
2030		-1,050		2,500		1000	1,600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	33,364		1,860	4,600	5,000	8,288	17,742	600	6,380	
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	
% Annual Energy Contribution (% of MWh)	58.8		4.5	8.4	1.2*	6.3	17.8	0.6	1.3	

Installed Capacity
Committed/Already Contracted Capacity
Capacity Decommissioned
New Additional Capacity
Extension of Koeberg Plant Design Life
Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030.
- Koeberg power station rated/installed capacity will revert to 1,926MW (original design capacity) following design life extension work.
- Other/ Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility.
- Short term capacity gap is estimated at 2,000MW.

Figure 4.5: A snapshot of the updated Energy Mix as per the IRP 2019

Although the majority of South Africa's electricity generation infrastructure (coal-fired power stations) is currently located within Mpumalanga due to the location of coal resources within this province, the North West Province has been identified as an area where electricity generation from solar energy facilities is highly feasible and a viable option. The location of the study area and project site within the North West is therefore considered to support the Province/Region's generation targets. The Stilfontein area is also considered as a hub for the development of solar energy projects due to the viability of the solar resource for the area and the number of projects proposed in the area.

The overarching objective for the solar energy facility is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. From a regional site selection perspective, this region is considered to be preferred for solar energy development by virtue of its annual solar irradiation values.

4.5 Receptiveness of the proposed development area for the establishment of Highveld Solar PV Facility

The placement of a solar PV facility is strongly dependent on several factors including climatic conditions (solar irradiation levels), topography, the location of the site, and in particular the location in a node for renewable projects, availability of grid connection, the extent of the site and the need and desirability for the project. From a local level perspective, the project site and development area have specifically been

identified by the proponent as being highly desirable from a technical perspective for the development of a solar PV facility due to the following site characteristics:

» **Solar resource**: The economic viability of a solar PV facility is directly dependent on the annual direct solar irradiation values. The Global Horizontal Irradiation (GHI) GHI for the area derived from the World Bank Group's Global Solar Atlas is between 2000 kWh/m²/annum and 2120 kWh/m²/annum, equivalent to the highest GHI values in the country (refer to **Figure 4.6**).

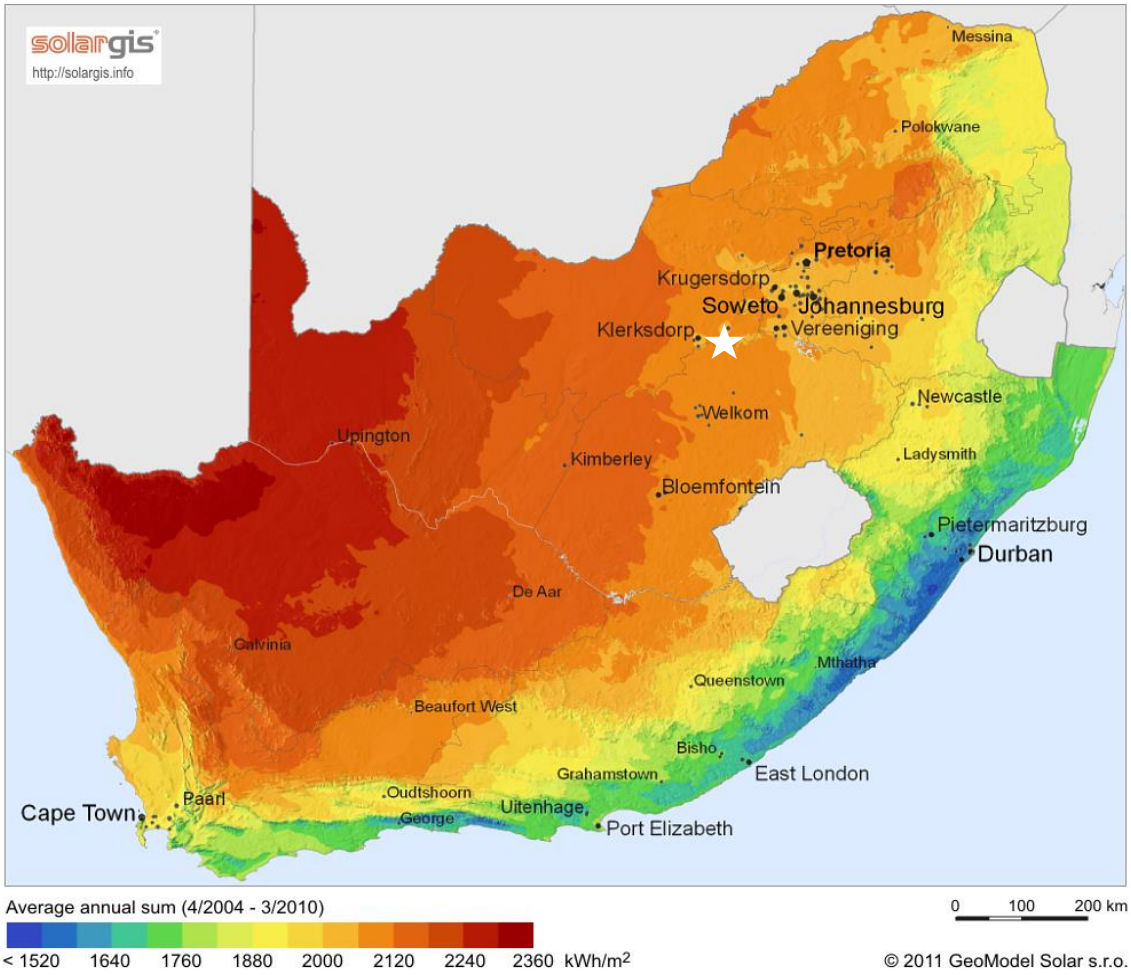


Figure 4.6: Solar irradiation map for South Africa, with the position of the Highveld Solar PV Facility shown by the white star (Source: GeoModel Solar)

» **Topography**: Sites that facilitate easy construction conditions, (i.e. relatively flat topography, lack of major rock outcrops, limited watercourse crossings, etc.) are favoured by developers during the site selection process. As a result, the development area for the Highveld Solar PV Facility consists of a slightly undulating topography, with slopes of less than 5% over most of the area, and with an average elevation of ~1 400m above sea level. There are no prominent hills within the project site. These characteristics are preferred for the development of a solar PV facility as construction efforts and costs are minimised, and therefore the study area is considered to be preferable and acceptable for the development of the Highveld Solar PV Facility.

» **Site extent and land availability:** Availability of relatively level land of sufficient extent can be a restraining factor to PV development, as a 240MW solar PV development and associated infrastructure requires sufficient land space. The development area, within which the project development footprint will be located, is ~1300ha. This area is considered to be sufficient for the planned 240MW PV facility and provides an opportunity for the avoidance of sensitive environmental features and areas.

» **Access to Road Infrastructure and Site access**: Access to the development area is considered as an important characteristic as easy access is required for the transportation of project related infrastructure and heavy machinery during construction. The proximity of the study area to viable access routes decreases the impact on secondary roads in terms of traffic during the construction and operation phases. The area can be readily accessed via the N12, located to the south of the development area; the Hartebeesfontein Road; and Rietfontein Road which are located to the west of the development area. The existing access road turning off from the Rietfontein Road towards the PV facility can be upgraded for safe access to the facility during the construction and operation phases. Considering the readily available site access to the study area and development area, the location of Highveld Solar PV Facility is considered to be suitable and appropriate.

» **Grid access:** Ease of access into the Eskom national electricity grid is vital to the viability of a solar PV facility and addresses Eskom's concerns for lower cost connection alternatives given current funding constraints. Solar PV facilities that are located near a grid connection point and/or demand centre are favourable and reduce the losses associated with power transmission. Various existing grid connection infrastructure are located within the area. The grid connection point for Highveld Solar PV Facility will be south of the project development area. The grid connection solution will be assessed within a separate BA process and will include a switching substation and a new 132kV power line.

» **Land suitability and land use activities:** The current land use of the development area is an important consideration in site selection in terms of limiting disruption to existing land use practices. The project site is currently used for grazing, which is generally preferred for developments of this nature as the grazing activities can continue on the project site in tandem with the operation of the solar PV facility. There is no cultivated agricultural land in the project site or directly adjacent to it which could be impacted upon by the proposed development. The proposed development is compatible with the surrounding land uses and does not present a conflicting land use.

» **Landowner Support:** The selection of a site where the landowner is supportive of the development of renewable energy is essential for ensuring the success of the project. The landowners do not view the development as a conflict with their current land use practices. The support from the landowners for the development to be undertaken on the affected properties has been solidified by the provision of consent for the project to proceed on the property through the signing of a land option to lease agreement with the proponent.

Taking into consideration the solar resource, grid access, land suitability, landowner support, access to road infrastructure, the current land use of the project site and development area, in conjunction with other large-scale solar PV projects that have been authorised within the vicinity of the project site, the development of the Highveld Solar PV Facility is therefore considered to be desirable and will ultimately contribute to, and further develop the successful power generation activities already being undertaken within the area.

Therefore, the development of the Highveld Solar PV Facility within the project site and development area is considered to be desirable considering the characteristics of the area.

4.6 Benefits of Renewable Energy and the Need and Desirability

The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa; these include:

Socio-economic upliftment of local communities: The Highveld Solar PV Facility has the potential to create much needed employment for unskilled locals during the construction phase. Training opportunities will also be afforded to qualified local people who can be upskilled to undertake certain roles during the construction and operation phases. In terms of the needs of the local community, the Local and District municipality IDPs identified the need to facilitate economic development by creating an environment that is conducive for business development, economic growth, sustainable employment opportunities and growth in personal income levels of communities; unlock opportunities to increase participation amongst all sectors of society in the mainstream economy to create decent job opportunities; promote Local Economic Development; and enhance rural development and agriculture. A study undertaken by the Department of Mineral Resource and Energy (DMRE), National Treasury and the Development Bank of Southern Africa (DBSA) in June 2017 found that employment opportunities created during the construction phase of the projects implemented to date had created 40% more jobs for South African citizens than anticipated. The study also found that significantly more people from local communities were employed during construction than was initially planned, confirming the potential benefits for local communities associated with the implementation of renewable energy projects.

Increased energy security: Given that renewables can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive distribution losses. As a result of the power constraints in the first half of 2015, power generators, meant to be the "barely-ever-used" safety net for the system (diesel-fired gas turbines), were running at > 30% average load factor in the first half of 2015. Load shedding occurred during 82 days in the first half of 2015 (out of 181 days). Results of a CSIR Energy Centre study for the period January to June 2015 (CSIR, August 2015), concluded that the already implemented renewable projects (wind and solar) within the country avoided 203 hours of so-called 'unserved energy'. During these hours the supply situation was so tight that some customers' energy supply would have had to be curtailed ('unserved') if it had not been for the renewables. The avoidance of unserved energy cumulated into the effect that during 15 days from January to June 2015, load shedding was avoided entirely, delayed, or a higher stage of load shedding was prevented due to the contribution of the wind and PV projects[28].

Resource saving: It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres per annum. 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. Renewable energy also translates into revenue savings, as fuel for renewable energy facilities is free compared to the continual purchase of fuel for conventional power stations. Results of a CSIR Energy Centre study for January to June 2015 (CSIR, August 2015) have quantified the contribution from renewable energy to the national power system and the economy over the first 6 months of 2015 compared to the 12 months of 2014:

2015 (6 months)	2014 (12 months)
R3.60 billion saving in diesel and coal fuel costs	R3.64 billion saving in diesel and coal fuel costs

[28] (http://ntww1.csir.co.za/plsql/ptl0002/PTL0002_PGE157_MEDIA_REL?MEDIA_RELEASE_NO=7526896)

200 hours of unserved energy avoided, saving at least an additional R1.20 billion–R4.60 billion for the economy	120 hours of unserved energy avoided, saving at least an additional R1.67 billion for the economy
Generated R4.0 billion more financial benefits than cost	Generated R0.8 billion more financial benefits than cost

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

By the end of March 2019, the REIPPPP had made the following significant impacts in terms of energy supply:

- 6 422MW of electricity had been procured from 112 Renewable Energy Independent Power Producers (IPPs) in seven bid rounds;
- 3 976 MW of electricity generation capacity from 64 IPP projects has been connected to the national grid;
- 35 669 GWh6 of energy has been generated by renewable energy sources procured under the REIPPPP since the first project became operational. Renewable energy IPPs have proved to be very reliable. Of the 64 projects that have reached COD, 62 projects have been operational for longer than a year. The energy generated over the past 12 month period for these 62 projects is 10 648 GWh, which is 96% of their annual energy contribution projections of 11 146 GWh over a 12 month delivery period. Twenty- eight (28) of the 62 projects (45%) have individually exceeded their projections.

Economics: As a result of the available renewable energy resources and the competitive renewable energy procurement process, both wind power and solar PV power have now been proven as cheaper forms of energy generation in South Africa than fossil fuel (coal) generated power. The IRP 2019 gazetted by the Minister of Mineral Resources and Energy in October 2019, updates the energy forecast for South Africa from the current period until the year 2030 and has made an allocation of 6000MW in addition to the already installed/committed capacity of 2 288MW from solar PV facilities which will be developed from 2022 – 2030.

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 irradiation or wind for power generation is a non-consumptive use of a natural resource which produces zero emissions during its operation.

The overview of the Independent Power Producers Procurement Report (March 2019) indicates that carbon emission reductions of 36.2 Mton CO_2 has been realised by the IPP programme from inception to date, of which 2.91 Mton is in this 2019 reporting quarter.

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. The renewable energy sector saved South Africa 1.4 million tons of carbon emissions over the first 6 months of 2015[29].

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 and for cementing its status as a leading player within the international community.

[29] http://www.iol.co.za/capetimes/renewable-energy-saving-sa-billions-csir-1.1903409#.VkNjdJq6FeU

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. In the short 8-year period, the REIPPPP has attracted R209.4 billion in committed private sector investment, resulting in 38 701 jobs for the youth and women from surrounding communities[30].

The overview of the Independent Power Producers Procurement Report (March 2019) indicates that all IPP projects to date have created 40 134 job years for South African citizens.

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, which will create jobs and skill local communities and result in community upliftment for the affected areas.

Protecting the natural foundations of life for future generations: Actions to reduce the disproportionate carbon footprint can play an important part in ensuring the human 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.

4.7 Alternatives Considered during the BA Process

In accordance with the requirements of Appendix 1 of the 2014 Environmental Impact Assessment (EIA) Regulations (GNR 326), reasonable and feasible alternatives including but not limited to site and technology alternatives, as well as the "do-nothing" alternative should be considered.

The DFFE Guidelines for determining alternatives states that the key criteria for consideration when identifying alternatives are that they should be "practicable", "feasible", "relevant", "reasonable" and "viable". Essentially there are two types of alternatives:

» Incrementally different (modifications) alternatives to the project.
» Fundamentally (totally) different alternatives to the project.

In this instance, 'the project' refers to the Highveld Solar PV Facility, a solar energy facility with capacity of up to 240MW, and associated infrastructure proposed to be developed by an Independent Power Producer (IPP) and intended to provide electricity to private off takers.

4.7.1 Consideration of Fundamentally Different Alternatives

Fundamentally different alternatives are usually assessed at a strategic level and, as a result, project specific environmental impact assessments (including BA processes) are therefore limited in scope and ability to address fundamentally different alternatives. At a strategic level, electricity generating alternatives have been addressed as part of the DMRE's current Integrated Resource Plan for Electricity 2010 – 2030 (IRP)[31], and will continue to be addressed as part of future revisions thereto. In this regard, the need for renewable energy

[30] https://www.sanews.gov.za/south-africa/renewable-energy-programme-attracts-r2094-billion-sa-economy
[31] The Integrated Resource Plan (IRP) is legislated policy which regulates power generation planning.

power generation from solar energy facilities has been identified as part of the technology mix for power generation in the country for the next 20 years.

The fundamental energy generation alternatives were assessed and considered within the development of the IRP and the need for the development of renewable energy projects has been defined. Therefore, fundamentally different alternatives to the proposed project are not considered within this BA process.

4.7.2 Consideration of Incrementally Different Alternatives

Incrementally different alternatives relate specifically to the project under investigation. "Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives for:

- The property on which, or location where the activity is proposed to be undertaken.
- The type of activity to be undertaken.
- The design or layout of the activity.
- The technology to be used in the activity.
- The operational aspects of the activity.

In addition, the option of not implementing the activity (i.e., the 'do-nothing' alternative) must also be considered.

The sections below describe the incrementally different alternatives being considered as part of the Highveld Solar PV Facility. Where no alternative is being considered, a motivation has been provided as required by the EIA Regulations, 2014 (as amended).

i. Property or Location Alternatives

The placement of a solar PV facility is dependent on several other factors including land suitability, climatic conditions (solar irradiation levels), topography, the location and extent of the study area, availability of grid connection infrastructure and the need and desirability of the project. WKN Windcurrent SA (Pty) Ltd as the Applicant, considers the preferred development area placed within the study area as being highly favourable and suitable for the establishment of a solar PV facility.

The development area is located within the Klerksdorp REDZ, which is a node identified by DFFE for the development of renewable energy projects. Based on those site-specific attributes discussed in Section 4.5, the Applicant considers the development area located within the study area as highly preferred in terms of the development of a solar PV facility. The project site is within a developing hub of renewable energy project, and the Highveld Solar PV Facility will be able to draw on synergies with the projects proposed and/or currently authorised within the vicinity of the study area. As a result, no property/location alternatives have been assessed further as part of this BA process.

ii. Design and Layout Alternatives

The affected properties (i.e. the Remainder of Portion 10 of Farm Rietfontein 388; Portion 79 of Farm Rietfontein 388; Portion 56 of Farm Rietfontein 388; and the Remaining Extent of Farm Rietfontein 3) is approximately 1300ha in extent, which is sufficient for the installation of a solar PV facility with a contracted capacity of up to 240MW, while allowing for the avoidance of environmental site sensitivities. The development footprint for

the Highveld Solar PV array plus associated infrastructure will be located) has been demarcated as an area of ~433ha.

Additional properties affected by the existing access road (which will be upgraded) includes Portion 62 of Farm Rietfontein 388 and the Remaining Extent of Farm Rietfontein 566.

Specialist field surveys and assessments were undertaken as part of the BA process in order to provide the proponent with site specific information regarding the study area and the development area considered for the project (refer to **Appendices D-I**). Prior to the finalisation of the layout assessed in this BA Report, the proponent undertook extensive consultations with ecological, avifauna and freshwater specialists to delineate areas of environmental sensitivity within the development area in order to ensure that the placement of the solar PV facility and the associated infrastructure does not have a significant and negative impact on the environment. Areas to be avoided that were identified during the specialist studies, have been utilised as a tool by the developer to identify and locate the development area of the PV facility. This has been undertaken with the aim of avoiding possible sensitive areas within the project site so as to limit impacts associated with the development which would result in unacceptable loss.

As a result, the preferred development footprint (433ha) within the affected property is considered as the most feasible and appropriate location for the Highveld Solar PV Facility, based on the following considerations:

i) Through consultation with specialists ahead of the BA process, the proponent was made aware of areas within the development area of a high ecological, avifauna and freshwater sensitivity. The proponent acknowledged these sensitivities and has proposed a development footprint that avoids significant environmental sensitivities that were identified during this process;
ii) WKN Windcurrent SA (Pty) Ltd the proponent to this application for environmental authorisation has entered into an option to lease agreement with the landowner; and
iii) The development area is considered suitable for the development of a solar PV facility from a technical perspective to ensure the success of the development.

Based on the ecological, avifauna and freshwater sensitivities identified within the development area, the proponent was able to place the development footprint for the Highveld Solar PV Facility in order to ensure avoidance of sensitive environmental features (i.e. bird habitat, protected flora, wetlands, and heritage features.). In addition, this approach is in accordance with the mitigation hierarchy to ensure that avoidance is the first priority for development.

Considering the process undertaken above, which includes the consideration of sensitive environmental features within the development area, a reduction in the on-ground impacts and the opportunity that the development area presents for the development of Highveld Solar PV Facility, no layout alternative is proposed for assessment.

» *Grid Connection Alternatives*

Two alternative LILO grid connection corridors have been considered for the establishment of the Highveld Solar PV Facility:

Both alternatives are considered and assessed in a separate BA process in order to determine the most optimal grid connection option from an environmental perspective.

4.7.3 Technology Alternatives

4.7.3.1 PV Technology Alternatives

The Stilfontein area has been identified for the development of renewable energy facilities. Few technology options are available for solar facilities, and the use of those that are considered are usually differentiated by weather and temperature conditions that prevail in the area, so that optimality is obtained by the final site selection. Solar energy is considered to be the most suitable renewable energy technology for this area, based on the site location, ambient conditions and energy resource availability.

Solar PV was determined as the most suitable option for further assessment. The IRP (2019) excludes the procurement of power from CSP facilities until 2030, whereas new additional capacity of approximately 6 000MW will be required from solar PV facilities. Therefore, PV technology was identified as being the preferred option for the study area and consists of a lower visual profile and limited water requirements when compared to the CSP technology alternative. Given the allocations in the IRP (2019), solar PV is considered as the most appropriate technology option.

Therefore, considering the above, no other technology alternatives are being assessed for the development of the Highveld Solar PV facility. When considering PV as a technology choice, several types of panels are available, including *inter alia*:

- Bifacial PV panels
- Monofacial PV panels
- Fixed mounted PV systems (static / fixed-tilt panels).
- Single-axis tracking or double-axis tracking systems (with solar panels that rotate around a defined axis to follow the sun's movement).

The primary difference between PV technologies available relate to the extent of the facility, as well as the height of the facility (visual impacts), however the potential for environmental impacts remains similar in magnitude. Fixed mounted PV systems are able to occupy a smaller extent and have a lower height when compared to tracking PV systems, which require both a larger extent of land, and are taller in height. However, both options are considered to be acceptable for implementation from an environmental perspective. Bifacial solar PV panels offer many advantages over monofacial PV panels, as power can be produced on both sides of the module, increasing total energy generation. The preference will therefore be determined on the basis of technical considerations and the site conditions.

The PV panels are designed to operate continuously for more than 20 years, mostly unattended and with low maintenance. The impacts associated with the construction, operation, and decommissioning of the facility are anticipated to be the same irrespective of the PV panel selected for implementation.

4.7.3.2 Battery Energy Storge System (BESS) technology alternatives

The general purpose and utilisation of a Battery Energy Storage System (BESS) is to save and store excess electrical output as it is generated, allowing for a timed release when the capacity is required. BESS systems therefore provide flexibility in the efficient operation of the electric grid through decoupling of the energy supply and demand. **Figures 4.7, 4.8, 4.9** and **4.10** below illustrate a typical utility scale BESS system (a Lithium-Ion BESS) as applied in the context of a renewable energy facility.

Figure 4.7: Li-Ion BESS implementation for a Renewable Energy facility (Source: Enel Green Power).

Figure 4.8: Li-Ion BESS containerised modules located within the BESS enclosure footprint (Source: Enel Green Power).

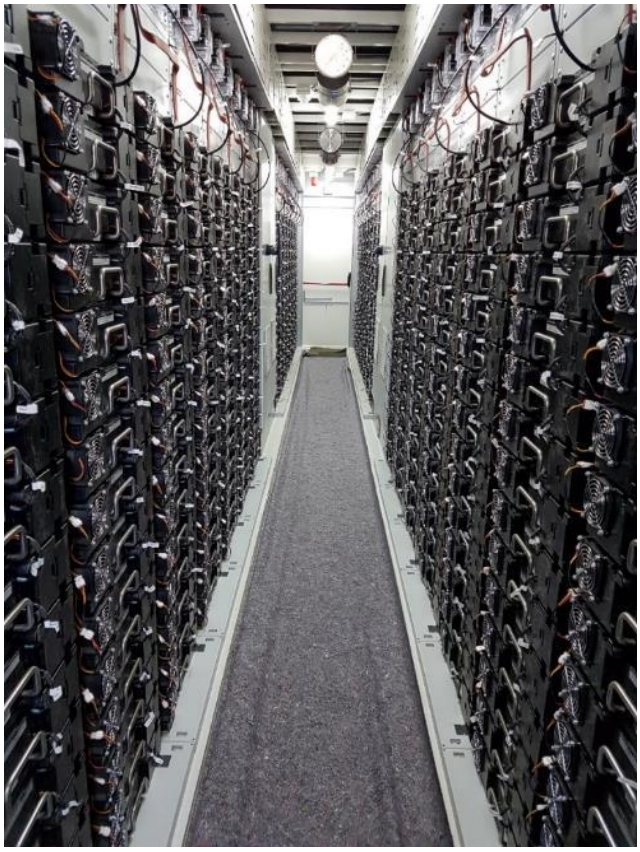


Figure 4.9: Li-Ion BESS internal design and implementation of a container used within a BESS. The image shows a series of sealed battery cell packs within a containerised module (Source: Enel Green Power).

Figure 4.10: Illustration of battery storage units installed by Tesla (Source: fastcompany.com).

As technological advances within battery energy storage systems (BESS) are frequent, two BESS technology alternatives are considered:

» Solid state battery electrolytes typically consist of Lead Acid (Pb), Nickel Cadium (NiCad), Lithium-Ion (Li-ion), Sodium Sulphur (NaS) or Sodium Nickle Chloride (Zebra) (NaNiCl) and use solid electrodes and electrolytes. As a result of the declining costs, Li-ion technology now accounts for more than 90% of battery storage additions globally (IRENA, 2019); and
» Redox-flow technology (e.g. vanadium flow battery, or similar technology and chemistries). Flow batteries use solid electrodes and liquid electrolytes. The most used flow battery is the Vanadium Redox Flow Battery (VRFB), which is a type of rechargeable flow battery that employs vanadium ions in different oxidative states to store chemical potential energy.

Considering the nature of the project, only a solid-state technology type would be envisaged for implementation. The technology includes batteries housed within containers which are fully enclosed and self-contained. Therefore, the assessment proposes all solid-state technologies for authorisation to allow the proponent to determine the precise technology when the project is implemented, on the understanding that further investigation into the specific technologies available at the time of being awarded preferred bidder status will allow for one of two to be selected and ultimately developed.

4.7.3.2.1 Compliance to local and international standards and Fire Prevention

The BESS will be compliant with all local laws and regulations and health and safety requirements governing battery facilities. Over and above that they will comply with international standards such as UN 38.3 (Transportation Testing for Lithium Batteries), UL 1642 (Standard for Safety – Lithium-ion Batteries) and IEC 62619 (Secondary cells and batteries containing alkaline or other non-acid electrolytes Safety requirements for secondary lithium cells and batteries, for use in industrial applications). Furthermore, the battery facility will also comply with standards such as UL 1973 (Batteries for Use in Stationary Applications) and IEC 62619-2017 including thermal runaway non-propagation and safety zone region operation limits and a failure mode analysis. The design will be compliant with UL 9540 (Energy Storage Systems and Equipment): this standard defines the safety requirements for battery installation in industrial and grid connected applications.

The design of the BESS in compliance with all the local and international standards ensures that fire risk is minimal. Furthermore, each container has a built-in fire detection and suppression system. This system continually monitors the batteries and in an unlikely event of a fire it supresses the fire using inert gas. Each container is also spaced about 3m apart ensuring the chance of a fire spreading between containers (which are made of metal and therefore not easily flammable) is also minimal.

Figure 4.11 below provides a typical configuration of fire detection and suppression system.

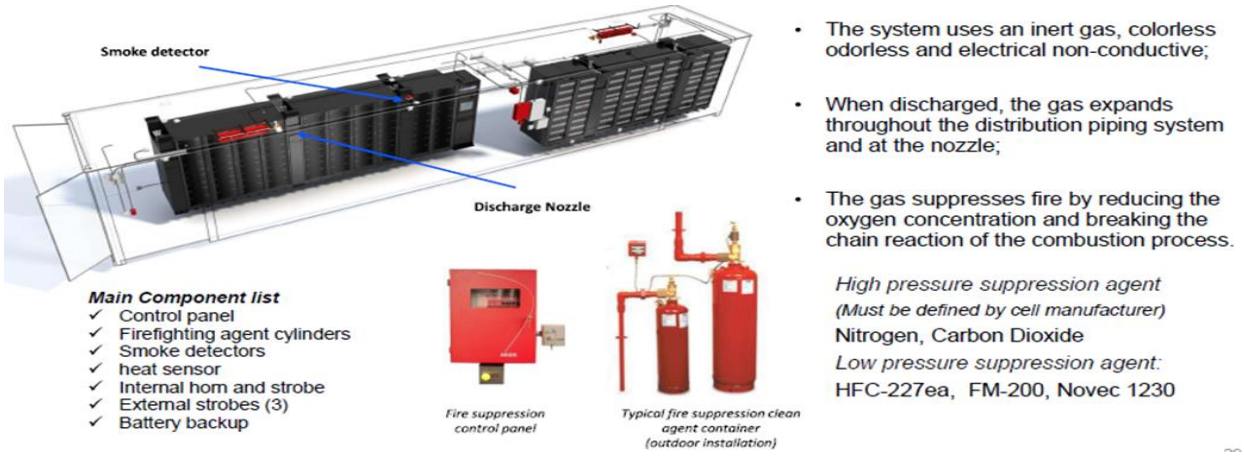


Figure 4.11: Typical configuration of fire detection and suppression system

4.7.4 The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of WKN Windcurrent (Pty) Ltd not constructing the Highveld Solar PV Facility on the proposed site and assumes the site remains in its current state. This would result in no environmental or social impacts (positive or negative) as a result of the development of a solar facility within the preferred project site. The 'Do-Nothing' alternative has been assessed as part of the BA process (refer to **Chapter 7** of this BA Report).

CHAPTER 5: APPROACH TO UNDERTAKING THE BASIC ASSESSMENT PROCESS

In terms of the EIA Regulations of December 2014 (as amended) published in terms of the NEMA (Act No. 107 of 1998) as amended, the construction and operation of the Highveld Solar PV Facility is a listed activity requiring environmental authorisation. In terms of GN R114 of February 2018, the application for environmental authorisation is required to be supported by a BA process based on the location of the project site within the Klerksdorp REDZ.

The BA process aims at identifying and describing potential environmental issues associated with the development of the proposed PV facility and the associated infrastructure. In order to ensure that a comprehensive assessment is provided to the competent authority and I&APs regarding the impacts of the facility, detailed independent specialist studies were undertaken as part of the BA process.

This chapter serves to outline the process that was followed during the BA process.

5.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of a Basic Assessment Report

This chapter of the BA report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 1: Content of Basic Assessment Reports:

Requirement	Relevant Section
3(1)(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 as a result of the development of the Highveld Solar PV Facility have been included in section 5.2, **Table 5.1**. The specific project activity relating to the relevant triggered listed activity has also been included in **Table 5.1**.
3(1)(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 details of the public participation process undertaken have been included and described in section 5.3.2.
3(1)(h)(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.	All comments received from the commencement of the BA process have been included and responded to in the Comments and Responses (C&R) Report (**Appendix C8**). All comments raised during the 30-day review and comment period of the BA Report and through on-going consultation with I&APs have been included and responded to as part of a C&R Report (**Appendix C8**) and is submitted as part of this Final BA Report to DFFE for decision-making.
3(1)(h)(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives.	The methodology used to assess the significance of the impacts of the Highveld Solar PV Facility has been included in section 5.4.
3(1)(p) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed.	The assumptions and limitations of the BA process being undertaken for the Highveld Solar PV Facility is included in section 5.6.

5.2 Relevant legislative permitting requirements

The legislative permitting requirements applicable to the Highveld Solar PV Facility, as identified at this stage in the process, are described in more detail under the respective sub-headings.

5.2.1 National Environmental Management Act (No. 107 of 1998) (NEMA)

NEMA is South Africa's key piece of national environmental legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(5) of NEMA, the potential impact on the environment associated with 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 EA. The Highveld Solar PV Facility is a power generation project, and therefore relates to the IRP 2010 – 2030, the National Department of Forestry, Fisheries and the Environment (DFFE) has been determined as the Competent Authority in terms of GN R779 of 01 July 2016. The Provincial North West Department of Economic Development, Environment, Conservation and Tourism (DEDECT) is the Commenting Authority on the project.

The need to comply with the requirements of the EIA Regulations published under the NEMA ensures that proponents are provided the opportunity to consider the potential environmental impacts of their activities early in the project development process, and also allows for an assessment to be made as to whether environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project and Application for Environmental Authorisation (EA).

The BA process being conducted for the Highveld Solar PV Facility is undertaken in accordance with Section 24(5) of the NEMA, which defines the procedure to be followed in applying for EA, and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the competent authority. Listed Activities are activities identified in terms of Section 24 of the NEMA which are likely to have a detrimental effect on the environment, and which may not commence without an EA from the competent authority subject to the completion of an environmental assessment process (either a Basic Assessment (BA) or full Scoping and EIA).

As the proposed development is located within Zone 10 of the REDZ (also known as the Klerksdorp REDZ), one of the eleven (11) designated REDZ areas, the EIA process to be followed for the PV facility will be as per GN R114, as formally gazetted on 16 February 2018. The Highveld Solar PV Facility is subject to a Basic Assessment process and not a full EIA process, as well as a shortened timeframe of 57 days for the processing of an application for environmental authorisation.

Table 5.1 details the listed activities in terms of the EIA Regulations, 2014 (as amended) that apply to the Highveld Solar PV Facility, and for which an application for EA has been submitted to the DFFE. The table also includes a description of the specific project activities that relate to the applicable listed activities.

Table 5.1: Listed activities as per the EIA regulations that are triggered by the Highveld PV Facility

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant notice):	Describe each listed activity as per project description
GN R327, 08 December 2014 (as amended on 07 April 2017)	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 275kV or more. ***Highveld Solar PV Facility will require the construction and operation of an on-site facility substation with a capacity of up to 132kV and an extent of up to 1ha to facilitate the connection of the facility to the national grid. The development area for the Highveld Solar PV Facility is located outside of an urban area.***
GN R327, 08 December 2014 (as amended on 07 April 2017)	12(ii)(a)(c)	The development of – (ii) infrastructure or structures with a physical footprint of 100 square meters or more, where such development occurs – (a) within a watercourse; or (c) if no development setback exists, within 32 meters of a watercourse, measured from the edge of a watercourse. ***The development of the Highveld Solar PV Facility will require the establishment of infrastructure (including access roads) with a physical footprint exceeding 100m², directly adjacent to a watercourse or within 32m of a watercourse identified within the project site. The development footprint of the PV facility will be ~433ha in extent.***
GN R327, 08 December 2014 (as amended on 07 April 2017)	14	The development and related operation of facilities and infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres. ***The development and operation of the project will require the construction and operation of facilities and infrastructure for the storage and handling of a dangerous good (combustible and flammable liquids, such as oils, lubricants, solvents) associated with the on-site substation where such storage will occur inside containers with a combined capacity exceeding 80 cubic meters but not exceeding 500 cubic meters.***
GN R327, 08 December 2014 (as amended on 07 April 2017)	19(i)	The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles, or rock of more than 10 cubic meters from a (i)watercourse. ***The development area is directly adjacent to a watercourse and will require the removal of >10 cubic metres of soil and rock from the watercourse during the construction phase of infrastructure, including access roads.***

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant notice):	Describe each listed activity as per project description
GN R327, 08 December 2014 (as amended on 07 April 2017)	28(ii)	Residential, mixed, retail, commercial, industrial, or institutional developments where such land was used for agriculture, game farming, equestrian purposes 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; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes. ***The Highveld Solar PV Facility will be constructed and operated on land currently used for agricultural purposes, mainly grazing. The development footprint considered for the establishment of the PV facility is ~433ha in extent and is located outside an urban area.***
GN R325, 08 December 2014 (as amended on 07 April 2017)	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 project comprises a renewable energy generation facility, which will utilise solar power technology and will have a contracted capacity of up to 240MW.*** ***The project area falls within the Klerksdorp REDZ and the Central Corridor of the Strategic Transmission Corridors.***
GN R325, 08 December 2014 (as amended on 07 April 2017)	15	The clearance of an area of 20 hectares or more of indigenous vegetation, ***The clearance of an area of indigenous vegetation greater than 20ha in extent will be required for the development of the PV facility and associated infrastructure.*** ***The project area falls within the Klerksdorp REDZ.***
GN R324, 08 December 2014 (as amended on 07 April 2017)	4(h)(iv)	The development of a road wider than 4 metres with a reserve of less than 13.5 metres. h. North West iv. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority. ***The development of the Highveld Solar PV Facility will require the construction of access roads up to 6m wide.*** ***The site is predominately listed as an Ecological Support Area 2 (ESA) as per the North West Biodiversity Plan, which functions in support of the Kromdraaispruit river, which is situated directly adjacent, to the west of the site.*** ***The development area is located within a Critical Biodiversity Area 2 (CBA2), as per the North West Biodiversity Plan.***

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant notice):	Describe each listed activity as per project description
GN R324, 08 December 2014 (as amended on 07 April 2017)	10(h)(iv)(vi)	The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. h. North West iv. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority. vi. Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland. ***The development of the project will require the construction and operation of facilities and infrastructure for the storage and handling of a dangerous good (combustible and flammable liquids, such as oils, lubricants, solvents) associated with the on-site substation where such storage will occur inside containers with a combined capacity exceeding 30 cubic meters.*** ***The site is predominately listed as an Ecological Support Area 2 (ESA) as per the North West Biodiversity Plan, which functions in support of the Kromdraaispruit river, which is situated directly adjacent, to the west of the site.*** ***The development area is located within a Critical Biodiversity Area 2 (CBA2), as per the North West Biodiversity Plan.***
GN R324, 08 December 2014 (as amended on 07 April 2017)	12(h)(iv)(vi)	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. h. North West iv. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority. vi. Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland. ***An area in excess of 300m^2 of indigenous vegetation would be required to be cleared.*** ***The area is predominately listed as an Ecological Support Area 2 (ESA) as per the North West Biodiversity Plan, which functions in support of the Kromdraaispruit river, which is situated directly adjacent, to the west of the site.*** ***The development area is located within a Critical Biodiversity Area 2 (CBA2), as per the North West Biodiversity Plan.***
GN R324, 08 December 2014 (as amended on 07 April 2017)	14(ii)(a)(c)(h)(iv)(vi)	The development of – (ii) infrastructure or structures with a physical footprint of 10 square meters or more, where such development occurs –

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant notice):	Describe each listed activity as per project description
		(a) within a watercourse; or (c) if no development setback exists, within 32 meters of a watercourse, measured from the edge of a watercourse. h. North West iv. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority. vi. Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland. ***The development of Highveld Solar PV Facility will require the establishment of infrastructure (including access roads) with a physical footprint exceeding 10m^2.*** ***The site is predominately listed as an Ecological Support Area 2 (ESA) as per the North West Biodiversity Plan, which functions in support of the Kromdraaispruit river, which is situated directly adjacent, to the west of the site.*** ***The development area is located within a Critical Biodiversity Area 2 (CBA2), as per the North West Biodiversity Plan.***
GN R324, 08 December 2014 (as amended on 07 April 2017)	18(h)(v)(ix)	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre h. North West (v) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority. (ix) Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland. ***Existing roads providing access to and within the project site are to be upgraded and widened by more than 4m. The project site is located in the North West, within an area defined as a Critical Biodiversity Area 1 (CBA1) as per the North West Biodiversity Plan. The upgrade will include widening to 6m and reinforcement of the low level crossing at a watercourse to the west of the site.***

5.2.2 National Water Act (No. 36 of 1998) (NWA)

In accordance with the provisions of the National Water Act (No. 36 of 1998) (NWA), all water uses must be licensed with the Competent Authority (i.e., the Regional Department of Water and Sanitation). Water use is defined broadly, and includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation.

Table 5.1 lists the possible Water Uses associated with the proposed project and identified in terms of the NWA which require licensing either in the form of a General Authorisation (GA), or in the form of a Water Use License (WUL). The table also includes a description of those project activities which relate to the applicable Water Uses.

Table 5.1: List of Water Uses published under Section 21 of NWA, as amended.

Activity No.	Description of Water Use
Section 21 (c)	Impeding or diverting the flow of water in a watercourse. ***The development footprint considered for the establishment of the PV facility is associated with the presence of watercourses[32]. . Activities pertaining to the establishment of the PV facility might encroach on watercourses which may lead to an impediment and diversion of the flow of water.***
Section 21 (i)	Altering the bed, banks, course or characteristics of a watercourse. ***The development footprint considered for the establishment of the PV facility is associated with the presence of watercourses. Activities pertaining to the establishment of the PV facility might encroach on these features, which may lead to the altering of the characteristics of the watercourses.***

An application for a Water Use Authorisation for the above-mentioned identified water uses will been made by the applicant. The process of applying for a WUL or GA registration will only be completed once a positive EA has been received. This is in line with the requirements of the Department of Water and Sanitation.

5.2.3 National Heritage Resources Act (No. 25 of 1999) (NHRA)

The National Heritage Resources Act (No. 25 of 1999) (NHRA) provides an integrated system which allows for the management of national heritage resources and to empower civil society to conserve heritage resources for future generations. Section 38 of NHRA provides a list of activities which potentially require the undertaking of a Heritage Impact Assessment.

Section 38: Heritage Resources Management

1). Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as –

- *a. the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*
- *b. the construction of a bridge or similar structure exceeding 50m in length;*
- *c. any development or other activity which will change the character of a site –*
  - *i). exceeding 5 000m² in extent; or*
  - *ii). involving three or more existing erven or subdivisions thereof; or*

[32] 'watercourse' 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.

iii). involving three or more erven or divisions thereof which have been consolidated within the past five years; or

iv). the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

Must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the Highveld Solar PV Facility, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668).

5.3 Overview of the Basic Assessment Process for the Highveld Solar PV Facility

Key tasks undertaken for the BA included:

- Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
- Submission of the completed Application for Environmental Authorisation to the competent authority (i.e., DFFE) in terms of Regulations 5 and 6 of the EIA Regulations, 2014 (GNR 326), as amended.
- Undertaking a public participation process in accordance with Chapter 6 of GNR 326, and the Department of Environmental Affairs (2017), as amended, Public Participation guidelines in terms of the NEMA EIA Regulations, Department of Environmental Affairs, Pretoria, South Africa (hereinafter referred to as "the Guidelines") in order to identify issues and concerns associated with the proposed project.
- Undertaking of independent specialist studies in accordance with Appendix 6 of the EIA Regulations, 2014 (GNR 326), as amended, and the requirements of the Specialist Protocols published in Regulation GNR 320, issued on 20 March 2020 and 30 October 2020.
- Preparation of a BA Report and EMPr in accordance with the requirements of Appendix 1 and Appendix 4 of GNR 326.
- 30-day public and authority review period of the BA Report.
- Compilation of a C&R Report detailing the comments raised by I&APs, addressing these comments, as applicable, and finalisation of the BA Report.
- Submission of a final BA Report to the DFFE for review and decision-making.

The tasks are discussed in detail in the sub-sections below.

5.3.1. Authority Consultation and Application for Authorisation in terms of the 2014 EIA Regulations (as amended)

In terms of Government Notice 779 of 01 July 2016, the National Department of Forestry, Fisheries and the Environment (DFFE) is the competent authority for all projects related to the IRP. As the project is located within the North West Province, the Provincial North West Department of Economic Development, Environment, Conservation and Tourism (DEDECT) is the commenting authority. Consultation with the

regulating authorities (i.e. DFFE and DEDECT) as well as with all other relevant Organs of State will continue throughout the BA process. To date, this consultation has included the following:

- Submission of the application form for Environmental Authorisation to the DFFE via the use of the DFFE Novell Filr System.
- Submission of the BA Report for review and comment to:
  - the competent and commenting authorities;
  - State departments that administer laws relating to a matter affecting the environment relevant to the application for Environmental Authorisation; and
  - Organs of State which have jurisdiction in respect of the activity to which the application relates to.

The submissions, as listed above, will be undertaken electronically, as required by the DFFE (in line with the directions for new Applications for Environmental Authorisations provided for in GNR650 of 05 June 2020).

A record of all authority correspondence undertaken during the BA process is included in **Appendix B** and **Appendix C**.

5.3.2. Public Participation Process

Public participation is an essential and regulatory requirement for an environmental authorisation process and is guided by Regulations 41 to 44 of the EIA Regulations 2014 (GN R326) (as amended). The purpose of public participation is clearly outlined in Regulation 40 of the EIA Regulations 2014 (GN R326) (as amended) and is being followed for this proposed project.

The sharing of information forms the basis of the public participation process and offers the opportunity for I&APs to become actively involved in the BA process from the outset. The public participation process is designed to provide sufficient and accessible information to I&APs in an objective manner. The public participation process affords I&APs opportunities to provide input into and receive information regarding the BA process in the following ways:

During the BA process:
- provide an opportunity to submit comments regarding the project;
- assist in identifying reasonable and feasible alternatives;
- contribute relevant local information and knowledge to the environmental assessment;
- allow registered I&APs to verify that their comments have been recorded, considered and addressed, where applicable, in the environmental investigations;
- foster trust and co-operation;
- generate a sense of joint responsibility and ownership of the environment; and
- comment on the findings of the environmental assessments.

During the decision-making phase:
- To advise I&APs of the outcome of the competent authority's decision, and how and by when the decision can be appealed.

The public participation process therefore aims to ensure that:
- Information containing all relevant facts in respect of the application is made available to potential stakeholders and I&APs for their review.

- The information presented during the public participation process is presented in such a manner, i.e., local language and technical issues, that it avoids the possible alienation of the public and prevents them from participating.
- Public participation is facilitated in such a manner that I&APs are provided with a reasonable opportunity to comment on the project.
- Various ways are provided to I&APs to correspond and submit their comments i.e., fax, post, email, SMS, WhatsApp or by sending a "*Please-call-me*" notification.
- An adequate review period is provided for I&APs to comment on the findings of the BA Report.

In terms of the requirement of Chapter 6 of the EIA Regulations of December 2014, as amended, the following key public participation tasks are required to be undertaken:

- Fix 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.
- Give 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.
- Place an advertisement in a local newspaper.
- Open and maintain a register of I&APs and Organs of State.
- Prepare a Comments and Responses (C&R) Report which documents the comments received on the BA process and the responses provided by the project team.
- Release of a BA Report for a 30-day review and comment period.
- Hold Focus Group Meetings and a Key Stakeholder Workshop during the 30-day review and comment period and compile meeting notes for record purposes of all meetings.
- Update the C&R Report with all comments raised during the 30-day review period for submission with the final BA Report.

The schematic process below provides an overview of the tools that are available to I&APs and stakeholders to access project information and interact with the public participation team to obtain project information and address any queries that may arise, and to meet the requirements for public participation.

i. Stakeholder identification and register of I&APs	•Register as an I&AP on the online platform or via completion of the registration and comment form which provide the contact information, by responding to an advert, or sending a '*please call me*' which will be responded to with a telephone call. •State interest in the project. •Receive all project related information via email, post or other appropriate means.
ii. Advertisments and notifications	•Advertisements, site notices and notifications provide information and details on the project and where to access project information. •Notifications regarding the BA process and availability of project report for public review and comment to be sent via email, post, WhatsApp or SMS notifications.
iii. Public Involvement and consultation	•Distribution of a BID providing details on the project and how I&APs can become involved in the process. •Submission of comments or queries via email, post, WhatsApp or SMS to the PP team. •Virtual presentations available via a virtual platform. •Availability of project information via the online platform, email, post, WhatsApp or SMS, and including telephonic discussions to provide description of information verbally. •An opportunity for I&APs and stakeholders to request meetings with the project team.
iv. Comment on the BA Report	•Availability of the project report via the online platform for a 30-day review and comment period. Hard copies to be available on written request. •Submission of comments via email, post, WhatsApp or SMS to the PP team. •Comments recorded and responded to, as applicable, as part of the process.
v. Recording of comments	•Comments and Responses Report (C&RR), including all comments received, to be included in the C&RR. •Comments received during BA process and on the BA Report to be included in the BA Report.

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

i. <u>Stakeholder identification and Register of Interested and Affected Parties</u>

42. A proponent or applicant must ensure the opening and maintenance of a register of I&APs and submit such a register to the competent authority, which register must contain the names, contact details and addresses of –
    (a) All persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP.
    (b) All persons who have requested the proponent or applicant, in writing, for their names to be placed on the register.
    (c) All organs of state which have jurisdiction in respect of the activity to which the application relates.

I&APs have been identified through a process of networking and referral, obtaining information from Savannah Environmental's existing stakeholder database, liaison with potentially affected parties in the greater study area and a registration process involving the completion of a reply form. Key stakeholders and affected and surrounding landowners have been identified and registered on the project database. Occupiers will be identified and consulted with during the consultation process. Other stakeholders are required to formally register their interest in the project through either directly contacting the Savannah Environmental Public Participation team via phone, message (SMS and WhatsApp), email or fax, or registering their interest via the online stakeholder engagement platform. An initial list of key stakeholders identified and registered is listed in **Table 5.3**.

Table 5.3: Initial list of Stakeholders identified for inclusion in the project database during the public participation process for the Highveld Solar PV Facility

Organs of State
National Government Departments
Department of Forestry, Fisheries, and the Environment
Department of Mineral Resources and Energy
Department of Agriculture, Land Reform and Rural Development
Department of Water and Sanitation
Government Bodies and State-Owned Companies
Eskom Holdings SOC Limited
National Energy Regulator of South Africa (NERSA)
South African Civil Aviation Authority (CAA)
South African Heritage Resources Agency (SAHRA)
South African National Roads Agency Limited (SANRAL)
South African Radio Astronomy Observatory (SARAO)
Telkom SA SOC Limited
Transnet SA SOC Limited
Provincial Government Departments
North West Department Agriculture, Rural Development, Land and Environmental Affairs
North West Department of Economic Development, Environment, Conservation and Tourism
North West Department of Public Works, Roads and Transport
North West Provincial Heritage Resources Authority
North West Parks Board
North West Department of Agriculture
Local Government Departments
Dr Kenneth Kaunda District Municipality
JB Marks Local Municipality – including the Ward Councillor & Ward Committee Members
Commenting Stakeholders and I&APs
BirdLife South Africa
Endangered Wildlife Trust (EWT)
SENTECH
Vodacom
MTN
Wildlife and Environment Society of South Africa (WESSA)
Affected landowner/s
Neighbouring landowners, tenants, and occupiers

Ratepayers Association
Community Representative / Local Community Forum Representatives

As per Regulation 42 of the EIA Regulations, 2014, as amended, all relevant stakeholder and I&AP information has been recorded within a register of I&APs (refer to **Appendix C1** for a listing of the recorded parties). In addition to the above-mentioned EIA Regulations, point 4.1 of the Public Participation Guidelines has also been followed. The register of I&APs contains the names[33] of:

- All persons who requested to be registered on the database through the use of the online stakeholder engagement platform or in writing and disclosed their interest in the project.
- All Organs of State which hold jurisdiction in respect of the activity to which the application relates.
- Affected landowners or person in control of the land, tenants and occupiers.
- Neighbouring landowners or person in control of the land, tenants and occupiers.
- All persons who submitted written comments or attended meetings (virtual or in-person, as applicable).

I&APs have been encouraged to register their interest in the BA process from the onset of the project, and the identification and registration of I&APs will be on-going for the duration of the BA process. The database of I&APs will be updated throughout the BA process and will act as a record of the I&APs involved in the public participation process.

ii. Advertisements and Notifications

40.(2)(a)	Fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of – (i) The site where the activity to which the application or proposed application relates is or is to be undertaken; and (ii) Any alternative site.
40.(2)(b)	Giving written notice, in any of the manners provided for in section 47D[34] of the Act, to – (i) The occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; (ii) Owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; (iii) The municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area; (iv) The municipality which has jurisdiction in the area; (v) Any organ of state having jurisdiction in respect of any aspect of the activity; and (vi) Any other party as required by the competent authority.
40.(2)(c)	Placing an advertisement in – (i) One local newspaper; or (ii) Any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;
40.(2)(d)	Placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in paragraph (c)(ii); and

[33] Contact details and addresses have not been included in the I&AP database as this information is protected by the Protection of Personal Information Act (No 4 of 2013).

40.(2)(e)	Using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desirous of but unable to participate in the process due to – (i) Illiteracy; (ii) Disability; or (iii) Any other disadvantage.

The BA process was announced with an invitation to the Organs of State, potentially affected and neighbouring landowners (including occupiers) and general public to register as I&APs and to actively participate in the process. This was achieved via the following:

- Compilation of a background information document (BID) (refer to **Appendix C3**) providing technical details on the project, details of the BA process being undertaken and how I&APs can become involved in the BA process. The BID and the BA process notification letter announcing the BA process and inviting I&APs to register on the project's database were distributed via email on **01 November 2022**. Evidence of distribution is contained in **Appendix C4** and **Appendix C5** of the BA Report. The BID is also available electronically on the Savannah Environmental website (https://savannahsa.com/public-documents/energy-generation/highveld-pv/).
- Placement of site notices announcing the BA process at visible points along the boundary of the project site (i.e., the boundary of the affected property), in accordance with the requirements of the EIA Regulations on **22 September 2022**. Photographs of the site notices and the GPS co-ordinates of the locations where the site notices were placed are contained within **Appendix C2** of the BA Report.
- Placement of an advertisement in one local newspaper (Klerksdorp Record Newspaper (in English)) on **10 November 2022**. This advert:
  - announced the BA process and project related information;
  - announced the availability of the BA Report and details of the review period; and
  - provided the Public Participation team's contact details and all relevant details to access the Savannah Environmental online stakeholder engagement platform.

  A copy of the newspaper advert as sent to the newspaper and the advert tear sheet are included in **Appendix C2** of the BA Report Report.
- The BA Report was made available for review and comment by I&APs from **11 November 2022** to **12 December 2022.** The BA Report was made available on the Savannah Environmental website and all registered I&APs were notified of the availability on **10 November 2022** via email which included the link to access the report on the Savannah Environmental website. The evidence of distribution of the BA Report is included in this final BA Report.

iii. Public Involvement and Consultation

In order to accommodate the varying needs of stakeholders and I&APs within the surrounding area, as well as capture their views, comments, issues and concerns regarding the project, various opportunities have been and will continue to be provided to I&APs to note their comments and issues. I&APs are being consulted through the following means:

Table 5.4: Public involvement for the Highveld Solar PV Facility

Activity	Date
Placement of site notices on the boundary of the project site, including placement of further notices in Stilfontein.	22 September 2022
One-on-one discussions with affected landowners.	22 September 2022

Activity	Date
Distribution of the BID, process notification letters and stakeholder reply form announcing the BA process and inviting I&APs to register on the project database. The BID and electronic reply form was also made available on the online stakeholder engagement platform.	01 November 2022
Advertising of the availability of the BA Report for a 30-day review and comment period in Klerksdorp Record Newspaper, including details on how to access the BA Report via the online stakeholder engagement platform.	10 November 2022
Distribution of notification letters announcing the availability of the BA Report for a 30-day review and comment period. These letters were distributed to Organs of State, Government Departments, Ward Councillors, landowners within the surrounding area (including neighbouring landowners) and key stakeholder groups.	01 November 2022
30-day review and comment period of the BA Report.	Friday, 11 November 2022 to Monday, 12 December 2022
Meetings, including the use of virtual platforms as determined through discussions with the relevant stakeholder group: » Landowners. » Authorities and key stakeholders (including Organs of State, local municipality and official representatives of community-based organisations). » Where an I&AP does not have access to a computer and/or internet to participate in a virtual meeting telephonic discussions (including WhatsApp video call) will be set-up and minuted for inclusion. The preferred language of the I&AP will be considered when setting up these discussions.	**Tuesday, 29 November 2022 at 11h00** – Virtual Key Stakeholders Workshop with National, Provincial and Local Authorities and Key Stakeholders i.e. Telkom, Eskom, South Africa Civil Aviation Authority, Representatives of Organisations i.e. Ratepayers Association;
On-going consultation (i.e., telephone liaison; e-mail communication) with all I&APs.	Throughout BA process

iv. Registered I&APs entitled to Comment on the BA Report

43.(1) A registered I&AP is entitled to comment, in writing, on all reports or plans submitted to such party during the public participation process contemplated in these Regulations and to bring to the attention of the proponent or applicant any issues which that party believes may be of significance to the consideration of the application, provided that the interested and affected party discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

(2) In order to give effect to section 24O of the Act, any State department that administers a law relating to a matter affecting the environment must be requested, subject to regulation 7(2), to comment within 30 days.

44.(1) The applicant must ensure that the comments of interested and affected parties are recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority in terms of these Regulations.

(2) Where a person desires but is unable to access written comments as contemplated in subregulation (1) due to –

(a) A lack of skills to read or write;
(b) Disability; or
(c) Any other disadvantage;

Reasonable alternative methods of recording comments must be provided for.

Organs of State and registered I&AP on the database have received the BID which contain technical information regarding the project, the BA and public participation process. Included with the BID was a locality map and a registration and comment form.

I&APs registered on the database were notified by means of a notification letter (e-mail) of the release of the BA Report for a 30-day review and comment period, invited to provide comment on the BA Report, and informed of the manner in which, and timeframe within which such comment must be made. The notification was distributed prior to the commencement of the 30-day review period, on 01 November 2022. An email was distributed to all registered I&APs on 10 November 2022, reminding them of the commencement of the BA report review period. Attached to this email will be the notification letter that was distributes (via e-mail) to notify all registered I&APs of the release of the BA Report.

The BA Report was made available on the Savannah Environmental website (i.e., online stakeholder engagement platform) (https://savannahsa.com/public-documents/energy-generation/highveld-pv/). The notification was distributed prior to the commencement of the 30-day review and comment period, on **01 November 2022.** A second notification was sent on **10 November 2022** to remind registered I&APs of the review period. Where I&APs were not able to provide written comments (including SMS and WhatsApp), other means of consultation, such as telephonic discussions were used to provide the I&APs with a platform to verbally raise their comments on the proposed development.

All comments raised as part of the discussions and written comments submitted during the 30-day review and comment period will recorded and included in **Appendix C7** of this final BA Report.

v. Identification and Recording of Comments

Comments raised by I&APs to date have been collated into a C&R Report which is included in **Appendix C8** of the BA Report. The C&R Report includes detailed responses from members of the project team and/or the project proponent to the issues and comments raised.

Meeting notes of all virtual meetings conducted during the 30-day review and comment period are included in **Appendix C6** of this final BA Report, and all telephonic discussion held and confirmed via e-mail are included in **Appendix C5** and verbal comments submitted on the BA Report are included in **Appendix C7** of this final BA Report.

The C&R Report has been updated with all comments received during the 30-day review and comment period and is included as **Appendix C8** of this final BA Report that will be submitted to the DFFE for decision-making.

5.4. Outcomes of the DFFE Web-Based Screening Tool

In terms of GN R960 (promulgated on 5 July 2019) and Regulation 16(1)(b)(v) of the 2014 EIA Regulations (as amended), the submission of a Screening Report generated from the national web based environmental screening tool is compulsory for the submission of applications in terms of Regulations 19 and 21 of the EIA Regulations.

The requirement for the submission of a Screening Report (included as **Appendix K** of the BA Report) for the Highveld Solar PV Facility is applicable as it triggers Regulation 19 of the EIA Regulations, 2014 (as amended). **Table 5.5** provides a summary of the specialist assessments identified in terms of the screening tool and

responses to each assessment from the project team considering the development area under consideration. This includes the verified sensitivity rating, as per each relevant specialist consultant.

A site verification report is also included as **Appendix O** of the BA Report.

The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas. The Screening Tool report indicates the (preliminary) environmental sensitivities that intersect with the proposed development footprint, as defined by the Applicant, as well as the relevant Protocols.

As the Screening Tool contains datasets that are mapped at a national scale, there may be areas where the Screening Tool erroneously assigns, or misses, environmental sensitivities because of mapping resolution and a high paucity of available and accurate data. Broad-scale site investigations will provide for an augmented and site-specific evaluation of the accuracy and 'infilling' of obvious and large-scale inaccuracies.

Table 5.5: Sensitivity ratings from the DFFE's web-based online Screening Tool associated with the development of the Highveld Solar PV Facility

Specialist Assessment	Sensitivity Rating and Specialist Input Identified in Terms of the DFFE Screening Tool	Verification of Site-Specific Sensitivity and Motivation of the Need for Specialist Investigation
Agricultural Impact Assessment	Screening tool: High Sensitivity Required an agricultural impact assessment (in accordance with the protocol prescribed in GNR 320). Verified Sensitivity by Specialist: **Medium to Low**	The Highveld Solar PV Facility is mostly characterised with "Very Low to Low" land capability and land potential sensitivities. It is anticipated that the construction and operation of the Highveld Solar PV Facility will have impacts that range from medium to low. Through the consistent implementation of the recommended mitigation measures, most of the impacts can be reduced to low significance. It is of the specialist's opinion that this project be considered favourably, permitting that the mitigation measures are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be affected. A Soils and Agricultural Potential Impact Assessment is included as **Appendix F** of the BA Report.
Landscape/Visual Impact Assessment	Screening tool: Very High Sensitivity (General Assessment Protocols) Verified Sensitivity by Specialist: **Medium to Low**	The significance of the visual impacts is expected to range from moderate to low as a result of the generally industrial and developed character of the landscape. There are a very limited number of potential sensitive visual receptors within a 3km radius of the proposed structures, although the possibility does exist for visitors to the region to venture into closer proximity to the PV facility structures. These observers may consider visual exposure to this type of infrastructure to be intrusive. A Visual Impact Assessment has been undertaken for the Highveld Solar PV Facility and is included in this BA Report as **Appendix H.**

Specialist Assessment	Sensitivity Rating and Specialist Input Identified in Terms of the DFFE Screening Tool	Verification of Site-Specific Sensitivity and Motivation of the Need for Specialist Investigation
Archaeological and Cultural Heritage Impact Assessment	Screening tool: Low Sensitivity Verified Sensitivity by Specialist: **Low**	None of the heritage resources identified fall within the area PV layout provided and as such, no direct impact to any heritage resources is anticipated. The low sensitivity rating is supported, and no study is required in this regard. However, a Heritage Impact Assessment (which covers both archaeological and cultural aspects of the development area and development footprint) has been undertaken for the Highveld Solar PV Facility and is included in this BA Report as **Appendix G.** The HIA complies with the requirements of the NHRA.
Palaeontology Impact Assessment	Screening tool: Very High Sensitivity Verified Sensitivity by Specialist: **Low** (If no fossils are uncovered during construction)	According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of very high fossil sensitivity. Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The site visit and walk through confirmed that there were no fossils in the project footprint. One small stromatolite only was found below the existing power line, i.e. not in the route for the new powerline. Furthermore, the main solar cluster area is not on dolomites, only some cherts were present. As such there is an extremely small chance that trace fossils from the Malmani Subgroup may be disturbed. Taking account of the defined criteria, it is the specialist's opinion that the potential impact to fossil heritage resources is extremely low. With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of the Highveld Solar PV Facility palaeontological resources will be low. A Heritage Impact Assessment (which covers both archaeological and cultural aspects of the development area and development footprint) has been undertaken for the Highveld Solar PV Facility and is included in this BA Report as **Appendix G.** The PIA complies with the requirements of the NHRA.
Terrestrial Biodiversity Impact Assessment	Screening tool: Very high Sensitivity Required a terrestrial biodiversity impact assessment and a plant species assessment (Terrestrial Biodiversity Assessment Protocols)	The completion of the terrestrial biodiversity assessment found a colony of Red Listed plants, *Lithops lesliei*, was identified in the south- eastern portion of the site. This species is currently listed as being Near Threatened and is regarded as having a very-high conservation value which corroborate with the Very high sensitivity rating from the screening tool report. However, a very small area provides the habitat suitable for this species, and it is only this habitat which must be avoided by the development footprint. With avoidance of this area as the primary mitigation, the sensitivity rating was verified to be Medium by the specialist.

Specialist Assessment	Sensitivity Rating and Specialist Input Identified in Terms of the DFFE Screening Tool	Verification of Site-Specific Sensitivity and Motivation of the Need for Specialist Investigation
	Verified Sensitivity by Specialist: **Medium**	An Ecological Impact Assessment (including terrestrial and freshwater ecology) has been undertaken for the Highveld Solar PV Facility and is included as **Appendix D** of the BA Report.
Aquatic Biodiversity Impact Assessment	Screening tool: Very high Sensitivity Required an Aquatic Biodiversity impact assessment (in accordance with the protocol prescribed in GNR 320, Aquatic Biodiversity Assessment Protocols). Verified Sensitivity by Specialist: **Low**	The project site is located directly adjacent to the Kromdraaispruit watercourse. The specialist has rated the site ecological importance for this wetland area as high. However, the PV development footprint avoids this regulated area (500m) entirely. It is of the specialist's opinion that the impact on wetlands and watercourses can be delineated to low after mitigation measures are implemented. An Ecological Impact Assessment (including terrestrial and freshwater ecology) has been undertaken for the Highveld Solar PV Facility and is included as **Appendix D** of the BA Report.
Avian Impact Assessment	Screening tool: Low Sensitivity Verified Sensitivity: **Medium to Low**	Sensitivities were compiled for the avifauna study based on the field results and desktop information. Based on the criteria provided in the specialist report, all habitats within the assessment area of the proposed project were allocated a sensitivity category. Three prominent avifaunal habitat types were identified on the development area, which consisted of open savannoid grassland with bush clump mosaics, artificial livestock watering points and the Kromdraaispruit floodplain. An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was moderate to low after mitigation (depending on the type of impact). However, the risk for certain waterbirds (mainly large-bodied waterfowl such as the South African Shelduck *Tadorna cana*, Egyptian Goose *Alopochen aegyptiacus* and members of the *genus Anas*) colliding with the PV infrastructure remained eminent due to the presence of the nearby Kromdraaispruit. It is recommended that the proposed mitigation measures and monitoring protocols (e.g. post construction monitoring) be implemented during the construction and operational phase of the project. An Avifauna Impact Assessment has been undertaken for the Highveld Solar PV Facility and is included as **Appendix E** of the BA Report. The assessment has been undertaken in accordance with the requirements of the BirdLife SA Best Practice Guidelines for Solar Developments.
Civil Aviation Assessment	Screening tool: Low Sensitivity	The Civil Aviation Authority (CAA) and Air Traffic Navigation Services (ATNS) have been consulted throughout the BA process

Specialist Assessment	Sensitivity Rating and Specialist Input Identified in Terms of the DFFE Screening Tool	Verification of Site-Specific Sensitivity and Motivation of the Need for Specialist Investigation
	Verified Sensitivity: **Low**	to obtain input and details of any requirements for further studies. No objections to the project have been received. The project site is not located within close proximity of any aerodromes, landing strips or infrastructure. The low sensitivity rating is supported, and no study is required in this regard.
Defence Assessment	Screening tool: Low Sensitivity Verified Sensitivity: **Low**	The project site is not located within close proximity of any military base or infrastructure. The low sensitivity rating is supported, and no study is required in this regard.
RFI Assessment	Screening tool: Low Sensitivity Verified Sensitivity: **Low**	The project site under consideration for the development of the Highveld Solar PV Facility is located outside of an Astronomy Advantage Area and within an area that as classified as having low sensitivity for telecommunication. The low sensitivity rating is supported, and no study is required in this regard. No comments or objections in this regard have been received during the public participation process.
Social Impact Assessment	The screening report does not indicate a rating for this theme.	A Social Impact Assessment has been undertaken for the Highveld Solar PV Facility and is included in the BA Report as **Appendix I**.
Plant Species Assessment	Screening tool: Medium Sensitivity Necessitating a plant species assessment (General Assessment Protocols). Verified Sensitivity by Specialist: **Medium**	Five (5) mammal species of Least Concern were observed that could naturally occur outside of protected areas. The completion of the terrestrial biodiversity assessment found a colony of Red Listed plants, *Lithops lesliei*, was identified in the south- eastern portion of the site. This species is currently listed as being Near Threatened and is regarded as having a very-high conservation value which corroborate with the Very high sensitivity rating from the screening tool report. However, a very small area provides the habitat suitable for this species, and it is only this habitat which must be avoided by the development footprint. With avoidance of this area as the primary mitigation, the sensitivity rating was verified to be Medium by the specialist. An Ecological Impact Assessment (including terrestrial and freshwater ecology) has been undertaken for the Highveld Solar PV Facility and is included as **Appendix D** of the BA Report.
Animal Species Assessment	Screening tool: Medium Sensitivity Necessitating an animal species assessment (in accordance with Animal Species Assessment Protocols prescribed in GN 43855) Verified Sensitivity by Specialist: **Medium**	

5.5. Assessment of Issues Identified through the BA Process

From the screening tool results, as well as through consideration of the questions as detailed within the DFFE Guideline on Need and Desirability, issues identified as requiring investigation within the BA Process were identified. The specialist studies undertaken as well as the specialist consultants involved in the assessment of these impacts are indicated in **Table 5.6** below.

Table 5.6: Specialist consultants appointed to evaluate the potential impacts associated with the Highveld Solar PV Facility

Specialist	Field of Study	Appendix
Daniel Meintjies and Andrew Husted of The Biodiversity Company	Ecology (including terrestrial and freshwater ecology)	Appendix D
Lukas Niemand of Pachnoda Consulting	Avifauna	Appendix E
Marine Pienaar of TerraAfrica	Soil and Agriculture	Appendix F
Jenna Lavin and Nicholas Wiltshire of CTS Heritage	Heritage (including archaeology and palaeontology)	Appendix G
Lourens du Plessis of LoGIS	Visual	Appendix H
Brogan Geldenhuys of Eco Thunder Consulting	Social	Appendix I

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the Highveld Solar 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; and
  - 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); and
  - 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); and
  - 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); and
- **> 60 points:** High (i.e., where the impact must have an influence on the decision process to develop in the area).

Specialist studies also considered cumulative impacts associated with similar developments within a 30km radius of the proposed project. The purpose of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e., whether the addition of the proposed project in the area will increase the impact). In this regard, specialist studies considered whether the construction of the proposed development will result in:

- Unacceptable risk.
- Unacceptable loss.
- Complete or whole-scale changes to the environment or sense of place.
- Unacceptable increase in impact.

A conclusion regarding whether the proposed development will result in any unacceptable loss or impact considering all the projects proposed in the area is included in the respective specialist reports. As the proponent has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations, 2014 (as amended)), the mitigation of significant impacts is discussed. An assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. An Environmental Management Programme (EMPr) that includes all the mitigation measures recommended by the specialists for the management of significant impacts is included as **Appendix J**.

5.6 Assumptions and Limitations of the BA Process

The following assumptions and limitations are applicable to the studies undertaken within this BA process:

- 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 project site, development area and development footprint for the PV facility identified by the developer represents a technically suitable site for the establishment of the Highveld Solar PV Facility, which is based on the design undertaken by technical consultants for the project.
- 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.

5.7 Legislation and Guidelines that have informed the preparation of this Basic Assessment Report

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

- National Environmental Management Act (Act No. 107 of 1998).
- EIA Regulations of December 2014, published under Chapter 5 of NEMA (as amended).
- Department of Environmental Affairs (2017), Public Participation guidelines in terms of NEMA EIA Regulations;
- Department of Environmental Affairs (2017), Integrated Environmental Management Guideline: Guideline on Need and Desirability.
- Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation.
- International guidelines – the Equator Principles, the IFC Performance Standards, the Sustainable Development Goals, World Bank Environmental and Social Framework, and the and World Bank Group Environmental, Health, and Safety Guidelines (EHS Guidelines).

Table 5.7 provides an outline of the legislative permitting requirements applicable to the Highveld Solar PV Facility as identified at this stage in the project process.

Table 5.7: Applicable Legislation, Policies and/or Guidelines associated with the development of the Highveld Solar PV Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
Constitution of the Republic of South Africa (No. 108 of 1996)	In terms of Section 24, the State has an obligation to give effect to the environmental right. The environmental right states that: "*Everyone has the right –* » *To an environment that is not harmful to their health or well-being, and* » *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:* * *Prevent pollution and ecological degradation,* * *Promote conservation, and* * *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*."	Applicable to all authorities	There are no permitting requirements associated with this Act. The application of the Environmental Right however implies that environmental impacts associated with proposed developments are considered separately and cumulatively. It is also important to note that the "right to an environment clause" includes the notion that justifiable economic and social development should be promoted, through the use of natural resources and ecologically sustainable development.
National Environmental Management Act (No. 107 of 1998) (NEMA)	The 2014 EIA Regulations have been promulgated in terms of Chapter 5 of NEMA. Listed activities which may not commence without EA are identified within the Listing Notices (GNR 327, GNR 325 and GNR 324) which form part of these Regulations (GNR 326). 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. Considering the capacity of the proposed solar PV facility (i.e., contracted capacity of 19MWac) and the	DFFE – competent authority	The listed activities triggered by the proposed project have been identified and are being assessed as part of the BA process currently underway for the project. The BA process will culminate in the submission of a final BA Report to the competent authority in support of the application for EA.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	triggering of Activity 1 of Listing Notice 1 (GN R.327), a Basic Assessment process is required in support of the application for EA.		
National Environmental Management Act (No 107 of 1998) (NEMA)	In terms of the "Duty of Care and Remediation of Environmental Damage" provision in Section 28(1) of NEMA, every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment. In terms of NEMA, it is the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	DFFE	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section finds application through the consideration of potential cumulative, direct, and indirect impacts. It will continue to apply throughout the life cycle of the project.
Environment Conservation Act (No. 73 of 1989) (ECA)	The Noise Control Regulations in terms of Section 25 of the ECA contain regulations applicable for the control of noise in the Provinces of Limpopo, North West, Mpumalanga, Northern Cape, Eastern Cape, and KwaZulu-Natal Provinces. The Noise Control Regulations cover the powers of a local authority, general prohibitions, prohibitions of disturbing noise, prohibitions of noise nuisance, use of measuring instruments, exemptions, attachments, and penalties. In terms of the Noise Control Regulations, no person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any	DFFE JB Marks Local Municipality By-Laws	Noise impacts are expected to be associated with the construction phase of the project. Minimal noise is expected during operation. As the site is located away from noise sensitive receptors and communities, construction noise is unlikely to present a significant intrusion to the local community. There is therefore no requirement for a noise permit in terms of the legislation.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	person, machine, device or apparatus or any combination thereof (Regulation 04). Furthermore, the South African noise control regulations describe a disturbing noise as any noise that exceeds the ambient noise by more than 7dB (ambient noise in rural areas being approximately 45dB). This difference is usually measured at the complainant's location should a noise complaint arise. Therefore, if a new noise source is introduced into the environment, irrespective of the current noise levels, and the new source is louder than the existing ambient environmental noise by more than 7dB, the complainant will have a legitimate complaint.		
National Water Act (No. 36 of 1998) (NWA)	A water use listed under Section 21 of the NWA must be licensed with the Regional DWS, unless it is listed in Schedule 1 of the NWA (i.e. is an existing lawful use), is permissible under a GA, or if a responsible authority waives the need for a licence. Water use is defined broadly, and includes consumptive and non-consumptive water uses, taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. Consumptive water uses may include taking water from a water resource (Section 21(a)) and storing water (Section 21(b)).	Regional DWS	No wetlands are present within the development footprint for the Highveld Solar PV Facility as indicated in the Ecological Impact Assessment (**Appendix D**). Where the development activities impede or divert the flow of water in a watercourse, or alter the bed, banks, course or characteristics of a watercourse, Section 21(c) and 21(i) of the NWA (Act 36 of 1998) would be triggered and the project proponent would need to apply for a WUL or register a GA with the DWS.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Non-consumptive water uses may include impeding or diverting of flow in a water course (Section 21(c)), and altering of bed, banks or characteristics of a watercourse (Section 21(i)).		
Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA)	In accordance with the provisions of the MPRDA a mining right or permit is required in accordance with Section 27(6) of the Act where a mineral in question is to be mined, including the mining of materials from a borrow pit.	Department of Mineral Resources and Energy (DMRE)	Any person who wishes to apply for a mining permit in accordance with Section 27(6) must simultaneously apply for an Environmental Authorisation in terms of the NEMA. No borrow pits are expected to be required for the construction of the project, and as a result a mining permit or EA in this regard is not required to be obtained.
	Section 53 of the MPRDA states that any person who intends to use the surface of any land in any way which may be contrary to any object of the Act, or which is likely to impede any such object must apply to the Minister for approval in the prescribed manner.		In terms of Section 53 of the MPRDA, approval is required from the Minister of Mineral Resources and Energy to ensure that the proposed development does not sterilise a mineral resource that might occur on site.
National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM:AQA)	The National Dust Control Regulations (GNR 827) published under Section 32 of NEM:AQA prescribe the general measures for the control of dust in all areas, and provide a standard for acceptable dustfall rates for residential and non-residential areas. In accordance with the Regulations (GNR 827), any person who conducts any activity in such a way as to give rise to dust in quantities and concentrations that may exceed the dustfall standard set out in Regulation 03 must, upon receipt of a notice from the air quality officer, implement a dustfall monitoring programme. Any person who has exceeded the dustfall standard set out in Regulation 03 must, within three months after	DFFE Dr Kenneth Kaunda District Municipality	In the event that the project results in the generation of excessive levels of dust, the possibility could exist that a dustfall monitoring programme would be required for the project, in which case dustfall monitoring results from the dustfall monitoring programme would need to be included in a dust monitoring report, and a dust management plan would need to be developed. However, with mitigation measures implemented, the Highveld Solar PV Facility is not anticipated to result in significant dust generation and at this stage, a dust fall monitoring programme is not deemed required.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	submission of the dustfall monitoring report, develop and submit a dust management plan to the air quality officer for approval.		
National Heritage Resources Act (No. 25 of 1999) (NHRA)	Section 07 of the NHRA stipulates assessment criteria and categories of heritage resources according to their significance. Section 35 of the NHRA provides for the protection of all archaeological and palaeontological sites, and meteorites. Section 36 of the NHRA provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority. Section 38(1) of the NHRA lists activities which require developers or any person who intends to undertake a listed activity to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development. Section 44 of the NHRA requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction.	South African Heritage Resources Agency (SAHRA) North West Provincial Heritage Resource Authority	A full Heritage Impact Assessment (HIA) (with field work) has been undertaken as part of the BA process (refer to **Appendix F** of this BA Report). Seven (7) heritage and palaeontological resources of significance were identified within the development area. Should a heritage resource be impacted upon, a permit may be required from SAHRA or the Mpumalanga Provincial Heritage Resource Authority in accordance with Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668).
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Section 53 of NEM:BA provides for the MEC / Minister to identify any process or activity in such a listed ecosystem as a threatening process. Three government notices have been published in terms of Section 56(1) of NEM:BA as follows:	DFFE North West DEDECT	Under NEM:BA, a permit would be required for any activity that is of a nature that may negatively impact an already threatened ecosystem. A Terrestrial Ecology Impact Assessment has been undertaken as part of the BA process. Ground truthing confirmed 16

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» Commencement of TOPS Regulations, 2007 (GNR 150). » Lists of critically endangered, vulnerable, and protected species (GNR 151), as amended in 2020 (GNR 627). » TOPS Regulations (GNR 152). NEM:BA provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), and vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process, including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (NEM:BA: National list of ecosystems that are threatened and in need of protection, (Government Gazette 1002, 9 December 2011, GG 34809).		Species of Conservation Concern expected to be present within the study area (refer to **Appendix D**). These were protected species from a provincial perspective, and one of them are Red List species. Should any species be affected by the project, a permit would be required to be obtained. During the survey no TOPS spp were recorded to date.
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Chapter 5 of NEM:BA pertains to alien and invasive species, and states that a person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7 of NEM:BA, and that a permit may only be issued after a prescribed assessment of risks and potential impacts on biodiversity is carried out. Applicable, and exempted alien and invasive species are contained within the Alien and Invasive Species List (GNR 864).	DFFE North West DEDECT	A Terrestrial Ecology Impact Assessment has been undertaken as part of the BA process to identify the presence of any alien and invasive species present on site. Four (4) IAP species were recorded within the project area. These species are listed under the Alien and Invasive Species List 2021, Government Gazette No. 44182 as Category 1b and Category 2. Category 1b species must be controlled by implementing an IAP Management Programme, in compliance of section 75 of the NEMBA (refer to **Appendix D**).

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) Regulations (GN R1048) (CARA Regulations)	Section 05 of CARA provides for the prohibition of the spreading of weeds. Regulation 15 of GN R1048 published under CARA provides for the classification of categories of weeds and invader plants, and restrictions in terms of where these species may occur. Regulation 15E of GN R1048 published under CARA provides requirement and methods to implement control measures for different categories of alien and invasive plant species. It should be noted that the CARA regulations for the legal obligations regarding alien invasive plants in South Africa have been superseded by the National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004) – Alien and Invasive Species (AIS) Regulations which were promulgated on 1 October 2014 (as amended in 2020). However, CARA has not been repealed and is still included as a reference point to use in terms of the management of invasive alien plans where certain species may not be included in the NEM: BA alien invasive species list.	Department of Agriculture, Land Reform and Rural Development (DALRD)	CARA will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies need to be developed and implemented. In addition, a weed control and management plan must be implemented. In terms of Regulation 15E (GN R1048) where Category 1, 2 or 3 plants occur, a land user is required to control such plants by means of one or more of the following methods: » Uprooting, felling, cutting, or burning. » Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer. » Biological control carried out in accordance with the stipulations of the Agricultural Pests Act (No. 36 of 1983), the ECA and any other applicable legislation. » Any other method of treatment recognised by the executive officer that has as its object the control of plants concerned, subject to the provisions of sub-regulation 4. » A combination of one or more of the methods prescribed, save that biological control reserves and areas where biological control agents are

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			effective shall not be disturbed by other control methods to the extent that the agents are destroyed or become ineffective. Four (4) IAP species were recorded within the project area. These species are listed under the Alien and Invasive Species List 2021, Government Gazette No. 44182 as Category 1b and Category 2.
National Forests Act (No. 84 of 1998) (NFA)	According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. Notice of the List of Protected Tree Species under the National Forests Act (No. 84 of 1998) was published in GNR 734 (as updated in 2018). 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".	DFFE	A licence is required for the removal of protected trees. It is therefore necessary to conduct a survey that will determine the number and relevant details pertaining to protected tree species present in the development footprint for the submission of relevant permits to authorities prior to the disturbance of these individuals. The Ecological Impact Assessment (**Appendix D**) identified one species of protected trees were observed: *Vachellia erioloba* (Camel Thorn). The protected trees observed are protected by the List of Protected Tree Species under the National Forests Act, 1998 (Act No. 84 of 1998) (NFA). In terms of the NFA, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate, or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Contravention of this declaration is regarded as a first category offence. The locations of the Camel thorn trees were not shared and would have to be determined with a follow-up site visit.
National Veld and Forest Fire Act (No. 101 of 1998) (NVFFA)	Chapter 4 of the NVFFA places a duty on owners to prepare and maintain firebreaks, the procedure in this regard, and the role of adjoining owners and the fire protection association. Provision is also made for the making of firebreaks on the international boundary of the Republic of South Africa. The applicant must ensure that firebreaks are wide and long enough to have a reasonable chance of preventing a veldfire from spreading to or from neighbouring land, it does not cause soil erosion, and it is reasonably free of inflammable material capable of carrying a veldfire across it. Chapter 5 of the Act places a duty on all owners to acquire equipment and have available personnel to fight fires. Every owner on whose land a veldfire may start or burn or from whose land it may spread must have such equipment, protective clothing and trained personnel for extinguishing fires, and ensure that in his or her absence responsible persons are present on or near his or her land who, in the event of fire, will extinguish the fire or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant fire protection association, if any.	DFFE	While no permitting or licensing requirements arise from this legislation, this Act will be applicable during the construction and operation of the Highveld Solar PV Facility, in terms of the preparation and maintenance of firebreaks, and the need to provide appropriate equipment and trained personnel for firefighting purposes.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
Hazardous Substances Act (No. 15 of 1973) (HAS)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger, to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance » Group IV: any electronic product, and » 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.	Department of Health (DoH)	It is necessary to identify and list all Group I, II, III, and IV hazardous substances that may be on site and in what operational context they are used, stored or handled. If applicable, a license would be required to be obtained from the Department of Health (DoH).
National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA)	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.	DFFE – Hazardous Waste North West DEDECT – General Waste	No waste listed activities are triggered by the Highveld Solar PV Facility, and as such, no Waste Management License is required to be obtained. General and hazardous waste handling, storage and disposal will be required during construction and operation. The National Norms and Standards for the Storage of Waste (GNR 926) published under Section 7(1)(c) of

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» 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 NEM:WA (GNR 921), a BA or EIA 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.		NEM:WA will need to be considered in this regard.
National Road Traffic Act (No. 93 of 1996) (NRTA)	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	South African National Roads Agency (SANRAL) – national roads North West Department of Public Works and Roads	An abnormal load/vehicle permit will 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. » Depending on the trailer configuration and height when loaded, some of the project components may not meet

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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.		specified dimensional limitations (height and width).
Astronomy Geographic Advantage Act (Act No. 21 of 2007) (AGA)	The Astronomy Geographic Advantage (AGA) 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. 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.	Department of Science and Technology.	The site proposed for the development of the Highveld Solar PV Facility is located within the North West Province and therefore falls outside of the areas considered to be uniquely suited in terms of nationally significant astronomy advantage areas.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km radius around such structure. Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft.	South African Civil Aviation Authority (SACAA) Air Traffic and Navigation Services SOC Limited (ATNS)	This Act will find application during the operation phase of the Highveld Solar PV Facility. Appropriate marking of project infrastructure >45m above ground level, such as the power line, is required to meet the specifications. as detailed in the CAR Regulations Part 139.01.33. An obstacle approval (or confirmation that no approval is required) would be required to be obtained from the South African CAA.
Provincial Policies / Legislation			
Bophuthatswana Nature Conservation Act. No. 3 of 1973.	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: » Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property; » Aquatic habitats may not be destroyed or damaged; » The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species;	North West DEDECT	A collection/destruction permit must be obtained from North West Department of Rural, Environment and Agricultural Development for the removal of any protected plant or animal species found on site. Two plant SCC is expected to occur in the project area: *Pearsonia bracteata* and *Adromischus umbraticola subsp. Umbraticola.* One amphibian SCC is expected to occur in the project area: *Pyxicephalus adspersus* also known as the Giant Bullfrog. Refer to the Ecological Impact Assessment Report (**Appendix D**).

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	The Act provides lists of protected species for the Province.		

5.7.1 The IFC EHS Guidelines

The IFC EHS Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). The following IFC EHS Guidelines have relevance to the Highveld Solar PV Facility:

- IFC EHS General Guidelines
- IFC Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants

The application of the General EHS Guidelines should be tailored to the hazards and risks associated with a project and should take into consideration site-specific variables which may be applicable, such as host country context, assimilative capacity of the environment, and other project factors. In instances where host country regulations differ from the standards presented in the EHS Guidelines, whichever is the more stringent of the two in this regard should be applied.

The General EHS Guidelines include consideration of the following:

- Environmental:
  - Air Emissions and Ambient Air Quality
  - Energy Conservation
  - Wastewater and Ambient Water Quality
  - Water Conservation
  - Hazardous Materials Management
  - Waste Management
  - Noise
  - Contaminated Land
- Occupational Health and Safety:
  - General Facility Design and Operation
  - Communication and Training
  - Physical Hazards
  - Chemical Hazards
  - Biological Hazards
  - Radiological Hazards
  - Personal Protective Equipment (PPE)
  - Special Hazard Environments
  - Monitoring
- Community Health and Safety:
  - Water Quality and Availability
  - Structural Safety of Project Infrastructure
  - Life and Fire Safety (L&FS)
  - Traffic Safety
  - Transport of Hazardous Materials
  - Disease Prevention
  - Emergency Preparedness and Response
- Construction and Decommissioning:
  - Environment
  - Occupational Health & Safety
  - Community Health & Safety

5.7.2 IFC Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (2015)

While no Industry Sector EHS Guidelines have been developed for PV Solar Power, the IFC has published a Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (IFC, 2015). Chapter 8 of the Project Developer's Guide pertains to Permits, Licensing and Environmental Considerations, and states that in order to deliver a project which will be acceptable to international lending institutions, environmental and social assessments should be carried out in accordance with the requirements of the key international standards and principles, namely the Equator Principles and the IFC Performance Standards.

Some of the key environmental considerations for solar PV power plants contained within the Project Developer's Guide include:

Construction Phase Impacts

Construction activities lead to temporary air emissions (dust and vehicle emissions), noise related to excavation, construction and vehicle transit, solid waste generation and wastewater generation from temporary building sites and worker accommodation. In addition, Occupational Health and Safety (OHS) is an issue that needs to be properly managed during construction in order to minimise the risk of preventable accidents leading to injuries and / or fatalities. Proper OHS risk identification and management measures should be incorporated in every project's management plan and standard Engineering, Procurement and Construction (EPC) contractual clauses.

Response:
Impacts associated with the construction phase of the development have been identified and assessed as part of the detailed independent specialist studies undertaken as part of the BA process. Where applicable, appropriate mitigation measures with which to minimise the significance of construction phase impacts have been identified and included in the EMPr prepared for Highveld Solar PV Facility and attached as **Appendix J** to this BA Report.

Water Usage

Although water use requirements are typically low for solar PV plants, clusters of PV plants may have a high cumulative water use requirement in arid areas where local communities rely upon scarce groundwater resources. In such scenarios, water consumption should be estimated and compared to local water abstraction by communities (if any), to ensure no adverse impacts on local people. O&M methods in relation to water availability and use should be carefully reviewed where risks of adverse impacts to community usage are identified.

Further, many projects are likely to be constructed in areas with a scarcity of water and electricity. Therefore, the use of these resources during construction and operation of the plant may have an impact on the local economy. Careful siting and design of the projects should minimise this potential impact.

Response:
Water will be required for the construction phase, which will be approximately 150 000m^3 for construction and 300 000m^3 for operation, washing of equipment, earthworks/dust suppression and civil works. Water will be sourced directly from a registered water services provider such as the municipality.

Land Matters

As solar power is one of the most land-intensive power generation technologies, land acquisition procedures and in particular the avoidance or proper mitigation of involuntary land acquisition / resettlement are critical to the success of the project. This includes land acquired either temporarily or permanently for the project site itself and any associated infrastructure – i.e., access roads, powerlines and construction camps (if any). If involuntary land acquisition is unavoidable, a Resettlement Action Plan (RAP) (dealing with physical displacement and any associated economic displacement) or Livelihood Restoration Plan (LRP) (dealing with economic displacement only) will be required. This is often a crucial issue with respect to local social license to operate and needs to be handled with due care and attention by suitably qualified persons.

Response:
Highveld Solar PV Facility and its associated infrastructure is proposed on privately owned properties. A landowner / lease agreement has been entered into between WKN Windcurrent SA (Pty) Ltd and the private landowners to provide for the utilisation of the land for the development of the solar facility and its associated infrastructure. No involuntary land acquisition or resettlement is required or will take place.

Landscape and Visual Impacts

Key impacts can include the visibility of the solar panels within the wider landscape and associated impacts on landscape designations, character types and surrounding communities. Common mitigation measures to reduce impacts can include consideration of layout, size and scale during the design process and landscaping / planting in order to screen the modules from surrounding receptors. Note that it is important that the impact of shading on energy yield is considered for any new planting requirements. Solar panels are designed to absorb, not reflect, irradiation. However, glint and glare should be a consideration in the environmental assessment process to account for potential impacts on landscape / visual and aviation aspects.

Response:
Potential visual impacts associated with the development of Highveld Solar PV Facility have been assessed as part of the Visual Impact Assessment specialist study conducted as part of the BA process. Measures required to avoid, or if avoidance is not possible minimise, and mitigate any negative visual impacts have been identified, and are contained within the EMPr prepared for the project and attached as **Appendix J** to this BA Report.

Ecology and Natural Resources

Potential impacts on ecology can include habitat loss / fragmentation, impacts on designated areas and disturbance or displacement of protected or vulnerable species. Receptors of key consideration are likely to include nationally and internationally important sites for wildlife and protected species such as bats, breeding birds and reptiles. Ecological baseline surveys should be carried out where potentially sensitive habitat, including undisturbed natural habitat, is to be impacted, to determine key receptors of relevance to each site. Mitigation measures can include careful site layout and design to avoid areas of high ecological value or translocation of valued ecological receptors. Habitat enhancement measures could be considered where appropriate to offset adverse impacts on sensitive habitat at a site, though avoidance of such habitats is a far more preferable option.

Response:
Potential ecological impacts associated with the development of Highveld Solar PV Facility have been assessed as part of the Ecology Impact Assessment (refer to **Appendix D**) conducted as part of the BA process. Measures with which to avoid, or if avoidance is not possible minimise, and mitigate any negative ecological impacts have been identified, and are contained within the EMPr prepared for the project and attached as **Appendix J** to this BA Report. Areas of ecological sensitivity are reflected in an environmental sensitivity map prepared for the project and have been utilised to inform the facility layout so that such areas are suitably avoided.

Cultural Heritage

Potential impacts on cultural heritage can include impacts on the setting of designated sites or direct impacts on below-ground archaeological deposits as a result of ground disturbance during construction. Where indicated as a potential issue by the initial environmental review / scoping study, field surveys should be carried out prior to construction to determine key heritage and archaeological features at, or in proximity to, the site. Mitigation measures can include careful site layout and design to avoid areas of cultural heritage or archaeological value and implementation of a 'chance find' procedure that addresses and protects cultural heritage finds made during a project's construction and/or operation phases.

Response:
Heritage impacts associated with the development of the Highveld Solar PV Facility have been assessed as part of the Heritage Impact Assessment conducted as part of the BA process (refer to **Appendix G**), which includes the consideration of heritage, archaeological, and palaeontological resources. Measures with which to avoid, or if avoidance is not possible minimise, and mitigate any negative heritage impacts (including those on heritage, archaeology, and palaeontology) have been identified, and are contained within the EMPr prepared for the project and attached as **Appendix J** to this BA Report.

Transport and Access

The impacts of transportation of materials and personnel should be assessed in order to identify the most appropriate transport route to the site while minimising the impacts on project-affected communities. The requirement for any oversized vehicles / abnormal loads should be considered to ensure access is appropriate. Onsite access tracks should be permeable and developed to minimise disturbance to agricultural land. Where project construction traffic has to traverse local communities, traffic management

plans should be incorporated into the environmental and social management plan and EPC requirements for the project.

Response:
The project site can be readily accessed via existing access roads in the region. In proximity of the facility development footprint, access will make use of new / existing roads for construction purposes (and limited access for maintenance during operation). The facility layout has been determined following the identification of site related sensitivities.

The national, regional, secondary, and proposed internal access roads will be used to transport all components and equipment required during the construction phase of the solar PV facility. Some of the components (i.e., on-site substation transformer) may be defined as abnormal loads in terms of the National Road Traffic Act (No. 93 of 1996) (NRTO) by virtue of the dimensional limitations. A permit will be required in accordance with Section 81 of the National Road Traffic Act (No. 93 of 1996) (NRTA) which pertains to vehicles and loads which may be exempted from provisions of the Act.

Drainage / Flooding

A review of flood risk should be undertaken to determine if there are any areas of high flood risk associated with the site. Existing and new drainage should also be considered to ensure run-off is controlled to minimise erosion.

Response:
A draft stormwater management plan is included within the project EMPr attached as **Appendix J** of this BA Report.

Consultation and Disclosure

It is recommended that early-stage consultation is sought with key authorities, statutory bodies, affected communities and other relevant stakeholders. This is valuable in the assessment of project viability and may guide and increase the efficiency of the development process. Early consultation can also inform the design process to minimise potential environmental impacts and maintain overall sustainability of the project. The authorities, statutory bodies and stakeholders that should be consulted vary from country to country but usually include the following organisation types:

- Local and / or regional consenting authority.
- Government energy department / ministry.
- Environmental agencies / departments.
- Archaeological agencies / departments.
- Civil aviation authorities / Ministry of Defence (if located near an airport).
- Roads authority.
- Health and safety agencies / departments.
- Electricity utilities.
- Military authorities.

Community engagement is an important part of project development and should be an on-going process involving the disclosure of information to project-affected communities. The purpose of community engagement is to build and maintain over time a constructive relationship with communities located in close

proximity to the project and to identify and mitigate the key impacts on project-affected communities. The nature and frequency of community engagement should reflect the project's risks to, and adverse impacts on, the affected communities.

Response:
A Public Participation Process, as prescribed by Chapter 6 of the 2014 EIA Regulations (GNR 326), is being conducted as part of the BA process being undertaken for the project. This Public Participation Process includes consultation with key authorities, affected and surrounding landowners, local communities, and other relevant stakeholders.

Consultation between surrounding communities and the proponent would also need to be undertaken during the planning and design phase of the proposed development.

Environmental and Social Management Plan (ESMP)

Whether or not an ESIA or equivalent has been completed for the site, an ESMP should be compiled to ensure that mitigation measures for relevant impacts of the type identified above (and any others) are identified and incorporated into project construction procedures and contracts. Mitigation measures may include, for example, dust suppression during construction, safety induction, training and monitoring programs for workers, traffic management measures where routes traverse local communities, implementation of proper waste management procedures, introduction of periodic community engagement activities, implementation of chance find procedures for cultural heritage, erosion control measures, fencing off of any vulnerable or threatened flora species, and so forth. The ESMP should indicate which party will be responsible for (a) funding, and (b) implementing each action, and how this will be monitored and reported on at the project level. The plan should be commensurate to the nature and type of impacts identified.

Response:
Impacts associated with the construction phase of the development have been identified and assessed as part of the independent specialist studies undertaken as part of the BA process. Appropriate mitigation measures with which to minimise the significance of negative impacts have been identified and are included in the EMPr prepared for the project and attached as **Appendix J** to this BA Report. The EMPr is comprehensive for the nature and extent of the planned project.

CHAPTER 6: DESCRIPTION OF THE RECEIVING ENVIRONMENT

This chapter provides a description of the local environment. This information is provided in order to assist the reader in understanding the possible effects of the project on the environment within which it is proposed to be developed. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the Highveld Solar PV Facility have been described. This information has been sourced from both existing information available for the area as well as collected field data by specialist consultants and aims to provide the context within which this BA process is being conducted.

6.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Content of an EIA report:

Requirement	Relevant Section
3(1)(h)(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	The environmental attributes associated with the development of the Highveld Solar PV Facility is included as a whole within this chapter. The environmental attributes that are assessed within this chapter includes the following: » The regional setting of the broader study area indicates the geographical aspects associated with the Highveld Solar PV Facility. This is included in **Section 6.2**. » The climatic conditions for the Stilfontein area have been included in **Section 6.3**. » The biophysical characteristics of the project site and the surrounding areas are included in **Section 6.4**. The characteristics considered are topography and terrain, geology, soils and agricultural potential and the ecological profile which includes the vegetation patterns, listed plant species, critical biodiversity areas and broad-scale processes, freshwater resources, terrestrial fauna and avifauna. » The heritage and cultural aspects (including archaeology, cultural landscape and palaeontology) has been included in **Section 6.5**. » The social and socio-economic characteristics associated with the study area and the project site has been included in **Section 6.7**

A more detailed description of each aspect of the affected environment is included in the specialist reports included in **Appendices D to I** of this BA report.

6.2. Regional Setting

The Highveld PV Solar Facility is located north of the N12 national road approximately 15km north east of Stilfontein, in the JB Marks Local Municipality in the North West Province. JB Marks Local Municipality is situated within the Dr Kenneth Kaunda District in the North West Province. It is the largest municipality of three in the district, making up almost half its geographical area.

The region has a strong mining character, interspersed with agricultural activities (dryland and livestock production) and human settlements. The south western and to a lesser extent northern portion of the study area are home to a number of operational and old gold mines and other industrial activities. These activities, especially the expansive mining and quarrying are rapidly changing the once rural and agricultural character to that of a predominantly industrial nature. Active mining activities in close proximity to the proposed Highveld PV Solar Facility include the Stilfontein Gold Mine to the south west. Matlwang to the east and Khuma to the south of the Highveld PV Solar Facility are generally associated with the mining activities, where employees of these mines are housed.

The north-western and central portions of the study area still have a largely agricultural and rural character where predominantly dryland agriculture (maize), livestock agricultural and limited irrigated agriculture activities are practised. Land capability is the combination of soil suitability and climate factors. In terms of future economic development, there is likely to be a decline in the role played by mining, which will also negatively impact employment in the North West Province.

Farm settlements or residences occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development site. Two large Eskom power lines run through the proposed development area, specifically in the eastern portion of Rietfontein 3 and the eastern border of Rietfontein 388, and several others criss-cross the study area. These include, but are not limited to: Pluto – Hermes 1 400kV, Pluto – Hermes 2 400kV, Potchefstroom DS – Machavie 1 88kV, Potchefstroom DS – Buffels East 1 132kV, Hermes DS – Potchefstroom DS 1 132kV. Numerous farm-related features are also found throughout the development footprint, such as cattle kraals, feeding stations, wind pumps, and water reservoirs.

The natural vegetation or land cover types of the region (where intact) are described as Grassland. This vegetation cover type is under increased pressure from both mining and township development and are often subject to varying levels degradation. It may also include old agricultural fields that are regenerating. The majority of the remaining natural vegetation within the study area is indicated as Carletonville Dolomite Grassland.

Prominent rivers or streams include the Kromdraaispruit and Koekemoerspruit to the west, as well as the Droëspruit to the east.

The Khora Lion Park and Club Louico, located to the south west of the site, were identified as known tourist attractions and resorts within the study area.

The study site is located approximately 13km east of the Faan Meintjies Nature Reserve (and within 10km of the reserve's 3km buffer area). This conservation area is a municipal reserve under management of the City of Matlosana Local Municipality. In addition, the study area is located within the confines (west) of the "un-proclaimed" Highveld Nature Reserve (also often referred to as the Highveld National Park, however it was advised that there are no formal plans to formally protect or form this Park). Although little information is available about the exact boundaries and management of the reserve, it is known as a "Community reserve"

claimed by the Barolong Bo Modiboa. The "reserve" is situated west of the town of Potchefstroom on the N12 route near the Ikageng township and Matlwang village (refer to Figure 6.1). It is an area of high conservation value as it conserves a portion of the western grassland biome. Popular attractions include an annual hiking event and community outreach programmes.

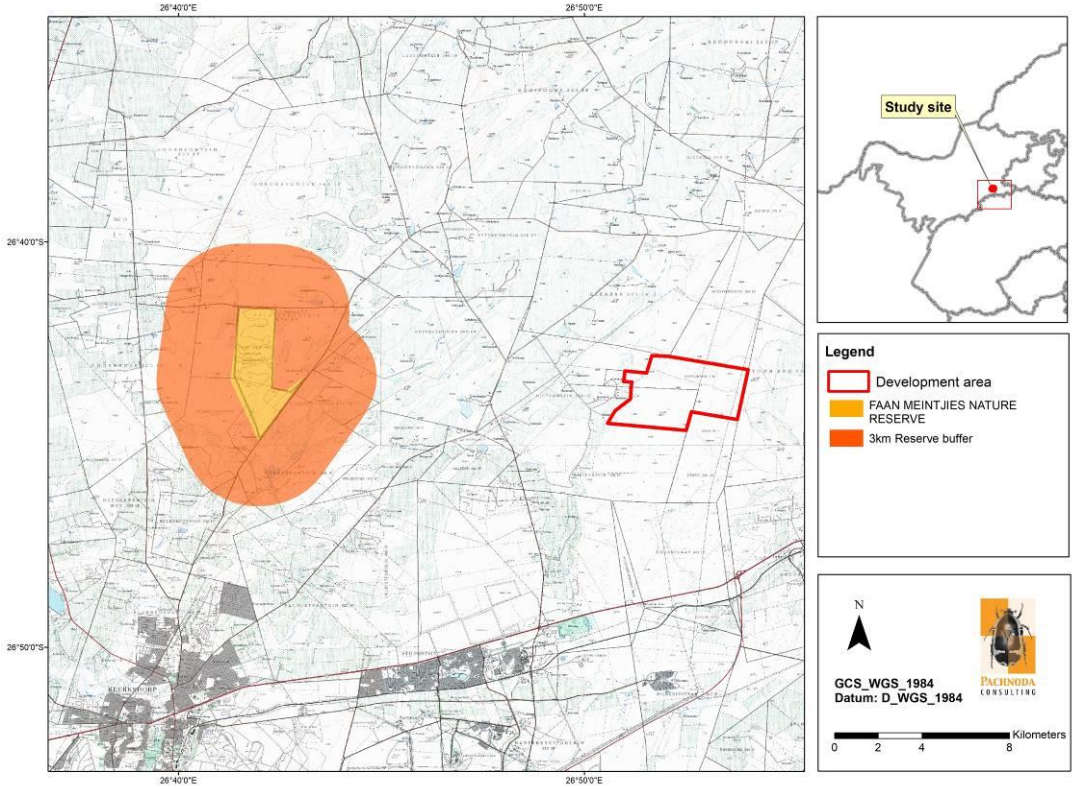


Figure 6.1: A map illustrating the locality of a conservation area in close proximity to the study site

Province	North West Province
District Municipality	Dr Kenneth Kaunda District Municipality
Local Municipality	JB Marks Local Municipality
Ward number(s)	27
Nearest town(s)	Stilfontein (15km south west)
Current Zoning	Mining and Agriculture
Current land use	Gold mining activities and livestock grazing
Access	The site can be readily accessed via the N12 and existing gravel access roads (Hartebeesfontein and Rietfontein Road)

North West Province

The North West Province is located in South Africa's central-northern region. It has a population of 3 509 953 (2011) and a population density of 33/km² (2011), making it South Africa's 7th most densely populated Province. It occupies an area of land of approximately 104 882km², making it South Africa's 6th largest in terms of area.

The North West Province has altitudes ranging from 920m to 1782m above sea level, making it one of the provinces with the most uniform terrain. The Province's central and western boundaries are defined by gently undulating plains, while the eastern boundary is mountainous and includes the Magaliesberg mountain range. The north-eastern and north-central extents of the Province are dominated by ancient igneous rock formations, and the Gatsrand between Potchefstroom and Carletonville is considered one of the world's most ancient preserved landscapes. The Province's geology is significant because of its mineral resources, which include platinum, gold, uranium, iron, chrome, manganese, and diamonds.

In terms of land use patterns, approximately 69% of the North West Province is in a natural or near-natural state, while 31% is irreversibly altered as a result of croplands (25.6%), urban (3.5%), and mining (0.7%) activities. The Province is mostly rural, with mining and agriculture being the main economic activities. The North West Province comprises of four (4) Districts, namely: Bojanala Platinum, Ngaka Modiri Molema, Dr Ruth Segomotsi Mompati, and Dr Kenneth Kaunda (refer to **Figure 6.2**).

Figure 6.2: District municipalities of the North West Province (Source: Municipalities of South Africa).

<u>Dr Kenneth Kaunda District Municipality</u>

The Dr Kenneth Kaunda District Municipality (DKKDM) is located in the southern part of the North West Province, bordering both Gauteng (65km south of Johannesburg) and the Free State Province. The DKKDM is the smallest of the four districts, consisting of three local municipalities: JB Marks, Matlosana City, and Maquassi Hills.

Mining is the district's dominant economic activity. Other employment sectors include social services, trade, and farming. Potchefstroom is home to several tertiary institutions and training centers, whereas agriculture is the economic backbone of Ventersdorp. Mining, trade, finance, business services, manufacturing, construction, government services, and agriculture are the DKKDM's main economic sectors.

The district is served by several major roads, with the N12 Treasure Corridor serving as the district's main development axis and a potential concentration point for future industrial, commercial, and tourism development. DKKDM is a region with a diverse natural and cultural heritage, as well as the potential for long-term economic growth. Hartbeesfontein, Klerksdorp, Leeudoringstad, Makwassie, Orkney, Potchefstroom, Stilfontein, Ventersdorp, Witpoort, and Wolmaransstad are among the major cities/towns in the district municipality.

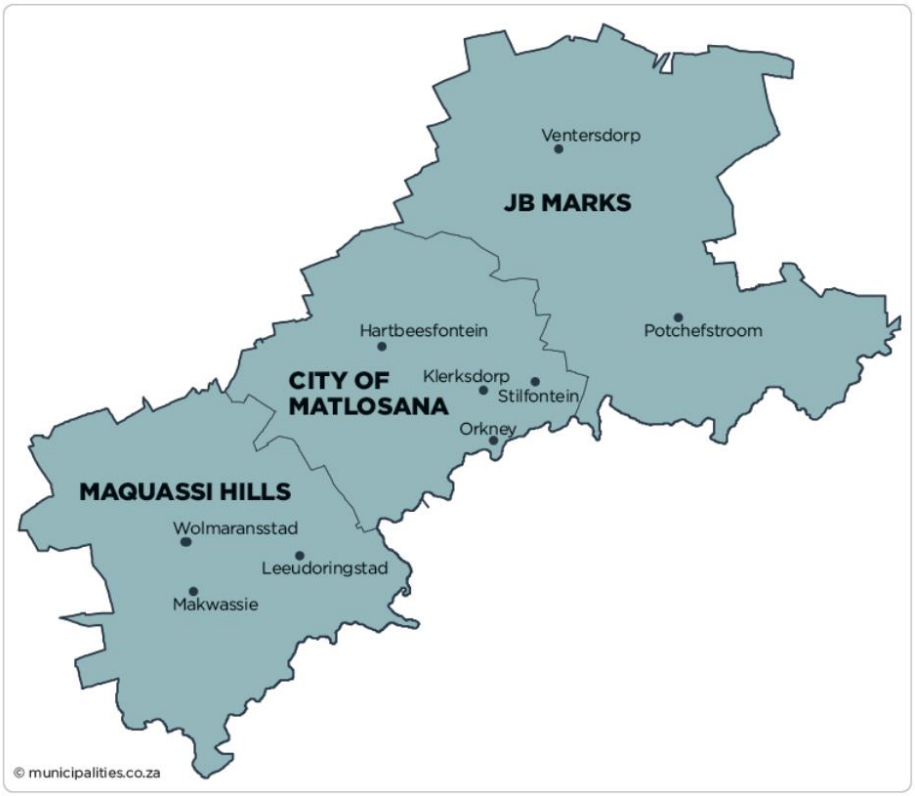


Figure 6.3: Map showing the local municipalities within the Dr Kenneth Kaunda (Source: Local Government Handbook, 2016)

JB Marks District Municipality

JB Marks Local Municipality is situated within the Dr Kenneth Kaunda District in the North West Province. It is the largest municipality of three in the district, making up almost half its geographical area.

It was established by the amalgamation of the former Ventersdorp and Tlokwe City Council Local Municipalities in August 2016. It combines the following areas from the Tlokwe Region: Ikageng and its extensions, Potchefstroom town, Mohadin, Promosa, Matlwang, Leliespan/Baitshoki, Haaskraal, Turfvlei, Vyfhoek, Mooibank, Machavie, Buffeldoorn, Miederpark, Kopjeskraal, Wilgeboom, Lindequesdrift. (Agricultural Holdings) Rooipoortjie, Venterskroon, Buffelshoek. (Rural) Vredefort Dome (World Heritage Site) Vaal River (Tourism attraction) and the rural hinterland.

The Ventersdorp Region consists of a vast rural / commercial farming area as well as the urban area of Ventersdorp, Tshing and Toevlug and has six (6) villages namely Goedgevonden, Welgevonden, Tsetse, Ga-Magopa, Boikhutso and Boikhutsong.

The N12 route that connects Johannesburg and Cape Town via the city of Kimberley runs through the municipality. The main railway route from Gauteng to the Northern and Western Cape also runs through one of the municipality's main cities, Potchefstroom. The city is 145km south-east of OR Tambo International Airport but has its own airfield, which can accommodate bigger aircraft and was formerly a military air base.

Gold mining is the dominant economic activity in the district, with Potchefstroom and Ventersdorp being the only exceptions. While Ventersdorp to the north-west of Potchefstroom focuses on agricultural activity, Potchefstroom's economic activity is driven by services and manufacturing.

A big role-player in the provision of services in Potchefstroom is the world-class North-West University, which has its main campus in Potchefstroom. Potchefstroom's industrial zone has many companies, focusing mainly on the industries of steel, food and chemicals. Within the city centre, the infrastructure of Potchefstroom supports roughly 600 businesses. Ventersdorp's main economic Sectors includes Agriculture, community services, manufacturing, trade, finance, transport and mining.

6.3. Climatic Conditions

Stilfontein is located at an elevation of approximately 1 200m above sea level and is influenced by the local steppe climate with rainfall mainly occurring during summer. The climate is strongly seasonal and semi-arid, rainfall for the Stilfontein area is given as 430mm per annum. Local thunderstorms and showers are responsible for most of the precipitation during the summer, from October to March and peaking in December.

The summers are hot, with summer temperatures ranging typically between 16-38°C. The winters are cold and dry, with wintertime temperatures ranging typically between 2 to 19°C.

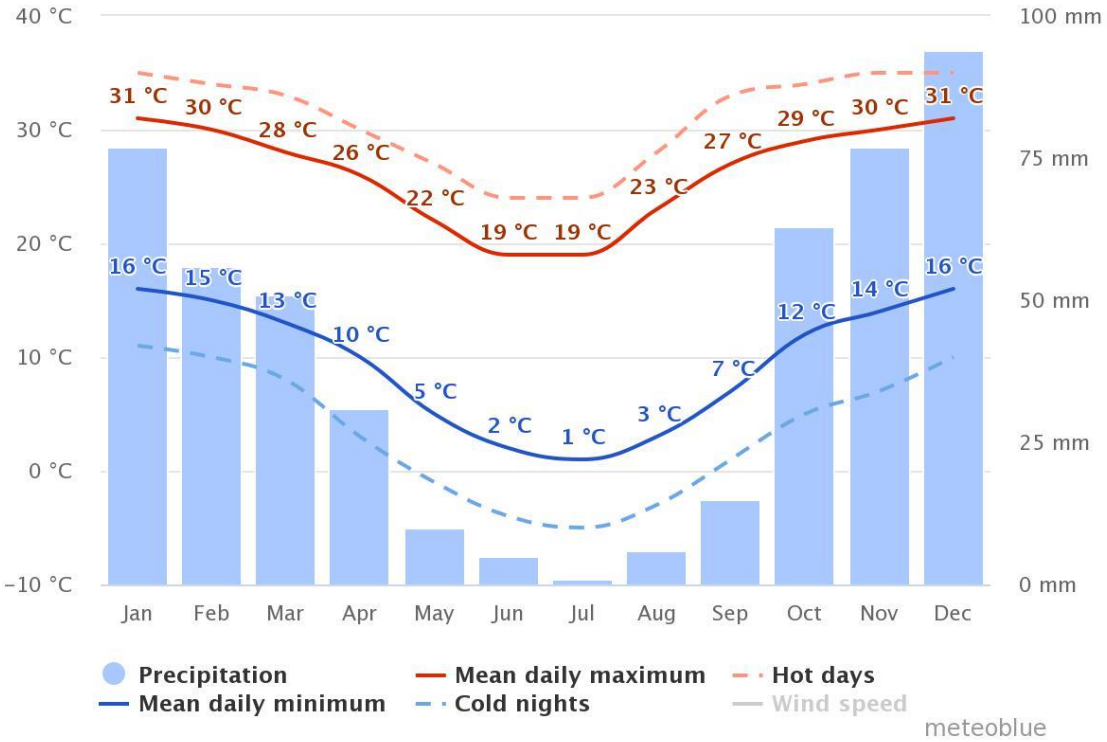


Figure 6.4: Climate graph for the Stilfontein area, North West Province within which the project site is located (source: Meteoblue 2022)

6.4. Biophysical Characteristics of the Development Area

The following section provides an overview and description of the biophysical characteristics of the study area and has been informed by specialist studies (**Appendix D-I**) undertaken for this BA Report.

6.4.1. Topographical profile

The topography or terrain morphology of the region is broadly described as slightly undulating plains dissected by prominent rocky chert ridges. The slope of the entire study area is generally even with very gradual drops towards the watercourses traversing the study area (hence the term undulating). The highest points above sea level within the study area are located on the ridgelines of the Buffelsrug (1519 m), Machavierug (1527.5 m) and Britzkop (1479.5 m) outcrop, located east of the proposed Highveld PV Facility. **Figure 6.5** provides a shaded relief/topography map of the study area.

6.4.2. Geology, Soils and Agricultural Potential

The project lies in the south western part of the Transvaal Basin where the lower rocks of the Transvaal Supergroup are exposed, in particular the dolomites of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup; ca 2585-2480 Ma).

The Late Archaean to early Proterozoic Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton. In South Africa are the Transvaal and Griqualand West Basins, and the Kanye Basin is in southern Botswana. The Griqualand West Basin is divided into the Ghaap Plateau sub-basin and the Prieska sub-basin. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences. Several tectonic events have greatly deformed the south western portion of the Griqualand West Basin between the two sub-basins. In the Transvaal Basin the Transvaal Supergroup is divided into two Groups, the lower Chuniespoort Group and the upper Pretoria Group. The Chuniespoort Group is divided into the basal Malmani Subgroup that comprises dolomites and limestones and is divided into five formations based on chert content, stromatolitic morphology, intercalated shales and erosion surfaces. The top of the Chuniespoort Group has the Penge Formation and the Duitschland Formation.

Making up the lower Pretoria Group are the Timeball Hill Formation and the Boshoek Formation. The Hekpoort, Dwaalheuwel, Strubenkop and Daspoort Formations form a sequence as the middle part of the Pretoria Group, Transvaal Supergroup, and represent rocks that are over 2060 million years old. The Hekpoort Formation is a massive lava deposit and is overlain by the rest of the Transvaal Supergroup. The Transvaal sequence has been interpreted as three major cycles of basin infill and tectonic activity with the first deep basin sediments forming the Chuniespoort Group, the second cycle deposited the lower Pretoria Group, and the sediments in this area are from the interim lowstand that preceded the third cycle. These sediments were deposited in shallow lacustrine, alluvial fan and braided stream environments.

The soils identified within the development footprint consist of the Mispah, Glenrosa and Vaalbos forms. **Figure 6.6** illustrates the distribution of the soil forms.

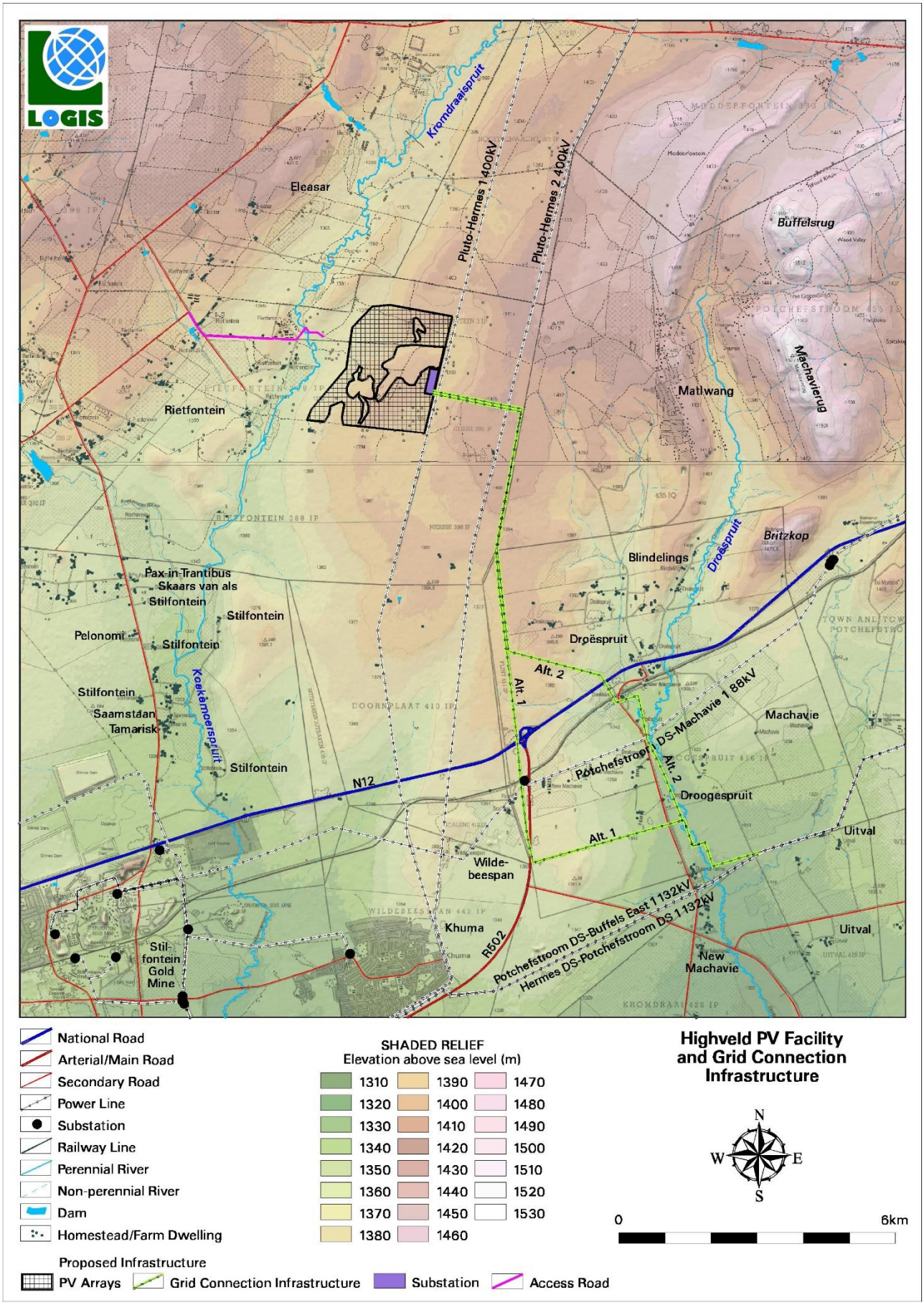


Figure 6.5: Shaded relief/topography map of the study area in the North West Province

Figure 6.6: Soil classification map of the Highveld Solar PV Facility development area

Mispah soils

The Mispah soils are present at 415.1ha of the development footprint assessed. These are the dominant soils of the area. The Mispah soils are very shallow, ranging in effective depth between 0.05 and 0.30m. The Mispah soils consist of orthic topsoil (mostly bleached) that covers fractured and solid rock (refer to **Figure 1.7**). In some areas, such as the existing farm roads of the properties, solid rock is visible on the surface as rock outcrops (as shown in **Figure 1.8**).

Figure 1.7: Photographic evidence of a Mispah soil profile within the development footprint

Figure 6.8: Solid rock boulders visible along existing farm roads

Vaalbos soils

One area of approximately 11.4ha consists of the Vaalbos soil form. The Vaalbos soils are present in the north-eastern part of the development footprint. The Vaalbos soils consist of chromic (red) topsoil with sandy-loam texture that overlies a red apedal horizon. The red apedal horizon is limited in soil depth by the presence of fractured hard rock. The effective soil depth of the Vaalbos profiles is 0.45m.

Figure 6.9: Photographic evidence of Vaalbos soils within the development footprint

Glenrosa soils

One area of 12ha of Glenrosa soils is present directly north of the Vaalbos soils. The average effective depth of the Glenrosa soils range in depth between 0.10m and 0.30m and consist of orthic topsoil horizons that are either bleached or chromic (light red in colour) with lithic material underneath (refer to **Figure 6.10**). The lithic horizon of the Glenrosa soils within the Highveld PV development footprint area belongs to the geolithic family and consists of soil material as illuvial infillings between partly weathered and fractured rock (Soil Classification Working Group, 2018).

Figure 6.10: Photographic example of the Glenrosa soils

Following the soil classification of the development footprint, the soils present were assigned into land capability classes. The very shallow soils of the largest part of the development footprint (Mispah soil form) has Very low (Class 03) land capability. The slightly deeper soils of the Glenrosa and Vaalbos forms have been assigned Low (Class 05) land capability. The position of the different land capability classes within the development area and grid connection alternatives, are illustrated in **Figure 6.11.**

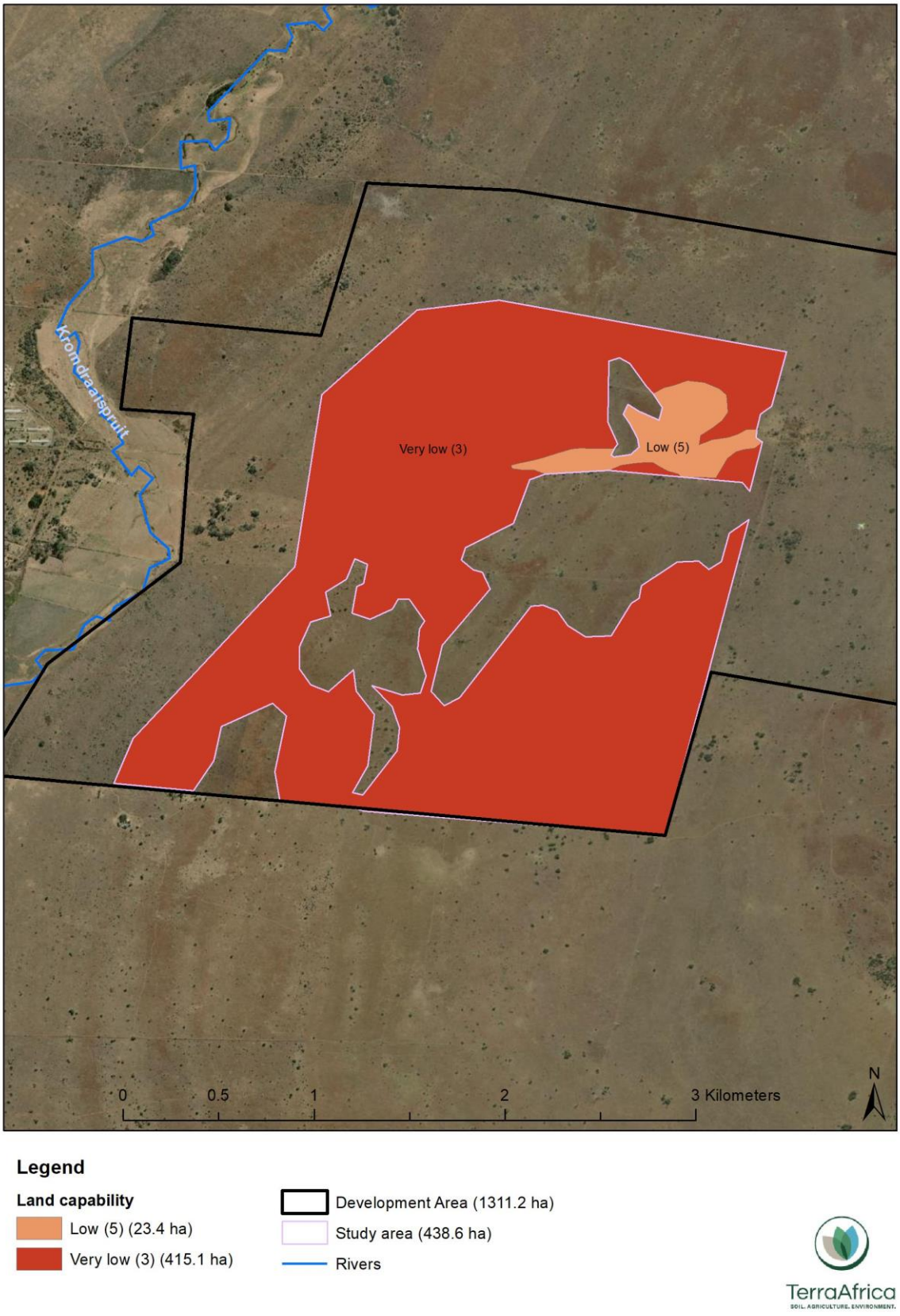


Figure 6.11: Land capability classification of the Highveld Solar PV Facility development footprint area

Following the classification of the soil and the consideration of the soil properties and limiting factors to rainfed crop production, the agricultural potential soil within the development footprint was determined. The total development footprint area assessed, has Low agricultural potential for the production of rainfed crops. The main constraint to production is the shallow depth of the soil profiles and the presence of fractured rock, solid rock and lithic material at effective depths shallower than 0.5m. The area is considered better suited to extensive livestock production, which is also the current land use on site.

6.4.3. Land Use

The proposed development is approximately 15km south east of Stilfontein and 20km west of the town Potchefstroom. The most prominent (and visible) land use within the region is the mining activities, mining infrastructure and mine dumps. Interspersed with these mining activities are agricultural land uses (dryland and livestock production). The farmers working these fields predominantly reside at homesteads or farm residences scattered throughout the study area.

The N12 national road provides access to the region and is the main connecting route in between Johannesburg and Cape Town via the city of Kimberley. The proposed PV facility site is accessible from the N12 south of the project site, via secondary gravel roads, including the Hartebeesfontein Secondary gravel road which is located adjacent, to the west of the project site.

No formally protected or conservation areas were identified within the study area. The Khora Lion Park and Club Louico, located to the south west of the site, were identified as known tourist attractions and resorts within the study area.

The Land Cover Map (**Figure 6.12**) indicates that most of the study site is covered by natural grassland and low shrubland. The study site is primarily used for livestock production and livestock grazing. Existing infrastructure includes powerline servitudes located on the eastern part of the development area. A natural drainage line and floodplain habitat (the Kromdraaispruit) of the Koekemoerspruit are located to the west of the development area.

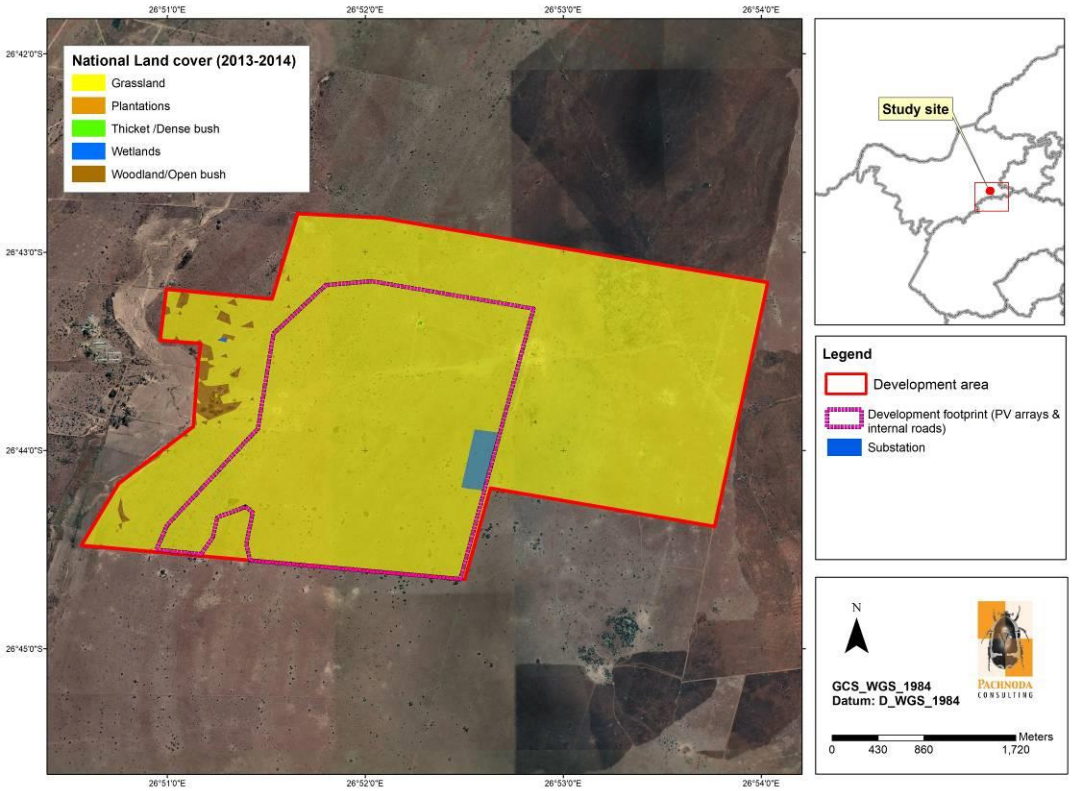


Figure 6.12: Illustration of land cover within the study area,

6.4.4. Ecological Profile of the Study Area and the Development Area

i. Vegetation Type

The project area is situated within the Grassland Biome. The Grassland Biome in South Africa occurs mainly on the Highveld, the inland areas of the eastern seaboard, the mountainous areas of KwaZulu-Natal and the central parts of the Eastern Cape.

The topography is mainly flat to rolling, but also includes mountainous regions and the Escarpment. Major macroclimatic traits that characterise the Grassland Biome include:

» Summer to strong summer rainfall and winter drought; and
» Frost is common, and fog is found on the upper slopes of the Great Escarpment and seaward scarps.

Grasslands characteristically contain herbaceous vegetation of a relatively short and simple structure that is dominated by graminoids, usually of the family Poaceae. Woody plants are rare (usually made up of low or medium-sized shrubs), absent, or confined to specific habitats such as smaller escarpments or koppies. Core grassland areas usually have deep, fertile soils although a wide spectrum of soil types occurs.

The Grassland Biome is comprised of 4 parent bioregions and a total of 72 different vegetation types. The project development area is situated within both the Vaal Reefs Dolomite Sinkhole Woodland and (predominantly) the Carletonville Dolomite Grassland – both of the Dry Highveld Grassland Bioregion (**Figure 6.13**).

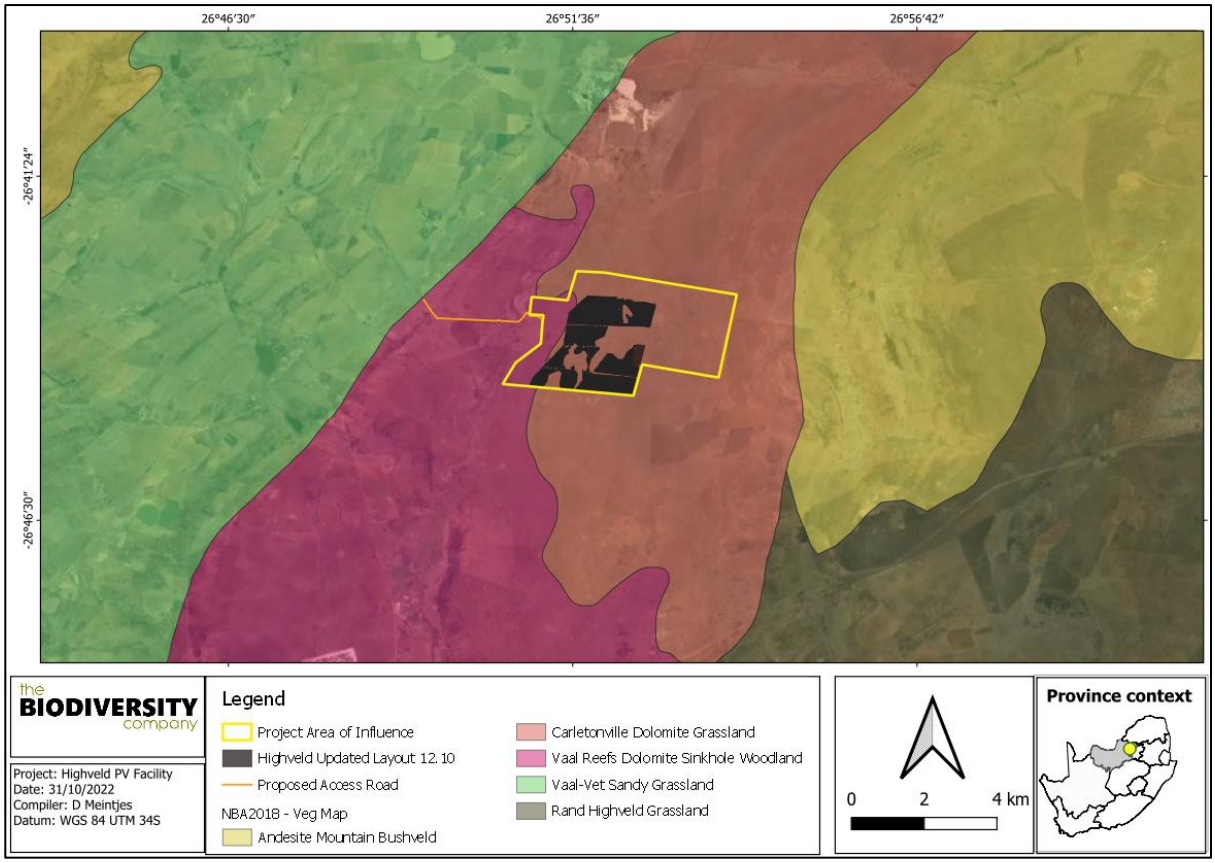


Figure 6.13: Vegetation map of the project site showing the Highveld Solar PV Facility.

Carletonville Dolomite Grassland

Carletonville Dolomite Grassland is restricted to the North-West (mainly) and Gauteng, and marginally extends into the Free State Province: In the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province. Its main vegetation and landscape features include slightly undulating plains dissected by prominent rocky chert ridges. These are a species-rich grasslands, forming a complex mosaic pattern dominated by many species.

Important Plant Taxa in Carletonville Dolomite Grassland

- **Graminiods:** *Aristida congesta, Brachiaria serrata, Cynodon dactylon, Digitaria tricholaenoides, Diheteropogon amplectens, Eragrostis chloromelas, E. racemosa, Heteropogon contortus, Loudetia simplex, Schizachyrium sanguineum, Setaria sphacelata, Themeda triandra, Alloteropsis semialata subsp. eckloniana, Andropogon schirensis, Aristida canescens, A. diffusa, Bewsia biflora, Bulbostylis burchellii, Cymbopogon caesius, C. pospischilii, Elionurus muticus, Eragrostis curvula, E. gummiflua, E. plana, Eustachys paspaloides, Hyparrhenia hirta, Melinis nerviglumis, M. repens subsp. repens, Monocymbium ceresiiforme, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides, Tristachya leucothrix, T. rehmannii.*
- **Herbs**: *Acalypha angustata, Barleria macrostegia, Chamaecrista mimosoides, Chamaesyce inaequilatera, Crabbea angustifolia, Dianthus mooiensis, Dicoma anomala, Helichrysum caespititium, H. miconiifolium, H. nudifolium var. nudifolium, Ipomoea ommaneyi, Justicia anagalloides, Kohautia*

amatymbica, Kyphocarpa angustifolia, Ophrestia oblongifolia, Pollichia campestris, Senecio coronatus, Vernonia oligocephala.

- **Geophytic Herbs**: *Boophone disticha, Habenaria mossii.*
- **Low Shrubs**: *Anthospermum rigidum subsp. pumilum, Indigofera comosa, Pygmaeothamnus zeyheri var. rogersii, Searsia magalismontana, Tylosema esculentum, Ziziphus zeyheriana.*
- **Geoxylic Suffrutices**: *Elephantorrhiza elephantina, Parinari capensis subsp. capensis*
- **Endemic Taxon - Succulent Shrub**: *Delosperma davyi.*

According to Mucina and Rutherford (2006) the Carletonville Dolomite Grassland is classified as Vulnerable. Although the target for conservation is 24%, only a small extent is conserved statutorily in the Sterkfontein Caves, Oog Van Malmanie, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifantsvlei, and Groenkloof protected areas, and in at least six private conservation areas. Almost a quarter is already transformed for cultivation, by urban sprawl or by mining activity as well as the building of the Boskop and Klerkskraal Dams.

Vaal Reefs Dolomite Sinkhole

Vaal Reefs Dolomite Sinkhole Woodland is restricted to the North-West and Free State Provinces, it covers a small area associated with the dolomite sinkholes in and around Stilfontein and Orkney (Vaal Reefs). The Vaal River forms the southern distribution limit of this vegetation unit. Its main vegetation and landscape features include a slightly undulating landscape dissected by prominent rocky chert ridges and supporting a grassland-woodland vegetation complex. The most typical vegetation feature is the woodland, which occurs naturally in clumps around sinkholes, especially in places of dolomite outcrops.

Important Plant Taxa in Vaal Reefs Dolomite Sinkhole Woodland

Based on Mucina and Rutherford's (2006) vegetation classification, important plant taxa are those species that have a high abundance, a frequent occurrence (not being particularly abundant) or are prominent in the landscape within a particular vegetation type. They note the following species that are important taxa in the Vaal Reefs Dolomite Sinkhole Woodland:

- **Graminoids**: *Aristida congesta, Digitaria eriantha, Eragrostis biflora, E. curvula, Themeda triandra, Anthephora pubescens, Aristida canescens, Bewsia biflora, Brachiaria nigropedata, B. serrata, Chloris pycnothrix, Cymbopogon caesius, C. pospischilii, Cynodon dactylon, Cyperus margaritaceus, Diheteropogon amplectens, Elionurus muticus, Eragrostis chloromelas, E. lehmanniana, E. racemosa, E. superba, Eustachys paspaloides, Heteropogon contortus, Melinis repens subsp. repens, Panicum coloratum, Setaria sphacelata, Triraphis andropogonoides.*
- **Small trees:** *Vachellia erioloba, Celtis africana, Searsia lancea, Senegalia caffra, Vachellia karroo, V. robusta subsp. clavigera.*
- **Tall shrubs**: *Diospyros lycioides subsp. lycioides, Ehretia rigida, Grewia flava.*
- **Low shrubs**: *Asparagus suaveolens, Gymnosporia heterophylla, Pavonia burchellii, Sida dregei, Anthospermum hispidulum, Asparagus laricinus, Diospyros pallens, Felicia muricata, Indigofera heterotricha, Menodora africana, Phyllanthus incurvus, Triumfetta sonderi, Ziziphus zeyheriana.*

According to Mucina and Rutherford (2006) the Vaal Reefs Dolomite Sinkhole Woodland is classified as Vulnerable. Although the target for conservation is 24%, only a small patch is conserved in the statutory

conservation area of Sterkfontein Caves. The proposed 'Highveld National Park'[35] is intended to conserve a considerable area of this vegetation unit. Aesthetically this is one of the most scenic landscapes in the western Grassland Biome and certainly deserves high conservation priority. Almost a quarter has been transformed already - mainly by mining, cultivation, urban sprawl and road-building. The region of this unit contains possibly the highest concentration of mines than any other vegetation in South Africa.

ii. Critical Biodiversity and Ecological Support Areas

The NWBSP dataset contains spatial data for both terrestrial and aquatic CBA and ESA areas as relevant to the Province.

Information extracted from the National Web-based Environmental Screening Tool (Department of Environmental Affairs, 2020), indicated that the study area holds a very high sensitivity with respect to the relative terrestrial biodiversity theme (**Figure 6.14**):

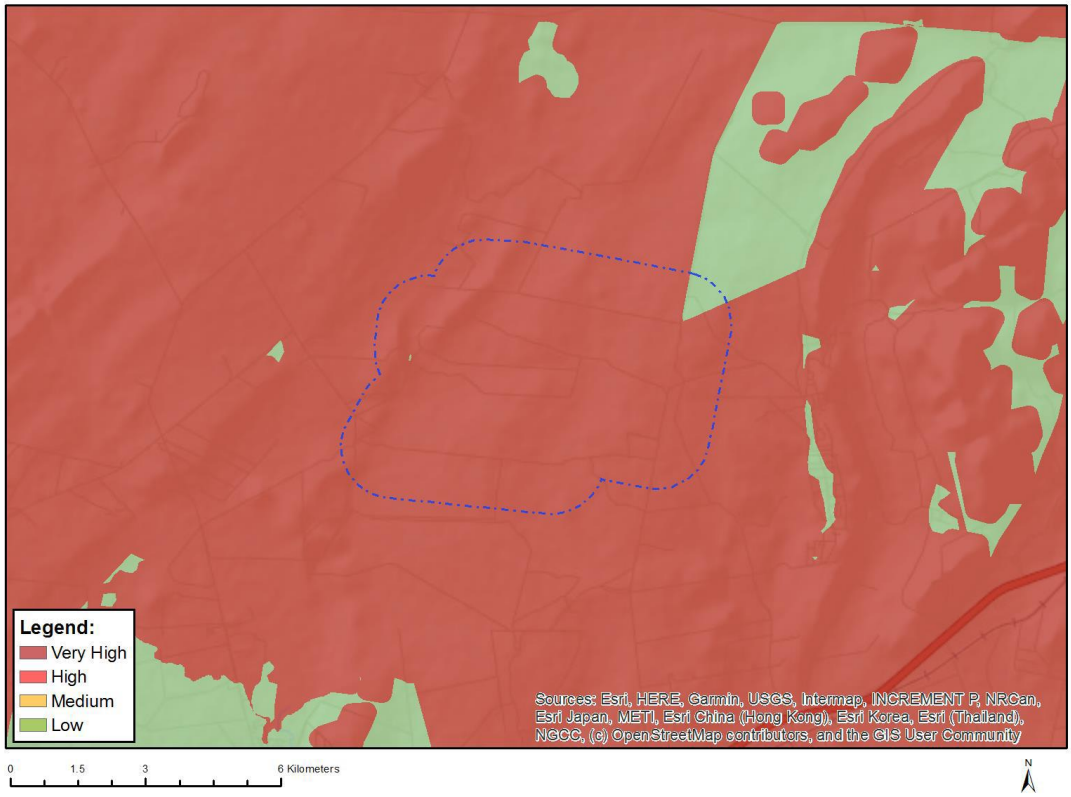


Figure 6.14: The relative terrestrial biodiversity sensitivity of the study area according to the Screening Tool.

Sensitive features include the following:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	Critical biodiversity area 1
Very High	Critical biodiversity area 2
Very High	Ecological support area 1
Very High	Ecological support area 2
Very High	Protected Areas Expansion Strategy

[35] It has been advised that there are no formal plans for this Park at this time, *pers comm*. As a result, this Park cannot be considered at this time.

It is evident from the results of the Screening Tool report that the study area coincides with Critical Biodiversity Areas (CBA 1 and CBA 2) and Ecological Support Areas (ESA 1 & 2) as per the North West Biodiversity Sector Plan (READ, 2015). It is also considered to be part of the Protected Areas Expansion Strategy, which include part of the "Highveld Nature Reserve".

Figure 6.15 below shows that the larger project area mostly overlaps with terrestrial CBA 2 areas, with a small portion overlapping with terrestrial CBA 1 in the west. In addition, the project area overlaps with an aquatic CBA 1 in the central region, an aquatic CBA 1 in the central region and a small portion of an aquatic CBA 1 in the west. CBA1 areas should be avoided as far as possible, and the proposed development footprint does achieve this.

Ecological Support Areas (ESAs) are terrestrial and aquatic areas that are not essential for meeting biodiversity representation targets (thresholds), but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree or extent of restriction on land use and resource use in these areas may be lower than that recommended for CBAs. ESA areas are typically not as essential as CBA areas and some development may occur over these areas where they are confirmed not to contain any sensitive features (such as in the case of the proposed development footprint and facility layout).

The land management objective for ESA1 areas is to maintain them in at least a semi-natural state as ecologically functional landscapes that retain basic natural attributes (READ, 2015).

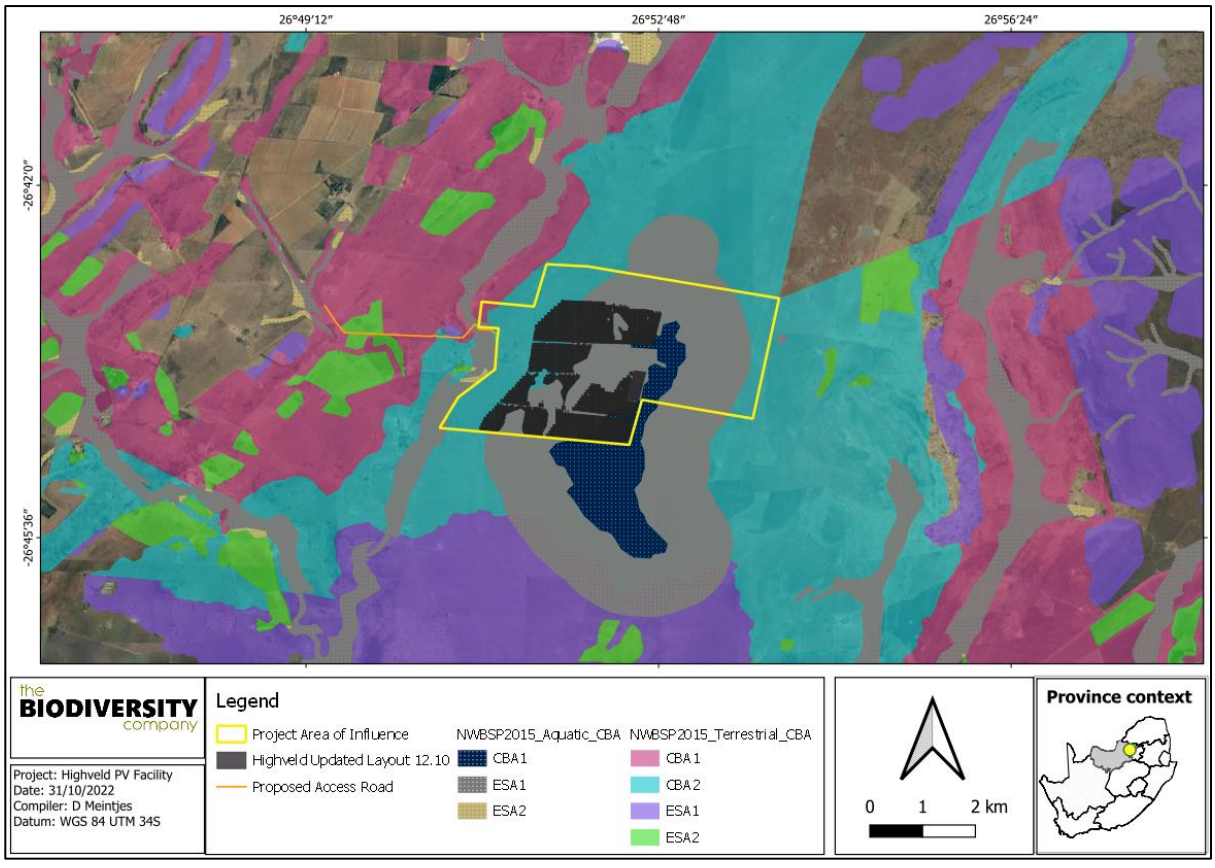


Figure 6.15: Map illustrating the locations of mapped CBAs and ESAs in the project area

iii. Terrestrial Fauna Communities in the Study Area

Information extracted from the National Web-based Environmental Screening Tool (Department of Environmental Affairs, 2020), indicated that the study area holds a medium sensitivity with respect to the relative animal species protocol (**Figure 6.16**):

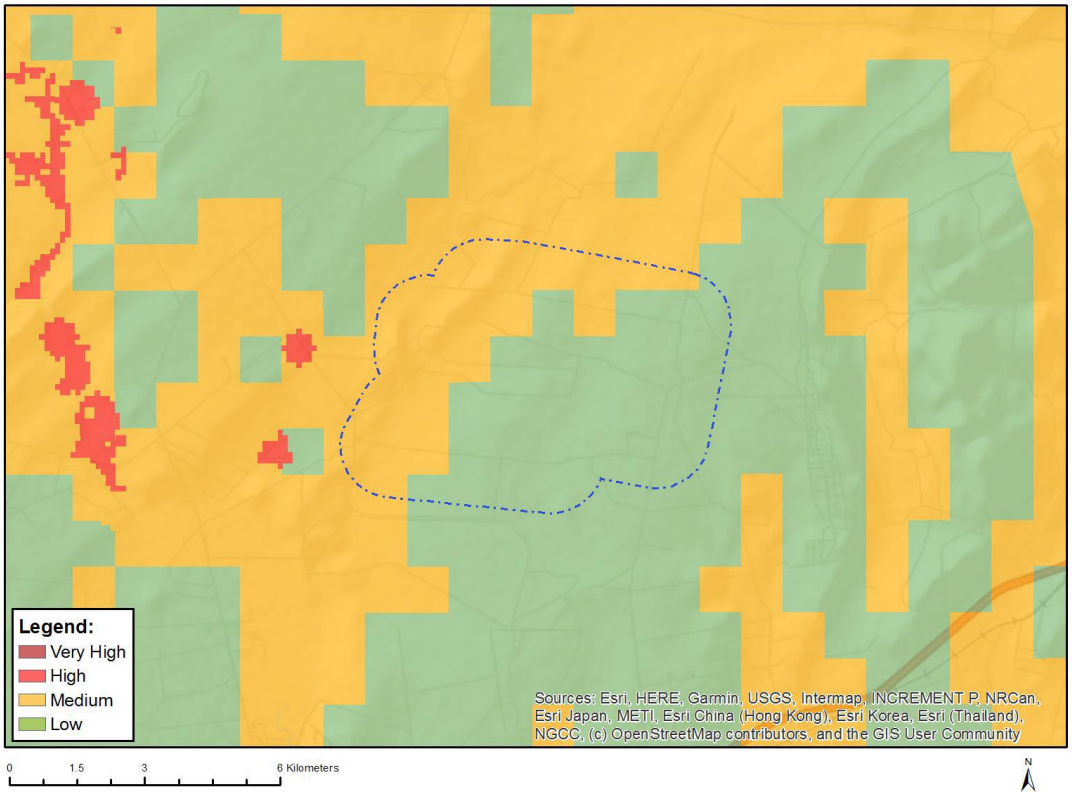


Figure 6.16: The animal species sensitivity of the study area according to the Screening Tool.

Sensitive features include the following:

Sensitivity	Feature(s)
Low	Subject to confirmation
Medium	Aves-*Circus ranivorus*
Medium	Mammalia-*Crocidura maquassiensis*
Medium	Mammalia-*Hydrictis maculicollis*

It is evident from the results of the Screening Tool report that the study area contains potential habitat (of medium sensitivity) for the endangered African Marsh Harrier (*Circus ranivorus*) along with two mammal species.

Amphibians

Based on the IUCN Red List Spatial Data and FrogMap, 21 amphibian species are expected to occur within the area. One of the expected species is an SCC (**Table 6.1**), the Giant Bullfrog. This species has a moderate likelihood of occurrence based on the wetlands found west near to the project area. The likelihood of occurrence is based on literature describing their habitat preferences and the level of adaptability to disturbed areas.

Table 6.1: Amphibians Species of conservation concern that may occur in the project area

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2021)	
Pyxicephalus adspersus	Giant Bullfrog	NT	LC	Moderate

Reptiles

Based on the IUCN Red List Spatial Data and the ReptileMAP database, 43 reptile species may occur within the area. One (1) is regarded as threatened (**Table**).

Table 6.2: Reptile Species of conservation concern that may occur within the project area

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2021)	
Psammophis leightoni	Cape Sand Snake	VU	LC	Low

Psammophis leightoni (Cape Sand Snake) is listed as VU on a regional basis. This snake is most commonly found in sand fynbos and strandveld habitat in the Western Cape. The species therefore has a low likelihood of occurrence.

Mammals

The IUCN Red List Spatial Data and the MammalMap database lists 90 mammal species that could be expected to occur within the area. This list excludes large mammal species that are normally limited to protected areas. Thirteen (13) of these expected species are regarded as SCC (**Table 6.3**), and five of these have a moderate-high likelihood of occurrence based on the suitable habitat and food sources present in the project area.

Table 6.3: Threatened mammal species that are expected to occur within the project area.

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2021)	
Aonyx capensis	African Clawless Otter	NT	NT	Low
Atelerix frontalis	Southern African Hedgehog	NT	LC	Moderate
Crocidura maquassiensis	Makwassie musk shrew	VU	LC	Low
Crocidura mariquensis	Swamp Musk Shrew	NT	LC	Low
Eidolon helvum	African Straw-colored Fruit Bat	LC	NT	Low
Felis nigripes	Black-footed Cat	VU	VU	Low
Hydrictis maculicollis	Spotted-necked Otter	VU	NT	Low
Leptailurus serval	Serval	NT	LC	High
Mystromys albicaudatus	African White-tailed Rat	VU	EN	Moderate
Otomys auratus	Southern African Vlei Rat (Grassland type)	NT	NT	High

Panthera pardus	Leopard	VU	VU	Low
Parahyaena brunnea	Brown Hyaena	NT	NT	Moderate
Poecilogale albinucha	African Striped Weasel	NT	LC	Low

Atelerix frontalis (South African Hedgehog) has a tolerance for a degree for habitat modification and occurs in a wide variety of semi-arid and sub-temperate habitats (IUCN, 2017). Based on the Red List of Mammals of South Africa, Lesotho and Swaziland (2016), *A. frontalis* populations are decreasing due to the threats of electrocution, veld fires, road collisions, predation from domestic pets and illegal harvesting. Suitable grasslands occur in the project area, although somewhat disturbed, that can function as habitat for this species, as such the likelihood of occurrence is rated as moderate.

Leptailurus serval (Serval) occurs widely through sub-Saharan Africa and is commonly recorded from most major national parks and reserves (IUCN, 2017). The Serval's status outside reserves is not certain, but they are inconspicuous and may be common in suitable habitat as they are tolerant of farming practices provided there is cover and food available. In sub-Saharan Africa, they are found in habitat with well-watered savanna long-grass environments and are particularly associated with reedbeds and other riparian vegetation types. Suitable habitat is present for this species in the project area, as such the likelihood of occurrence is rated as high.

Mystromys albicaudatus (African White-tailed Rat) is endemic to South Africa and Lesotho, where they inhabit Highveld grasslands primarily, but also Succulent Karoo and fynbos. They are often associated with calcrete soils within grasslands, and they are never found on soft, sandy substrate, rocks, wetlands or river banks. Furthermore, records from the Free State Province and Borakalalo Nature Reserve, North West Province, show that they can occur in disturbed areas and in sparse grasslands (Avenant *et al.,* 2016). This species has a moderate likelihood of project area occurrence due to the type of grassland habitat present. *Otomys auratus* (Southern African Vlei Rat (Grassland type)) is widely distributed throughout the Highveld grasslands and Drakensberg Escarpment of South Africa, Lesotho and Swaziland, with isolated populations found in the Soutpansberg Mountains of northern Limpopo and the Eastern Highlands of Zimbabwe. The species is associated with mesic grasslands and wetlands within alpine, montane and sub-montane regions, typically occurring in dense vegetation in close proximity to water (Taylor *et al.,* 2016). The state of the grasslands and the proximity to water means that this species has a high likelihood of project area occurrence.

Parahyaena brunnea (Brown Hyaena) is endemic to southern Africa except for a marginal extension into the arid parts of southwestern Angola. It mainly occurs in the arid countries of Namibia, Botswana, South Africa and Zimbabwe. This species remains widespread in South Africa, with high levels of occupancy recorded in the northwest regions. It is commonly found in desert and semi-desert, open scrub and open woodland savannah habitats, also showing an ability to survive close to urban areas (Yarnell *et al*., 2016). The large open grassland habitat available, and close proximity to water sources, means that the Brown Hyaena has a moderate likelihood of project area occurrence.

iv. Wetlands and Freshwater Resources

Ecological Functional Assessment

The ecosystem services provided by the wetland unit identified on site were assessed and rated. The summarised results for the Highveld Solar PV Facility are illustrated in **Table 6.4** and **Figure 6.17**. The supply and demand for the wetland is provided in **Figure 6.18**.

The supply indicates the capacity of an ecosystem (wetland) to deliver a service where the demand indicates the societal demand for an ecosystem service. The integration of supply and demand to provide a rating of importance relative to the case ecosystem services provision.

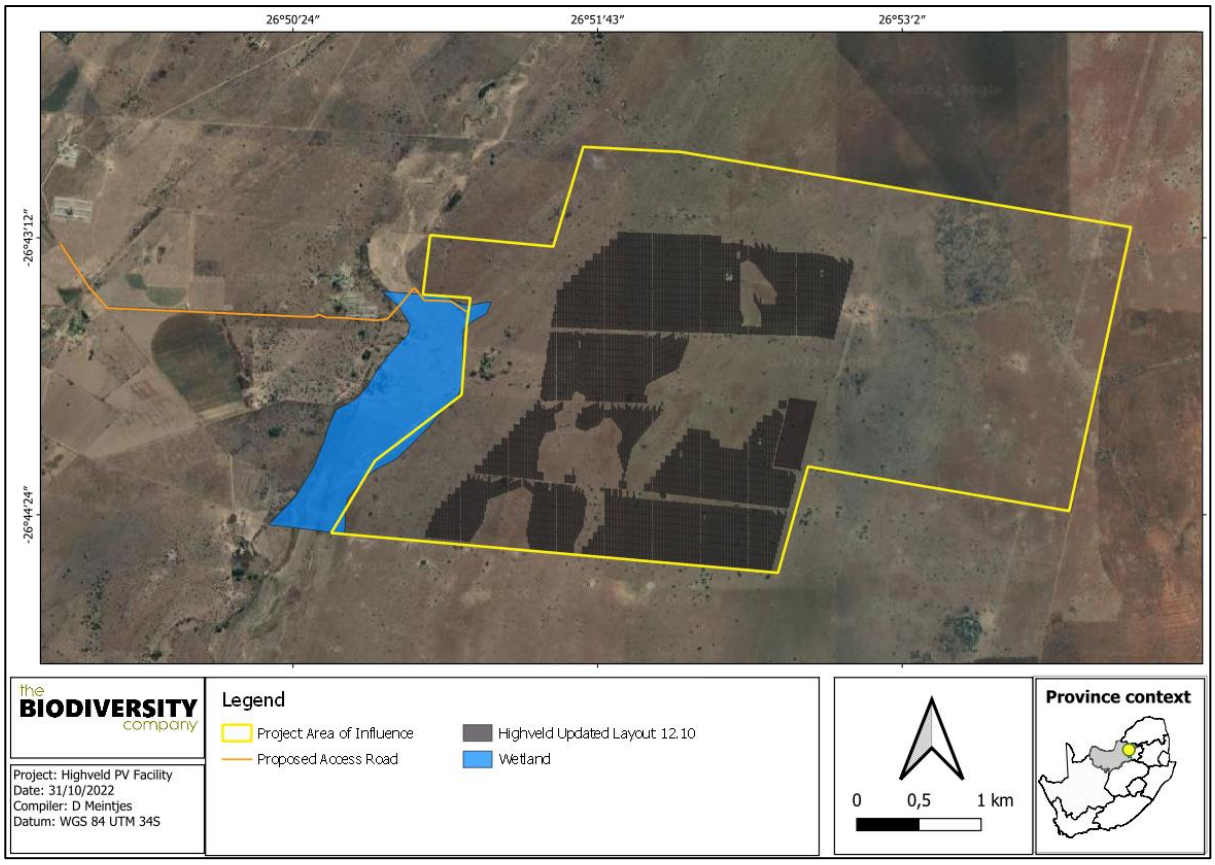


Figure 6.17: Map illustrating the wetland associated with the project area

The average ecosystem services score for the project area have been determined to be "Intermediate" to "Moderately High" due to its ability to regulate stream flow as well as to trap sediment. The HGM unit had high volumes of hydromorphic vegetation cover which help with the assimilation of toxicants in the aquatic ecosystem to ensure cleaner water downstream. The project site scored a "Very High" score for the biodiversity maintenance due to the different habitats provided within the wetland (see **Table 6.4**).

Table 6.4: The ecosystem services being provided by the HGM 1

ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	2,3	0,3	1,0	Low
	Stream flow regulation	3,7	1,3	2,8	High
	Sediment trapping	2,8	2,0	2,3	Moderate
	Erosion control	1,3	1,9	0,8	Very Low
	Phosphate assimilation	2,6	2,0	2,1	Moderate
	Nitrate assimilation	2,8	2,0	2,3	Moderately High
	Toxicant assimilation	2,6	2,0	2,1	Moderate
	Carbon storage	2,6	2,7	2,4	Moderately High
	Biodiversity maintenance	3,9	3,0	3,9	Very High
PROVISIONING SERVICES	Water for human use	3,2	2,0	2,7	High
	Harvestable resources	2,5	1,3	1,7	Moderately Low
	Food for livestock	1,5	1,3	0,7	Very Low
	Cultivated foods	1,7	0,7	0,5	Very Low
CULTURAL SERVICES	Tourism and Recreation	1,8	1,3	0,9	Low
	Education and Research	1,5	0,3	0,2	Very Low
	Cultural and Spiritual	3,0	0,3	1,7	Moderately Low

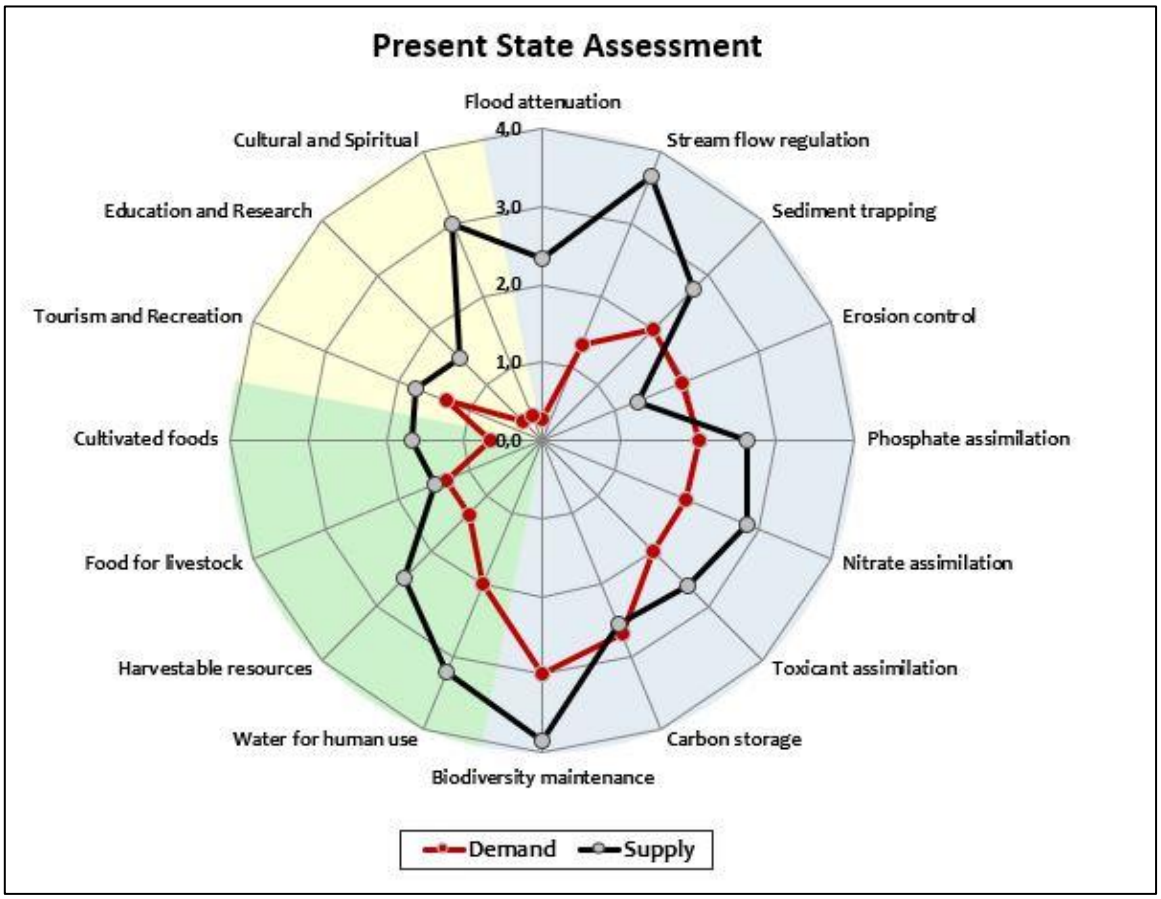


Figure 6.18: Radar map showing the demand and supply of the different ecosystem services in HGM 1

The Present Ecological State Assessment (PES)

The PES for the assessed HGM type is presented in **Table 6.5**. The hydrology of HGM 1 has been rated as being "Largely Modified" predominantly by grazing of livestock and channelisation within the system. The grazing and trampling by livestock inside the wetlands affect the natural draining and waterflow within the wetland as well as limits the effectiveness of the hydrophytes in erosion control and water retention. In addition, the historical agricultural practices within the wetland's catchment have contributed to the level of modification. Channelisation also causes and increase in flow rate within the wetland that will cause the outer parts of the system to lose their function over time.

The occurrence of some alien invasive shrubs and weeds (*Opuntia ficus-indica, Cirsium vulgare, Eucalyptus* camaldulensis) inside HGM 1 contributes to the "Moderately Modified" rating. At present time, the alien invasives do not pose a major threat to the wetland but if left unattended they will begin to out compete the endemic hydrophytes which will lead to a decrease in wetland function in the long haul. The vegetation is also under threat by grazing of livestock within the wetland.
The overall PES for HGM 1 has been determined to be "Moderately Modified" which indicates that the wetland have been altered by anthropogenic activities but not yet to such an extent that the wetland is completely degraded.

Table 6.5: Summary of the scores for the HGM 1

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	D: Largely Modified	4.0	C: Moderately Modified	2.2	C: Moderately Modified	3.4
Overall PES Score		3.8		Overall, PES Class		C: Moderately Modified

The Importance & Sensitivity (IS) Assessment

The results of the ecological IS assessment for the HGM unit is shown in **Table 6.6**. Various components pertaining to the protection status of a wetland are considered for the IS, including Strategic Water Source Areas (SWSA), the NFEPA wet veg protection status and the protection status of the wetland itself considering the NBA wetland data set. The IS for the HGM unit has been calculated to be "Low", which combines the relatively low protection status of the wet veg type and the low protection status of the wetland itself.

Table 6.6: The IS results for the delineated HGM unit

HGM Type	Wet Veg			NBA Wetlands			SWSA (Y/N)	Calculated IS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018	Ecosystem Protection Level		
HGM 1	Mesic Highveld Grassland Group 3	Critically Threatened	Not Protected	D/E/F Largely Modified	Critical	Not Protected	N	**Low**

Buffer Requirements

The "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries" (Macfarlane *et al.,* 2014) was used to determine the appropriate buffer zone for the proposed activity. A pre-mitigation buffer zone of 30m from identified wetlands is recommended for all project infrastructure, which can be decreased to 15m if all prescribed mitigation measures are implemented (refer to **Error! Reference source not found. 6.6** as well as **Error! Reference source not found. 6.7**).

Table 6.7: Pre- and post-mitigation buffer sizes

	Buffer Widths
Pre-mitigation buffer	30 m
Post-mitigation buffer	15 m

6.4.5. Avifauna profile for the area

Regional vegetation and avifauna

From an avifaunal perspective it is evident that bird diversity is positively correlated with vegetation structure, and floristic richness is not often regarded to be a significant contributor of patterns in bird abundance and their spatial distributions. Grasslands are generally poor in woody plant species, and subsequently support lower bird richness values, it is often considered as an important habitat for many terrestrial bird species such as larks, pipits, korhaans, cisticolas, widowbirds including large terrestrial birds such as Secretarybirds, cranes and storks. Many of these species are also endemic to South Africa and display particularly narrow distribution ranges. Due to the restricted spatial occurrence of the Grassland Biome and severe habitat transformation, many of the bird species that are restricted to the grasslands are also threatened or experiencing declining population sizes. Bushveld and woodland habitat consist of higher floristic structure (owing to the presence of tree and shrub species) with a subsequent increase in vertical heterogeneity. The increase in vertical heterogeneity also increases niche space and allow for niche-packing by species which often share the same prey resource. Therefore, bushveld and woodland habitat is often rich in bird species numbers, but often lacks the high endemicity observed in Highveld grassland habitat.

Conservation Areas, Protected Areas and Important Bird Areas

There are no other formal protected areas or any Important Bird and Biodiversity Areas in close proximity to the study site.

Annotations on the National Web-Based Environmental Screening Tool

Information extracted from the National Web-based Environmental Screening Tool (Department of Environmental Affairs, 2020), indicated that the study area contains potential habitat (of medium sensitivity) for the endangered African Marsh Harrier (*Circus ranivorus*). The study area holds a low sensitivity with respect to the relative avian theme (**Figure 6.19**).

It is evident from the results of the Screening Tool report that the study area is potentially not an important area for bird species with a high probability to interact with the solar infrastructure and that the site does not potentially overlap with important avian flyways.

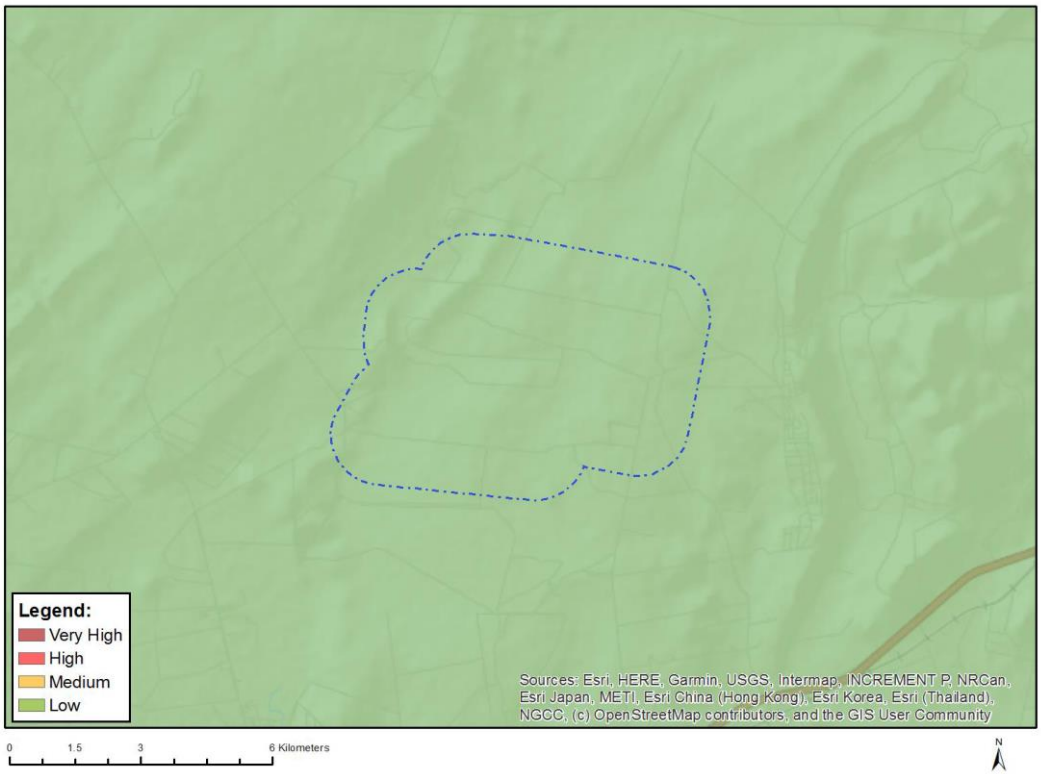


Figure 6.19: The relative avian sensitivity of the study site according to the Screening Tool.

Preliminary avifaunal habitat types

Apart from the regional vegetation types, the local composition and distribution of the vegetation associations on the study area are a consequence of a combination of factors simulated by historical disturbances, the presence of drainage lines and grazing intensity (presence of livestock) which have culminated in a number of habitat types that deserve further discussion (**Figure 6.20** and **Figure 6.21**):

» **Open savannoid grassland with bush clump mosaics**: This unit is dominant on the study area and covers a large surface area of the development area. It is represented by two discrete floristic variations which also provide habitat for two discrete avifaunal associations. The first floristic variation is predominantly represented by both untransformed and grazed grassland, depending on grazing intensity, and dominated by "late-successional" graminoids such a *Themeda triandra, Cymbopogon caesius, C. pospischilii, Trachypogon spicatus, Schizachyrium sanguineum* and *Diheteropogon amplectens*. It is occupied by a typical grassland bird composition dominated by insectivorous and granivore passerine bird species such as Desert Cisticola (*Cisticola aridulus*), Cloud Cisticola (*C. textrix*), Rufous-naped Lark (*Mirafra africana*), Eastern Clapper Lark (*Mirafra fasciolata*) and Red-billed Quelea (*Quelea quelea*). When the grass is burned, large numbers of Capped Wheatear (*Oenanthe pileata*) occur. Prominent non-passerine species include Orange River Francolin (*Scleroptila gutturalis*), Swainson's Spurfowl (*Pternistis swainsonii*), Northern Black Korhaan (*Afrotis afraoides*), Crowned Lapwing (*Vanellus coronatus*) and Helmeted Guineafowl (*Numida meleagris*). Some parts of this habitat, especially on higher-lying areas provide potential foraging habitat for large terrestrial bird species such as the Secretarybird (*Sagittarius serpentarius*) due to the large distances of open ground between adjacent grass culms.

The bush clumps form a prominent mosaic characterised by the dominance of a woody layer of *Searsia lancea, Grewia flava, Celtis africana, Asparagus laricinus, Vachellia erioloba* and *V. karoo* forms canopy constituents in some areas. Some parts of the bush clumps show extensive signs of grazing disturbances which resulted in the proliferation of agrestal weed species and secondary graminoids such as *Bidens pilosa, Tagetes minuta, Nidorella resedifolia, Eragrostis* spp. The eminent increase in vertical heterogeneity provided by the woody layer is colonised by a "Bushveld" bird association consisting of insectivorous and frugivore passerines such as Black-chested Prinia (*Prinia flavicans*), Chestnut-vented Warbler (*Curruca subcoerulea*), African Red-eyed Bulbul (*Pycnonotus nigricans*), Kalahari Scrub-robin (*Cercotrichas paena*) as well as granivores such as Southern Masked Weaver (*Ploceus velatus*). Non-passerine bird taxa are represented by Ring-necked Dove (*Streptopelia capicola*), Acacia Pied Barbet (*Tricholaema leucomelas*) and Red-faced Mousebird (*Urocolius indicus*).

» ***Artificial livestock watering points**:* These are represented by cattle kraal features containing artificial water troughs and reservoirs with the purpose to provide drinking water to livestock. However, they act as focal congregation areas for many of granivore passerine and non-passerine species, including Cape Sparrow (*Passer melanurus*), Laughing Dove (*Spilopelia senegalensis*), Black-throated Canary (*Crithagra atrogularis*), Speckled Pigeon (*Columba guinea*), Pied Crow (*Corvus albus*), Cape Starling (*Lamprotornis nitens*) and large numbers of Red-billed Quelea (*Quelea quelea*). Due to the congregation of passerine species at these features, they could invariably attract small to medium sized bird of prey species (members of the genera *Falco, Micronisus* and *Accipiter*).

» ***Kromdraaispruit floodplain and avian flyway*:** This area is represented by the Kromdraaispruit and associated floodplain (a tributary of the Koekemoerspruit) which is located along the western boundary of the development area. It is earmarked by a well-defined channel and an extensive floodplain that is located on heavy clay soils. Although the boundaries of the development area does not coincide with Kromdraaspruit system, the latter does provide important foraging, roosting and potentially also breeding habitat for waterfowl and a variety of waterbird taxa such as Yellow-billed Duck (*Anas undulata*), Red-billed Teal (*A. erythrorhyncha*), Egyptian Goose (*Alopochen aegyptiacus*), South African Shelduck (*Tadorna cana*), Reed Cormorant (*Microcarbo africanus*) and Hamerkop (*Scopus umbretta*). The moist and/or inundated grassland of the floodplain is colonised by facultative grassland species such as Levaillant's Cisticola (*Cisticola tinniens*), African Stonechat (*Saxicola torquatus*) and Southern Red Bishop (*Euplectes orix*). Certain parts of the Kromdraaispruit system downstream of the development area tend to retain surface water for extended periods of time during the austral dry season (areas that are covered by *Phragmites australis* reedbeds and *Populus x canescens* groves) which tend to provide foraging habitat for waterbirds over long periods of time.

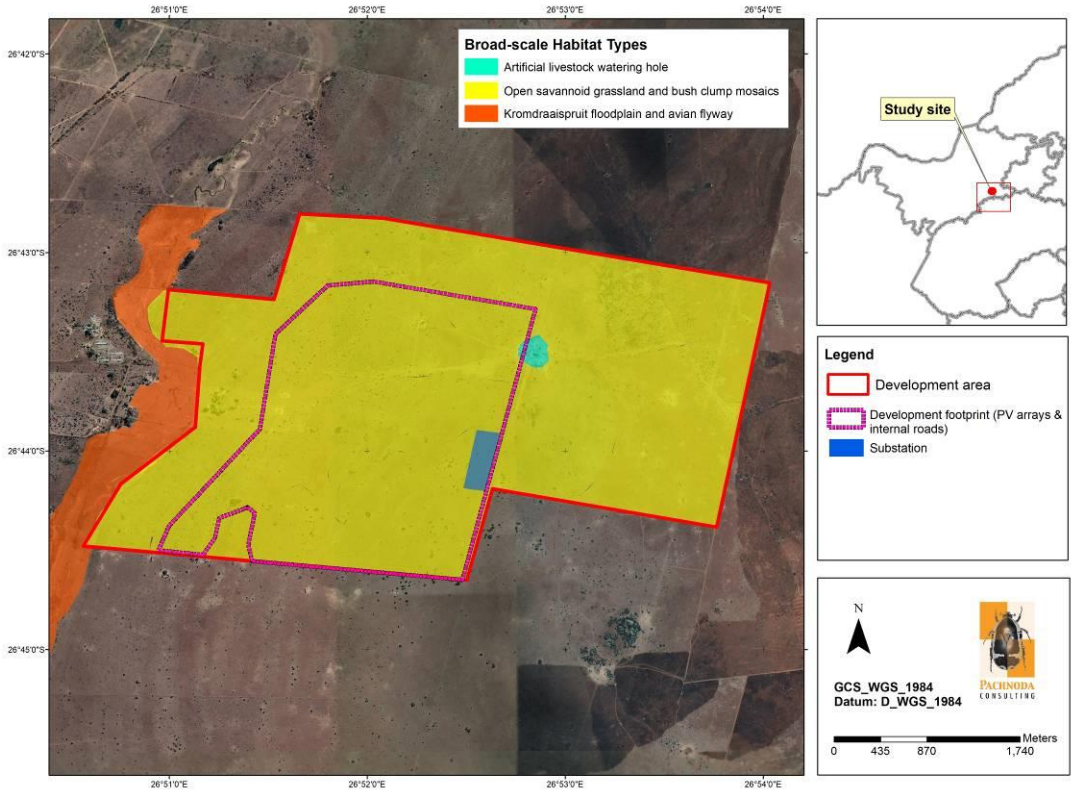
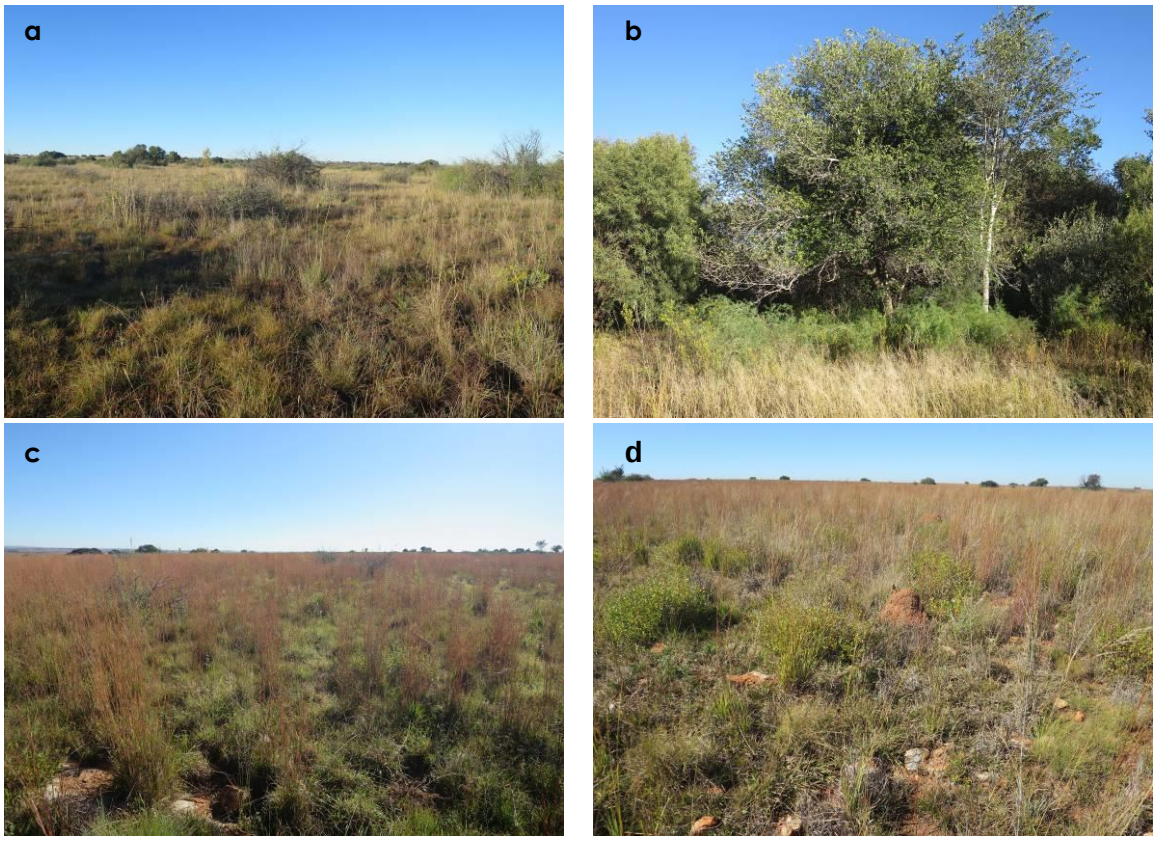


Figure 6.20: A habitat map illustrating the important avifaunal habitat types on the study area.




e


f


g


h


i


j


k


l

Figure 6.21: A collage of images illustrating examples of avifaunal habitat types observed on the study area and the immediate surroundings: (a - l) open savannoid grassland with bush clump mosaics, (m - p) artificial livestock watering points and (q - t) the Kromdraai floodplain.

Species Richness and Predicted summary statistics

Approximately 245 bird species are expected to occur in the wider study area (**Table 6.8**). The expected richness was inferred from the South African Bird Atlas Project (SABAP1 & SABAP2)[36] (Harrison et al., 1997; www.sabap2.birdmap.africa) and the presence of suitable habitat in the study area. The expected richness is also strongly correlated with favourable environmental conditions (e.g. during good rains) and seasonality (e.g. when migratory species are present). This equates to 25 % of the approximate 990[37] species listed for the southern African subregion[38] (and approximately 28 % of the 871 species recorded within South Africa[39]). However, the species richness obtained[40] from the pentad grid 2640_2650 corresponding to the project area was lower than the expected number of species, with 178 species recorded. According to field observations, the total number of species observed on the development area is *ca*. 106 species. However, an average number of 56.4 species is recorded for each full protocol card submitted for the pentad grid corresponding to the study site 2640_2650 (for observations of two hours or more), which shows that the current surveys produced a higher tally and were regarded as sufficient. On a national scale, the species richness per pentad on the study area is considered to be high.

According to **Table 6.8**, the study area is poorly represented by biome-restricted[41] (see **Table 6.9**) and local endemic bird species. It also supports *ca*. 34 % of the near -endemic species present in the subregion. Of the 245 bird species expected to occur in the project area, nine are threatened or near threatened species, 16 are southern African endemics and 21 are near-endemic species. In addition, three threatened species (c. White-backed Vulture *Gyps africanus*, Cape Vulture *G. coprotheres* and Lanner Falcon *Falco biarmicus*) were observed on the study area (**Table 6.10**). Furthermore, 13 southern African endemics and 15 near-endemic species were confirmed on the study site and the immediate surroundings (**Table 6.10**).

Table 6.8: A summary table of the total number of species, Red listed species (according to Taylor *et al*., 2015 and the IUCN, 2022), endemics and biome-restricted species (Marnewick *et al*., 2015) expected (*sensu* SABAP1 and SABAP2) to occur in the study site and immediate surroundings.

Description	Expected Richness Value (project area and surroundings)***	Observed Richness Value (project area)****
Total number of species*	245 (28 %)	106 (43 %)
Number of Red Listed species*	9 (6 %)	3 (33 %)
Number of biome-restricted species – Zambezian and Kalahari-Highveld Biomes*	3 (21 %)	3 (100 %)
Number of local endemics (BirdLife SA, 2022)*	2 (5 %)	2 (100 %)
Number of local near-endemics (BirdLife SA, 2022)*	6 (20 %)	4 (67 %)
Number of regional endemics (Hockey *et al.*, 2005)**	16 (15 %)	13 (81 %)

[36] The expected richness statistic was derived from the pentad grid 2640_2650 (including adjacent grids) totalling 312 bird species (based on 485 full protocol cards).

37 *sensu* www.zestforbirds.co.za (Hardaker, 2022) including several recently confirmed bird species (vagrants).

38 A geographical area south of the Cunene and Zambezi Rivers (includes Namibia, Botswana, Zimbabwe, southern Mozambique, South Africa, Swaziland and Lesotho).

39 With reference to South Africa (including Lesotho and Swaziland (BirdLife South Africa, 2022).

40 Including observations made during the April/May 2022 and September 2022 surveys.

[41] A species with a breeding distribution confined to one biome. Many biome-restricted species are also endemic to southern Africa.

Number of regional near-endemics (Hockey *et al.*, 2005)**	21 (34 %)	15 (71 %)

* only species in the geographic boundaries of South Africa (including Lesotho and Swaziland) were considered.
** only species in the geographic boundaries of southern Africa (including Namibia, Botswana, Zimbabwe and Mozambique south of the Zambezi River) were considered
*** Percentage values in brackets refer to totals compared against the South African avifauna (*sensu* BirdLife SA, 2022).
**** Percentage values in brackets refer to totals compared against the expected number of species in the project area.

Table 6.9: Expected biome-restricted species (Marnewick *et al*, 2015) observed on the study area and immediate surroundings

Species	Kalahari-Highveld	Zambezian	Expected Frequency of occurrence
Kalahari Scrub-robin (*Cercotrichas paena)*	X		Common
White-throated Robin-chat (*Cossypha humeralis*)		X	Common
White-bellied Sunbird (*Cinnyris talatala*)		X	Common

Table 6.10: Important bird species occurring in the broader study area which could collide and/or become displaced by the proposed PV infrastructure

Common Name	Scientific name	Regional Status	Global Status	Observed (April & Sept. 2022)	Collision with power lines	Displacement (disturbance & loss of habitat)
White-backed Vulture	*Gyps africanus*	CR	CR	1	1	
Cape Vulture	*Gyps coprotheres*	EN, End	VU	1	1	
Secretarybird	*Sagittarius serpentarius*	EN	EN		1	1
Martial Eagle	*Polemaetus bellicosus*	EN	EN		1	
African Marsh Harrier	*Circus ranivorus*	EN	EN		1	1
South African Shelduck	*Tadorna cana*	End		1	1	1
Cape Shoveler	*Anas smithii*	End			1	1
Northern Black Korhaan	*Afrotis afraoides*	End		1	1	1
White-backed Mousebird	*Colius colius*	End		1		1
Melodious Lark	*Mirafra cheniana*	End		1		1
Karoo Thrush	*Turdus smithi*	End				1
Ant-eating Chat	*Myrmecocichla formicivora*	End		1		1
White-throated Robin-chat	*Cossypha humeralis*	End		1		1
Fiscal Flycatcher	*Sigelus silens*	End		1		1
Fairy Flycatcher	*Stenostira scita*	End				1
Cape Longclaw	*Macronyx capensis*	End		1		1
Pied Starling	*Lamprotornis bicolor*	End		1		1
Cape White-eye	*Zosterops virens*	End		1		1
Orange River White-eye	*Zosterops pallidus*	End		1		1
South African Cliff Swallow	*Petrochelidon spilodera*	End		1		1
Pale Chanting Goshawk	*Melierax canorus*	N-end		1	1	1
Orange River Francolin	*Scleroptila gutturalis*	N-end		1	1	1
Acacia Pied Barbet	*Tricholaema leucomelas*	N-end		1		1
Natal Spurfowl	*Pternistis natalensis*	N-end			1	1

Eastern Clapper Lark	*Mirafra fasciolata*	N-end		1		1
Pink-billed Lark	*Spizocorys conirostris*	N-end				1
Ashy Tit	*Parus cinerascens*	N-end		1		1
Cape Penduline-tit	*Anthoscopus minutus*	N-end		1		1
African Red-eyed Bulbul	*Pycnonotus nigricans*	N-end		1		1
Kalahari Scrub Robin	*Cercotrichas paena*	N-end		1		1
Chestnut-vented Warbler	*Curruca subcoerulea*	N-end		1		1
Marico flycatcher	*Bradornis mariquensis*	N-end				1
Pririt Batis	*Batis pririt*	N-end				1
Crimson-breasted Shrike	*Laniarius atrococcineus*	N-end		1		1
Bokmakierie	*Telophorus zeylonus*	N-end		1		1
Cape Sparrow	*Passer melanurus*	N-end		1		1
Scaly-feathered Weaver	*Sporopipes squamifrons*	N-end		1		1
Red-headed Finch	*Amadina erythrocephala*	N-end				1
Shaft-tailed Whydah	*Vidua regia*	N-end				1
Yellow Canary	*Crithagra flaviventris*	N-end		1		1
Cloud Cisticola	*Cisticola textrix*	N-end		1		1
Abdim's Stork	*Ciconia abdimii*	NT			1	
Yello-billed Stork	*Mycteria ibis*	EN			1	
Black-winged Pratincole	*Glareola normdanni*	NT	NT		1	1
Falcon, Lanner	*Falco biarmicus*	VU		1	1	
	Totals:	**45**	**6**	**30**	**15**	**39**

Threatened and near threatened species are indicated in red
CR - Critically endangered, EN - endangered, VU - vulnerable, NT - near threatened
End - southern African endemic
N-end - southern African near-endemic

Prior to further analyses where species richness values are considered, it is imperative to determine if all bird species present were sufficiently sampled. Species accumulation curves (SAC) provide a means to examine data and sampling efficacy. For this project the species accumulation curves (SAC) for the point count data were generated using the software program Estimates S (version 9) with 100 randomizations (as recommended in Colwell, 2013). Curves were generated for the full data set (all point counts). Sampling sufficiency was determined by establishing whether a point had been reached where a line representing one new sample adding one new species was tangent to the curve (Brewer & McCann, 1982). The Michaelis-Menten equation (Soberôn & Llorente 1993) was fitted to the predicted number of species using Estimates S (Raaijmakers, 1987). A satisfactory level of sampling was achieved if 90 % of the bird species were detected, and hence predicted by the model (Moreno & Halffter, 2000).

The species accumulation curve (SAC) reached an asymptote at approximately 23-point counts (**Figure 6.22).** The sampling captured approximately 75% of the number of species predicted by the Michaelis-Menten model at 23-point counts. Approximately 90% of the predicted species that could occur on the study area was captured by 66 counts. Therefore, sampling effort was considered sufficient and recorded 90% the species present on the project area during the respective survey sessions.

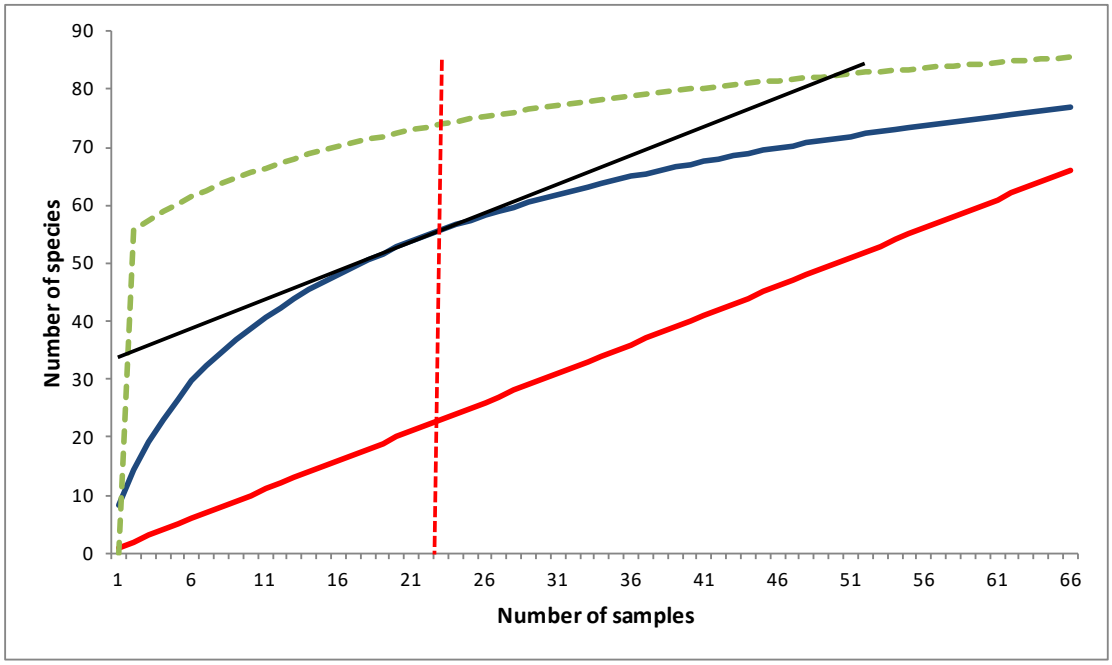


Figure 6.22: The species accumulation curve (SAC) (red line) for bird points sampled during the April/May and September 2022 survey sessions. The blue line represents an accumulation of one species for every additional point count. The black line is parallel to the blue one and is tangent to the SAC approximately after 23 counts (as represented by the vertical red stippled line). The green stippled line represents the Michaelis-Menten curve.

Bird species of conservation concern

Table 6.10 provides an overview of bird species of conservation concern that could occur on the development area based on their historical distribution ranges and the presence of suitable habitat. According to **Table 6.10**, a total of nine species have been recorded in the wider study area (sensu SABAP1 & SABAP2) which include four globally threatened species, one globally near threatened species, three regionally threatened species and one regionally near-threatened species[42].

The globally critically endangered White-backed Vulture (*Gyps africanus*) and the globally endangered Cape Vulture (*G. coprotheres*) were observed from the development area during the respective site visits and were respectively represented by five and six individuals (**Figure 6.23**). These two species are recorded as regular foraging visitors to the study area pending on the availability of carcasses. The presence of both species is also tied to practice of extensive livestock and game husbandry which often provide a readily supply of foraging opportunities (e.g. carcasses). These species also often utilise the nearby electricity pylons as roosting sites (pers. obs).

In addition, a pair of the regionally vulnerable Lanner Falcons (*Falco biarmicus*) was confirmed from the south eastern part of the development area, and could potentially breed on the study area (buffered by 400m) (**Figure 6.23**).

[42] Please note that an additional six species (e.g. flamingo species) were also confirmed from the wider study area (see Table 4), but the probability that these species could occur on the development itself is very low due to the absence of suitable foraging and/or breeding habitat.

The remaining species are regarded as irregular foraging visitors with low probabilities of occurrence due to the absence of suitable habitat on the development area itself. However, the Kromdraaispruit floodplain provides ephemeral foraging habitat for the occurrence of the endangered African Marsh-harrier (*Circus ranivorus*). According to SABAP2 data, it is known to occur downstream along the Kromdraaispruit from the study area (see **Figure 6.24**), whereby it is recommended that a 500m buffer be assigned to the Kromdraaispruit (based on Ruddock and Whitfield (2007) and references therein for breeding *Circus* sp.). In addition, during the site visits it was noticed that extensive areas of suitable foraging habitat persist for the globally endangered Secretarybird (*Sagittarius serpentarius*) to occur despite being ominously absent from the area.

Table 6.10: Bird species of conservation concern that could utilise the study site based on their historical distribution range and the presence of suitable habitat. Red list categories according to the IUCN (2022)* and Taylor et al. (2015)**

Species	Global Conservation Status*	National Conservation Status**	SABAP 2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
Ciconia abdimii (Abdim's Stork)	-	Near threatened	0.21 (single observation)	Open stunted grassland, fallow land and agricultural fields.	An uncommon summer foraging visitor to areas consisting of open grassland or arable land. It has not been observed on the study area since 2009.
Circus ranivorus (African Marsh Harrier)	-	Endangered	0.14 (two observations)	Restricted to permanent wetlands with extensive reedbeds.	Probably absent from the physical study site due to the absence of suitable habitat. Ephemeral foraging habitat observed along the Kromdraaispruit located near the western boundary of the site. Only known from two observations, with most recent observation during 2001. (sensu SABAP2).
Falco biarmicus (Lanner Falcon)	-	Vulnerable	3.93	Varied, but prefers to breed in mountainous areas.	A regular foraging visitor to the study area. Two adult individuals were observed hunting near the eastern boundary of the development area on 05 May 2022.
Glareola nordmanni (Black-winged Pratincole)	Near threatened	Near threatened	0.41 (two observations))	Varied, but forages over open short grassland, pastures and agricultural lands (especially when being tilled)	An irregular foraging visitor to the study area. Only known from two observations, most recent observation during 2019.

Gyps coprotheres (Cape Vulture)	Endangered	Endangered	0.41	Mainly confined to mountain ranges, especially near breeding site. Ventures far afield in search of food.	A regular foraging/scavenging visitor to the study area pending the presence of food (e.g. livestock/game carcasses). Approximately six Cape Vulture individuals were observed during the site visits.
Gyps africanus (White-backed Vulture)	Critically Endangered	Critically Endangered	0.83	Breed on tall, flat-topped trees. Mainly restricted to large rural or game farming areas.	A regular foraging/scavenging visitor to the study area pending the presence of food (e.g. livestock/game carcasses). Approximately four individuals were also observed utilising the pylon structures at the eastern section of the study area when roosting.
Polemaetus bellicosus (Martial Eagle)	Endangered	Endangered	0.21 (single observation)	Varied, from open karroid shrub to lowland savanna.	A highly irregular foraging visitor. It has not been observed on the study area since 2010.
Mycteria ibis (Yellow-billed Stork)	-	Endangered	0.83 (known from four individuals)	Wetlands, pans and flooded grassland.	Probably a highly irregular foraging visitor to the Kromdraaispruit (when inundated) adjacent to the study area (probably absent from the study site itself).
Sagittarius serpentarius (Secretarybird)	Endangered	Endangered	0.62 (three observations)	Prefers open grassland or lightly wooded habitat.	Probably a highly irregular foraging visitor to the study area even though the presence of optimal foraging habitat. It was not recently observed from the pentad grid 2640_2650 corresponding to the development area.

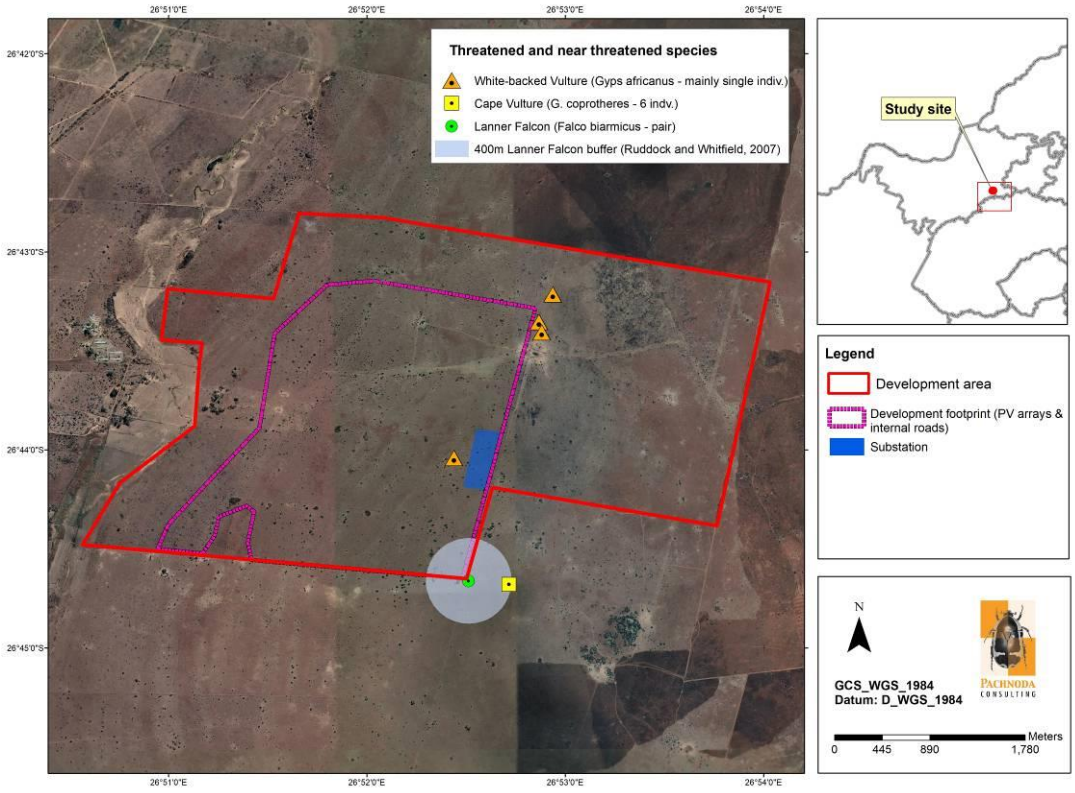


Figure 6.23: A map illustrating the occurrence of threatened and near threatened bird species observed on the development area and immediate surroundings during April/May 2022 and September 2022

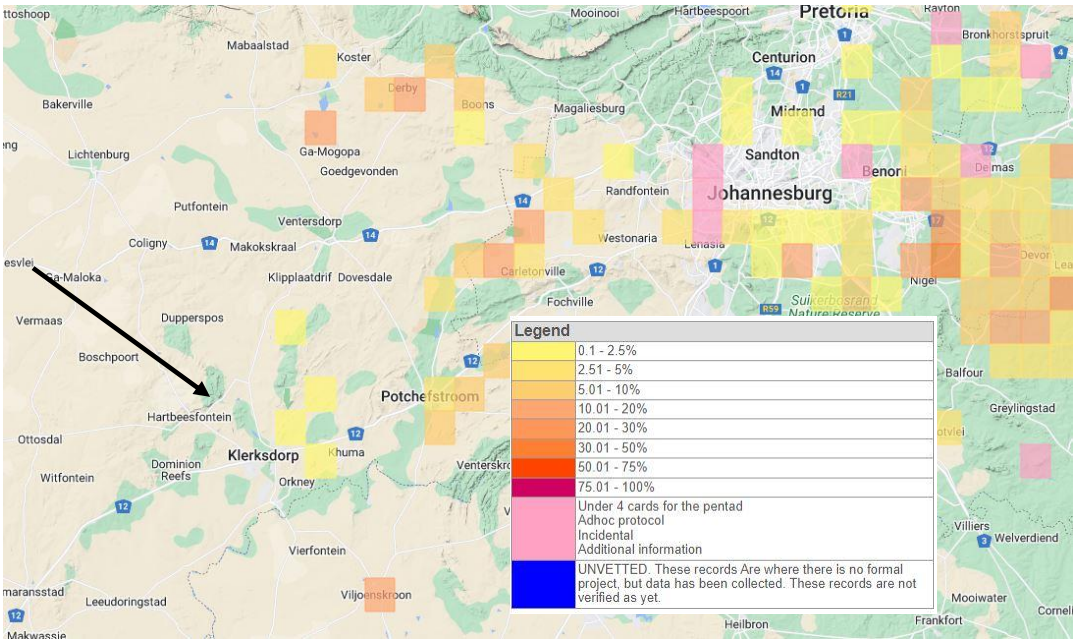


Figure 6.24: The extant (current) occurrence of African Marsh Harrier (*Circus ranivorus*) on the wider study area according to SABAP2 reporting rates (the arrow indicates the position of the study area). Note the presence of observations (c. low reporting rates) on the study area (map courtesy and copyright of SABAP2 and Animal Demography Unit)

Land cover, land use and existing infrastructure.

According to the South African National dataset of 2013-2014 (Geoterrainimage, 2015) the project area comprehends the following land cover categories (**Figure 6.25**):

Natural areas:
» Grassland;
» Low shrubland;
» Wetlands; and
» Woodland and open bush.

From the land cover dataset it is evident that most of the study site is covered by natural grassland and low shrubland. The study site is primarily used for livestock production and livestock grazing. Existing infrastructure includes powerline servitudes located on the eastern part of the development area. A natural drainage line and floodplain habitat (the Kromdraaispruit) of the Koekemoerspruit are located to the west of the development area.

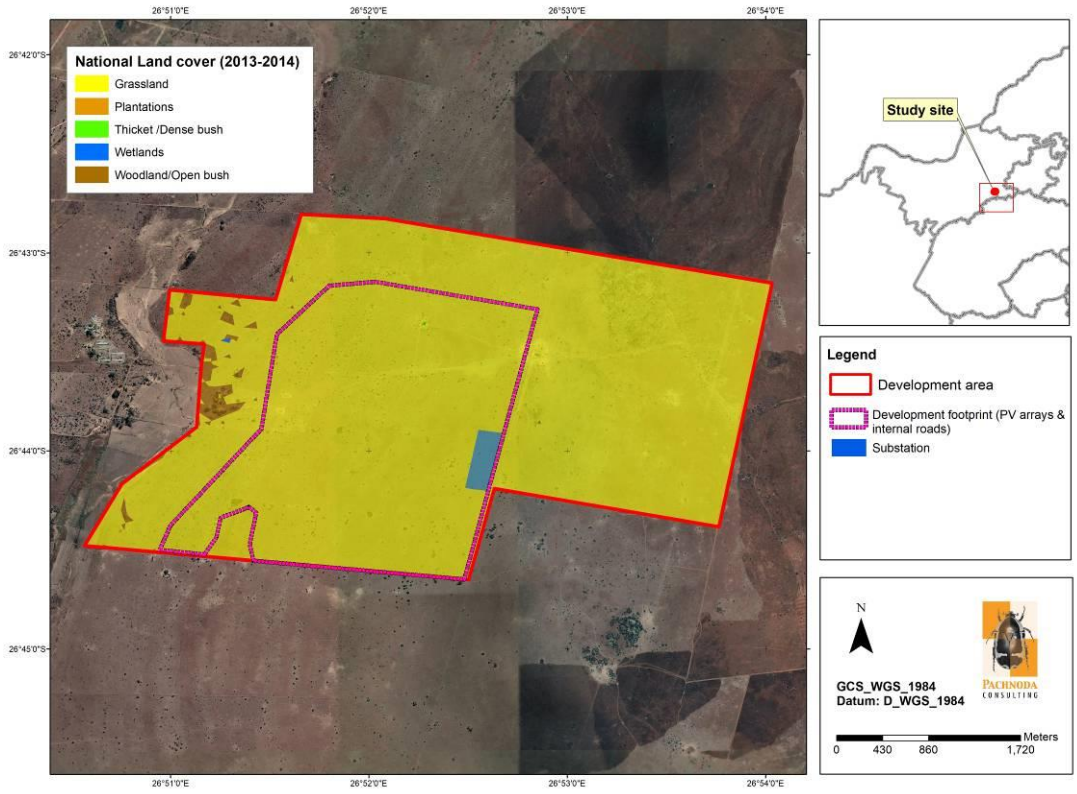


Figure 6.25: A map illustrating the land cover classes (Geoterrainimage, 2015) corresponding to the proposed study site and immediate surroundings.

6.5. Integrated Heritage including Archaeology, Palaeontology and the Cultural Landscape

6.5.1. State of the Site

The town of Stilfontein has significance resulting from its position along the South-Western Railway line developed to link the Southern Railway Line (1886) to the Rand Tram (1888) and lucrative mines to the east. A built heritage inventory of the infrastructure associated with railway development was completed in 2016 and through this process, a number of significant features were identified. Much of the infrastructure associated with this railway development remains present in the town of Stilfontein. While this infrastructure clearly has significance for the mining and industrial heritage of South Africa, it is unlikely that each identified feature is a Grade II heritage resource. Rather, all of the railway infrastructure identified through this inventory process may well have sufficient significance as a grouping to warrant Grade II significance. That being understood, it is unlikely that the proposed development of the PV facility and grid connection will have a negative impact on any significant built environment resources associated with the railway line. Furthermore, the town of Stilfontein was established in 1949 and as such, is not considered to be a town of particular historic value. In addition, the proposed development is located within the existing Chemwes mine and as such, it is not anticipated that any significant built environment or cultural landscape resources will be negatively impacted by the proposed development.

6.5.2. Archaeology

According to Van Schalkwyk (2015), "No stratified sites dating to the Stone Age are known from the region. However, surface scatters of tools dating to the Early Stone Age are known to occur in the region of the Vaal River. Apart from that, rock engravings dating to the Late Stone Age are known from various sites in the larger region. One such site is Bosworth located some distance to the north of Klerksdorp. Here, there are nearly 600 engravings of animals as well as geometrical patterns." He goes on to note that "The occupation of the larger geographical area (including the study area) did not start much before the 1500s. By the 16th century things changed, with the climate becoming warmer and wetter, creating condition that allowed Late Iron Age (LIA) farmers to occupy areas previously unsuitable, for example the Witwatersrand and the treeless plains of the Free State. The earliest Iron Age settlers who moved into the North-West Province region were Sothospeaking groups such as the Hurutshe, Kwena, Fokeng, Kgatla and Rolong. Sections of the Rolong settled on a flat-topped mountain (Platberg) to the north of Klerksdorp. Here, they built stone walled settlements that were mainly concentrated along the northern plateau of the mountain." Due to the high levels of archaeological sensitivity of the broader area, it is recommended that potential impacts to archaeological heritage are assessed further.

6.5.3. Palaeontology

The project lies in the south western part of the Transvaal Basin where the lower rocks of the Transvaal Supergroup are exposed, in particular the dolomites of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup; ca 2585-2480 Ma).

The Late Archaean to early Proterozoic Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton (Eriksson et al., 2006). In South Africa are the Transvaal and Griqualand West Basins, and the Kanye Basin is in southern Botswana. The Griqualand West Basin is divided into the Ghaap Plateau sub-basin and the Prieska sub-basin. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences. Several tectonic events have greatly deformed the south western portion of the Griqualand West Basin between the two sub-basins. In the Transvaal Basin the Transvaal Supergroup is divided

into two Groups, the lower Chuniespoort Group and the upper Pretoria Group (with ten formations; Eriksson et al., 2006). The Chuniespoort Group is divided into the basal Malmani Subgroup that comprises dolomites and limestones and is divided into five formations based on chert content, stromatolitic morphology, intercalated shales and erosion surfaces. The top of the Chuniespoort Group has the Penge Formation and the Duitschland Formation.

Making up the lower Pretoria Group are the Timeball Hill Formation and the Boshoek Formation. The Hekpoort, Dwaalheuwel, Strubenkop and Daspoort Formations form a sequence as the middle part of the Pretoria Group, Transvaal Supergroup, and represent rocks that are over 2060 million years old. The Hekpoort Formation is a massive lava deposit and is overlain by the rest of the Transvaal Supergroup. The Transvaal sequence has been interpreted as three major cycles of basin infill and tectonic activity with the first deep basin sediments forming the Chuniespoort Group, the second cycle deposited the lower Pretoria Group, and the sediments in this area are from the interim lowstand that preceded the third cycle. These sediments were deposited in shallow lacustrine, alluvial fan and braided stream environments (Eriksson et al., 2012).

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of very high fossil sensitivity. According to the extract from the Council of GeoScience Map 2626 West Rand, the area proposed for development is underlain by the Malmani Formation of the Chuniespoort Group. This is the same geological group that has resulted in the preservation of fossil remains at the Cradle of Humankind in its Transvaal Dolomite outcrop area. More broadly, the Chuniespoort Group is known for its preservation of Stromatolitic carbonates (limestones / dolomites), minor secondary cherts and mudrocks including carbonaceous shales.

6.6 Visual Quality

The Highveld PV Solar Facility is located north of the N12 national road approximately 20km west of Potchefstroom. The region has a strong mining character, interspersed with agricultural activities (dryland and livestock production) and human settlements. The south western and to a lesser extent northern portion of the study area are home to a number of operational and old gold mines and other industrial activities. These activities, especially the expansive mining and quarrying are rapidly changing the once rural and agricultural character to that of a predominantly industrial nature. Mining activities in close proximity include the Stilfontein Gold Mine to the south west.

Figure 6.26: Stilfontein Gold Mine located south-west of the proposed Highveld PV Solar Facility, view from the N12

Figure 6.27: Example of livestock agricultural activities in the region.

The topography or terrain morphology of the region is broadly described as slightly undulating plains dissected by prominent rocky chert ridges. The slope of the entire study area is generally even with very gradual drops towards the watercourses traversing the study area (hence the term undulating). The highest points above sea level within the study area are located on the ridgelines of the Buffelsrug (1519 m), Machavierug (1527.5 m) and Britzkop (1479.5 m) outcrop, located east of the proposed Highveld PV Facility.

Figure 6.28: General topography of the study area – undulating plains dissected with rocky ridges.

Prominent rivers or streams include the Kromdraaispruit and Koekemoerspruit to the west, as well as the Droëspruit to the east.

A host of power lines criss-cross the study area, these include, but are not limited to:

- Pluto – Hermes 1 400kV
- Pluto – Hermes 2 400kV
- Potchefstroom DS – Machavie 1 88kV
- Potchefstroom DS – Buffels East 1 132kV
- Hermes DS – Potchefstroom DS 1 132kV

Figure 6.29: Photograph of some of the existing power lines in the study area

The north-western and central portions of the study area still have a largely agricultural and rural character where predominantly dryland agriculture (maize), livestock agricultural and limited irrigated agriculture activities are practised. Matlwang to the east and Khuma to the south of the Highveld PV Solar Facility are generally associated with the mining activities, where employees of these mines are housed.

The natural vegetation or land cover types of the region (where intact) are described as Grassland. This vegetation cover type is under increased pressure from both mining and township development and are often subject to varying levels degradation. It may also include old agricultural fields that are regenerating. The majority of the remaining natural vegetation within the study area is indicated as Carletonville Dolomite Grassland.

Farm settlements or residences found within the study area include:
» Eleasar
» Matlwang
» Rietfontein
» Stilfontein
» Saamstaan
» Tamarisk
» Pelonomi

No formally protected or conservation areas were identified within the study area. The Khora Lion Park and Club Louico, located to the south west of the site, were identified as known tourist attractions and resorts within the study area.

6.7 Social Context

6.7.1 Profile of the Broader Area

JB Marks Local Municipality is situated within the Dr Kenneth Kaunda District in the North West Province. It is the largest municipality of three in the district, making up almost half its geographical area.

It was established by the amalgamation of the former Ventersdorp and Tlokwe City Council Local Municipalities in August 2016. It combines the following areas from the Tlokwe Region: Ikageng and its extensions, Potchefstroom town, Mohadin, Promosa, Matlwang, Leliespan/Baitshoki, Haaskraal, Turfvlei, Vyfhoek, Mooibank, Machavie, Buffeldoorn,

Miederpark, Kopjeskraal, Wilgeboom, Lindequesdrift (Agricultural Holdings), Rooipoortjie, Venterskroon, Buffelshoek. (Rural) Vredefort Dome (World Heritage Site) Vaal River (Tourism attraction), and the rural hinterland.

Ventersdorp Region consists of a vast rural / commercial farming area as well as the urban area of Ventersdorp, Tshing and Toevlug and has six (6) villages namely Goedgevonden, Welgevonden, Tsetse, Ga-Magopa, Boikhutso and Boikhutsong.

The N12 route that connects Johannesburg and Cape Town via the city of Kimberley runs through the municipality. The main railway route from Gauteng to the Northern and Western Cape also runs through one of the municipality's main cities, Potchefstroom. The City is 145km south-east of OR Tambo International Airport but has its own airfield, which can accommodate bigger aircraft and was formerly a military air base.

Gold mining is the dominant economic activity in the district, with Potchefstroom and Ventersdorp being the only exceptions. While Ventersdorp to the north-west of Potchefstroom focuses on agricultural activity, Potchefstroom's economic activity is driven by services and manufacturing.

A big role-player in the provision of services in Potchefstroom is the world-class North-West University, which has its main campus in Potchefstroom. Potchefstroom's industrial zone has many companies, focusing mainly on the industries of steel, food and chemicals, with big entities such as King Korn, Kynoch, Naschem and the Nestle Company.

Within the city centre, the infrastructure of Potchefstroom supports roughly 600 businesses. Ventersdorp's main economic Sectors includes: Agriculture, community services, manufacturing, trade, finance, transport and mining.

Population

The population of JB Marks Municipality has increased from 219 463 to 243 527 between 2011 and 2016. The vast majority of the population is made up of black Africans followed by whites as reflected below.

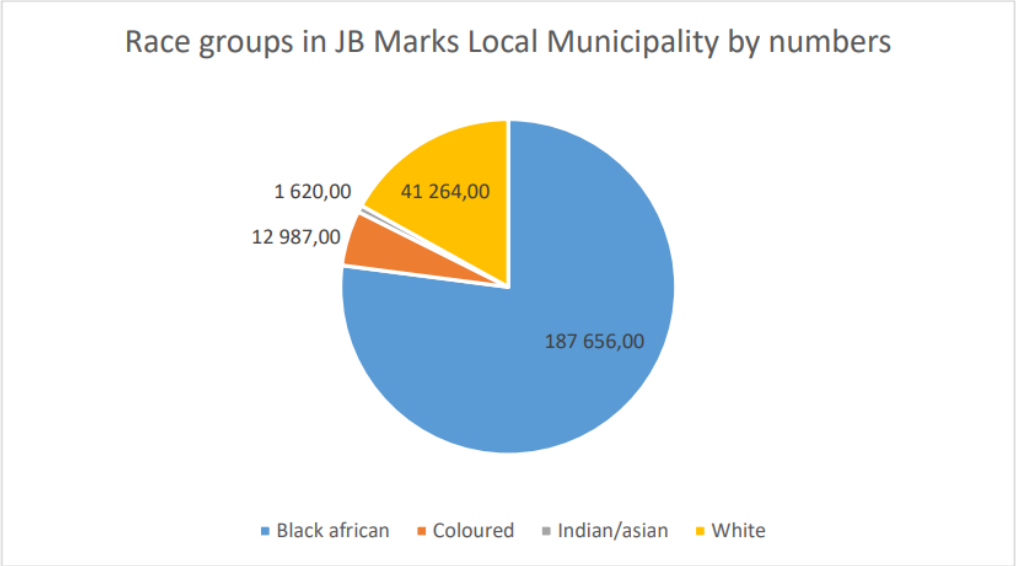


Figure 6.30: Race Groups in JB Marks Local Municipality

Figure 6.31: Below indicates the breakdown of the population of JB Marks Municipality into a number of age groups. The data also confirms that the economically active group forms the majority of members in the population.

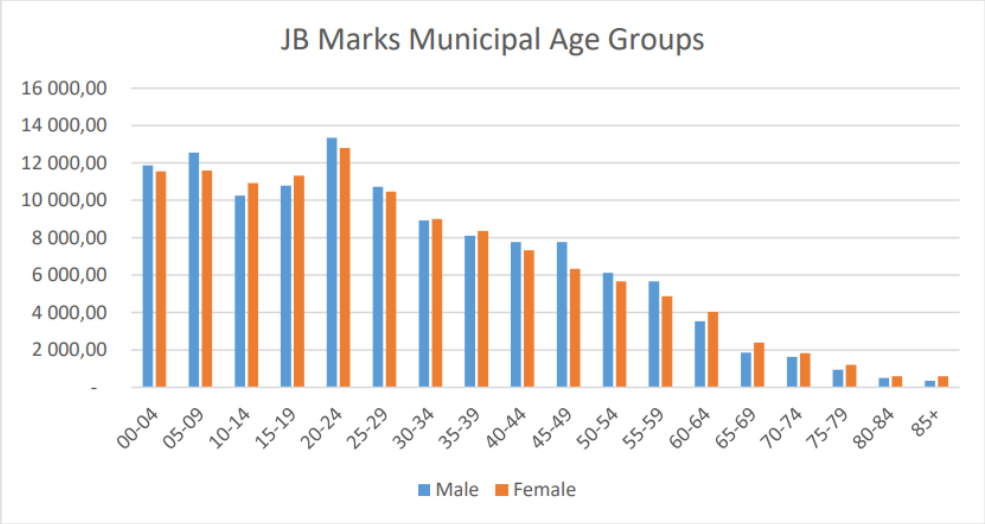


Figure 6.31: JB Marks Municipal Age Groups

The economic state of JB Marks Local Municipality is put in perspective by comparing it on a spatial level with its neighbouring locals, Dr Kenneth Kaunda District Municipality, North West Province and South Africa.

The JB Marks Local Municipality does not function in isolation from Dr Kenneth Kaunda, North West Province, South Africa and the world and now, more than ever, it is crucial to have reliable information on its economy for effective planning. Information is needed that will empower the Municipality to plan and implement policies that will encourage the social development and economic growth of the people and industries in the Municipality respectively.

In 2017, the community services sector is the largest within JB Marks Local Municipality accounting for R 6.41 billion or 33.3% of the total GVA in the local municipality's economy. The sector that contributes the second most to the GVA of the JB Marks Local Municipality.

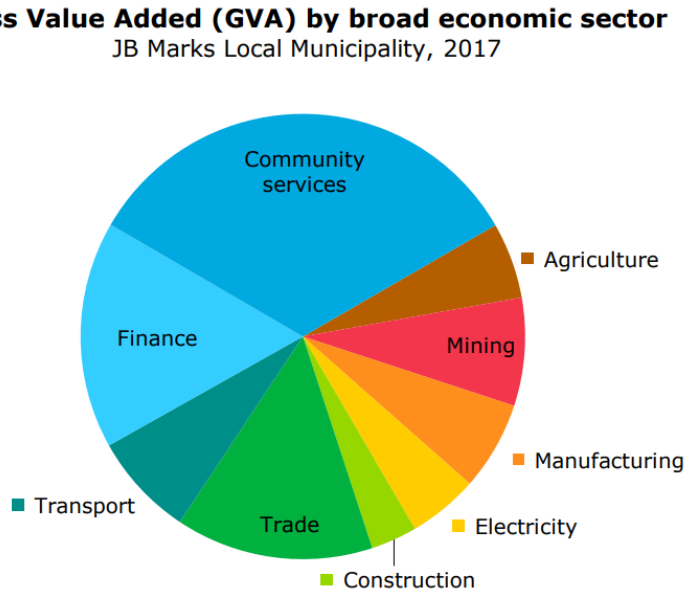


Figure 6.32: GVA by Broad Economic Sector

In 2007, 39.5% of the total population in JB Marks Local Municipality were classified as economically active which decreased to 35.7% in 2017. Compared to the other regions in Dr Kenneth Kaunda District Municipality, JB Marks Local Municipality had the highest Economically Active Population (EAP) as a percentage of the total population within its own region relative to the other regions. On the other hand, Maquassi Hills Local Municipality had the lowest EAP with 27.8% people classified as economically active population in 2017.

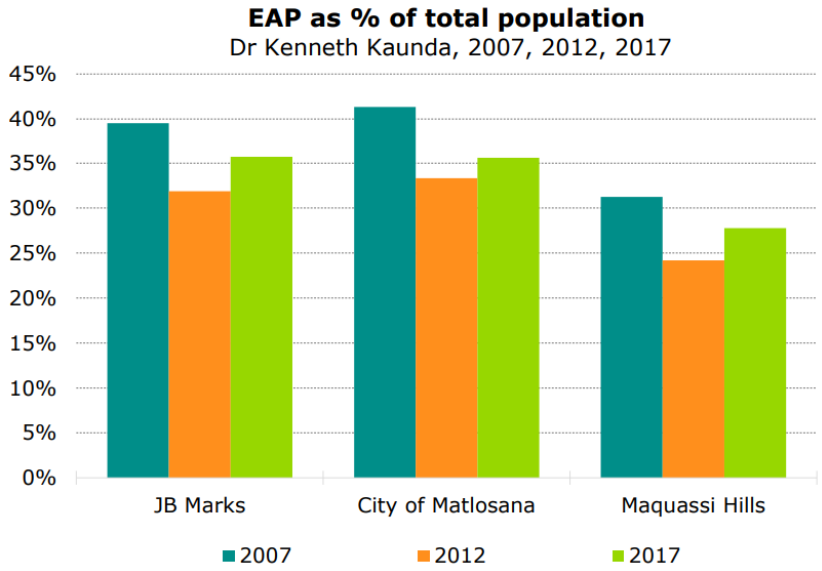


Figure 6.33: EAP as % of Total Population

During 2017 the Trade sector recorded the highest number of informally employed, with a total of 3 540 employees or 39.48% of the total informal employment. This can be expected as the barriers to enter the Trade sector in terms of capital and skills required is less than with most of the other sectors. The Manufacturing sector has the lowest informal employment with 619 and only contributes 6.91% to total informal employment.

Figure 6.34: Below depicts the level of education in the municipality for the period 2011 and 2016. The figure shows that there was a drop of less than one per cent in the number of people without any schooling and a

positive increase in those with matric from 27 per cent to 30 percent. There was a one percent drop in the number of people with higher education during the same period.

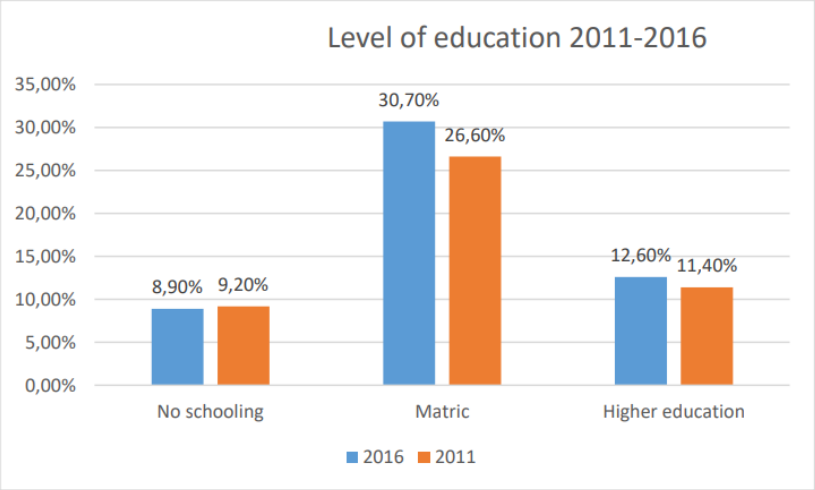


Figure 6.34: JB Marks Local Municipality Level of Education (2011 – 2016)

Within JB Marks Local Municipality, the number of people without any schooling decreased from 2007 to 2017 with an average annual rate of -0.17%, while the number of people within the 'matric only' category, increased from 28,800 to 44,000. The number of people with 'matric and a certificate/diploma' increased with an average annual rate of 2.85%, with the number of people with a 'matric and a Bachelor's' degree increasing with an average annual rate of 4.03%. Overall improvement in the level of education increased in the number of people with 'matric' or higher education.

It was estimated that in 2017 14.27% of all the households in the JB Marks Local Municipality, were living on R30,000 or less per annum. For the period 2007 to 2017 the number of households earning more than R30,000 per annum has increased from 67.64% to 85.73%. It can be seen that the number of households with income equal to or lower than R6,000 per year has decreased by a significant amount.

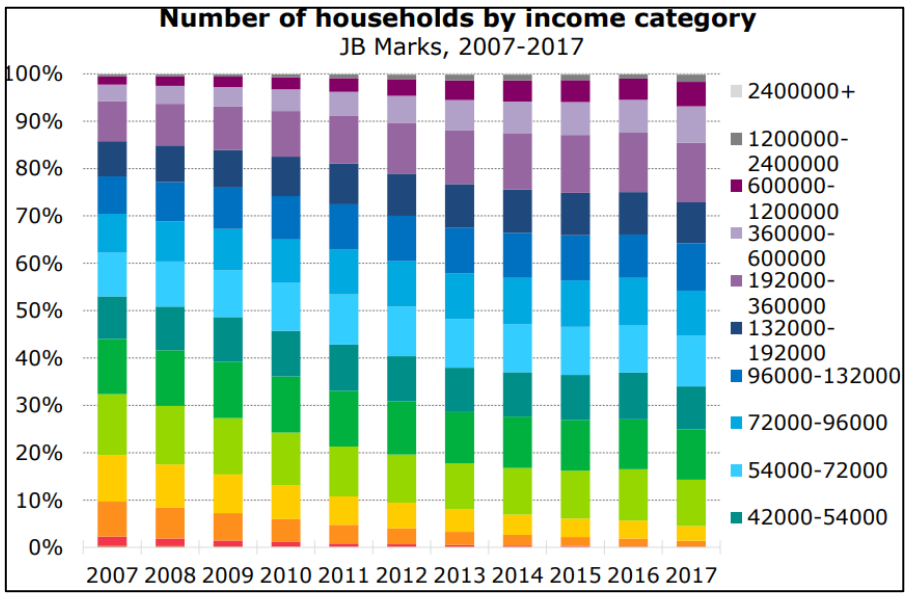


Figure 6.35: Number of Households by Income Category

CHAPTER 7: ASSESSMENTS OF IMPACTS

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, and indirect) expected to be associated with the development of the Highveld Solar PV Facility and its associated infrastructure. This assessment has considered the construction and operation of a PV facility with a contracted capacity of up to 240MW with a development footprint of approximately ~433ha (excluding environmentally constrained areas). The project will comprise the following key infrastructure and components:

- Solar PV arrays, modules and mounting structures
- Inverters and transformers
- A Battery Energy Storage System (BESS)
- On-site facility substation
- Cabling between the project components
- Site and internal access roads up to 6m in width, where required
- Temporary and permanent laydown areas and O&M buildings and fencing around the development area.

In order to connect the Highveld Solar PV Facility to the national grid, a grid connection (known as Highveld Grid Connection) will need to be developed and implemented, which will be assessed within a separate BA process.

The full extent of the project site was considered in this Basic Assessment Process by the independent specialists and the EAP. On-site sensitivities were identified through the review of existing information, desk-top evaluations and field surveys. A development footprint for the PV facility within the project site was proposed by the developer through consideration of the sensitive environmental features and areas identified through the screening process. **Figure 7.1** illustrates the Highveld Solar PV development area.

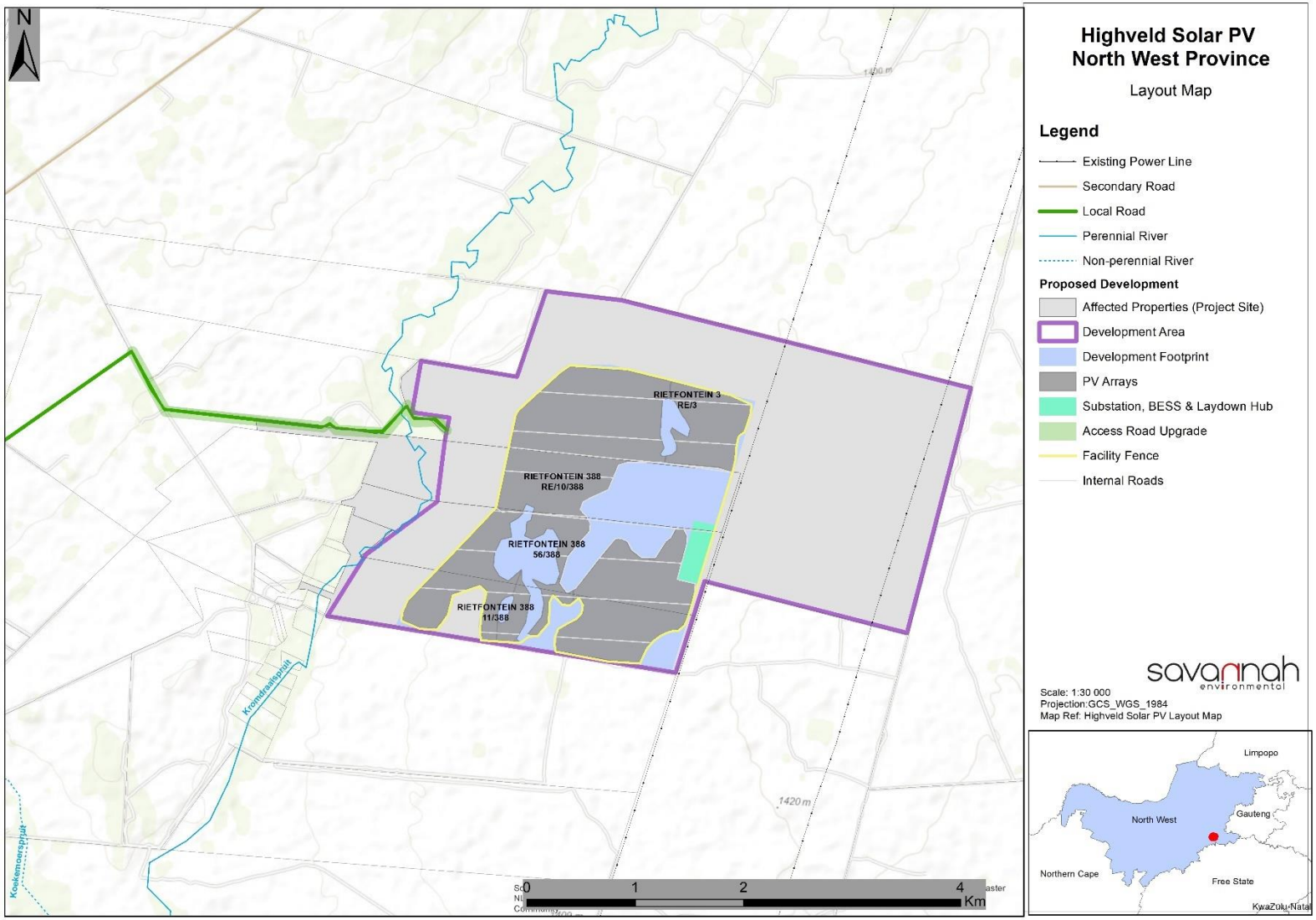


Figure 7.1: Map of the Highveld Solar PV Facility development area, internal infrastructure and access road (refer to **Appendix L** for A3 map).

The development of the Highveld Solar PV Facility will comprise the following phases:

- *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of access roads, laydown areas, and facility infrastructure (including PV panels and substation); construction of foundations involving excavations; the transportation of components/construction equipment to site, manoeuvring and operating vehicles for unloading and installation of equipment; and commissioning of new equipment and site rehabilitation. The construction phase is estimated at 9 - 12 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 (which will be assessed as two alternatives, in a separate BA Process). The operation phase is expected to be 20-25 years (with maintenance).
- *Decommissioning* – depending on the economic viability of the PV facility, the length of the operation phase may be extended beyond a 20–25-year period. At the end of the project's life, decommissioning will include site preparation, disassembling of the components of the PV facility, clearance of the relevant infrastructure at the site and appropriate disposal thereof, 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.

Environmental impacts associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to fauna, avifauna and flora, impacts to sites of heritage value, soil contamination, erosion and loss of agricultural land, nuisance from the movement of vehicles transporting equipment and materials, and loss of income from agricultural land.

Environmental impacts associated with the operation phase includes soil contamination, erosion and potential invasion by alien and invasive plant species. Other impacts include visual impacts and social impacts.

7.1. Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the Highveld Solar PV Facility relate to the direct loss of vegetation and species of special concern, disturbance of animals (including avifauna) and loss of habitat and impacts to soils. In order to assess the impacts associated with the Highveld Solar PV Facility, it is necessary to understand the extent of the affected area.

- The project site being assessed for the Highveld Solar PV Facility requires a development footprint of approximately 433ha in extent within a larger development footprint area of approximately 522ha (including environmentally constrained areas)). This development footprint includes infrastructure such as PV modules and mounting structures, Inverters and transformers, on-site facility substation (footprint area up to 2ha in extent), temporary and permanent laydown area, site offices and maintenance buildings, including workshop areas for maintenance and storage and site and internal access roads.

7.2. Potential Impacts on Terrestrial Ecology and Wetlands

The majority of the ecological impacts associated with the development would occur during the construction phase as a result of the disturbance associated with site clearance, excavations, the operation of heavy machinery at the site and the presence of construction personnel. The significance of the impacts on terrestrial ecology expected with the development of the Highveld Solar PV Facility has been assessed as medium and low-medium, depending on the impact being considered, with the implementation of mitigation measures. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix D** for more details).

7.2.1 Results of the Terrestrial Ecology Impact Assessment

The project area is situated within the Grassland Biome. The project area is situated within the Vaal Reefs Dolomite Sinkhole Woodland and predominantly within the Carletonville Dolomite Grassland – both of the Dry Highveld Grassland Bioregion.

The following potential impacts to the terrestrial biodiversity were assessed:

» Destruction, loss and fragmentation of the habitats (including watercourses), ecosystems (ESA areas) and vegetation community including protected species;
» Spread and/or establishment of alien and/or invasive species;
» Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, dust, vibration, fencing and poaching); and
» Chemical pollution associated with dust suppressants.

Figure 7.2 below shows that the project area mostly overlaps with terrestrial CBA 2 areas, with a small portion overlapping with terrestrial CBA 1 in the west. In addition, the project area overlaps with an aquatic CBA 1 in the central region, an aquatic CBA 1 in the central region and a small portion of an aquatic CBA 1 in the west. CBA1 areas should be avoided as far as possible, and the proposed development footprint does achieve this.

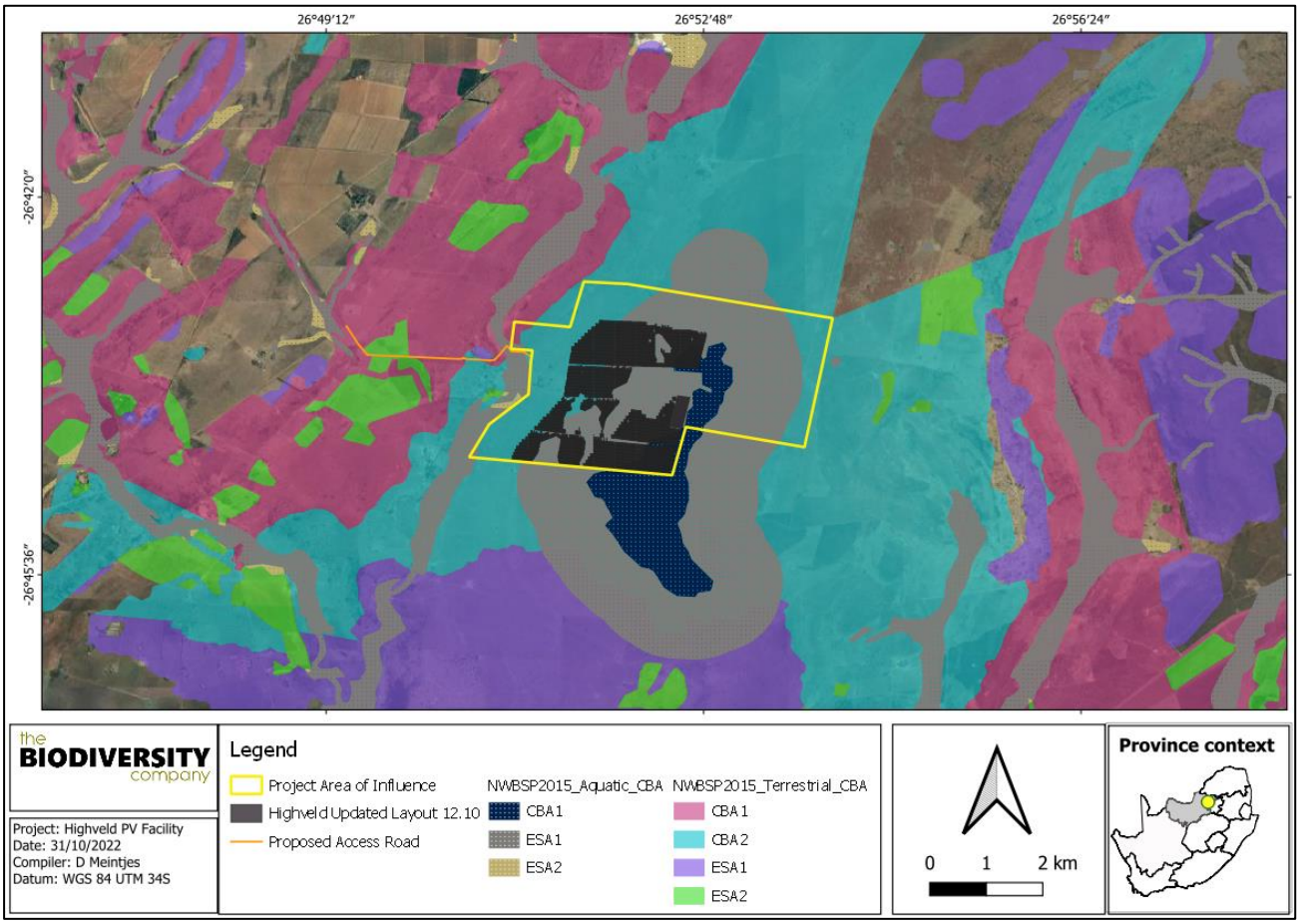


Figure 7.2: Map illustrating the locations of CBAs and ESAs in the project area.

Any development on the High sensitivity areas will lead the direct destruction and loss of portions of functional ESA, and also the floral and faunal species that are expected to utilise this habitat. Therefore, if these areas are not maintained in a natural or near natural state, destroyed or fragmented, then meeting targets for biodiversity features will not be achieved.

Development within confirmed CBA areas is not considered to be preferred, and implementation of the mitigation hierarchy for this project is demonstrated. This includes a concerted effort by the Applicant to avoid these high sensitivity areas. The area indicated as a depression wetland (Aquatic CBA 1 and ESA 1) is dominated by fractured dolomite and no wetland conditions are present. Disturbances to the medium sensitivity area must be kept to a minimum.

The high sensitivity terrestrial areas still:

» Serve as and represent ESA as per the Conservation Plan;
» Serve as fundamental water resources for the region;
» Supports and protects fauna and flora (including protected and threatened species); and

» Support various organisms and may play a more important role in the ecosystem if left to recover from the superficial impacts.

During the field assessment one species of protected trees (by the List of Protected Tree Species under the National Forests Act, 1998) were observed: *Vachellia erioloba* (Camel Thorn). A colony of Red Listed plants, *Lithops lesliei,* was identified in the south-eastern portion of the site. This species is currently listed as being Near Threatened and is regarded as having a high conservation value. This colony consists of approximately 50 to 100 plants scattered over an area of stony ridges and should be excluded from the development.

Historically, overgrazing from livestock and mismanagement has led to the deterioration of these habitats. However, the high sensitivity areas can be regarded as important, not only within the local landscape, but also regionally; as they are used for habitat, foraging, water resource and movement corridors for fauna within the landscape.

According to the protected area spatial datasets from SAPAD (2022) and SACAD (2022), the project area does not overlap with any protected areas or conservation areas. However, it is located approximately 3km north west from the Faan Meintjes Private Nature Reserve. The project area does overlap with a Priority Focus Area and the proposed Highveld National Park[43] would be situated adjacent to the project area in the north-east corner, should the national park come into existence.

The ecological integrity, importance and functioning of these terrestrial biodiversity areas provide a variety of ecological services considered beneficial, with one key service being the maintenance of biodiversity and water resources. The preservation of these systems is the most important aspect to consider for the proposed project.

The Terrestrial Fauna survey of the site was conducted by means of active searching and recording any tracks or signs of mammals and actual observations of mammals. From the survey the following actual observations were recorded:

» No reptile or amphibian species were recorded during the site assessment.
» Five (5) mammal species were observed that could naturally occur outside of protected areas. This species include *Canis mesomelas, Cryptomys hottentotus,Hystrix africaeaustralis, Pedetes capensis* and *Raphicerus campestris*.

7.2.2 Results of the Wetland Impact Assessment

Even though somewhat disturbed, the ecological integrity, importance and functioning of wetland habitat play a crucial role as a water resource system. The preservation of this system is the most important aspect to consider for the proposed development, and the wetland habitat has been completely excluded from the development footprint (avoidance in terms of the mitigation hierarchy).

Figure 7.3 shows that the POAI does not overlap with any wetlands, but an unclassified NFEPA river is located on the western boundary of the area.

[43] It has been communicated (to us) by the North West Parks Board that this park is no longer being planned for development, and official communication has not been gazetted.

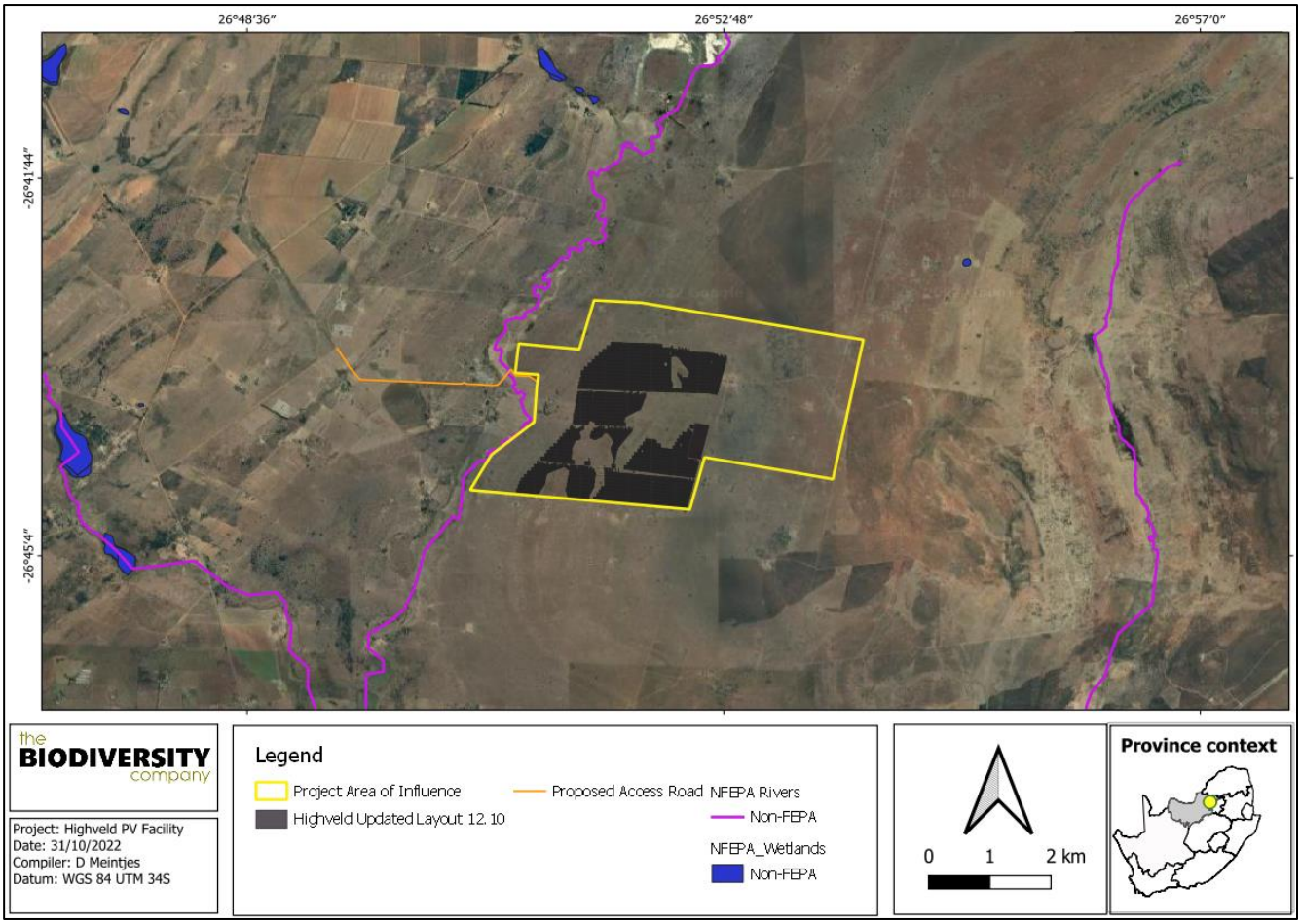


Figure 7.3: The project area in relation to the National Freshwater Ecosystem Priority Areas

7.2.3 Impact tables summarising the significance of impacts on ecology related to the PV facility, substations and the grid line during construction and operation (with and without mitigation)

Impacts on Terrestrial Ecology

Nature: Habitat and vegetation loss

Impact Description:
Destruction, loss and fragmentation of the of habitats, ecosystems (CBA 1, CBA2 and ESA 1) and vegetation community, including protected species and red listed species.

	Without mitigation	**With mitigation**
Extent	Low (2)	Very low (1)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Definite (8)	Definite (5)
Significance	**High (70)**	**Medium (55)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Can impacts be mitigated?	Yes	

Mitigation:

» Very high and high sensitivity areas should be excluded from development and should be permanently cordoned off to avoid any disturbance to these areas (treated as no-go areas).

- A walk-through survey should be conducted by a qualified ecologist to identify any remaining individuals of Lithops lesliei that potentially grow outside the areas already rated as having a very-high sensitivity. Permits should be obtained to transplant any remaining individuals of the species Lithops lesliei.
- *Vachellia erioloba* (Camel thorn) specimens were recorded on the project area. Prior to development a thorough walk-through survey should be conducted to mark the locations of remaining Camel thorns. Permits will have to be obtained for the translocation / destruction of Camel Thorn trees.

Residual Impacts:
The loss of currently intact vegetation is an unavoidable consequence of the development and cannot be entirely mitigated. The residual impact would however be low.

Nature: Introduction of alien species, especially plants.

Impact Description:
Spread of alien and/or invasive species.

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:
- Compilation of and implementation of an alien vegetation management plan
- Waste must be removed from the area on a weekly basis to prevent pest species from becoming a problem.

Residual Impacts:
Erosion and habitat degradation.

Nature: Loss of Fauna.

Impact Description:
Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, dust, vibration, fencing and poaching).

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Moderate (3)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- A qualified environmental control officer must be on site when construction begins to identify species that will be directly disturbed and to relocate fauna/flora that is found during construction (including all reptiles and amphibians)
- All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the project area to inform contractors and site staff of the presence of likely Red / Orange List species, their identification, conservation status and importance, biology, habitat requirements and management requirements the Environmental Authorisation and within the EMPr.
- If any faunal species are recorded during construction, activities should temporarily cease, and an appropriate specialist should be consulted to identify the correct course of action
- No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals. Signs must be put up to enforce this.

Residual Impacts:
Loss of fauna species, including locally common species, will lead to the loss of ecological services such as seed dispersal, pest control and soil management.

Nature: *Pollution*.

Impact Description:
Chemical pollution associated with dust suppressants or spills.

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (3)	Moderate (3)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (45)**	**Low (22)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:
- A spill management plan must be in place.
- Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and dumps especially. This includes wetting of exposed soft soil surfaces and not conducting activities on windy days which will increase the likelihood of dust being generated.
- No non environmentally friendly suppressants may be used as this could result in pollution of water sources.
- Reducing the dust generated by the listed activities above, especially the earth moving machinery, through wetting the soil surface (with "dirty water") and putting up signs to enforce speed limit as well as speed bumps built to force slow speeds.

Residual Impacts:
Pollution can enter water sources and spread well beyond the project area.

Operations Phase

Nature: Continued fragmentation and degradation of habitats and ecosystems.

Impact Description:
Continued fragmentation and degradation of habitats, ecosystems and CBA/ESA areas.

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (3)	Moderate (3)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and dumps especially. This includes wetting of exposed soft soil surfaces and not conducting activities on windy days which will increase the likelihood of dust being generated.
» Progressive rehabilitation will enable topsoil to be returned more rapidly, thus ensuring more recruitment from the existing seedbank.
» It should be made an offence for any staff to /take bring any plant species into/out of any portion of the project area. No plant species whether indigenous or exotic should be brought into/taken from the project area, to prevent the spread of exotic or invasive species or the illegal collection of plants.

Residual Impacts:
No notable impacts.

Nature: Spread of alien and/or invasive species.

Impact Description:
Degradation and loss of surrounding natural vegetation due to AIP.

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Short term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (39)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Implementation of an alien vegetation management plan.
» Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site.
» Refuse bins will be emptied and secured.
» Temporary storage of domestic waste shall be in covered waste skips. Maximum domestic waste storage period will be 10 days.

» A pest control plan must be put in place and implemented; it is imperative that poisons not be used due to the likely presence of SCCs.
Residual Impacts:
None.

Nature: Ongoing displacement and direct mortalities of faunal community due to disturbance.

Impact Description:
Road collisions, noise, light, dust and vibration, and the reduced dispersal/migration of fauna.

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Moderate term (3)	Short (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Noise reduction measures must be installed for all machines, vehicles and equipment. Appropriate silencers to control potentially disrupting noises to be fitted. The noise impact assessment must advise.
» Lighting should be kept to a minimum to avoid disturbing crepuscular and nocturnal species. Lighting fixtures should be fitted with baffles, hoods or louvres and directed downward, to minimize light pollution which could attract night-flying birds and night migrating species.
» Staff should be made environmentally aware during the inductions and potentially as part of the environmental awareness plan.

Residual Impacts:
None.

Nature: *Pollution*.

Impact Description:
Chemical pollution associated with dust suppressants or spills.

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (3)	Very Short term (2)
Magnitude	High (8)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (45)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» No non environmentally friendly suppressants may be used as this could result in pollution of water sources.

Residual Impacts:
Extensive pollution to surrounding watercourse.

Decommissioning phase

Nature: Continued fragmentation and degradation of habitats.		
	Without mitigation	**With mitigation**
Extent	Low (2)	Low (2)
Duration	Long term (4)	Very short term (1)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
» Implementation of rehabilitation plan. » Develop post-development environments in conjunction with regional development plans as well as the recreation of habitats where possible or structure altered landscapes to be compatible with regional habitats. » Monitoring of rehabilitation implementation on an annual basis for 5 years post-closure. The plan and interventions must be amended accordingly. » Any gullies or dongas must also be backfilled. » The area must be shaped to a natural topography. » Trees (or vegetation stands) removed must be replaced. » No grazing must be permitted to allow for the recovery of the area.		
Residual Impacts:		
None.		

Nature: Spread of alien and/or invasive species. ***Impact Description:*** Degradation and loss of surrounding natural vegetation due to AIP.		
	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
» Ongoing Implementation of an alien vegetation management plan as well as the monitoring of the plants.		
Residual Impacts:		
None.		

Impacts on Wetlands

Nature: Wetland disturbance / loss

Impact Description:
Direct disturbance / degradation / loss to soils or vegetation due to the construction of the solar facility

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Very low (1)
Duration	Moderate term (3)	Short term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Can impacts be mitigated?	Yes	

Mitigation:

» Clearly demarcate the construction footprint and restrict all construction activities to within the proposed infrastructure area.
» When clearing vegetation, allow for some vegetation cover as opposed to bare areas. Keep as much vegetation as possible beneath the panels.
» Minimize the disturbance footprint and unnecessary clearing of vegetation outside of this area.
» Educate staff and relevant contractors on the location and importance of the identified wetlands through toolbox talks and by including them in site inductions and the overall master plan.
» All activities (including driving) must adhere to the 15 m buffer area.
» Promptly remove / control all AIPs that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed.
» Landscape and re-vegetate all denuded areas as soon as possible.

Residual Impacts:
The loss of wetlands is unexpected, as no wetlands overlap with the development area. The proposed development does overlap with a drainage feature. The residual impact would be low.

Nature: Altered hydrology

Impact Description:
Changes to the hydrology of the watercourse due to infrastructure traversing the system/s

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Moderate term (3)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Undertake the upgrade of the crossing during the low flow period (between May and August).
» Minimise the extent of activities within the watercourse. Prioritise the upgrade by placing machines and equipment on the existing structure and embankments, and not within the watercourse. Where necessary, machines and equipment may be positioned in the watercourse. Disturbed areas must be rehabilitated once machinery and equipment are removed.

» The upgraded structure must accommodate high flows, and be designed for a 1:100 year flood peak.
» Minimise the number (and extent) of piers within the watercourse. The piers must not be placed within a preferential flow path.
» The crossing must also be inspected frequently (suggested weekly) during the high flow period (between October and April), and after rainfall events. All debris trapped by the crossing must be removed.

Residual Impacts:
Long term broad scale erosion and sedimentation

Nature: Water runoff from construction site

Impact Description:
Increased erosion and sedimentation

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Moderate term (3)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (48)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:
» Limit construction activities near (< 30 m) of wetland to winter (as much as possible) when rain is least likely to wash concrete and sand into the wetland.
» Only clear vegetation on a needs, keeping to a minimum the amount of vegetation to be cleared.
» Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash.
» No activities are permitted within the wetland and associated buffer areas.
» Landscape and re-vegetate all unnecessarily denuded areas as soon as possible.

Residual Impacts:
Long term broad scale erosion and sedimentation

Operations Phase

Nature: Hardened surfaces

Impact Description:
Potential for increased stormwater runoff leading to increased erosion and sedimentation

	Without mitigation	**With mitigation**
Extent	High (4)	Low (2)
Duration	Moderate term (3)	Short term (2)
Magnitude	High (8)	Moderate (6)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (60)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Yes	No

Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.

Mitigation:

» Design and Implement an effective stormwater management plan. This plan must consider the drainage feature overlapped by the facility.
» Promote water infiltration into the ground beneath the solar panels.
» Release only clean water into the environment.
» Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site, each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in).
» Re-vegetate denuded areas as soon as possible.
» Regularly clear drains.
» Minimise the extent of concreted / paved / gravel areas.
» A covering of soil and grass (regularly cut and maintained) below the solar panels is ideal for infiltration. If not feasible, then gravel is preferable over concrete or paving.
» Avoid excessively compacting the ground beneath the solar panels.

Residual Impacts:

Long-term broad scale erosion and sedimentation

Nature: Contamination

Impact Description:

Potential for increased contaminants entering the wetland systems

	Without mitigation	**With mitigation**
Extent	High (4)	Low (2)
Duration	Long term (4)	Short term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (56)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Where possible, minimise the use of surfactants to clean solar panels and herbicides to control vegetation beneath the panels. If surfactants and herbicides must be used, do so well prior to any significant predicted rainfall events.

Residual Impacts:

Wetland deterioration over time

Decommissioning phase

Nature: Water runoff from construction site

Impact Description:

Increased erosion and sedimentation

	Without mitigation	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Moderate term (3)	Short term (2)
Magnitude	Moderate (6)	Low (4)

Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (48)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » No activities are permitted within the wetland and associated buffer areas. » Landscape and re-vegetate all unnecessarily denuded areas as soon as possible.		
Residual Impacts: Long term broad scale erosion and sedimentation		

7.2.4 Conclusion

From the outcomes of the studies undertaken, it is concluded that:

» The bulk of the development footprint is located within a Low to Medium sensitivity area, while small localised areas of high sensitivity have been demarcated and are to be avoided by the optimised development footprint
» No significant terrestrial ecological flaws, that could pose a problem to the proposed PV Facility development, were identified during the assessment.

The completion of the terrestrial biodiversity assessment found a colony of Red Listed plants, *Lithops lesliei*, was identified in the south- eastern portion of the site. This species is currently listed as being Near Threatened and is regarded as having a very-high conservation value which corroborate with the Very high sensitivity rating from the screening tool report. However, a very small area provides the habitat suitable for this species, and it is only this habitat which must be avoided by the development footprint. With avoidance of this area as the primary mitigation, the sensitivity rating was verified to be Medium by the specialist.

The field survey ensured that there was a suitable ground truth coverage of the assessment area and most habitats and ecosystems were assessed to obtain a general species (fauna and flora) overview and the major current impacts were observed. The conservation status is classified as Least Concern albeit the protection level is regarded as 'Poorly Protected' Ecosystem. The proposed activity overlaps with an ESA 1, CBA 1, CBA 2 areas.

Historically, overgrazing from livestock and mismanagement has led to the deterioration of these habitats. However, the high sensitivity areas can be regarded as important, not only within the local landscape, but also regionally; as they are used for habitat, foraging, water resource and movement corridors for fauna within the landscape.

A key consideration for the impact assessment is the presence of the identified water resources in relation to the project area. The available data also suggests the presence of features in proximity to the project area, with wetland systems expected for the 500 m regulation area.

Construction could result in the encroachment into water resources and result in the loss or degradation of these system, most of which are functional and provide ecological services. These disturbances could also result in the infestation and establishment of alien vegetation would affect the functioning of the systems. Leaks and/or spillages could result in contamination of the receiving water resources. Contaminated water

resources are likely to have an effect on the associated biota. An increase in stormwater runoff could result in physical changes to the receiving systems caused by erosion, run-off and also sedimentation, and the functional changes could result in changes to the vegetative structure of the systems.

The main expected impacts of the proposed solar PV infrastructure will include the following:

» Habitat loss and fragmentation;
» Degradation of surrounding habitat;
» Mortality, disturbance and displacement caused during the construction and operational phases; and
» Direct impact to or loss of drainage areas; and

Disturbances as a result of construction and/or operation could also result in the infestation and establishment of alien vegetation which would affect the functioning of natural systems; leaks and/or spillages could result in contamination of receiving water resources; an increase in stormwater runoff could result in physical changes to the receiving systems caused by erosion, run-off and also sedimentation, and the functional changes could result in changes to the vegetative structure of the terrestrial systems.

Mitigation measures can be implemented to reduce the significance of the risk. Considering that this area has been identified as being of significance for biodiversity maintenance and ecological processes (ESAs and CBA), development may proceed outside of the CBA areas, but caution and the implementation of mitigation measures are required, especially in relation to the red listed plant community, which must be avoided and protected.

No fatal flaws are considered for the proposed project. It is the opinion of the specialists that the project, may be cautiously considered, on the condition that all prescribed mitigation measures and supporting recommendations are implemented.

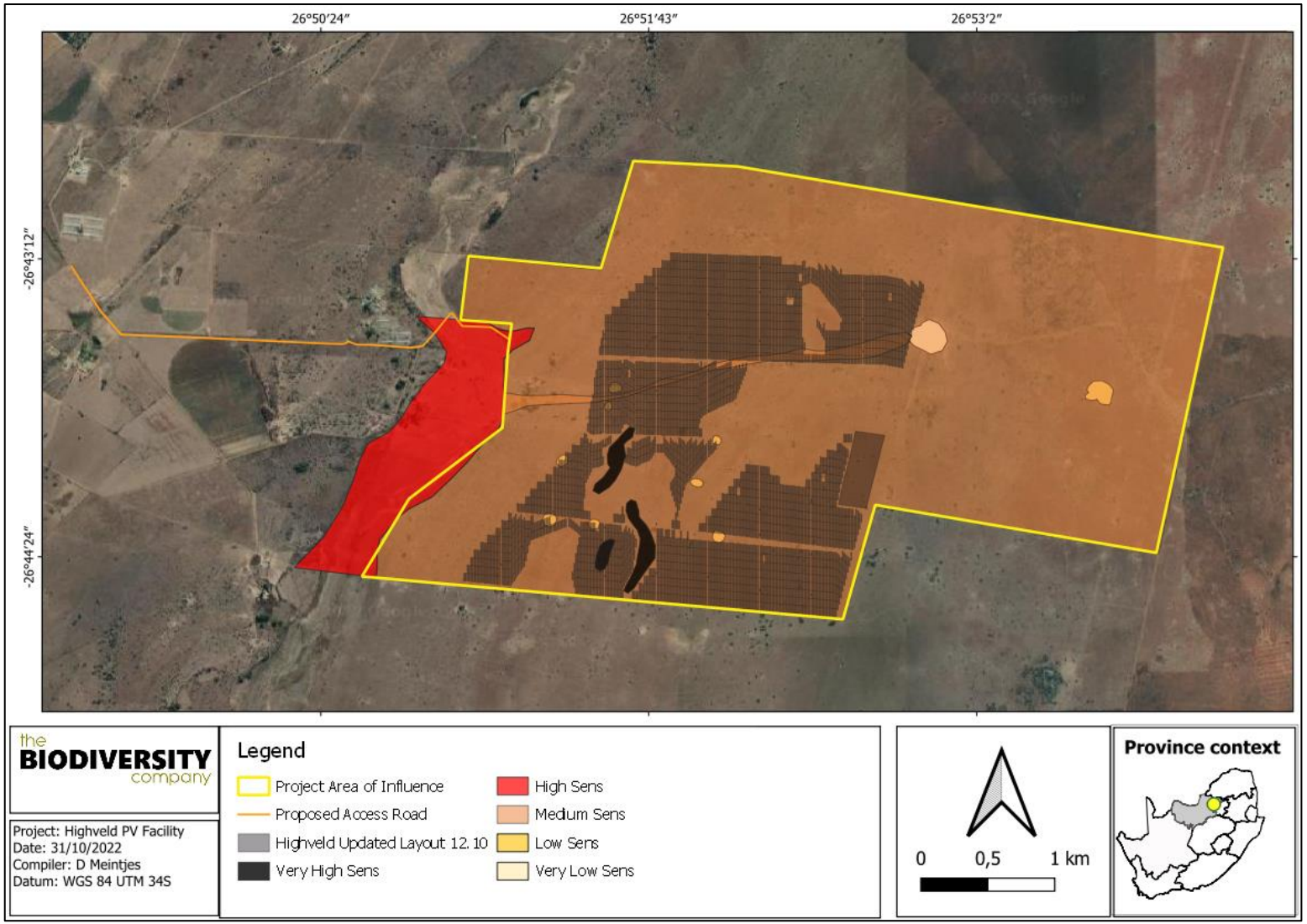


Figure 7.4: The site ecological importance of the various habitats identified in the project area

7.3. Potential Impacts on Avifauna

The significance of the impacts on avifauna expected with the development of the Highveld Solar PV Facility has been assessed as high to moderate, after mitigation. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E** for more details).

7.3.1 Results of the Avifauna Impact Assessment

The following avifauna impacts are expected to occur with the development of Highveld Solar PV Facility:

» Loss of the habitat and displacement of bird;
» The creation of "new" avian habitat;
» Bird pollution;
» Collision trauma caused by PV panels

Loss of habitat and displacement of birds

Approximately 433ha (consisting of the PV arrays, internal roads and substation) of the available development footprint (c. 522 ha) will be cleared of vegetation and habitat to accommodate the panel arrays and associated infrastructure. This 433 ha takes the sensitivity map into consideration by avoiding areas that were initially classified with high sensitivity. In addition, clearing of additional vegetation during the widening of the proposed access road will also take place, even though this is an existing road. Clearing of vegetation will inevitably result in the loss of habitat and displacement of bird species. From the results, approximately 15.35 species.ha-1 and 1.28 birds.ha-1 will become displaced should the activity occur across all the habitat types on the study area (as per Jenkins et al., 2017). Displacement will mainly affect passerine and smaller non-passerine species inhabiting the open savannoid grasslands with bush clump mosaics (mainly habitat identified with medium avifaunal sensitivity. However, it is possible that roadworks (during the upgrade of the access road) will temporary displace passerine and smaller non-passerine species from the road reserve. Since the proposed access road crosses the Kromdraaispruit and due to the location of a small impoundment near the Rietspruit Road turnoff, it is also anticipated that waterbirds may become temporarily displaced from habitat where inundation (surface water) is prevalent. However, the latter impact is unlikely to result in the mortality of birds.

The following bird species are most likely to be impacted by the loss of habitat due to their habitat requirements, endemism and conservation status (although not limited to) due to the proposed PV development:

» Northern Black Korhaan (*Afrotis afraoides*);
» White-throated Scrub-robin (*Cossypha humeralis*);
» Ashy Tit (*Melaniparus cinerascens*);
» Kalahari Scrub Robin (*Cercotrichas paena*);
» Orange River Francolin (*Scleroptila gutturalis*) and potentially also small to medium birds of prey such as:
» Black-winged Kite (*Elanus caeruleus*);
» Lesser Kestrel (*Falco naumanni*);
» Lanner Falcon (*Falco biarmicus*);
» Greater Kestrel (*Falco rupicoloides*);
» Pale Chanting Goshawk (*Melierax canorus*)

» Gabar Goshawk (*Micronisus gabar*).

When considering the number of displaced bird species and their widespread occurrence in the region, the predicted impact due to the overall displacement and habitat loss is moderate without mitigation measures. However, the possibility exists that the endangered Secretarybird (*Sagittarius serpentarius*) could become displaced should construction activities overspill onto suitable foraging habitat.

Creation of "new" avian habitat and bird pollution

It is possible that the infrastructure (during operation) could attract bird species which may occupy the site or interact with the local bird assemblages in the wider region. These include alien and cosmopolitan species, as well as aggressive omnivorous passerines which could displace other bird species from the area:

» House Sparrow (*Passer domesticus*);
» Common Myna (*Acridotheres tristis*);
» Pied Crow (*Corvus albus*); and
» Speckled Pigeon (*Columba guinea*).

The infrastructure may attract large numbers of roosting *columbid taxa*, especially Speckled Pigeons (Columba guinea), which may result in avian "pollution" through excreta, thereby fouling the panel surfaces. The impact is manageable and will result in a low significance.

Collision trauma caused by PV panels (the " lake-effect")

The presence of wetland-associated habitat units (e.g. Kromdraaispruit system) nearby to the development footprint could increase the risk of waterbirds and shorebird taxa interacting with the proposed PV panels. Placement of the proposed PV panels will be critical and should preferably avoid areas of high sensitivity. Appropriate bird deterrent devices should be installed at strategic localities (especially facing the Kromdraaispruit - facing west, northwest and southwest), and these should include a combination of rotating flashers/reflectors to increase the visibility of the infrastructure. In addition, post construction monitoring to quantify mortalities will be important during to early operational phase in order to determine "hotspot" areas (areas where high mortalities are prevalent) which may require additional mitigation measures. Waterbirds with a high frequency of occurrence which could interact with the PV panels are the *Egyptian Goose (Alopochen aegyptiaca), South African Shelduck (Tadorna cana), Yellow-billed Duck (Anas undulata), Red-billed Teal (Anas erythrorhynchus), African Black Duck (A. sparsa) and potentially also Reed Cormorant (Microcarbo africanus)* and *Glossy Ibis (Plegadis falcinellus*).

However, desktop results and site observations show that the following species could interact with the panel infrastructure (based on species with high reporting rates):

» Yellow-billed Duck (*Anas undulata*);
» Red-billed Teal (*Anas erythrorhynchus*);
» African Black Duck (*Anas sparsa);*
» South African Shelduck (*Tadorna cana*);
» Spur-winged Goose (*Plectropterus gambiensis*);
» Egyptian Goose (*Alopochen aegyptiaca*);
» Little Grebe (*Tachybaptus ruficollis*);

- Reed Cormorant (*Microcarbo africanus*);
- Black-headed Heron (*Ardea melanocephala*);
- Little Egret (*Egretta garzetta*);
- Red-knobbed Coot (*Fulica cristata*) and probably also
- Grey Heron (*Ardea cinerea*);
- African Sacred Ibis (*Threskiornis aethiopicus*);
- Glossy Ibis (*Plegadis falcinellus*);
- Wood Sandpiper (*Tringa glareola*) and
- White-faced Duck (*Dendrocygna viduata*).

Interaction with substation, overhead power lines and reticulation

The on-site facility substation could result in bird collisions and electrocutions. Overhead power lines are not part of the facility infrastructure and all internal cabling and MV corridors will be placed underground. However, a 132kV switching substation and a 132kV overhead powerline within a 300m wide and 20km long corridor is proposed to be constructed between the between the switching substation located on the Highveld Solar PV Facility and a point of connection on the Hermes DS - Potchefstroom DS 1 and Buffels East 1 - Potchefstroom 132kV Feeder lines located east of Khuma and the R502. This proposed power line could result in bird collisions and electrocutions, and these impacts will be assessed as part of a separate Environmental Application (separate BA report).

However, it is highly recommended that all new and existing overhead power lines (irrespective of size) that span the Highveld Solar PV facility be retrofitted with bird guards and appropriate bird flight diverters to reduce any potential collision trauma in birds due to birds attracted to the facility by the PV panels, especially due to the presence of vultures.

7.3.2 Impact tables summarising the significance of impacts on avifauna related to the proposed PV facility and its infrastructure.

Nature: Losses of natural habitat and displacement of birds through physical transformation, modifications, removals and land clearance. This impact is mainly restricted to the construction phase and is permanent.		
PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Moderate (6)
Probability	Definite (5)	Highly Probable (4)
Significance	**High (65)**	**Medium (48)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, to some extent	
Mitigation: » It is difficult to mitigate against the loss of habitat since clearing of vegetation (or habitat) will be required for the infrastructure associated with the project.		

» Both the PV facility and associated infrastructure occur predominantly on habitat types of medium sensitivity. The best practicable mitigation will be to consolidate infrastructure to areas where existing impacts occur and to avoid any proposed buffer areas. » However, the proposed access road corresponds to an existing road, and the potential impact of bird displacement is considered to be temporary (during the implementation of best practicable mitigation measures).
Residual Impacts: It is anticipated that during rehabilitation (after removal of the panels), the vegetation will revert to secondary grassland and shrubland resulting in a potential decrease in bird species richness with low evenness values at a local scale. The residual impact of the PV facility will be medium.

Nature:
The creation of novel or new avian habitat for commensal bird species or superior competitive species. This is expected to occur during the operation phase of the facility.

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Footprint (1)	Footprint (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (18)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, with experimentation	Yes

Mitigation:
» Apply bird deterrent devices and remove nest structures constructed on infrastructure associated with the PV facility under the guidance of the ECO.

Residual Impacts:
Secondary displacement by competitive bird species such as crows and increased fecundity rate for commensal bird species that are adapted to anthropogenic activities. The impact is regarded as low.

Nature:
Avian collision impacts related to the PV facility during the operation phase (collision with the PV panels).

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Site and immediate surroundings (4)	Site and immediate surroundings (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Medium (6)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (64)**	**Medium (39)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, potential loss of waterfowl and certain shorebird taxa species.	Yes, potential loss of waterfowl and certain shorebird taxa species.

Can impacts be mitigated?	Yes, to some extent

Mitigation:

» Apply bird deterrent devices such as rotating flashers/reflectors to the panels for birds that may mistake the panels for open water and to prevent them from landing on the panels - these should be placed at panels nearest (facing) to pans and other water features.
» Bird deterrent devices should also include light-emitting devices to increase the visibility of the PV infrastructure for waterbird species that migrate at night (e.g. flamingo species).
» Security/CCTV cameras may be installed to quantify mortalities (cameras are also installed along the perimeter fence for security measures and may also prove to be effective to quantify mortalities).
» Buffer pans/depressions and even tailing facilities by at least 500m. If post-construction monitoring predicts and/or confirms any bird mortalities, an option is to employ video cameras at selected areas to document bird mortalities and to conduct direct observations and carcass searches on a regular and systematic basis.

Residual Impacts:

Direct mortality is possible and may still occur irrespective of applied mitigation measures. Regular and systematic monitoring is proposed to assess the efficacy of applied mitigation and further research and testing is suggested to improve mitigation measures (e.g. bird deterrent devices). The residual impact is regarded as low.

7.3.3 Conclusion

Three (3) prominent avifaunal habitat types were identified on the development area, which consisted of open savannoid grassland with bush clump mosaics, artificial livestock watering points and the Kromdraaispruit floodplain. The highest number of bird species and bird individuals were observed from the artificial livestock watering points and from bush clump habitat consisting of a prominent (tall) canopy. Approximately 245 bird species were expected to occur in the wider study area, of which 106 species were observed on the development area during the respective surveys.

The expected richness included nine threatened or near threatened species, 16 southern African endemics and 21 near-endemic species. The critically endangered White-backed Vulture (Gyps africanus) and endangered Cape Vulture (*G. coprotheres*) were observed as foraging individuals soaring overhead. In addition, a pair of vulnerable Lanner Falcons (*Falco biarmicus*) occurred within the study area. The nearby Kromdraaispruit floodplain west of development area provided potential suitable foraging habitat for the regionally endangered African Marsh Harrier (*Circus ranivorus*), although this species was not observed during the respective surveys. Although the African Marsh Harrier was not recorded on the study area during the survey period, it was recommended that all potential habitats be conserved (as a precautionary principle) by applying a 500m buffer to the edge of the Kromdraaispruit floodplain. Thirteen southern African endemics and 15 near-endemic species were confirmed on the development area.

An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was moderate to low after mitigation (depending on the type of impact). However, the risk for certain waterbirds (mainly large-bodied waterfowl such as the South African Shelduck *Tadorna cana*, Egyptian Goose *Alopochen aegyptiacus* and members of the *genus Anas*) colliding with the PV infrastructure remained eminent due to the presence of the nearby Kromdraaispruit.

No fatal flaws were identified during the assessment, although it was strongly recommended that the proposed mitigation measures and monitoring protocols (e.g. post construction monitoring) be implemented during the construction and operational phase of the project.

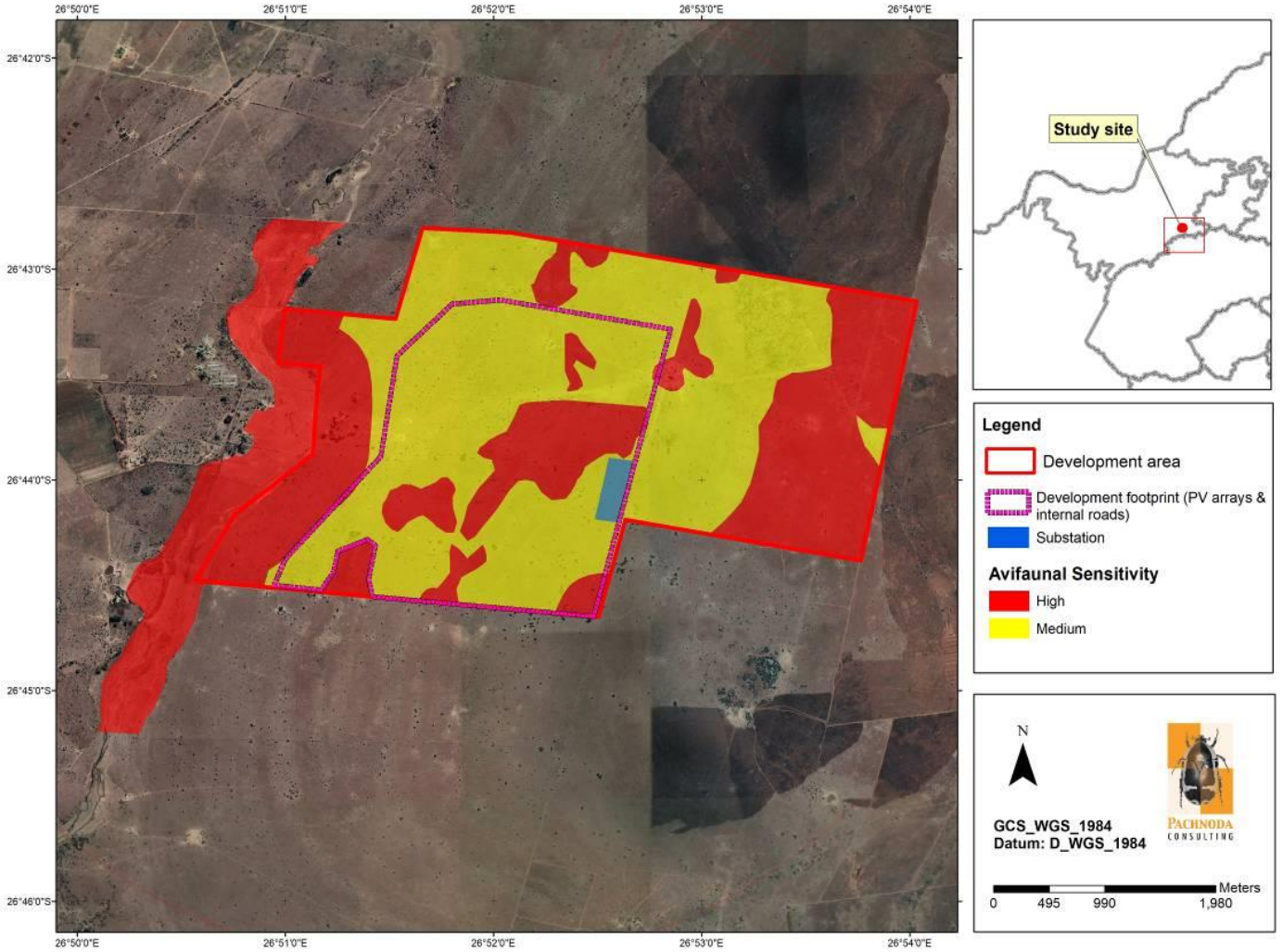


Figure 7.5: A map illustrating the avifaunal sensitivity of the study site based on the ecological condition of habitat types and the occurrence of collision prone bird species.

7.4. Assessment of Impacts on Land Use, Soil and Agricultural Potential

The impact of the Highveld Solar PV Facility on the soils, land use, land capability and agricultural potential has been assessed as low to medium (after mitigation), depending on the impact being considered. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix F** – Soils Impact Assessment for more details).

7.4.1 Results of the Land Use, Soil and Agricultural Potential Study

Agricultural potential

The soil profiles classified within the project site consist of the Mispah, Glenrosa, and Vaalbos forms. The soils present were assigned into land capability classes. The very shallow soils of the largest part of the development footprint (Mispah soil form) have Very low (Class 03) land capability. The slightly deeper soils of the Glenrosa and Vaalbos forms have been assigned Low (Class 05) land capability (refer to **Figure 7.6**).

Following the classification of the soil and the consideration of the soil properties and limiting factors to rainfed crop production, the agricultural potential soil within the development footprint was determined. The total development footprint area assessed, has Low agricultural potential for the production of rainfed crops. The main constraint to production is the shallow depth of the soil profiles and the presence of fractured rock, solid rock and lithic material at effective depths shallower than 0.5m. The area is considered better suited to extensive livestock production, which is also the current land use on site.

Sensitivity analysis

Following the consideration of all the desktop and gathered baseline data above, the findings of the report differ with the results of the Environmental Screening Tool. The soil forms present within the development footprint, are shallow to very soils that range in depth between 0.05 and 0.45m. Rock outcrops are present on the surface in several areas within the proposed development footprint. The area has not historically been used for crop production and also not recently, as confirmed by the field crop boundary data of DALRRD (2019). No irrigation infrastructure, such as centre pivots or drip irrigation, are present within the project area and irrigated agricultural is currently not practiced in the area.

The area is currently used for livestock farming and the Highveld Solar PV Facility development footprint can support 72 head of cattle at the long-term grazing capacity of 8ha/LSU (DALRRD, 2018). Considering the soil properties, land capability and agricultural potential of the development area, the entire area has Low Agricultural Sensitivity. Soil in the project area will have Low to Medium sensitivity, depending on the successful implementation of mitigation measures to prevent soil erosion, compaction and pollution.

Allowable development limits

Although the data layer of High Potential Agricultural Areas indicate that about 70% of the development footprint falls within an area that is classified as a Category B Rainfed High Potential Agricultural Area (DALRRD 2021), the site verification visit confirmed that there is no crop production within the entire development area. There was also no historical crop production within this area. The soil forms present are all shallow with the effective depth not deeper than 0.45m. It is therefore concluded that the entire development footprint has

Low agricultural sensitivity. It is therefore confirmed that the current layout and development footprint for the proposed Highveld Solar PV Facility, does not exceed the allowable development limits.

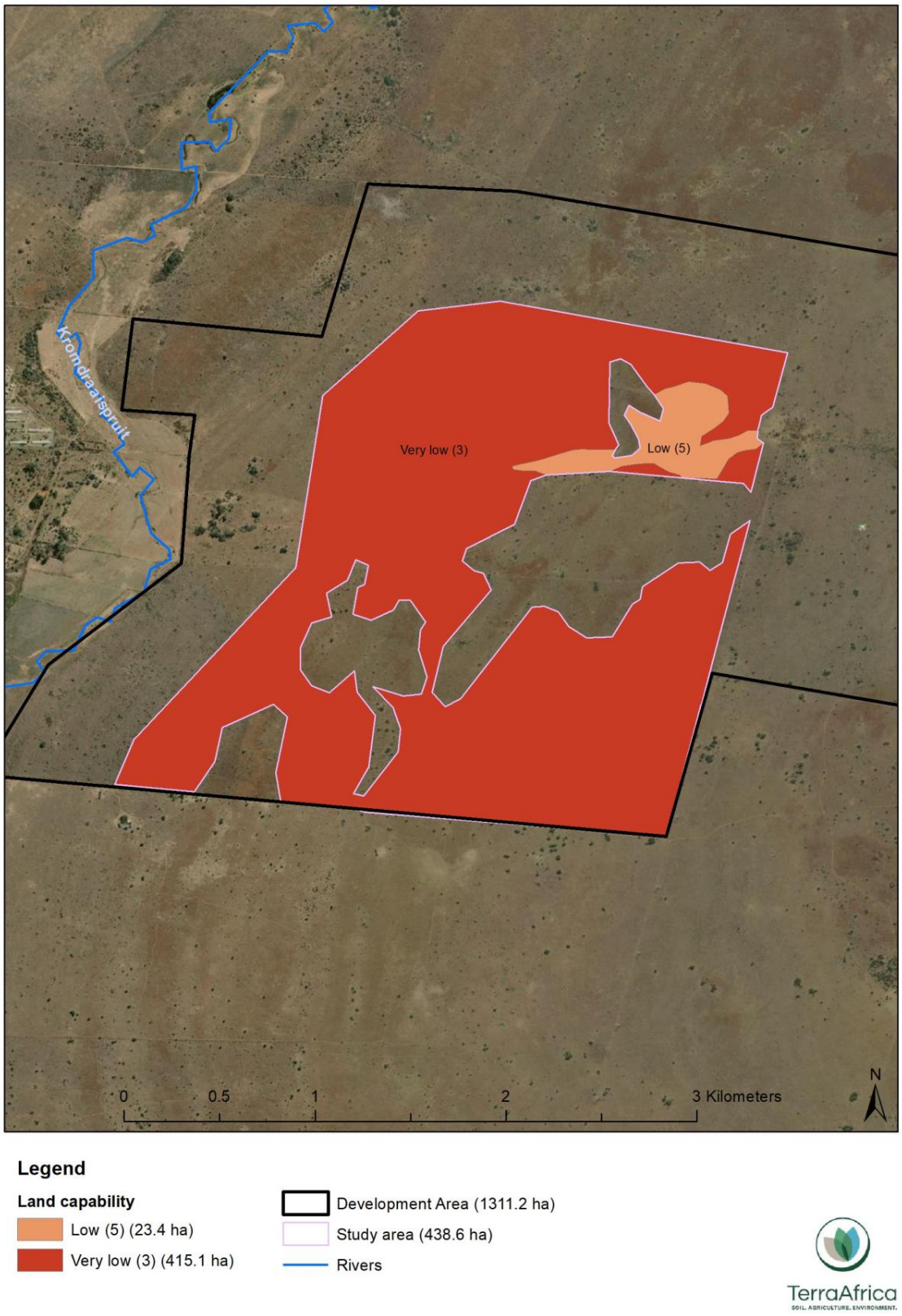


Figure 7.6: Land capability classification of the Highveld Solar PV Facility development footprint area

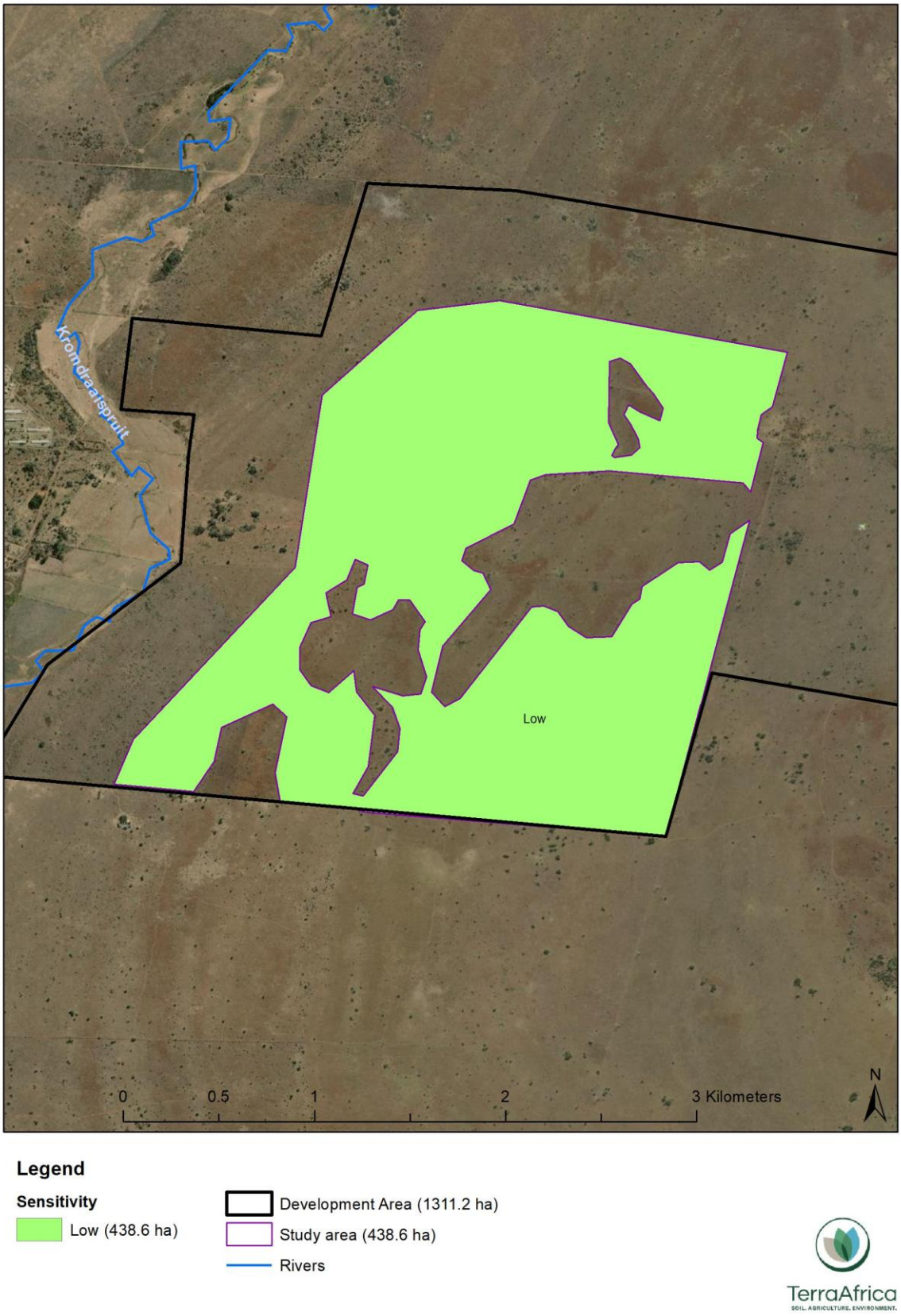


Figure 7.7: Agricultural sensitivity rating of the proposed Highveld Solar PV Facility development footprint area

7.4.2 Description of Land Use, Soil and Agricultural Potential Impacts

The most significant impacts of the project on soil and agricultural productivity will occur during the construction phase when the vegetation is removed, and the soil surface is prepared for the delivery of materials and erection of the infrastructure. During the operational phase, the risk remains that soil will be polluted by the waste generated or in the case of a spill incident. During the decommissioning phase, soil will be prone to erosion when the infrastructure is removed from the soil surface.

7.4.3 Impact tables summarising the significance of impacts on Land Use, Soil and Agricultural Potential during construction and operation (with and without mitigation)

Construction phase

Impact: Change in land use from livestock farming to energy generation.

Nature: Prior to construction of the project infrastructure, the PV development footprint will be fenced off and livestock farming will be excluded from up to 433ha of land.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (4)	Definite (4)
Significance	**Medium (40)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	

Mitigation:

- Vegetation clearance must be restricted to areas where infrastructure is constructed.
- No materials removed from development area must be allowed to be dumped in nearby livestock farming areas.
- Prior arrangements must be made with the landowners to ensure that livestock and game animals are moved to areas where they cannot be injured by vehicles traversing the area.
- No boundary fence must be opened without the landowners' permission.
- All left-over construction material must be removed from site once construction on a land portion is completed.
- No open fires made by the construction teams are allowable during the construction phase.

Residual:
The residual impact from the construction of the Highveld PV facility and associated infrastructure is considered medium.

Impact: *Soil erosion.*

Nature: All areas where vegetation is removed from the soil surface in preparation for the infrastructure construction will result in exposed soil surfaces that will be prone to erosion. Both wind and water erosion are a risk, as the area falls within a region that experiences thunderstorms in the summer months and sometimes strong winds during the dry winter months, especially August and September.

	Without mitigation	**With mitigation**

Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

» Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint;
» Unnecessary land clearance must be avoided;
» Level any remaining soil removed from excavation pits (where the PV modules will be mounted) that remained on the surface, instead of allowing small stockpiles of soil to remain on the surface;
» Where possible, conduct the construction activities outside of the rainy season; and
» Stormwater channels must be designed to minimise soil erosion risk resulting from surface water runoff.

Residua*l:*

The residual impact from the construction and operation of the project on the susceptibility to erosion is considered low.

Impact: Soil compaction.

Nature*:* The clearing and levelling of land for construction of the infrastructure will result in soil compaction. In the area where the substation will be constructed, topsoil will be removed, and the remaining soil material will be deliberately compacted to ensure a stable surface prior to construction.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

» Vehicles and equipment must travel within demarcated areas and not outside of the construction footprint;
» Unnecessary land clearance must be avoided;
» Materials must be off-loaded and stored in designated laydown areas;
» Where possible, conduct the construction activities outside of the rainy season; and
» Vehicles and equipment must park in designated parking areas.

Residua*l:*

Any additional infrastructure development in support of the project, will result in additional areas exposed to soil compaction.

Impact: *Soil Pollution*

During the construction phase, construction workers will access the land for the preparation of the terrain and the construction of the thermal plant and access road. Potential spills and leaks from construction vehicles and equipment and waste generation on site can result in soil pollution.

Nature: The following construction activities can result in the chemical pollution of the soil:

- Petroleum hydrocarbon (present in oil and diesel) spills by machinery and vehicles during earthworks and the removal of vegetation as part of site preparation;
- Spills from vehicles transporting workers, equipment, and construction material to and from the construction site;
- The accidental spills from temporary chemical toilets used by construction workers;
- The generation of domestic waste by construction workers;
- Spills from fuel storage tanks during construction;
- Pollution from concrete mixing;
- Pollution from road-building materials; and
- Any construction material remaining within the construction area once construction is completed.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	Improbable (2)
Significance	**Medium (36)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
- Any waste generated during construction must be stored into designated containers and removed from the site by the construction teams;
- Any left-over construction materials must be removed from site;
- The construction site must be monitored by the Environmental Control Officer (ECO) to detect any early signs of fuel and oil spills and waste dumping;
- Ensure battery transport and installation by accredited staff / contractors; and
- Compile (and adhere to) a procedure for the safe handling of battery cells during transport and installation.

Residual*:*

The residual impact from the construction and operation of the proposed project will be low to negligible.

Operations phase

Impact: *Soil Erosion*

During the operations phase, staff and maintenance personnel will access the project area daily.

Nature: The areas where vegetation was cleared will remain at risk of soil erosion, especially during a rainfall event when runoff from the cleared surfaces will increase the risk of soil erosion in the areas directly surrounding the project area

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative

Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » The area around the project, including the internal access roads, must regularly be monitored to detect early signs of soil erosion on-set; and » If soil erosion is detected, the area must be stabilised using geo-textiles and facilitated re-vegetation.		
Residual: The residual impact from the operation of the project on the susceptibility to erosion is considered low.		

Impact: Soil Pollution ***Nature:*** During the operations phase, potential spills and leaks from maintenance vehicles and equipment and waste generation on site can result in soil pollution. Also, any spillages around the workshop area or damaged infrastructure, such as inverters and transformers, can be a source of soil pollution.		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	Improbable (2)
Significance	**Medium (36)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » Maintenance must be undertaken regularly on all vehicles and maintenance machinery to prevent hydrocarbon spills; » No domestic and other waste must be left at the site and must be transported with the maintenance vehicles to an authorised waste dumping area; and » Regularly monitor areas alongside the roads, parking area and workshop for any signs of oil, grease and fuel spillage or the presence of waste.		
Residual: The residual impact from the operation of the proposed project will be low to negligible.		

<u>Decommissioning phase</u>

The decommissioning phase will have the same impacts as the construction phase i.e. soil erosion, soil compaction and soil pollution. It is anticipated that the risk of soil erosion will especially remain until the vegetation growth has re-established in the area where the project infrastructure was decommissioned.

7.4.4 Conclusion

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of Highveld Solar PV is expected to have a **Medium and Low impact** on soils and agricultural potential, depending on which impact is being considered. These impacts can be reduced by keeping the footprints minimised where possible and strictly following soil management measures pertaining to erosion control and management and monitoring of any possible soil pollution sources such as vehicles traversing over the sites. From the outcomes of the studies undertaken, it is concluded that the PV facility can be developed and impacts on soils managed by taking the following into consideration:

- Limit vegetation clearance to only the areas where the surface infrastructure will be constructed
- Avoid parking of vehicles and equipment outside of designated parking areas.
- Plan vegetation clearance activities for dry seasons (late autumn, winter and early spring).
- Design and implement a Stormwater Management System where run-off from surfaced areas is expected.
- Re-establish vegetation along the access road to reduce the impact of run-off from the road surface.
- Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills.
- Any waste generated during construction must be stored in designated containers and removed from the site by the construction teams.
- Any left-over construction materials must be removed from site.

7.5. Assessment of Impacts on Heritage Resources

Negative impacts on heritage resources will be due to loss of archaeological and palaeontological resources during construction activities of the Highveld Solar PV Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix G**).

7.5.1 Results of the Heritage Impact Assessment (including archaeology and palaeontology)

Archaeology

None of the heritage resources identified fall within the area PV layout provided and as such, no direct impact to any heritage resources is anticipated. The heritage resources that were identified fall within close proximity to the layout provided and as such, it is important that impact to the significant sites is avoided. It is recommended that the sensitive heritage areas identified in this report are avoided by any proposed development of new infrastructure.

All the graves are highly significant, and a 100m buffer zone with a fence is recommended. Furthermore, it is recommended that a Conservation Management Plan be drafted for the ongoing management and conservation of the identified burials and other heritage resources. The road proposed for upgrade falls within the recommended 100m no development buffer for site 117 however, no direct impact to the site is anticipated as long as the alignment of the existing road is followed and any widening of the road takes place to the south, away from the identified burial.

Palaeontology

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of very high fossil sensitivity. According to the extract from the Council of GeoScience Map 2626 West Rand, the area proposed for development is underlain by the Malmani Formation of the Chuniespoort Group. This is the same geological group that has resulted in the preservation of fossil remains at the Cradle of Humankind in its Transvaal Dolomite outcrop area. More broadly, the Chuniespoort Group is known for its preservation of Stromatolitic carbonates (limestones / dolomites), minor secondary cherts and mudrocks including carbonaceous shales.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to

preserve fossils. The site visit and walk through confirmed that there were no fossils in the project footprint. One smallstromatolite only was found below the existing power line, i.e. not in the route for the new powerline. Furthermore, the main solar cluster area is not on dolomites, only some cherts were present. As such there is an extremely small chance that trace fossils from the Malmani Subgroup may be disturbed. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

Table 7.1 below shows the identified heritage resources identified in the archaeological field assessment.

Table 7.1: Heritage resources identified within the Highveld Solar PV development area

Point ID.	Description	Density	Co-ordinates		Grading	Mitigation
1	Water reservoir	NA	26°43'43.16"S	26°51'14.21"E	NCW	Buffer
2	Water reservoir	NA	26°43'43.19"S	26°51'14.36"E	NCW	Buffer
3	House structure and related features. Two structures associated with one another. Possibly the original werf. Appears that the modern bricks may have been added later.	NA	26°43'44.61"S	26°51'14.11"E	IIIC	Buffer
4	Possible historic midden nearby, however, it is covered by dense vegetation. Glass, ceramics and metal.	5/m^2	26°43'44.98"S	26°51'14.94"E	IIIC	Buffer
5	Farming structures associated with werf (003)	NA	26°43'45.51"S	26°51'14.16"E	IIIC	Buffer
6	Stonewalling associated with other structures	NA	26°43'46.77"S	26°51'15.26"E	IIIC	Buffer
7	Stonewalling associated with other structures	NA	26°43'44.41"S	26°51'16.05"E	IIIC	Buffer
8	Possible historic midden nearby, however, it is covered by dense vegetation. Glass, ceramics and metal.	6/m^2	26°43'42.16"S	26°51'17.96"E	NCW	NA
9	Possible historic midden nearby, however, it is covered by dense vegetation. Glass, ceramics and metal.	NA	26°43'41.22"S	26°51'18.92"E	NCW	NA
110	One possible Stone packed grave, no inscriptions, north-south orientation, located within the development area	NA	26°43'49.65"S	26°51'22.93"E	IIIA	Buffer
111	LSA Dolerite scraper near dirt road and within development footprint	1/20m^2	26°43'53.01"S	26°51'8.76"E	NCW	NA
112	6 fieldstone cairns with cement headstones. One grave has an inscription, although nearby	NA	26°43'56.59"S	26°51'9.46"E	IIIA	Buffer

	plants have scratched the surface of the inscription. The dates indicated are 1865-1928. Northwest-Southeast orientation. Four of the graves have been fenced off, 12 are unfenced. Directly in development footprint.					
113	Stonewalled structure. A piece of metal recorded nearby, no other material recorded	NA	26°43'57.70"S	26°51'6.48"E	IIIC	Buffer
114	Stonewalled structure	NA	26°43'57.95"S	26°51'6.85"E	IIIC	Buffer
115	Possible historic midden nearby, however, it is covered by dense vegetation. Metal.	1/m^2	26°43'56.62"S	26°51'7.95"E	IIIC	Buffer
116	LSA Dolerite flake near rocky outcrop and within development footprint	1/20m^2	26°43'40.12"S	26°51'20.36"E	NCW	Buffer
117	24 fieldstone cairns, cement and slate headstones, and bricks. Northwest – Southeast Only one headstone had a visible inscription: In loving memory of our son, brother & uncle KELOPA SURGEON MABE B: 1964-04-01 D1989-12-23. Three have been fenced off, and additional one has also been fenced off. Graves are approximately 80m from development area, however, they are situated on the farm Rietfontein, by one of the possible access road.	NA				NA

7.5.2 Impact tables summarising the significance of impacts on heritage related to the PV facility and associated infrastructure during construction and operation (with and without mitigation)

Nature: The construction phase of the project will require excavation, which may impact on archaeological heritage resources if present.		
PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Localised within the site boundary (1)	Localised within the site boundary (1)
Duration	Where an impact to a resource occurs, the impact will be permanent. (5)	Where an impact to a resource occurs, the impact will be permanent. (5)
Magnitude	No archaeological heritage resources of significance were identified within	No archaeological heritage resources of significance were identified within

	the development footprint, however some were identified within the broader development are (3)	the development footprint, however some were identified within the broader development area (1)
Probability	It is possible that significant heritage resources will be impacted if the layout provided is followed (3)	It is unlikely that significant heritage resources will be impacted if the layout provided is followed (1)
Significance	**Low (24)**	**Low (7)**
Status (positive or negative)	Neutral	Neutral
Reversibility	Any impacts to heritage resources that do occur are irreversible	Any impacts to heritage resources that do occur are irreversible
Irreplaceable loss of resources?	Likely	unlikely
Can impacts be mitigated?	Yes	

Mitigation:

- A no development buffer of 100m is implemented around the burial sites identified within the broader development area
- Proposed widening of the road takes place to the south, away from the identified burial at Site 117
- The identified sensitive archaeology areas are not impacted by the development of any new infrastructure.
- Ongoing community access to these burials, as well as their conservation into the future, must be ensured. This can be managed through the development of a Heritage Management Plan for the burials to be implemented for the duration of the project.
- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.

Residual Impacts:
Should any significant resources be impacted (however unlikely) residual impacts may occur, including a negative impact due to the loss of potentially scientific cultural resources.

Nature:
The construction phase of the project will require excavation, which may impact on palaeontological heritage resources if present

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Limited to the development footprint (1)	Limited to the development footprint (1)
Duration	Where manifest, the impact will be permanent (5)	Where manifest, the impact will be permanent. (5)
Magnitude	The area proposed for development is underlain by sediments of very high palaeontological sensitivity although no specific areas for exclusion have been identified within the development footprint (8)	The area proposed for development is underlain by sediments of very high palaeontological sensitivity although no specific areas for exclusion have been identified within the development footprint (8)
Probability	It is unlikely that significant fossils will be impacted (1)	It is unlikely that significant fossils will be impacted (1)
Significance	**Low (14)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Any impacts to heritage resources that do occur are irreversible	Any impacts to heritage resources that do occur are irreversible
Irreplaceable loss of resources?	Unlikely	Not Likely

Can impacts be mitigated?	Yes
Mitigation: » The Chance Fossil Finds Procedure attached to the HIA in **Appendix G** must be implemented for the duration of construction activities	
Residual Impacts: Should any significant resources be impacted (however unlikely) residual impacts may occur, including a negative impact due to the loss of potentially scientific cultural resources.	

7.5.3 Conclusion

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of the Highveld Solar PV Facility will be low. From the outcomes of the studies undertaken, it is concluded that the solar PV facility can be developed. Although no archaeological or heritage resources identified fall within the development footprint; however, some archaeological material, including artefacts and graves can be buried underground and as such, may not have been identified during the initial survey and site visits. In the case where the proposed development activities bring these materials to the surface, work must cease and SAHRA must be contacted immediately to determine a way forward.

7.6. Assessment of Visual Impacts

Negative impacts on visual receptors will occur during the undertaking of construction activities and the operation of the Highveld Solar PV Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix H**).

7.6.1 Results of the Visual Impact Assessment

The construction and operation of the Highveld Solar PV Facility and its associated infrastructure may have a visual impact on the area surrounding the project site, especially within (but not restricted to) a 0 -3km radius of the facility. The visual impact will differ amongst places, depending on the distance from the facility.

» 0 to 1 km will have the majority of exposed areas in this zone fall within the Highveld property itself, generally devoid of observers or potential sensitive visual receptors.

The following sensitive visual receptors may experience visual impacts of **very high** magnitude:
- Residents at an unknown homestead located to the immediate south (site 1)
- Resident at Rietfontein East homesteads located to the west of the proposed facility (site 2)

» 1 to 3km will also have a high majority of exposed areas in this zone falls within open grasslands or dryland agriculture to the west which is generally devoid of observers or potential sensitive visual receptors. The following sensitive visual receptors may experience visual impacts of **high** magnitude:
- Resident at Rietfontein East homesteads located to the west of the proposed facility (site 3)
- Observers travelling along the secondary road in the west (site 4)

Most of the visual exposure within 3 to 6km falls within grassland or vacant agricultural land to the north and west of the site. The following sensitive visual receptors may experience visual impacts of **moderate** magnitude:
- Resident at Rietfontein west homesteads located to the west of the proposed facility, this includes the identified Ostrich Farm (site 5)

- Eleasar homesteads (site 6)
- Khora Lion Park - Rietfontein south-west homesteads (site 7)
- Pax-in-Transitbus, Skaars van als and Stilfontein group of homesteads (site 8)
- Matlwang (site 9)
- Club Louico

» Visibility beyond 6km from the proposed development is expected to have a negligible or very low visual impact.

Overall, the significance of the visual impacts is expected to range from moderate to low as a result of the generally industrial and developed character of the landscape. There are a very limited number of potential sensitive visual receptors within a 3km radius of the proposed structures, although the possibility does exist for visitors to the region to venture into closer proximity to the PV facility structures. These observers may consider visual exposure to this type of infrastructure to be intrusive (refer to **Figure 7.8**).

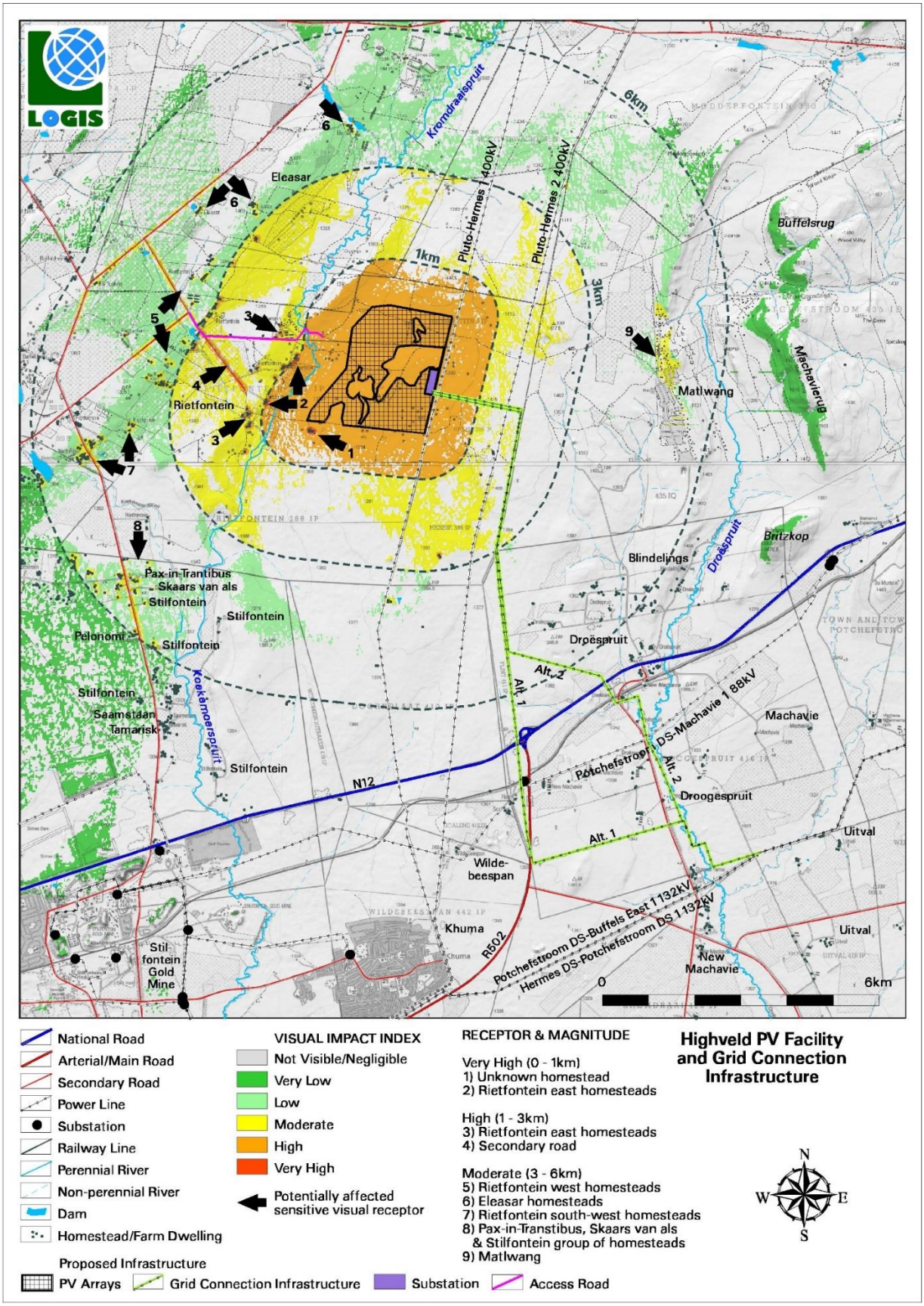


Figure 7.8: Visual impact index and potentially affected sensitive visual receptors.

7.6.2 Impact table summarising the significance of visual impacts during construction and operation (with and without mitigation)

During the construction phase, there may be a noticeable increase in heavy vehicles utilising the roads to the project site that may cause, at the very least, a visual nuisance to other road users and landowners in the area. Construction activities may potentially result in a moderate, temporary visual impact, that may be mitigated to low.

During the operation phase there will be a moderate visual impact on observers (residents and road users) located between a 1-3km radius of the PV facility structures. Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact.

Visual impacts during the operation phase will also include lighting impacts relating to glint and glare. It is possible that the Highveld Solar PV Facility may contribute to the effect of glint and glare within the environment which is currently undeveloped.

The tables below are applicable to all alternatives under consideration for the project infrastructure.

Construction Phase Impacts

Nature: Visual impact of construction activities on residents in close proximity to the proposed PV facility.		
PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Very Short Distance (4)	Very Short Distance (4)
Duration	Short term (2)	Short term (2)
Magnitude	Very high (10)	Moderate (4)
Probability	High Probable (4)	High Probable (4)
Significance	**High (64)**	**Moderate (56)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

Planning:

- Retain and maintain natural vegetation (if present) immediately adjacent to the development footprint.

Construction:

- Ensure that vegetation cover adjacent to the development footprint (if present) is not unnecessarily removed during the construction phase, where possible.
- Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
- Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts.
- Rehabilitate all disturbed areas (if present/if required) immediately after the completion of construction works.

Residual Impacts: None, provided rehabilitation works are carried out as specified.

Operation Impacts

Nature: Visual impact on residents of Rietfontein East homesteads within a 1km radius of the PV facility structures.		
PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Very short distance (4)	Very short distance (4)
Duration	Long term (4)	Long term (4)
Magnitude	Very High (10)	High (8)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (72)**	**Moderate (48)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

Planning:

- Retain and maintain natural vegetation in all areas outside of the development footprint.
- Consult adjacent landowners (if present) in order to inform them of the development and to identify any (valid) visual impact concerns.
- Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover.

Operations:

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

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the
- facility.
- Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual Impacts:

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

Nature: Visual impact on sensitive receptors within a 1 – 3km radius of the PV facility structures		
PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Short distance (3)	Short distance (3)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (45)**	**Low (26)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	yes, however best practice measures are recommended.	

Mitigation:

General mitigation/management:

Planning:

- Retain and maintain natural vegetation (if present) immediately adjacent to the development footprint.

Operations:

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

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual Impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

Nature: Visual impact on sensitive receptors within a 3 – 6km radius of the PV facility structures

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Medium to long distance (2)	Medium to long distance (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (36)**	**Low (20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	yes, however best practice measures are recommended.	

Mitigation:

General mitigation/management:

Planning:

- Retain and maintain natural vegetation (if present) immediately adjacent to the development footprint.

Operations:

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

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual Impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

Nature: Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed PV facility.

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Very short distance (4)	Very short distance (4)
Duration	Long term (4)	Long term (4)

Magnitude	Very High (10)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (54)**	**Low (28)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

General mitigation/management:

Planning & Operations:

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

Residual Impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

Nature: The visual impact of solar glint and glare as a visual distraction and possible road travel hazard

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Very Short distance (4)	Very Short distance (4)
Duration	Long term (4)	Long term (4)
Magnitude	None (0)	None (0)
Probability	Very improbable (1)	Very Improbable (1)
Significance	**Negligible (8)**	**Negligible (8)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	Very short distance (4)
Can impacts be mitigated?	No, however best practice measures are recommended.	

Mitigation:

Planning & operation:

- Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint.
- Use anti-reflective panels and dull polishing on structures, where possible and industry standard.
- Adjust tilt angles of the panels if glint and glare issues become evident, where possible.
- If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.

Residual Impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

Nature: The visual impact of solar glint and glare on residents of homesteads in closer proximity to the PV facility

PV Layout (and associated infrastructure)	Without mitigation	With mitigation
Extent	Very short distance (4)	Very short distance (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (24)**	**Low (24)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

Planning & operation:

» Use anti-reflective panels and dull polishing on structures, where possible and industry standard.
» Adjust tilt angles of the panels if glint and glare issues become evident, where possible.
» If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.

Residual Impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

Nature: Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.

PV Layout (and associated infrastructure)	Without mitigation	With mitigation
Extent	Very Short distance (4)	Very short distance (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (42)**	**Low (24)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, however best practice measures are recommended.	

Mitigation:

General mitigation/management:

Planning:

» Retain and maintain natural vegetation (if present) immediately adjacent to the development footprint.

Operations:

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

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use.
» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual Impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

Nature: Visual impact on sensitive receptors within a 3 – 6km radius of the PV facility structures		
PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Medium to long distance (2)	Medium to long distance (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, neutral or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, however best practice measures are recommended.	
Mitigation: **General mitigation/management:** Planning: » Retain and maintain natural vegetation (if present) immediately adjacent to the development footprint or servitude where possible. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use. » Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual Impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

7.6.3 Conclusion

The construction and operation of the Highveld PV Solar Facility and its associated infrastructure may have a visual impact on the study area, especially within a 1km radius (and potentially up to a radius of 3km) of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility. The following is a summary of impacts remaining, assuming mitigation as recommended, is exercised:

» During construction, there may be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and landowners in the area. Construction activities may potentially result in a high, temporary visual impact, that may be mitigated to moderate.
» The PV facility is expected to have a high visual impact pre-mitigation and a moderate visual impact post mitigation on residents of the Rietfontein East homesteads and one unknown homestead., within a 1km radius of the proposed PV facility.
» The operational PV facility could have a moderate visual impact on sensitive receptors within a 1 – 3km radius of the PV facility structures. This impact may be mitigated to low.

- The operational PV facility could have a moderate visual impact on sensitive receptors within a 3 – 6km radius of the PV facility structures. This impact may be mitigated to low.
- The anticipated impact of lighting at the PV facility is likely to be of moderate significance, and may be mitigated to low.
- The potential visual impact related to solar glint and glare as a road travel hazard is expected to be of negligible significance before and after mitigation.
- The only residences within a 1km radius of the proposed PV facility are the residents of the Rietfontein East homesteads to the west and one unknown homestead to the south. Since these residents are located to west and south of the site and it is assumed that the PV panels will be oriented to the north for maximum sun exposure it is unlikely that these receptors will be impacted upon by solar glint and glare. Therefore, the potential visual impact related to solar glint and glare on static ground-based receptors (residents of homesteads) is therefore expected to be of low significance, both before and after mitigation.
- The anticipated visual impact resulting from the construction of on-site ancillary infrastructure is likely to be of moderate significance pre-mitigation and low post mitigation.
- The anticipated visual impact of the proposed PV facility on the regional visual quality (i.e. beyond 6km of the proposed infrastructure), and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of low significance.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **moderate** to **low** significance. Anticipated visual impacts on sensitive visual receptors (if and where present) in close proximity to the proposed facility are not considered to be fatal flaws for the proposed PV facility**.**

7.7. Assessment of Social Impacts

Potential social impacts and the relative significance of the impacts associated with the development of the Highveld Solar PV Facility are summarised below (refer to **Appendix I**).

7.7.1 Results of the Social Impact Assessment

The development of the Highveld Solar Facility and its associated infrastructure may have an impact on some vulnerable communities within the project area. Traditionally, the majority of social impacts are associated with the construction phase of a PV solar development. Many of the social consequences are unavoidable and will occur to some extent, but they can be managed through careful planning and implementation of appropriate mitigation measures. Several potential positive and negative social impacts for the project have been identified; however, an assessment of the potential social impacts revealed that there are no perceived negative impacts that are significant enough to be classified as "fatal flaws."

Mitigation measures should be implemented to limit the negative impacts and enhance the positive impacts associated with the project.

The facility and associated infrastructure are unlikely to result in permanent damaging social impacts. From a social perspective it is concluded that the project could be developed subject to the implementation of recommended mitigation measures and management actions identified for the project.

7.7.2 Impact tables summarising the significance of social impacts during construction and operation (with and without mitigation measures)

Construction and Operation Phase Impacts

Most of the social impacts associated with the project are expected to occur during the development's construction phase and are typical of the types of social impacts typically associated with construction activities. These effects will be temporary and short-term (12 months), but they may have long-term consequences on the surrounding social environment if not properly planned and managed. As a result, the detailed design phase must be carried out in such a way that it does not result in long-term social impacts due to improper placement of project components or associated infrastructure, or mismanagement of construction phase activities.

During operation, it is expected that maintenance and security staff will periodically visit the facility. Based on experience with similar projects, the number of full-time employees is generally low and consequently, the associated trips are negligible. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network. The traffic generated during the construction and decommissioning phases will be temporary and impacts are considered to be negative and of low significance before and after mitigation. The traffic and the impact on the surrounding road network is of low significance before and after mitigation.

As the highest total additional hourly vehicular trip generation (including pass-by and diverted trips) will not exceed 50 trips per hour, a traffic assessment is not required. However, potential impacts on the traffic components of the project area and relative significance of the impacts associated with the proposed development have been considered as a social impact.

The positive and negative social impacts identified and assessed for the construction phase includes:

Potential positive impacts
- » Creation of employment and business opportunities
- » Contribution to the local economy
- » Skills Development
- » Growth of the local communities

Potential negative impacts
- » Impacts associated with the presence of construction workers on site
- » Threat to safety and security with the presence of construction workers on site
- » Fire risks
- » Impact of heavy vehicles, including damage to roads, safety, noise and dust
- » Pressure to local services

***Nature**: Employment opportunities and skills development*

Impact description: The area is primarily dominated by agricultural and mining activities with small scale industrial and commercial activities taking place within the surrounding communities.

The directly affected communities are unskilled subsistence farmers which are migrating for more permanent work or taking work within these primary sectors. Areas such as Stilfontein, Potchefstroom and Klerksdorp may attract more semi-skilled

workers, a need for employment and direct skill-based work is required aimed at providing either long term employment or generating new skills within the existing work force.

A PV Facility of this size will create an average of 300 employment opportunities comprising a mixture of skilled, semi-skilled and unskilled positions during the operational phase.

It is vital that all employment be sourced locally where possible, and where not possible (highly skilled provisions) the opportunity for skills transfer is made available.

It must also be taken into consideration that the PV facility be utilized as an opportunity to create awareness on the importance of renewable energy for the local community by utilizing platforms such as schools.

Several indirect employment opportunities will also be created. Indirect employment opportunities will predominantly be created in the service industry, through the opportunity for the provision of secondary services to the construction team. Services may include, but are not limited to, accommodation, catering, and laundry services.

	Without enhancement	**With enhancement**
Extent	Local – Regional (5)	Regional (4)
Duration	Short-term (1)	Short term (1)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Low (30)**	**Medium (55)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

To enhance the local employment, skills development and business opportunities associated with the construction phase, the following measures should be implemented:

- The developers be committed to involving and benefiting the communities surrounding the development, contributing to their development and growth
- It is recommended to conduct structured and proactive engagement sessions within the municipal district, to expose local small, micro and medium enterprises which will benefit from the proposed development
- Training and skills development programmes should be initiated prior to the commencement of the construction phase
- Utilize platforms such as schools to create awareness regarding the importance of renewable energy
- The communities which are most in need of employment on a local level should be considered for employment before outsourcing

Residual Impacts:

- Initiatives to eliminate unfair discrimination in employment
- Recruit and select suitably qualified individuals from the designated groups
- Employees from designated groups who have been identified in the talent pool should be advanced and accelerated through targeted training and development programs
- Assist individuals in obtaining an initial vocational education and pre-qualification, as well as additional education and training that refreshes knowledge, skills, work and life competencies that are critical for overall development
- Provide portable skills training to employees who express an interest in obtaining such training, with a special emphasis on employees who have been incapacitated or retrenched, in order for them to remain economically active, employable, or self-sustaining in their communities
- Growth of talent is facilitated, thereby providing opportunities for all employees to contribute to their full potential

***Nature**: Contributions to the local economy*

Impact description: The developer should be committed to the long-term socioeconomic development and well-being of the communities in which they operate by contributing to community development that will last long after the PV development has been decommissioned.

It is therefore important that the developer use and source from local suppliers as much as possible to stimulate the local economy, this includes but is not limited to things such as the purchasing of construction materials, provision of services, transportation, and acquisition of other goods, from the SIA overview it was noted that some light commercial and industrial activities exist within the direct surrounding area which could be utilized for these purposes.

	Without enhancement	**With enhancement**
Extent	Local – Regional (4)	Local – Regional (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**Medium (60)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

- Preference is given to suppliers that are local to the operation where the service will be consumed
- Establishing liaison and communication structures with the district and local government structures
- Liaises with the local governmental structures and municipal authorities in the labour- sending communities to ensure that group development initiatives are integrated into the economic and development plans of those areas
- The continuous review of the economic development of the project during the implementation process will ensure that the project does not become static but is revised in terms of changing needs and also to ensure sustainability
- It is recommended that a local procurement policy be adopted by the developer to maximise the benefit to the local economy, where feasible
- Create job opportunities, boost local economies by supporting business activities, and contribute to government tax revenues through the development of the Solar Facility
- Prior to the start of the construction contractor procurement, the Developer of the Solar Facility should create a database of local companies, specifically Historically Disadvantaged (HD) companies, that qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies, etc.). These businesses should be informed about the tender process and invited to bid on project-related work, if applicable
- Engage with local authorities and business organisations to investigate the feasibility of obtaining construction materials, goods, and products from local suppliers, where possible

Residual Impacts:

- Improved local service sector, growth in local business.
- Community development and stimulation of the local economy
- Growth in the local markets

***Nature**: Safety and security*

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

The development of the solar PV facility will result in an increase of foot traffic in an area which is relativity quite, as experienced during the site visit, a lot of the neighbouring properties may not be aware of the risks associated with the influx of individuals and may be subjected to safety and security risks.

Additionally, although the intention is to employ locally, some job seekers may migrate from the surrounding communities seeking employment opportunities which may place the local communities, subsistence farms or

residential settlements at risk and temporarily increase the level of crime, in the area, cause social disruption and put pressure on basic services.		
	Without enhancement	**With enhancement**
Extent	Local – Regional (3)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

» Stopping significant unwanted events by focusing on critical control management
» Safety awareness and training as well as positive behaviour reinforcement
» Improving system monitoring and analysis to improve risk management
» Employment of a local security company
» Making the surrounding landowners aware of the dangers associated with the influx of workers during the construction period
» Identifying abandoned buildings and utilizing them or ensuring they can not be used for malicious activities
» Ensuring that access can not be gained to surrounding properties
» Encourage employees to stop working when a workplace is considered unsafe and/or to prevent unsafe actions
» Education, Training and Development Services must be implemented
» Access in and out of the construction area should be strictly controlled by a security company
» The contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff
» Have clear rules and regulations for access to the proposed site to control loitering
» A comprehensive employee induction programme would cover land access protocols, fire management and road safety must be prepared
» A Community Liaison Officer should be appointed
» A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process

Residual Impacts:

» Theft of livestock, equipment and stock
» Trespassing onto private property

***Nature**: Disruption of daily living and movement patterns*

Impact description: The transportation of components of the solar PV facility via the access roads, which will result in increase traffic conditions, over utilizations of the roads, road safety concerns, congestion and disruption to local commuters

As indicated previously a lot of the social aspects identified sit along the access roads and therefore increased traffic may slightly inconvenience these businesses. It must be noted that the majority of the road is gravel and therefore the correct safety may not be in place (such as road signs and speed limits) to ensure the general public's safety, this must be given attention to when developing the preferred access routes.

	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Improbable (2)

Significance	**Medium (40)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

- Implement standard dust control measures on gravel roads, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation
- Stagger component delivery to site
- Reduce the construction period
- Make use of mobile batch plants and quarries in close proximity to the site
- All vehicles must be road worthy, and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues
- Heavy vehicles should be inspected regularly to ensure their road worthiness
- Provision of adequate and strategically placed traffic warning signs, which must be maintained throughout the construction phase, as well as control measures along the gravel roads to warn road users of construction activities taking place throughout the construction phase. Warning signs must be always visible, especially at night.
- Implement penalties for reckless driving to enforce compliance to traffic rules
- Avoid heavy vehicle activity during "peak" hours (when children are taken to school, or people are driving to work)
- Ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed due to construction activities
- The Contractor must ensure that damage/wear and tear caused by construction related traffic to the access roads is repaired before the completion of the construction phase
- Method of communication must be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process

Residual Impacts:
None anticipated.

***Nature**: Increased pressure on local services/resources*

Impact description: Added pressure on economic and social infrastructure during construction as a result of in-migration of people.

	Without enhancement	**With enhancement**
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	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

- It is necessary to appoint a Community Liaison Officer. A method of communication should be implemented, with procedures for filing complaints outlined, so that the local community can express any complaints or grievances about the construction process
- Current procurement channels set up by the mine should be utilized to reduce any complications which may arise from the development

Residual Impacts:
Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure.

***Nature**: Increased pressure on local services/resources*

Impact description: Risk from accidental or intentional fire being set to the surrounding area which then spreads to the adjacent properties

	Without enhancement	**With enhancement**
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	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:
- Ensure training is given to employees on the risks of fires
- Ensure that firefighting equipment is present and working
- No fires are to be made on site for any reason
- No hunting or cooking of any animals or plants in or around the development footprint

Residual Impacts:
None identified

***Nature**: Nuisance impacts (noise & dust)*

Impact description: Construction activities will result in the generation of noise and dust, the area is situated in a relatively agricultural area which is not frequently subjected to dust and noise disturbances therefore all possible measures must be made to mitigate these impacts

	Without enhancement	**With enhancement**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	High (8)	Moderate (6)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (44)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:
- During construction, care should be taken to ensure that noise from construction vehicles and plant equipment does not intrude on the residential areas nearby. Plant equipment such as generators, compressors, concrete mixers, and vehicles should be kept in good working order and, where possible, equipped with effective exhaust mufflers
- The movement of construction vehicles on the site should be confined to agreed access road/s
- Heavy vehicle movement during the construction phase should be timed (where possible) to avoid times of the week, such as weekends, when the volume of traffic on the access roads may be higher

» Dust suppression measures should be implemented, such as wetting on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
Residual Impacts: Noise and Dust generation will remain an issue irrespective of the Solar PV development

Decommissioning Phase Impacts

The social impact of decommissioning the Highveld Solar PV project is likely to be significant. While the relatively small number of people employed during the operational phase, the associated funding available for community projects and benefits are significant and expected to end with decommissioning of the plant. With mitigation however, the impacts are assessed to be low.

The proponent should inform and discuss the stakeholder and wider community involved and affected in the governance, management, and implementation of community funds about the decommissioning of the energy project. This communication needs to be timed well in advance of the decommissioning, allowing all relevant parties to prepare. Further consideration is required to develop strategies for rehabilitation of the land.

7.7.3 Conclusion

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 it cannot be successfully mitigated. Positive impacts could be enhanced by implementing appropriate enhancement measures and through careful planning. Based on the social assessment, the following general conclusions and findings can be made:

- The potential negative social impacts associated with the construction phase are typical of construction related projects and not just focused on the construction of PV facilities (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 development also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society.

7.8. Risks Associated with Energy Storage

A Battery Energy Storage Systems (BESS) comprising a solid-state battery system will allow for energy storage for an extended period. The general purpose and utilisation of the BESS will be to save and store excess

electrical output from the facility as it is generated, allowing for a timed release to the national grid when the capacity is required. The BESS will be contained within insulated containers and will connect to the on-site facility substation via underground cabling. **Figure 7.9** provides a general illustration of a BESS.

Figure 7.9: Example of battery storage units integrated as part of wind farm (Source: http://ultrabattery.com/applications/stationary-energy-storage/)

The risks associated with battery technologies are generally well understood and researched. The primary risks relate to fire hazards and the potential for a condition known as 'thermal runaway'. Thermal runaway occurs in situations where an increase in temperature changes the conditions in a way that causes a further increase in temperature, often leading to a destructive result. The risks detailed in the table below considers only the risks associated with on-site use of battery energy storage systems.

Possible risks associated with the construction and operation of the BESS from a technical perspective within the development footprint of the Highveld Solar PV Facility are limited to health and safety aspects during the project life cycle of the BESS. The risks identified for the construction and operation of the BESS are detailed below. Mitigation measures have been included within the project EMPr (refer to **Appendix J**).

Table 7.2: Risks associated with Battery Energy Storage Systems

Nature of Risk	Likelihood	Impact	Mitigation / Management of Risk
1. Mechanical breakdown/ Exposure to high temperatures » Incidents where the batteries are broken or exposed to temperature above room temperature could lead to overheating as well as fires which can affect infrastructure components of the BESS. » Leakages of substances contained within the battery cells (should they not be assembled off-site).	Low	» Fires, electrocutions and spillage of toxic substances into the surrounding environment. » Spillage of hazardous substances into the surrounding environment. » Soil contamination – leachate from spillages which could lead to an impact of the productivity of soil forms in affected areas. » Water pollution – spillages into surrounding watercourses as well as groundwater. » Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as a primary source of water.	Operators are trained and competent to operate the BESS. Training should include the discussion of the following: * Potential impact of electrolyte spills on groundwater; * Suitable disposal of waste and effluent; * Key measures in the EMPr relevant to worker's activities; * How incidents and suggestions for improvement can be reported. » Training records should be kept on file and be made available during audits. » Battery supplier user manuals safety specifications and Material Safety Data Sheets (MSDS) are filed on site at all times. » Compile method statements for approval by the Technical/SHEQ Manager for the operation and management and replacement of the battery units / electrolyte for the duration of the project life cycle. Method statements should be kept on site at all times. » Provide signage on site specifying the types of batteries in use and the risk of exposure to hazardous material and electric shock. Signage should also specify how electrical and chemical fires should be dealt with by first responders, and the potential risks to first responders (e.g. the inhalation of toxic fumes, etc.). » Firefighting equipment should readily be available at the BESS area and within the site. » Maintain strict access control to the BESS area. » Ensure all maintenance contractors / staff are familiar with the supplier's specifications. » Undertake daily risk assessment prior to the commencement of daily tasks at the BESS. This should consider any aspects which could result in fire or spillage, and appropriate actions should be taken to prevent these. » Standard Operating Procedures (SOPs) should be made available by the Supplier to ensure that the batteries are handled in accordance with required best practices.

Nature of Risk	Likelihood	Impact	Mitigation / Management of Risk
			» Spill kits must be made available to address any incidents associated with the flow of chemicals from the batteries into the surrounding environment. » The assembly of the batteries on-site should be avoided as far as possible. Activities on-site for the BESS should only be limited to the placement of the container wherein the batteries are placed. » Undertake periodic inspections on the BESS to ensure issues are identified timeously and addressed with the supplier where relevant. » The applicant in consultation with the supplier must compile and implement a Leak and Detection Monitoring Programme during the project life cycle of the BESS. » Batteries must be strictly maintained by the supplier or suitably qualified persons for the duration of the project life cycle. No unauthorised personnel should be allowed to maintain the BESS.
2. <u>Generation of hazardous waste</u> » The incorrect disposal of the batteries and the associated components could have an adverse impact on the environment.	Medium	» Spillage of hazardous substances into the surrounding environment. » Soil contamination – leachate from the disposed batteries into the soil, which could lead to an impact of the productivity of soil forms in affected areas. » Water pollution – leachate from the disposed batteries spilling into surrounding watercourses as well as groundwater. » Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as a primary source of water.	» Damaged and used batteries must be removed from site by the supplier or any other suitably qualified professional for recycling or appropriate disposal. » The applicant should obtain a cradle to grave battery management plan from the supplier during the planning and design phase of the system. The plan must be kept on site and adhered to.

7.9. Assessment of the 'Do Nothing' Alternative

The 'do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the Highveld Solar 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 PV facility.

a) Land use and agriculture

Cattle farming is a viable long-term land use of the site as long as the field quality is maintained by never exceeding the grazing capacity. Small stock (goats and sheep) as well as game farming may also be viable land use options for the project site

The implementation of the 'do-nothing' alternative would leave the land-use restricted to the current agricultural activities, losing out on the opportunity to generate renewable energy from solar energy as additive thereto (i.e. current agricultural activities would continue). Therefore, from a land-use perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of a viable and compatible land use for the project site which allows the current land-use activities to continue.

The 'do nothing' alternative would result in a lost opportunity for the landowners (in terms of implementing a compatible land use option, while still retaining the current land use) and the country (in terms of renewable energy). From this perspective the no-go alternative is not preferred when considering land use and agricultural potential of the project site.

b) Socio-economic impact

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

Potential negative social impacts associated with the construction and operation of the project include the following:

- Potential influx of job seekers and an associated change in population and increase in pressure on basic services.
- Potential safety and security impacts.
- Potential impacts on daily living and movement patterns.
- Potential nuisance impacts (noise and dust).
- Potential visual impact and impact on the sense of place.

Potential positive social impacts associated with the construction and operation of the project include the following:

- Potential direct and indirect employment opportunities.
- Skills development and training
- Development of Renewable energy facilities
- Potential economic multiplier effect.

The impacts of pursuing the "no-go" alternative can therefore be summarised as follows:

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

impact is considered to be negative.
- The opportunity to strengthen the grid connection within the municipal area would be lost which will have a negative impact on economic growth and development and therefore result in negative social impacts.

The No-Development option would mean that the electricity generated through renewable sources, in this case solar energy, is not generated and fed into the national electricity grid. In the given and described policy context, this would represent a negative social and environmental cost.

In addition, the employment opportunities associated with the construction and operational phase, as well as the benefits associated with the additional funding for socio-economic and enterprise development measures and the established local ownership entity representing beneficiary communities would be forgone.

c) Conclusion

As the project site experiences ample solar resource and optimal grid connection opportunities are available, not developing the Highveld Solar PV Facility would see such an opportunity being lost. As current land use activities can continue on the project site once the project is operational, the loss of the land to this project during the operation phase is not considered significant. Therefore, from a regional perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of benefits for the regional area.

From the specialist studies undertaken, no environmental fatal flaws were identified to be associated with the Highveld Solar PV Facility. All impacts associated with the project can be mitigated to acceptable levels. If the PV facility is not developed the following positive impacts will not be realised:

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

As detailed above, the 'do-nothing' alternative will result in a number of lost opportunities. The 'do nothing' alternative is therefore not preferred and not proposed to be implemented for the development of the Highveld Solar PV Facility.

CHAPTER 8: ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

As identified and assessed in Chapter 7, a PV facility and the associated infrastructure may have effects (positive and negative) on the natural and social environments and on the people living in a project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with the Highveld Solar PV Facility largely in isolation (from other similar developments).

The DMRE, under the 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 11 years, in which developers submit planned renewable energy projects for evaluation and selection. The bid selection process considers a number of qualification and evaluation criteria. The proposed tariff and socio-economic development contributions by the project bidder are the main basis for selection after the qualification criteria have been met.

As a result of the REIPPP Programme, there has been a substantial increase in interest in PV facility developments in South Africa (largely in the Northern Cape and North West Provinces), with a number of PV facilities selected as Preferred Bidder projects. It is, therefore, important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts[44] are considered and avoided where possible.

This chapter assesses the potential for the impacts associated with the project to become more significant when considered in combination with the other known or proposed PV facility projects within the area.

8.1 Approach taken to Assess Cumulative Impacts

The cumulative impacts that have the potential to be compounded through the development of the 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 Highveld Solar PV Facility within the project site being considered for the development:

- Unacceptable loss of threatened or protected vegetation types, habitat or species through clearing, resulting in an impact on the conservation status of such flora, fauna or ecological functioning;
- Unacceptable risk to avifauna through habitat loss, displacement, collision and interaction with power infrastructure;
- Unacceptable loss of high agricultural potential areas presenting a risk to food security and increased soil erosion;
- Unacceptable loss of heritage resources;
- Complete or whole-scale change in sense of place and character of an area and unacceptable visual intrusion;
- Unacceptable impact to socio-economic factors and components; and
- Unacceptable risk and degradation due to traffic related impacts.

[44] Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (Government Notice R326) as 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 existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

It is important to explore the potential for cumulative impacts as this will lead to a better understanding of these impacts and the potential for mitigation that may be required. 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 PV facility developments throughout South Africa, while the significance of the cumulative impact on visual amenity may only be influenced by PV facility developments that are in closer proximity to each other. For practical purposes a sub-regional scale of 30km has been selected for this cumulative impact evaluation.

Figure 8.1 indicates the location of the Highveld Solar PV Facility in relation to all other known and viable PV facilities (i.e. projects with a valid Environmental Authorisation) located within a radius of 30km from the project site. These projects were identified using the Department of Forestry, Fisheries and the Environment Renewable Energy Database and current knowledge of projects being proposed in the area. In the case of the Highveld Solar PV Facility, there are six (6) authorised PV facilities located within a 30km radius of the project site, as well as one (1) new PV solar energy facility proposed for development (refer to **Figure 8.1** and **Table 8.1**). The potential for cumulative impacts is summarised in the sections that follow and has been considered within the specialist studies (refer to **Appendices D – I**).

Table 8.1: PV facilities located within the broader area (within a 30km radius) of the Highveld Solar PV Facility

Project Name	DEA Reference Number(s)	Approximate distance from the Highveld Solar PV Facility	Project Status
Farm Town and Townlands 435 Solar PV (20MW)	12/12/20/2629	~ 17.7 km east	Environmental Authorisation issued
Buffels Solar PV (75MW)	14/12/16/3/3/2/777	~ 15.6 km south-west	Environmental Authorisation issued
Siyanda Solar PV (150MW)	14/12/16/3/3/2/1/2369	~ 28.6 km south-west	Environmental Authorisation issued
Paleso Solar PV (150MW)	14/12/16/3/3/1/2365	~ 30.5 km south-west	Environmental Authorisation issued
VRS 1, 2, 3 Solar PV (75MW)	12/12/20/2513/1-4	~ 22.9 km south-west	Environmental Authorisation issued
Thakadu Solar PV (150MW)	14/12/16/3/3/1/2476	~ 24.3 km south-west	Environmental Authorisation issued
Nyarhi Solar PV (150MW)	-	~ 23.6 km south-west	Environmental Authorisation application in process

It should be noted that not all the PV facilities presently under consideration by various solar energy developers will be built for operation. Not all proposed developments will be granted the relevant permits by the relevant authorities (DFFE, DMRE, NERSA and Eskom) due to the following reasons:

- There may be limitations to the capacity of the existing or future Eskom grid;
- Not all applications will receive a positive environmental authorisation;
- There are stringent requirements to be met by applicants in terms of the REIPPP Programme and a highly competitive process that only selects the most competitive projects;

- Not all proposed PV facilities will be able to reduce the associated negative impacts to acceptable levels or be able to mitigate the impacts to acceptable levels (fatally flawed);
- Not all proposed facilities will eventually be granted a generation license by NERSA and sign a Power Purchase Agreement with Eskom; and
- Not all developers will be successful in securing financial support to advance their projects further.

As there is therefore a level of uncertainty as to whether all the above-mentioned PV facilities will be implemented, this results in it being difficult to quantitatively assess the potential cumulative impacts. The cumulative impacts of other known PV facilities in the broader area and the Highveld Solar PV Facility are therefore qualitatively assessed in this Chapter. The following potential impacts are considered:

- Cumulative Impacts on Terrestrial Biodiversity and Wetlands
- Cumulative Impacts on Avifauna
- Cumulative Impacts on Land use, soil and agricultural potential
- Cumulative Impacts on Heritage Resources
- Cumulative Visual Impacts
- Cumulative Socio-economic Impacts

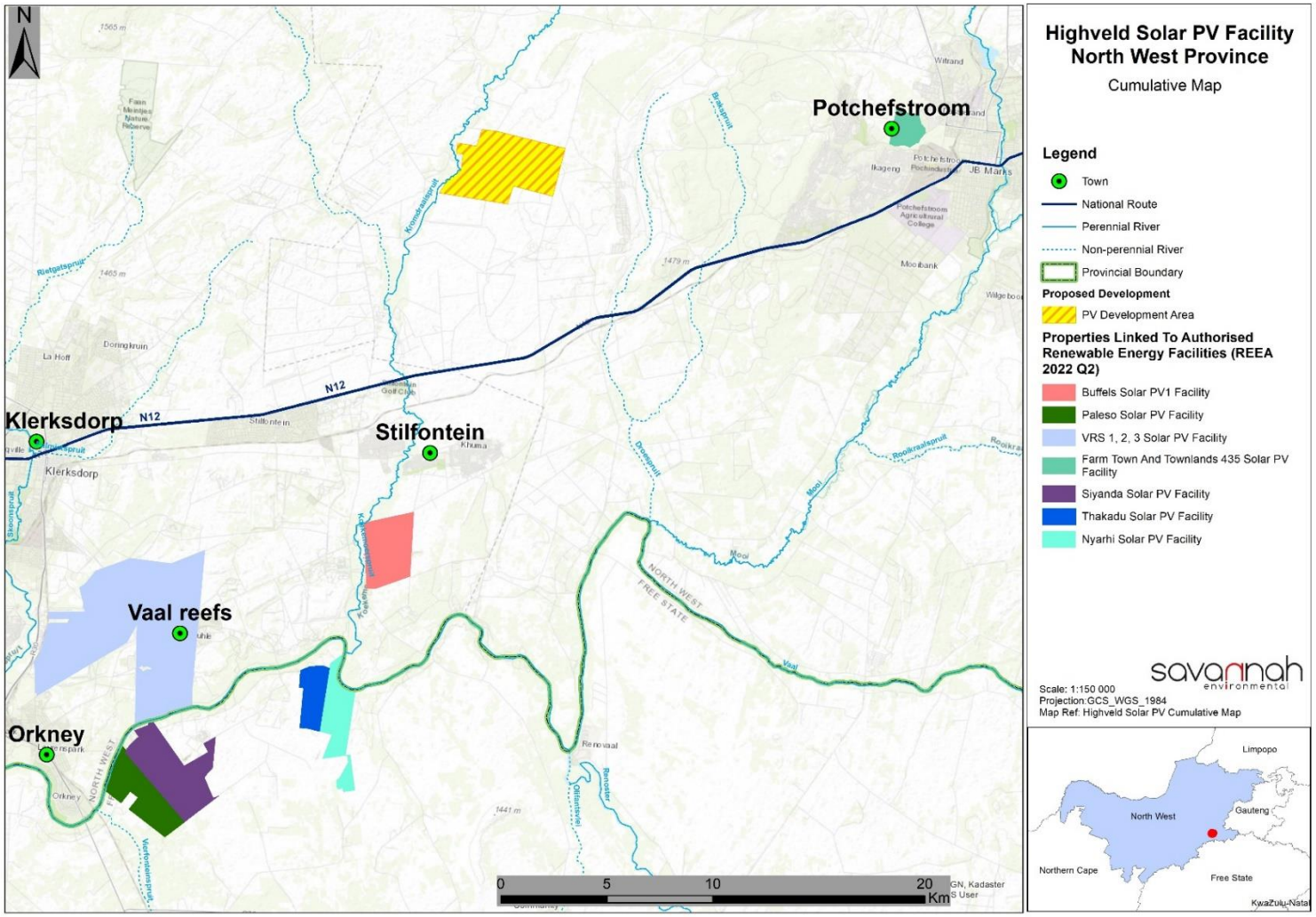


Figure 8.1: Identified PV facility projects located within a 30km radius of the Highveld Solar PV Facility that are considered as part of the cumulative impact assessment for the Highveld Solar PV project

8.2 Cumulative Impacts on Terrestrial Biodiversity and Wetlands

Cumulative impacts associated with the Highveld Solar PV Facility and associated infrastructure have been identified by the ecological specialist (refer to **Appendix D**) and are assessed in context of the extent of the proposed project area; other developments in the area; and general habitat loss and transformation resulting from other activities in the area.

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative terrestrial biodiversity and wetlands.

Localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers (such as nearby renewable energy or PV activities within the area). These include dust deposition, noise and vibration, disruption of corridors or habitat, groundwater drawdown, groundwater and surface water quality, and transport.

Cumulative impacts from an ecological perspective can lead to the loss of endemic species and threatened species, loss of habitat and vegetation types and even degradation of well conserved areas. The PV panels and associated infrastructure are expected to have a moderate detrimental cumulative impact, due to the mining, urban area, and agriculture in the regional area, especially to the south. Cumulatively these developments will be responsible for the destruction of a large portion of grassland in the area, could compromise the ecological functioning of these habitats, and may contribute to the further fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.

Impact: *Cumulative habitat loss within the region* ***Nature:*** *The development of the proposed infrastructure will contribute to cumulative habitat loss within CBA/ESAs and thereby impact the ecological processes in the region.*		
	Cumulative without Mitigation	**Cumulative with mitigation**
Extent	Very high (5)	High (4)
Duration	Long term (4)	Moderate term (3)
Magnitude	High (8)	High (8)
Probability	Highly probable (4)	Probable (3)
Significance	**High (68)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » The remaining local vegetation types must be carefully managed to maintain intact habitat corridors.		

The overall cumulative impact on watercourses is expected to be low, this is based on the assumption that complete clearing of vegetation will not be undertaken beneath the panels. The catchment area is characterised by degraded grassland and some agricultural practices, with limited hardened surfaces in the

area. The placement of the PV facility in the catchment will contribute to altered surface flow characteristics, but an effective stormwater management plan can mitigate any impacts stemming from changes to surface flow dynamics. The upgrade of the crossing for the access route poses a negligible cumulative impact owing to the fact this is an upgraded structure.

Impact: *Cumulative habitat loss within the region* ***Nature:*** *The development of the proposed infrastructure will contribute to cumulative wetland loss and altered hydrology of the receiving watercourse*		
	Cumulative without Mitigation	**Cumulative with mitigation**
Extent	High (4)	Low (2)
Duration	Long term (4)	Moderate term (3)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Improbable (2)
Significance	**High (64)**	**Low (22)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » Water loss is not expected for the catchment but altered surface hydrology may contribute to erosion and sedimentation of the watercourse.		

8.2.1. Spatial cumulative assessment

In order to spatially quantify the cumulative effects of the proposed development, the project in isolation is compared with the overall effects of surrounding development (including total transformation and transformation as a result of new and proposed developments of a similar type, i.e., solar). According to the 2018 National Biodiversity Assessment, the total amount of Vaal Reefs Dolomite Sinkhole Woodland habitat within 30 km of the project amounts to 34 640 ha, but when considering the transformation that has taken place within this radius – only 20 784 ha remains. Therefore, the area within 30 km of the project has experienced approximately 40% loss in natural habitat.

The project development area impacts predominately on Carletonville Dolomite Grassland habitat, which is considered in detail further.

According to the 2018 National Biodiversity Assessment, the total amount of Carletonville Dolomite Grassland habitat within 30 km of the project amounts to 36 316 ha, but when considering the transformation that has taken place within this radius – only 32 684 ha remains. Therefore, the area within 30 km of the project has experienced approximately 10% loss in natural habitat. Considering this context, the project footprint that will overlap with this habitat is 1073 ha (assuming the total extent of the PAOI is developed), and one similar project exists in the 30 km region measuring a maximum of 25 ha (as per the latest South African Renewable Energy EIA Application Database). This means that the total amount of remaining habitat lost as a result of solar projects in the region amounts to 3.4% (the sum of all related developments as a percentage of the total remaining habitat).

Table outlines the calculation procedure for the spatial assessment of cumulative impacts.

Table 8.2. Loss of Carletonville Dolomite Grassland habitat within a 30 km radius of the project

	Total Habitat (ha)	Tot. Remaining Habitat (ha)	Total Historical Loss	Project Footprint (ha)	Similar Projects (ha)	Cumulative Habitat Lost
Project cumulative effects (Spatial)	36 316	32 684	**10%**	1073	25	**3.4%**

Some functional corridors remain, and this means that the 3.4% loss in remaining habitat is relatively significant, the cumulative impact of the project is therefore rated as 'Medium'. This means that the careful spatial management and planning of the entire region must be a future priority, and existing large infrastructure projects must be carefully monitored over the long term.

8.3 Cumulative Impacts on Avifauna

Cumulative impacts from an avifauna perspective include exacerbated displacement and loss of habitat. In addition, the grid connection (via power lines) of these facilities could potentially contribute towards bird strikes with power lines and PV structures in the region.

The cumulative avifauna impacts, considering the development of the Highveld Solar PV Facility and the PV facilities within the surrounding area will be of medium significance.

Nature: *Habitat loss* The development of the Highveld Solar PV Facility and the other PV facilities will cause regional losses of natural habitat, as well as the subsequent displacement of birds.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Local and immediate surroundings (3)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (52)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: » It is difficult to mitigate against the loss of habitat without considering alternative sites. The best practicable mitigation will be to consolidate infrastructure (e.g. proposed power line) to areas where existing impacts occur (e.g. placing the proposed infrastructure alongside existing infrastructure) and to concentrate infrastructure on land with a low biodiversity conservation value.		

Nature: *Collision – PV panels*

Avian collision impacts (i.e. collision impacts with the PV panels) are expected during the operation phase of the Highveld Solar PV Facility and other PV facilities.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and immediate surroundings (3)	Local and immediate surroundings (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	High (8)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (39)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, potential loss of waterfowl and certain shorebird taxa species.	Yes, potential loss of waterfowl and certain shorebird taxa species.
Can impacts be mitigated?	Yes, to some extent	
Mitigation: » Apply bird deterrent devices to the panels for birds that may mistake the panels for open water and to prevent them from landing on the panels. » To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to employ video cameras to document any bird mortalities and to conduct direct observations and carcass searches on a regular and systematic basis. » Apply appropriate buffer zones to water features and wetlands.		

8.4 Cumulative Impacts on Land Use, Soil and Agricultural Potential

Cumulative impacts from a soils perspective are related to an increase in the loss of agricultural land used for livestock farming and cultivation, as well as an increased risk of erosion. These impacts can be reduced by keeping the footprints of the PV facilities minimised where possible and strictly following soil management measures pertaining to erosion control and management and monitoring of any possible soil pollution sources such as vehicles traversing over the sites.

Nature: *Decrease in areas with suitable land capability for cattle farming.* With the development of the Highveld Solar PV Facility and other PV facilities in the area, the decrease in land capability for livestock is expected to occur, due to construction and operational activities of the PV facility.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Short duration (2)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly likely (4)	Highly likely (4)
Significance	**Low (28)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	High	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Mitigation:		

» Keep the footprints of all solar energy facilities as small as possible and to manage the soil quality by avoiding far-reaching soil degradation such as erosion.

Nature: *Cumulative impact areas susceptible to soil erosion.*
During construction the Highveld Solar PV Facility and other PV facilities in the area will be highly vulnerable to soil erosion due to the disturbances that will be created.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No

Mitigation:
» Each of the projects should adhere to the highest standards for soil erosion prevention and management.
» The area around the project, including the internal access roads, must regularly be monitored to detect early signs of soil erosion on-set; and
» If soil erosion is detected, the area must be stabilised using geo-textiles and facilitated re-vegetation.

Nature: *Cumulative impact on areas susceptible to soil compaction.*
During construction the Highveld Solar PV Facility and other PV facilities in the area will be highly vulnerable to soil compaction due to heavy machineries on site.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:
» Each of the projects should adhere to the highest standards for soil erosion prevention and management.
» Vehicles and equipment must travel within demarcated areas and not outside of the construction footprint;
» Unnecessary land clearance must be avoided;
» Materials must be off-loaded and stored in designated laydown areas;
» Where possible, conduct the construction activities outside of the rainy season; and
» Vehicles and equipment must park in designated parking areas.

Nature: *Cumulative impact on increased risk of soil pollution*

During construction the Highveld Solar PV Facility and other PV facilities in the area will be vulnerable to soil pollution due to activities such as spills from fuel storage tanks, pollution from concreate mixing and spills from vehicles transporting workers and construction equipment.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Mitigation: » Each of the projects should adhere to the highest standards for soil erosion prevention and management. » Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills; » Any waste generated during construction must be stored into designated containers and removed from the site by the construction teams; » Any left-over construction materials must be removed from site; » The construction site must be monitored by the Environmental Control Officer (ECO) to detect any early signs of fuel and oil spills and waste dumping; » Ensure battery transport and installation by accredited staff / contractors; and » Compile (and adhere to) a procedure for the safe handling of battery cells during transport and installation.		

8.5 Cumulative Impacts on Heritage (including archaeology and palaeontology)

In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location and is not sprawled across an otherwise open or agricultural landscape. The cumulative impacts associated with the development and others in this area are unlikely to result in unacceptable risk or loss, or in a complete change to the sense of place of the area (and no impact table is required to reflect a no impact). The facility is not likely to result in an unacceptable increase in impact due to its location, considering it is one of many renewable energy facilities in this area, and its proximity to the existing Mercury Substation. Furthermore, this development is located within the Klerksdorp REDZ, an area that has been pre-identified as suitable for renewable energy development. As such, cumulative impact is expected within this area, but the preference is for the consolidation of infrastructure to areas where existing impacts occur. The anticipated cumulative impact is expected to be of low significance, which is considered to be acceptable from a heritage perspective.

8.6 Cumulative Visual Impacts

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect how the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility of a range of developments and /or the combined effects of individual components of the proposed development occurring in different locations or over some time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation, and distance as this affects visual acuity, which is also influenced by weather and light conditions (LI-IEMA (2013)).

The anticipated cumulative visual impact is expected to be of low significance, which is considered to be acceptable from a visual perspective.

Nature: *Potential cumulative visual impact on the visual quality of the landscape* The proposed Highveld Solar PV Facility will increase the cumulative impact of electricity related infrastructure within the region. The cumulative impact of additional traffic on the local and regional roads as well as combined impacts from potential night-time lighting will also affect the sense of place of the larger region. The Development will however shift the development trend away from mining creating different landscape features.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Very short distance (4)	Medium to longer distance (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (42)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented.	
Mitigation: Planning: » Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint where possible. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use. » Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		

8.7 Cumulative Social Impacts

The potential cumulative impacts on the areas sense of place will be largely linked to potential visual impacts, and include:

» Combined visibility (whether two or more facilities will be visible from one location).
» Sequential visibility (e.g. the effect of seeing two or more facilities along a single journey, e.g. road or walking trail).
» Visual compatibility.
» Perceived or actual change in land use across a character type or region.
» Loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

Cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one renewable energy facility and the associated infrastructure at a time, but if each successive stretch of the road is dominated by views of renewable energy facilities, then that can be argued to be a cumulative visual impact.

The potential impact of the facility and associated infrastructure on the area's sense of place is considered likely to be negligible. The cumulative impacts are, therefore, also likely to be very low.

The facility has the potential to result in significant positive cumulative impacts; specifically with the establishment of a number of solar PV facilities in the Local Municipality will create a number of socio-economic opportunities for the area, which in turn, will result in a positive social benefit. Job creation, skill development, and downstream business opportunities are good cumulative effects. Local, regional, and national economies could profit from job creation and service procurement if many renewable energy installations are established. This value will be considerably increased if a critical mass is reached that allows local enterprises to develop the capabilities to support building and maintenance activities and to manufacture renewable energy facility components in South Africa. The cumulative impact at the municipal level could be good, encouraging O&M companies to focus on education and training.

Nature: *An increase in employment opportunities, skills development and business opportunities with the establishment of a solar PV facility*

During the construction and operation phase the establishment of a number of solar power projects in the area has the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities

	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	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Medium (39)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	

Enhancement measures:

» The establishment of a number of solar PV facilities in the area does have the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities. The positive benefits will be enhanced if local employment policies are adopted and local services providers are utilised by the developers to maximise the project opportunities available to the local community.

Nature: *Cumulative impact with large-scale in-migration of people*

Negative impacts and change to the local economy with an in-migration of labourers, businesses and jobseekers to the area

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local-regional (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Low (4)
Probability	Very improbable (1)	Improbable (2)
Significance	**Low (7)**	**Low (22)**
Status (positive or negative)	Negative	Negative
Reversibility	Local (1)	Local-regional (3)
Irreplaceable loss of resources?	Long-term (4)	Long-term (4)
Can impacts be mitigated?	Yes	
Mitigation: » Develop a recruitment policy / process (to be implemented by contractors), which will ensure the sourcing of labour locally, where available. » Work together with government agencies to ensure that service provision is in line with the development needs of the local area. » Form joint ventures with community organisations, through Trusts, which can provide local communities with benefits, such as employment opportunities and services. » Develop and implement a recruitment protocol in consultation with the municipality and local community leaders. Ensure that the procedures for applications for employment are clearly communicated.		

8.8 Conclusion Regarding Cumulative Impacts

Cumulative impacts are expected to occur with the development of the Highveld Solar PV Facility throughout all phases of the project life cycle and within all areas of study considered as part of this BA Report. The main aim for the assessment of cumulative impacts considering the Highveld Solar PV Facility is to test and determine whether the development will be acceptable within the landscape proposed for the development, and whether the loss, from an environmental and social perspective, will be acceptable without whole-scale change.

The following conclusions can be drawn regarding the cumulative impacts associated with the project:

- There will be no unacceptable loss or impact on ecological aspects (vegetation types, species and ecological processes) due to the development of the Highveld Solar PV Facility and other renewable energy facilities within the surrounding area, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no unacceptable risk to wetlands/watercourses with the development of the Highveld Solar PV Facility and other renewable energy projects within the surrounding area, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- The upgrade of the crossing for the access route poses a negligible cumulative impact on owing to the fact this is an upgraded structure.
- There will be no unacceptable risk to avifauna with the development of the Highveld Solar PV Facility and other renewable energy projects within the surrounding area, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no unacceptable loss of land capability due to the development of the Highveld Solar PV Facility and other renewable energy projects within the surrounding areas, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.

- There will be no unacceptable loss of heritage resources associated with the development of the Highveld Solar PV Facility and other renewable energy projects within the surrounding areas. The cumulative impact is therefore acceptable.
- Change to the sense of place and character of the area is expected with the development of renewable energy facilities. However, the change is not considered to be significant.
- No unacceptable socio-economic impacts are expected to occur. The cumulative impact is therefore acceptable.

A summary of the cumulative impacts is included in **Table 8.3** below.

Table 8.3: Summary of the cumulative impact significance for the Highveld Solar PV Facility

Specialist assessment	Cumulative significance of impact of the project and other projects in the area (without Mitigation)	Cumulative significance of impact of the project and other projects in the area (with Mitigation)
Terrestrial Ecology	High	Medium
Wetlands	High	Low
Avifauna	Medium	Medium
Land use, soil and agricultural potential	Low to Medium (depending on the impact being considered)	Low to Medium (depending on the impact being considered)
Heritage (archaeology and palaeontology)	Negligible	Negligible
Visual	Low	Low
Socio-Economic	Low to Medium (depending on the impact being considered)	Low to Medium (depending on the impact being considered)

Based on the specialist cumulative assessment and findings, the development of the Highveld Solar PV Facility and its contribution to the overall impact of all renewable energy facilities to be developed within a 30km radius, it can be concluded that the Highveld Solar PV Facility cumulative impacts will be of a medium to low significance. It was concluded that the development of the Highveld Solar PV Facility will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment.

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

WKN Windcurrent SA (Pty) Ltd is proposing the construction of a photovoltaic (PV) solar energy facility (known as Highveld Solar PV Facility) located on a site located approximately 15km north east of the town of Stilfontein, in the North West Province. The solar energy facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 240MW.

A preferred project site[45] with an extent of ~1400ha has been identified by WKN Windcurrent SA (Pty) Ltd as a technically suitable area for the development of the Highveld Solar PV Facility. The project site consists of four (4) affected properties:

- Remainder of Portion 10 of Farm Rietfontein 388;
- Portion 79 of Farm Rietfontein 388;
- Portion 56 of Farm Rietfontein 388; and
- Remaining Extent of Farm Rietfontein 3.

Additional properties affected by the existing access road (which will be upgraded) includes Portion 62 of Farm Rietfontein 388 and the Remaining Extent of Farm Rietfontein 566.

A development area[46] of approximately 1300ha has been identified within the study area and has been fully considered within this BA process and assessed in terms of its suitability from an environmental and social perspective within this BA Report. Within this identified development area, a development footprint[47] or facility layout has been defined. This development footprint/facility layout of approximately ~433ha has been fully considered within this Basic Assessment (BA) process and assessed in terms of its suitability from an environmental and social perspective. The development area is larger than the area needed for the construction of a 240MW PV facility and provided the opportunity for the optimal placement of the infrastructure, ensuring avoidance of major identified environmental sensitivities by the development footprint. Site-specific studies and assessments have delineated areas of potential sensitivity within the identified project site.

The Highveld Solar PV Facility will have a contracted capacity of up to 240MW and will include specific infrastructure, namely:

- Solar PV arrays, modules and mounting structures.
- Inverters and transformers.
- A Battery Energy Storage System (BESS)
- On-site facility substation
- Cabling between the project components

[45] The project site is that identified area within which the development area and development footprint are located. It is the broader geographic area assessed as part of the BA process, within which indirect and direct effects of the project may occur. The project site is ~1400ha in extent.

[46] The development area is that identified area where the 240MW PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~1300ha in extent.

[47] The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for the Highveld Solar PV facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

- Site and internal access roads up to 6m in width, where required
- Temporary and permanent laydown areas and O&M buildings and fencing around the development area.

From a regional perspective, the Stilfontein area is considered favourable for the development of a solar energy facility by virtue of prevailing climatic conditions, relief, aspect, the extent of the affected properties, the availability of a direct grid connection (i.e. a point of connection to the national grid) and the availability of land on which the development can take place. The complete extent of the study area, inclusive of the development area is located within the Klerksdorp Renewable Energy Development Zone (REDZ)[48] as well as the Central Corridor of the Strategic Transmission Corridors[49]. Furthermore, six (6) authorised solar PV facilities are located to the South and East of the development area for the Highveld Solar PV Facility.

The Highveld Solar PV Facility is planned to be bid into the Department of Mineral Resource and Energy's (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply with the facility set to inject up to 240MW into the national grid.

As the project has the potential to impact on the environment, an Environmental Impact Assessment process is required to be completed in support of an application for Environmental Authorisation prior to the commencement of construction and operation of the Highveld Solar PV Facility.

9.1 Legal Requirements as per the EIA Regulations, 2014 (as amended). For the undertaking of a Basic Assessment Report

This chapter of the BA Report includes the following information required in terms of Appendix 1: Content of the BA Report:

Requirement	Relevant Section
3(k) where applicable, a summary of the findings and impact management measures identified in 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 report	A summary of the findings of the specialist studies undertaken for the Highveld Solar PV Facility has been included in section 9.2
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 containing the key findings of the environmental impacts of the Highveld Solar PV Facility has been included as section 9.5. Sensitive environmental features located within the study area and development area, overlain with the proposed development footprint have been identified and are shown in Figure 9.1.

[48] The REDZ are zones identified by the Department of Forestry Fisheries and the Environment (DFFE) as geographical areas of strategic importance for the development of large-scale solar PV and wind energy development activities and which have been earmarked for the development of renewable energy facilities within South Africa as per GNR114 of February 2018 and GNR142 of February 2021.

[49] The Strategic Environmental Assessment for Electricity Grid Infrastructure (EGI) in South Africa has identified five Strategic Transmission Corridors that are of strategic importance for the rollout of the supporting large-scale electricity transmission and distribution infrastructure in terms of Strategic Integrated Project 10: Electricity Transmission and Distribution. The Central Corridor is one of these five Strategic Transmission Corridors as per GNR113 of February 2018.

Requirement	Relevant Section
3(p) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	A reasoned opinion as to whether t the Highveld Solar PV Facility should be authorised has been included in section 9.6.
3(n) 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.	All conditions required to be included in the Environmental Authorisation of the Highveld Solar PV Facility have been included in section 9.6.

9.2 Evaluation of Highveld Solar PV Facility

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 development of proposed Highveld Solar PV Facility. This chapter concludes the environmental assessment of Highveld Solar PV Facility and associated infrastructure by providing a summary of the results and conclusions of the assessment of the development area. In so doing, it draws on the information gathered as part of the BA process, the knowledge gained by the environmental specialists and the EAP and presents a combined and informed opinion of the environmental impacts associated with the project.

No environmental fatal flaws were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of no-go features or buffers within the project development area by the development footprint and the undertaking of monitoring, as specified by the specialists.

The potential environmental impacts associated with the Highveld Solar PV Facility identified and assessed through the BA process include:

» Impacts on ecology, including flora, fauna and wetlands
» Impacts on avifauna
» Impacts to soils and agricultural potential
» Impacts on heritage resources, including archaeology and palaeontology
» Visual impacts on the area imposed by the components of the facility
» Social impacts.

9.2.1 Impacts on Ecology (including flora, fauna and wetlands)

The Terrestrial Biodiversity and Wetlands Assessment (**Appendix D**) undertaken determined that there are no impacts associated with the Highveld Solar PV Facility and associated infrastructure (including access road upgrade) that cannot be mitigated to an acceptable level and as such, the assessed layout was considered acceptable. The findings indicate that the bulk of the project site is located within the Carletonville Dolomite Grassland vegetation type, which is listed as Least Threatened.

A majority of the development area for the project is located within an ESA1 (Corridor/Linkage). Ecological Support Areas (ESAs) are terrestrial and aquatic areas that are not essential for meeting biodiversity representation targets (thresholds), but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development. Due to the extent of this ESA1, and the availability of ample natural to near natural areas still available in the area, the development will not have a significant impact on this ESA, and its ability to function

as an important corridor. CBA1 areas should be avoided as far as possible, and the proposed development footprint does achieve this.

The species, *Lithops lesliei*, identified in the south- eastern portion of the site is currently listed as being Near Threatened and is regarded as having a very-high conservation value. However, a very small area provides the habitat suitable for this species, and it is only this habitat which must be avoided by the development footprint. With avoidance of this area as the primary mitigation, the sensitivity rating was verified to be Medium by the specialist.

An optimised facility layout (as indicated in section 9.3 and Figure 9.1) achieves this mitigation, as required. Thus, according to this optimized layout, all of the highly sensitive areas will be avoided, and the Highveld Solar PV Facility will not significantly impact sensitive areas or impact conservation targets set out by the province.

Wetland and freshwater features include the Kromdraaispruit, an unclassified NFEPA river located on the western boundary of the project area. The wetland habitat, including the 500m buffer, has been completely excluded from the development footprint (avoidance in terms of the mitigation hierarchy).

Construction could result in the encroachment into water resources and result in the loss or degradation of these system, most of which are functional and provide ecological services. These disturbances could also result in the infestation and establishment of alien vegetation would affect the functioning of the systems. Leaks and/or spillages could result in contamination of the receiving water resources. Contaminated water resources are likely to have an effect on the associated biota. An increase in stormwater runoff could result in physical changes to the receiving systems caused by erosion, run-off and also sedimentation, and the functional changes could result in changes to the vegetative structure of the systems.

Overall, there are no specific long-term impacts likely to be associated with the development of the Highveld Solar PV Facility that cannot be reduced to a low significance. As such, there are no fatal flaws associated with the development and no terrestrial ecological and wetland considerations that should prevent it from proceeding.

9.2.2 Impacts on Avifauna

The Avifauna Impact Assessment (**Appendix E**), which considered the results of two seasons of pre-construction bird monitoring, determined the significance of potential avifauna impact to be moderate to low after mitigation (depending on the type of impact). However, the risk for certain waterbirds (mainly large-bodied waterfowl such as the South African Shelduck *Tadorna cana*, Egyptian Goose *Alopochen aegyptiacus* and members of the *genus Anas*) colliding with the PV infrastructure remained eminent due to the presence of the nearby Kromdraaispruit.

The critically endangered White-backed Vulture (*Gyps africanus*) and endangered Cape Vulture (*G. coprotheres*) were observed as foraging individuals soaring overhead. In addition, a pair of vulnerable Lanner Falcons (*Falco biarmicus*) occurred within the study area. The nearby Kromdraaispruit floodplain west of development area provided potential suitable foraging habitat for the regionally endangered African Marsh Harrier (*Circus ranivorus*), although this species was not observed during the respective surveys. Although the African Marsh Harrier was not recorded on the study area during the survey period, it was recommended that all potential habitats be conserved (as a precautionary principle) by applying a 500m buffer to the edge of the Kromdraaispruit floodplain.

No fatal-flaws were identified during the assessment, although it has been recommended that the mitigation measures and monitoring protocols (e.g. post construction monitoring) be implemented during the construction and operational phase of the project.

9.2.3 Impacts on Soil and Agricultural Potential

The soil forms present within the development footprint, are shallow to very shallow soils that range in depth between 0.05m and 0.45m. Rock outcrops are present on the surface in several areas within the proposed development footprint. The area has not historically been used for crop production and also not recently, as confirmed by the field crop boundary data of DALRRD (2019). No irrigation infrastructure is present within the project area and irrigated agricultural is currently not practiced in the area. Considering the soil properties, land capability and agricultural potential of the development area, the entire area has Low Agricultural Sensitivity.

It is anticipated that the construction and operation of the Highveld Solar PV Facility and associated infrastructure will have impacts that range from medium to low. Through the consistent implementation of the recommendation mitigation measures, most of impacts can all be reduced to low. It is therefore the specialist's opinion that the proposed development is considered favourably, permitting that the mitigation measures are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be affected. The project infrastructure should also remain within the proposed project area that will be fenced off.

9.2.4 Impacts on Heritage Resources (archaeological and paleontological)

None of the heritage resources identified fall within the area PV layout provided and as such, no direct impact to any heritage resources is anticipated. The heritage resources that were identified fall within close proximity to the layout provided and as such, it is important that impact to the significant sites is avoided. It is recommended that the sensitive heritage areas identified in this report are avoided by any proposed development of new infrastructure.

All the graves are highly significant, and a 100m buffer zone with a fence is recommended.

The geological structures suggest that the rocks are the correct age and type to preserve fossils. The site visit and walk through confirmed that there were, however, no fossils in the project footprint.

The heritage specialists have no objection to the proposed development of the Highveld Solar PV facility. A Conservation Management Plan is recommended to be drafted for the ongoing management and conservation of the identified burials and other heritage resources. The road proposed for upgrade falls within the recommended 100m no development buffer for site 117, however, no direct impact to the site is anticipated as long as the alignment of the existing road is followed and any widening of the road takes place to the south, away from the identified burial.

9.2.5 Visual Impacts

The anticipated visual impacts associated with the construction and operation phases of the Highveld Solar PV facility and associated infrastructure range from moderate to low significance as a result of the generally industrial and developed character of the landscape. There are a very limited number of potential sensitive

visual receptors within a 3km radius of the proposed structures. These anticipated visual impacts on sensitive visual receptors, if and where present, in close proximity to the proposed facility (resident at Rietfontein East homesteads, and observers travelling the along the secondary road to the west of the facility) are not considered to be fatal flaws.

In the specialist's opinion, considering all factors, it is recommended that the development of the facility as proposed be supported; subject to the implementation of the recommended mitigation measures and management programme.

9.2.6 Social Impacts

The social impacts identified (including all positive and negative impacts) will be either of a low or medium significance. No negative impacts with a high significance rating have been identified to be associated with the development of the Highveld Solar PV Facility and associated infrastructure. All negative social impacts are within acceptable limits with no impacts considered as unacceptable from a social perspective. The recommendations proposed for the project are appropriate and suitable for the mitigation of the negative impacts and the enhancement of the positive impacts. Highveld Solar PV Facility is supported at a national, provincial, and local level, and that the proposed project will contribute positively towards a number of targets and policy aims.

Based on the findings of the SIA the proposed establishment of the Highveld Solar PV is supported.

9.2.7 Assessment of 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 and within the surrounding areas of the development area. 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.

Based on the specialist cumulative assessment and findings (**Appendix D** to **Appendix I** and Chapter 8 of the BA), the development of the Highveld Solar PV facility, and its contribution to the overall impact of all existing and proposed solar energy facilities within a 30km radius, it can be concluded that cumulative impacts will be of a low to moderate significance, with impacts of a high significance mainly relating to impacts on habitat. There are however no impacts or risks identified to be considered as unacceptable with the development of Highveld Solar PV and other solar energy facilities within the surrounding area. In addition, no impacts which will result in whole-scale change are expected.

9.3 Environmental Sensitivity Mapping

As part of the specialist investigations undertaken within the project development area, which includes the development footprint, specific environmental features and areas were identified which will be impacted by the placement of the Highveld Solar PV facility. The current condition of the features identified (i.e. intact or disturbed) will inform the sensitivity of the environmental features and its capacity for disturbance and change associated with the proposed development.

The environmental features identified within and directly adjacent to the project site and development footprint are illustrated in **Figure 9.2**. The sensitive features identified and indicated on the sensitivity map to be avoided/buffered relate to heritage resources, and ecological and avifauna sensitivities/features. The following provides a description of the sensitivities identified within the development footprint:

» **Ecological features:**
- Low Medium Ecological Sensitivity:
  From a terrestrial ecological perspective, it was found that the bulk of project site is located within grassland.

- High Ecological Sensitivity:

The adjacent Kromdraaispruit to the west of the development area, including a regulated 500m buffer (remains outside the of the development footprint)

- Very High Ecological Sensitivity:
  The Red listed plant community is required to be avoided by the development footprint. These are the only areas identified which are required to be excluded from the development footprint.

Portions of the project site are located within an ESA1 (Corridor/Linkage). Due to the large extent of this ESA1, and the availability of ample natural to near natural areas still available the development will not have a significant impact on this ESA, and its ability to function as an important corridor.

» **Avifauna:**
- » High Avifauna Sensitivity:
  - Floodplain and avian flyway (500m buffer) associated with the Kromdraaispruit.
  - Artificial livestock watering hole
  - Optimal foraging habitat (which is considered a constraint to the development footprint and is treated as an excluded area)
  - Lanner Falcon 400m buffer

» **Soils:**
The project area is located on areas of moderate sensitivity.
There are no areas identified which are required to be excluded from the proposed development footprint.

» **Heritage Resources:**
A number of stone structures were identified within and beyond the development area. It is likely that a number of these are burial sites, and a no-development buffer of 100m is recommended around these sites. There are no areas identified which are required to be excluded from the proposed development footprint.

» **Visual and social:**
Overall, the significance of the visual impacts is expected to range from moderate to low as a result of the generally undeveloped character of the landscape. The facility would be visible within an area that incorporates certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads and residents of

surrounding agricultural holdings. No no-go areas have been identified and no buffers have been recommended.

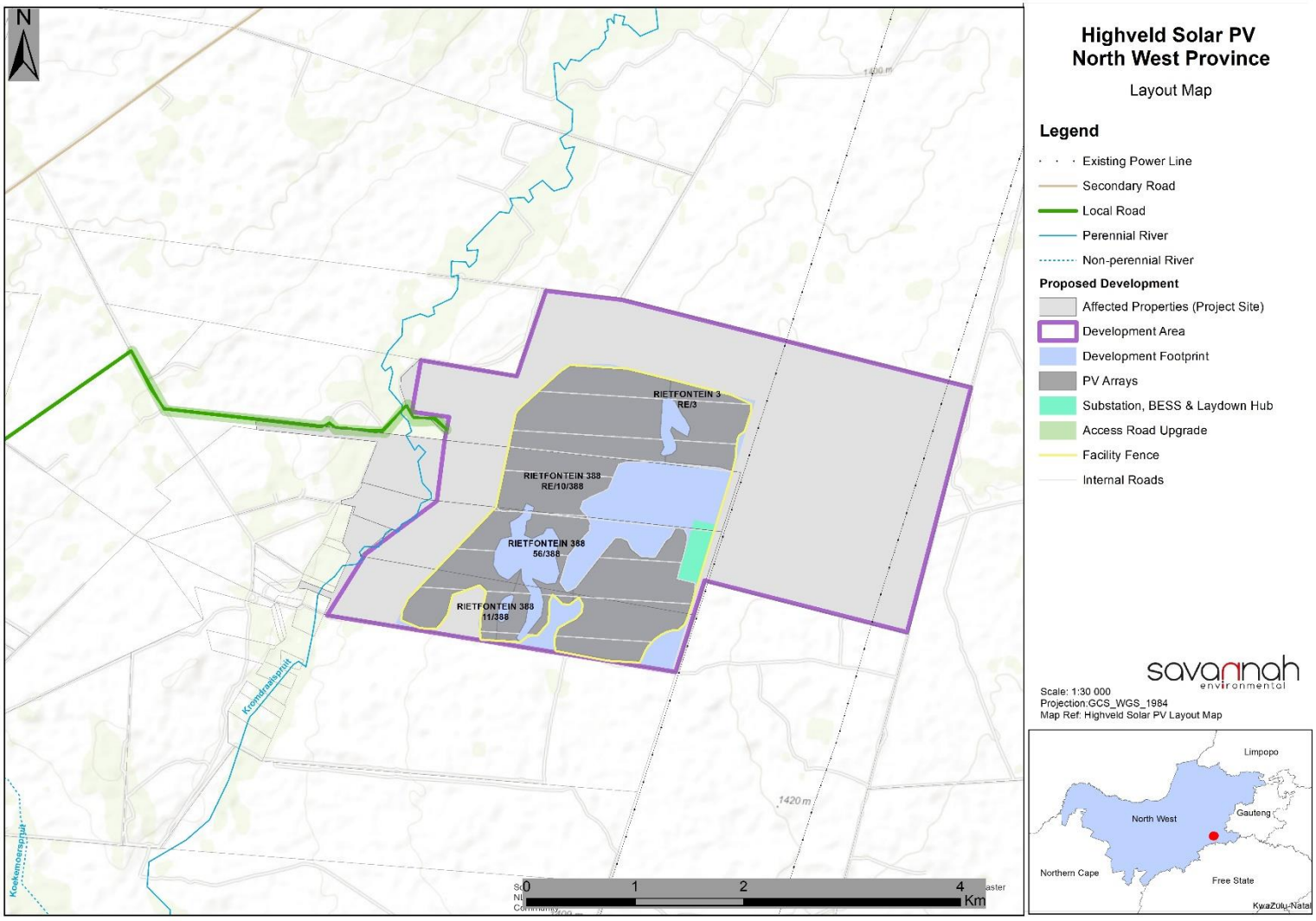


Figure 9.1: Optimised facility layout map of the development footprint for the Highveld Solar PV Facility, as was assessed as part of the BAR (A3 map is included in **Appendix L**).

9.4 Assessment of the Optimised Facility Layout

The indicative facility layout/development footprint assessed within this BA Report (**Figure 9.1**) was designed by the project developer in order to respond to and avoid the sensitive environmental and social features located within the project site, which were identified by the specialists. This approach ensured the application of the mitigation hierarchy (i.e., avoid, minimise, mitigate, and offset) to the proposed project, which ultimately ensures that the development is appropriate from an environmental perspective and is suitable for development within the project site. The optimised facility layout is in response to the primary mitigation of the Ecology report plus comments/requirement from the DFFE Biodiversity Directorate (refer to **Appendices C7 and C8).**

Based on the findings as documented in this BA report, it was concluded that this optimised layout avoids areas of sensitivity and therefore no further optimisation was recommended. As such, the impact of this proposed Facility Layout is considered to be acceptable, and the layout is recommended for approval. Final micro-siting must however be undertaken prior to construction considering all mitigation measures recommended within this BA Report and associated specialist studies.

9.5 Environmental Costs of the Solar PV Facility versus Benefits of the Solar PV Facility

Environmental costs (including those to the natural environment, economic and social environment) can be anticipated at a local and site-specific level and are considered acceptable provided the mitigation measures as outlined in the Basic Assessment Report and the EMPr are implemented and adhered to. No fatal flaws have been identified.

These environmental costs could include:

- A loss of biodiversity, flora and fauna due to the clearing of land for the construction and utilisation of land for the PV facility. The cost of loss of biodiversity has been minimised/avoided through the implementation of recommendations provided by the specialist. All wetland features are avoided. All CBA1 areas are avoided. The resulting impact is considered to be acceptable.
- Impacts on birds. The development will result in a loss of habitat. The impact is however considered to be acceptable without any impact of high significance.
- Heritage impacts associated with the PV facility and upgrade to the access road may occur. The heritage resources are outside of the facility development footprint, and have a 100m no-go buffer which is required to be adhered to. Mitigation measures that have been recommended will reduce the anticipated impacts.
- Loss of land for agriculture. The development will remove areas available for agricultural activities. However, based on the low sensitivity of the soils within the development footprint of the PV Facility, this will not be significant.
- Visual impacts associated with the PV facility. It is envisaged that the structures where visible from shorter distances, and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence. General mitigations have been recommended to minimise the impact.
- Impacts on the social environment. Socio-economic impacts include impacts on the sense of place and property and business values that could occur during both construction and operation, the effect on social and economic infrastructure, and crime and social conflicts in the area that could be created during only the construction phase. These impacts though will only affect local communities either temporarily or over the long term. These impacts are not highly significant and can be traded off for the net positive impact created by the project in terms of production, employment, government revenue, community benefits and households' earnings.

Benefits of the Highveld Solar PV Facility include the following:

» The project will result in important economic benefits at the local and regional scale through job creation, income and other associated downstream economic development. These will persist during the preconstruction, construction, operation and decommissioning phases of the project.
» The project provides an opportunity for a new land use on the affected properties which is considered as a more efficient use of the land and provides an opportunity for financial benefits to the current land use.
» The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective IDPs.
» The project serves to diversify the economy and electricity generation mix of South Africa through the addition of solar energy.
» The water requirement for a solar facility is negligible compared to the levels of water used by coal-based technologies. This generation technology is therefore supported in dry climatic areas.
» South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to the reliance on fossil fuels. The Highveld Solar PV Facility will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.

The benefits of the Highveld Solar PV Facility are expected to occur at a national, regional, and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility.

9.6 Overall Conclusion (Impact Statement)

The preferred activity was determined by the developer to be the development of a renewable energy facility on site using solar irradiation as the preferred technology, due to the availability of a suitable solar resource. Independent specialists appointed to undertake the assessment of potential impacts associated with the project assessed a larger area in order to inform the best location for the solar facility infrastructure. The Specialists considered desktop data, results from field work, existing literature and the National Web-based Environmental Screening Tool to inform the identification of sensitivities. A proposed layout was designed after provision of sensitivity data by the specialists with the aim of avoiding the identified sensitive areas.

Based on the specialist investigations of the larger area, a technically viable development footprint was proposed by the developer and assessed as part of the BA process. The findings of the assessment of the development footprint undertaken by independent specialists have informed the results of this report. The specialist findings have indicated that there are no identified fatal flaws associated with the implementation of the project within the project site.

Site verification summary for the Highveld Solar PV Facility:

» Impacts on Terrestrial Ecology were rated as Very High Sensitivity by the Screening Tool due to the presence of Red Listed Plant Species within the development area. However, a very small area provides the habitat suitable for this species, and it is only this habitat which have to be avoided by the development footprint. The optimised facility layout avoids this area entirely. Therefore, the sensitivity verified by the specialist was rated as Medium (refer to **Appendix D**).
» The DFFE Web-Based Screening Tool rated the Agricultural sensitivity as High due to the presence of Moderate-High Land Capability (Classes 09 and 10). However, the Agticultural Impact Assessment (refer to **Appendix F**) concluded that the site is mostly characterised with "Very Low to Low" land

capability and land potential sensitivities. It is anticipated that the construction and operation of the Highveld Solar PV Facility will have impacts that range from medium to low.

- Aquatic Biodiversity Sensitivity were rated as Very High by the DFFE Screening Tool as the project site is located directly adjacent to the Kromdraaispruit watercourse. The specialist has rated the site ecological importance for this wetland area as high. However, the PV development footprint avoids this regulated area (500m) entirely. It is of the specialist's opinion that the impact on wetlands and watercourses can be delineated to low after mitigation measures are implemented.
- According to the SAHRIS Palaeosensitivity Map and the DFFE Screening Tool, the development sites are underlain by sediments of very high fossil sensitivity. The site visit and walk through confirmed that there were no fossils in the project footprint. One small stromatolite only was found below the existing power line, i.e. not in the route for the new powerline. Furthermore, the main solar cluster area is not on dolomites, only some cherts were present.
- Taking account of the defined criteria, it is the specialist's opinion that the potential impact to fossil heritage resources is extremely low.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen from a policy perspective at a local, provincial and National level. The project development area is located outside of any protected area, outside of any Critical Biodiversity Areas (CBAs) as defined in the Provincial Conservation Plan, and away from any freshwater resource features. When considering biodiversity and socio-economic benefits and impacts on the affected and surrounding areas, the following is concluded from the specialist studies undertaken within this BA process.

From a biodiversity perspective, the site is not located within a protected area. The site is located within an extensive ESA. However, overall, there are no specific long-term impacts likely to be associated with the development of the Highveld Solar PV Facility that cannot be reduced to a moderate or low significance. There are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Identified avifauna sensitivities were identified and avoided by the development footprint, and the layout proposed ensures that all heritage sensitivities identified are avoided and recommended buffer areas are honoured. This approach is in line with the application of the mitigation hierarchy, where all the sensitive areas which could be impacted by the development have been avoided (i.e. tier 1 of the mitigation hierarchy). Where impacts could not be avoided, appropriate mitigation has been proposed to minimise impacts. It follows therefore that the project does not adversely impact on the ecological integrity of the area.

The Social Impact Assessment has identified short-term (construction related) impact indicators and operational related socio-economic impact indicators. The assessment of the proposed facility, and its net effect from a socio-economic perspective, indicates that the project would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of its establishment.

As detailed in the cost-benefit analysis, the benefits of the Highveld Solar PV Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility. From an economic perspective, both positive and negative impacts are expected.

Based on the conclusions of the specialist studies undertaken, it can be concluded that the development of the Highveld Solar PV Facility based on the current layout as provided by the Applicant will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures).

9.7 Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the optimised development footprint proposed by the developer within the development site, the avoidance of the sensitive environmental features within the project development area, as well as the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the Highveld Solar PV Facility is acceptable within the landscape and can reasonably be authorised subject to implementation of the optimised facility layout and the mitigation and enhancement measures recommended by the specialists. The optimised facility layout as provided by the Applicant (**Figure 9.1**) is considered to be appropriate from an environmental perspective, with micro-siting of panels and roads required to ensure that the layout avoids all identified sensitivities and recommended buffer areas.

The following infrastructure would be included within an authorisation issued for the project:

240MW Solar PV facility: Highveld Solar PV Facility located within Portions 79 and 56 and the Remainder of Portion 10 of Farm Rietfontein 388; and Remainder of Farm Rietfontein 3, including:

- Solar PV arrays, modules and mounting structures.
- Inverters and transformers.
- A Battery Energy Storage System (BESS)
- On-site facility substation
- Cabling between the project components
- Site and internal access roads up to 6m in width, where required
- Temporary and permanent laydown areas and O&M buildings and fencing around the development area.

The following key conditions would be required to be included within an authorisation issued for the Highveld Solar PV Facility:

- Where feasible, mitigation measures detailed within this BA report, as well as the specialist reports contained within **Appendices D to I** are to be implemented.
- The EMPr as contained within **Appendix K** of this BA report should form part of the contract with the Contractors appointed to construct and maintain the solar facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the Highveld Solar PV Facility is considered key in achieving the appropriate environmental management standards as detailed for this project.
- Exclude all areas of Very High Ecological Sensitivity (the Red listed plant community) from the development footprint, in line with the Optimised facility layout.
- Following the final design of the Highveld Solar PV Facility, a final layout must be submitted to DFFE for review and approval prior to commencing with construction. No development is permitted within the identified no-go areas as detailed in **Figure 9.2.**

- A pre-construction walk-through of the final layout, including roads and underground cables, should be undertaken before construction commences and adjusted where required to reduce impacts on species of conservation concern and habitats of concern.
- Before construction commences individuals of listed species within the development footprint that would be affected, must be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey. Permits from the relevant national and provincial authorities, must be obtained before the individuals are disturbed.
- A detailed site-specific eradication and management programme for alien invasive plants must be developed and implemented.
- Implement a Conservation Management Plan for the ongoing management and conservation of the identified burials and other heritage resources.
- Implement a chance finds procedure for the rescuing of any fossils or heritage resources discovered during construction.
- If any archaeological material or human burials are uncovered during construction activities, work in the immediate area should be halted, the find reported to the heritage authorities and inspected by an archaeologist. Such heritage is the property of the State and may require excavation and curation in an approved institution.
- Maintain vegetation cover (i.e. either natural or cultivated) immediately adjacent to the actual development footprint, both during construction and operation of the proposed facility.
- Monitor all rehabilitated areas for one year following decommissioning and implement remedial actions as and when required.

A validity period of 10 years of the Environmental Authorisation is requested, should the project obtain approval from DFFE.

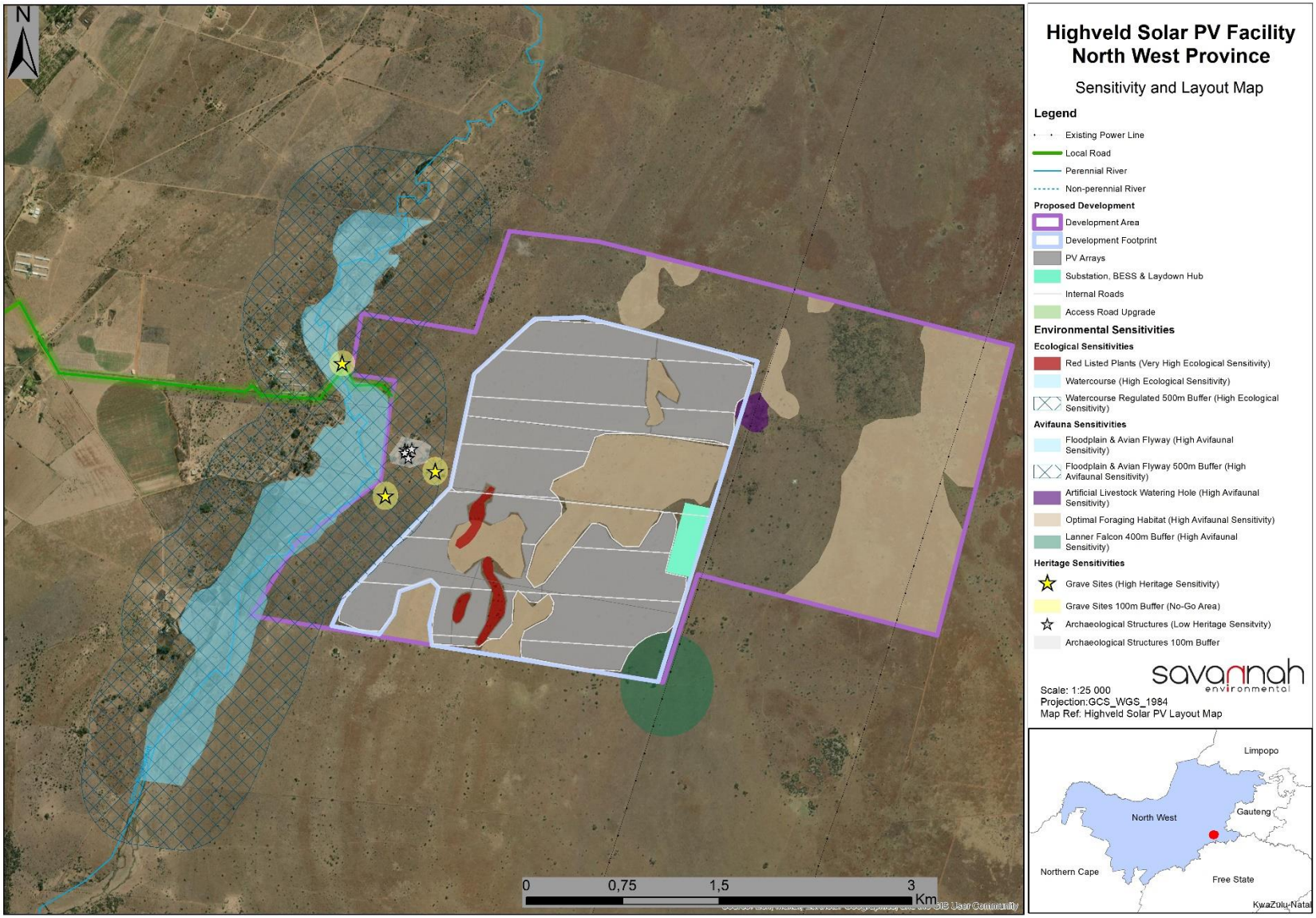


Figure 9.2: Optimised facility layout and sensitivity map of the development footprint for the Highveld Solar PV Facility, as was assessed as part of the BAR (A3 map is included in **Appendix L**).

CHAPTER 10: REFERENCES

Terrestrial Biodiversity and Wetland Impact Assessment

ADU (Animal Demography Unit). (2017). Virtual Museum.

Alexander, G. & Marais, J. (2007). A guide to the Reptiles of Southern Africa. Struik, Cape Town.

Apps, P. 2008. Smithers' Mammals of Southern Africa. Struik, Cape Town.

Avenant N, Wilson B, Power RJ, Palmer G, Child MF. 2016. A conservation assessment of Mystromys albicaudatus. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J & de Villiers, M.S. (Eds). 2014. Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland. Suricata 1. South African Biodiversity Institute, Pretoria.

BGIS (Biodiversity GIS). (2017). http://bgis.sanbi.org/

BirdLife South Africa. 2015. Important Bird Areas 2015 [vector geospatial dataset]. Available from the Biodiversity GIS website, downloaded on 09 March 2022.

BirdLife (2022a) Species factsheet: Circus macrourus. Downloaded from http://www.birdlife.org on 10/03/2022.

BODATSA-POSA. (2021). Plants of South Africa - an online checklist. POSA ver. 3.0. http://newposa.sanbi.org/.

Boycott, R. and Bourquin, R. 2000. The Southern African Tortoise Book – A Guide to Southern African Tortoises, Terrapins and Turtles. Revised Edition. Hilton. 228 pages.

Branch, W.R. (1998). Field Guide to Snakes and Other Reptiles of Southern Africa. Struik, Cape Town.

Bird Atlas Project (SABAP2). (2012). http://vmus.adu.org.za/

DEA. 2016. Department of Environmental Affairs (DEA), 2016. National Protected Areas Expansion Strategy for South Africa 2016. Department of Environmental Affairs, Pretoria, South Africa.

DEA. 2021. SAPAD (South Africa Protected Areas Database) and SACAD (South Africa Conservation Areas Database) (2021). http://egis.environment.gov.za

Du Preez, L. & Carruthers, V. (2009) A Complete Guide to the Frogs of Southern Africa. Struik Nature, Cape Town.

Eskom. (2015). Taylor, M.R., Peacock, F. & Wanless, R.M. (Eds). The 2015 Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

Exigo Sustainability (2016). An ecological impact assessment for the proposed expansion of the Thaba Cronimet chrome mine, Northam area, Limpopo province

EWT. (2016). Mammal Red List 2016. www.ewt.org.za

EWT (Endangered Wildlife Trust). (2017). Threatened Amphibian Programme. (2015). The Southern African Frog Atlas Project https://www.ewt.org.za/TAP/refrence.html (SAFAP, now FrogMAP). http://vmus.adu.org.za

Fish, L., Mashau, A.C., Moeaha, M.J. & Nembudani, M.T. (2015). Identification Guide to Southern African Grasses: An Identification Manual with Keys, Descriptions, and Distributions. SANBI, Pretoria.

Fitzpatrick Institute of African Ornithology. 2021a. Frog Atlas of Southern Africa. http://frogmap.adu.org.za/

Fitzpatrick Institute of African Ornithology. 2021b. Reptile Atlas of Africa. http://sarca.adu.org.za

Fitzpatrick Institute of African Ornithology. 2021c. Virtual Museum of African Mammals. Website.

Goff, F., Dawson, G., & Rochow, J. (1982). Site examination for threatened and endangered plant species. Environmental Management, 6(4), 307-316.

IUCN spatial dataset. (2017). The IUCN Red List of Threatened Species. Version 2017-1. http://www.iucnredlist.org. Downloaded: March 2022.

IUCN. (2021). The IUCN Red List of Threatened Species. www.iucnredlist.org

Johnson, S. & Bytebier, B. (2015). Orchids of South Africa: A Field Guide. Struik publishers, Cape Town.

MammalMap. (2017). http://mammalmap.adu.org.za/

Marais. 2004. A Complete Guide to the Snakes of Southern Africa. Second Addition. Struik publishers, Cape Town.

Measey, G.J. (2011). Ensuring a Future for South Africa's Frogs: A Strategy for Conservation Research. South African National Biodiversity Institute, Pretoria.

Minter, L., Burger, M., Harrison, J.A. & Kloepfer, D. (2004). Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. Smithsonian Institute Avian Demography Unit, Washington; Cape Town.

Monadjem, A., Taylor, P.J., Coterrill, F.D.P. & Schoeman, C. (2010). Bats of southern and central Africa: a biogeographic and taxonomic synthesis. Wits University Press, Johannesburg.

Mucina, L. & Rutherford, M.C. (Eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria, South African.

Mucina, L., Rutherford, M.C. & Powrie, L.W. (Eds.). 2007. Vegetation map of South Africa, Lesotho and Swaziland. 1:1 000 000 scale sheet maps. 2nd ed. South African National Biodiversity Institute, Pretoria.

NBA (2018). National Biodiversity Assessment spatial data. http://bgis.sanbi.org/

Nel JL, Murray KM, Maherry AM, Petersen CP, Roux DJ, Driver A, Hill L, Van Deventer H, Funke N, Swartz ER, Smith-Adao LB, Mbona N, Downsborough L and Nienaber S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

National Protected Areas Expansion Strategy for South Africa (NPAES) (2016). Department of Environmental Affairs, Pretoria, South Africa.

Raimondo, D. (2009). Red list of South African Plants. SANBI, Pretoria.

READ. 2015. North West Department of Rural, Environment and Agricultural Development (READ). (2015) North West Biodiversity Sector Plan. North West Provincial Government, Mahikeng. December 2015

SABAP2. 2019. South African Bird Atlas Project. Available at: https://sabap2.birdmap.africa/coverage. (Accessed: March 2022).

SANBI. 2013. Grasslands Ecosystem Guidelines: landscape interpretation for planners and managers. Compiled by Cadman, M., de Villiers, C., Lechmere-Oertel, R. and D. McCulloch. South African National Biodiversity Institute, Pretoria. 139 pages.

SANBI-BGIS. 2017. Technical guidelines for CBA Maps: Guidelines for developing a map of Critical Biodiversity Areas & Ecological Support Areas using systematic biodiversity planning.

SANBI. (2017). South African National Biodiversity Institute – Red List of South African Plants. http://redlist.sanbi.org/

Scientific Aquatic services (2020a). Biodiversity status quo assessment for surface right area of the Rustenburg Platinum mines limited, Amandelbult Section near Thabazimbi, Limpopo Province. Section C Faunal Assessment

Scientific Aquatic services (2020b). Biodiversity status quo assessment for surface right area of the Rustenburg Platinum mines limited, Amandelbult Section near Thabazimbi, Limpopo Province. Section B Flora Assessment

Scientific Terrestrial services (2019). Terrestrial ecological assessment as part of the environmental impact assessment process for the proposed diversion of the Bierspruit river associated with the proposed opencast mine at Amandelbult, Thabazimbi, Limpopo province.

Skowno, A.L., Raimondo, D.C., Poole, C.J., Fizzotti, B. & Slingsby, J.A. (eds.). 2019. South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm. South African National Biodiversity Institute, Pretoria.

Sinclair, I and Ryan, P. 2010. Birds of Africa. Struik Nature, Cape Town.

Stuart, C and Stuart, M. 2000. A Field Guide to the Tracks and Signs of Southern and East African Wildlife. Southern Book Publishers.

TBC (The Biodiversity Company) (2022). Baseline & Impact Assessment for the Proposed Mainstream Solar Projects.

Taylor MR, Peacock F, Wanless RM (eds). 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa. Johannesburg, South Africa.

Taylor P, Baxter R, Child MF. 2016. A conservation assessment of Otomys auratus. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F. and Van der Colff D. 2019. South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6230.

Van Deventer, H., Smith-Adao, L., Mbona, N., Petersen, C., Skowno, A., Collins, N.B., Grenfell, M., Job, N., Lötter, M., Ollis, D., Scherman, P., Sieben, E. & Snaddon, K. 2018. South African National Biodiversity Assessment 2018: Technical Report. Volume 2a: South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Version 3, final released on 3 October 2019. Council for Scientific and Industrial Research (CSIR) and South African National Biodiversity Institute (SANBI): Pretoria, South Africa.

Yarnell RW, Richmond-Coggan L, Bussière E, Williams K, Bissett C, Welch R, Wiesel I. 2016. A conservation assessment of Parahyaena brunnea. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Avifaunal Impact Assessment

Birdlife South Africa. 2022. BirdLife South Africa Checklist of Birds in South Africa, 2022.

Brewer, R. & Mccann, M.T. 1982. Laboratory and field manual of ecology. Saunders Publishing, Philadelphia.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L. 1993. Distance Sampling: Estimating abundance of biological populations. Chapman and Hall, London.

Clarke, K.R. & Warwick, R.M. 1994. Changes in marine communities: An approach to statistical analysis and interpretation. Natural Environmental Research Council, United Kingdom.

Colwell, R.K. 2013. EstimateS: Statistical estimation of species richness and shared species from samples. Version 9. User's Guide and application published at: http://purl.oclc.org/estimates.

Del Hoyo, J., Elliott, A. & Christie, D.A. eds. 1992-2011. Handbook of the Birds of the World. Vol 1-16. Lynx Edicions, Barcelona.

Geoterrainimage. 2015. The South African National Land cover Dataset. Version 05.

Gill, F, Donsker, D., & Rasmussen, P. (Eds). 2022. IOC World Bird List (v 12.2). Doi 10.14344/IOC.ML.12.1. http://www.worldbirdnames.org/.

Gunerhan, H., Hepbasli, A. & Giresunlu, U. 2009. Environmental impacts from the solar energy systems. Energy Sources, Part A: Recovery, Utilization and Environmental Effects 31: 131-138.

Hardaker, T. 2022. Southern African Bird List - Version 11 - 29 August 2022.

Harrison, C., Lloyd, H. & Field, C. 2016. Evidence review of the impact of solar farms on birds, bats and general ecology. NEER012 report, Manchester Metropolitan University, UK.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds.). 1997. The Atlas of Southern African Birds. Vol. 1 & 2. BirdLife South Africa, Johannesburg.

Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. (eds.) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelker Bird Book Fund, Cape Town.

IUCN Red List of Threatened Species. Version 2022. http://www.iucnredlist.org/.

Jenkins, A.R, Ralston-Paton, S & Smit-Robinson, H.A. 2017. Best practice guidelines: Birds and Solar Energy. Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa.

Kagen, R.A., Verner, T.C., Trail, PW & Espinoza, E.O. 2014. Avian mortality at solar energy facilities in southern California: A preliminary analysis. Unpublished report by the National Fish and Wildlife Forensics Laboratory, USA.

Kruger, R. 1999. Towards solving raptor electrocutions on Eskom Distribution Structures in South Africa. M. Phil. Mini-thesis. University of the Orange Free State. Bloemfontein. South Africa.

Ledger, J. & Annegarn, H.J. 1981. Electrocution Hazards to the Cape Vulture (Gyps coprotheres) in South Africa. Biological Conservation 20: 15-24.

Marnewick, M.D., Retief, E.F., Theron, N.T., Wright, D.R. And Anderson, T.A. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.

McCrary, M.D., McKernan, R.L., Schreiber, R.W., Wagner, W.D. & Sciarotta, T.C. 1986. Avian mortality at a solar energy power plant. Journal of Field Ornithology 57: 135-141.

Moreno, C. E. & Halffter, G. 2000. Assessing the completeness of bat biodiversity inventories using species accumulation curves. Journal of Applied Ecology 37, 149– 158.

Mucina, L. & Rutherford, M.C. (eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

North West Department of Rural, Environment and Agricultural Development (READ). 2015 North West Biodiversity Sector Plan. North West Provincial Government, Mahikeng. December 2015.

Raaijmakers, J.G.W. 1987. Statistical analysis of the Michaelis-Menten equation. Biometrics 43: 793-803.

Ruddock, M. and Whitfield, D.P. 2007. A Review of disturbance distances in selected bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

Soberón, J., & J. Llorente. 1993. The use of species accumulation functions for the prediction of species richness. Conservation Biology 7 , 480-488.

Sutherland, W.J. 2006. Ecological census techniques. A handbook. 2nd Edn. Cambridge University Press.

Sutherland, W.J., Newton, I. and Green, R. E. 2004. Bird Ecology and Conservation. A handbook of techniques. Oxford University Press.

Taylor, M.R., Peacock, F. & Wanless, R. (eds.). 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg

Tsoutsos, T., Frantzeskaki, N. & Gekas, V. 2005. Environmental impacts from solar energy technologies. Energy Policy 33: 289-296.

Van Rooyen, C.S. 2000. An overview of Vulture Electrocutions in South Africa. Vulture News 43: 5-22.

Van Rooyen, C.S. & Taylor, P.V. 1999. Bird streamers as probable cause of electrocutions in South Africa. EPRI Workshop on Avian Interactions with Utility Structures, Charleston, South Carolina.

Vosloo, H. 2003. Birds and power lines. ESI Africa 3: 38.

Walston Jr. L.J., Rollins, K.E., LaGory, K.E., Smith, K.P. & Meyers, S.A. 2016. A preliminary assessment of avian mortality at utility-scale solar energy facilities in the United States. Renewable Energy 92 (2016) 405-414.

Watson, D.M. 2003. The 'standardized search': An improved way to conduct bird surveys. Austral Ecology 28: 515-525

Whitecross, M.A., Retief, E.F. and Smit-Robinson, H.A. 2019. Dispersal dynamics of juvenile Secretarybirds Sagittarius serpentarius in southern Africa. Ostrich 90(2): 97-110.

www.sabap2.birdmap.africa

Agricultural Impact Assessment

Crop Estimates Consortium, 2019. Field crop boundary data layer (NW province), 2019. Pretoria. Department of Agriculture, Land Reform and Rural Development.

Department of Agriculture, Land Reform and Rural Development, 2019. High potential agricultural areas 2019 – Spatial data layer, North West Province, 2021. Pretoria.
Department of Agriculture, Land Reform and Rural Development, 2018. Long-term grazing capacity for South Africa: Data layer. Government Gazette Vol. 638, No. 41870. 31 August 2018. Regulation 10 of the Conservation of Agricultural Resources Act (CARA): Act 43 of 1983. Pretoria. Government Printing Works.
Department of Agriculture, Land Reform and Rural Development, 2016. National land capability evaluation raster data: Land capability data layer, 2016. Pretoria.
Land Type Survey Staff, 1972 – 2006. Land Types of South Africa data set. ARC – Institute for Soil, Climate and Water. Pretoria.
The Soil Classification Working Group, 2018. Soil Classification – Taxonomic System for South Africa. Dept. of Agric., Pretoria.

Heritage Impact Assessment (including archaeology and palaeontology)

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
138237	Anton Pelser		HIA Phase 1	Sun Valley Heritage Report
146257	Anton Pelser	14/11/2013	HIA Phase 1	Report on a Phase 1 HIA for the Proposed Wilkoppies Ext. 108 Township Development on Holdings 19, 20, 21, 22, 23 and 48, Wilkoppies Agricultural Holdings (Elandsheuvel 402IP) in Klerksdorp, North West Province
168281	Polke Birkholtz	25/06/2014	Heritage Impact Assessment Specialist Reports	Heritage Impact Assessment: Matlosana 132 kV Loop-in-Loop-Out Line and Substation: Proposed Eskom Line on Sections of Portions 36 and 60 of the farm Palmietfontein 403 IP, City of Matlosana Local Municipality, North West Province.
321166	Jaco van der Walt	17/06/2015	Archaeological Specialist Reports	Archaeological Scoping Report for the Proposed BuLels Solar 1 SEF, Klerksdorp, North West Province
321168	Barry Millsteed	21/06/2015	PIA Desktop	Palaeontological Heritage Impact Assessment Report on the Site of a Proposed Solar Power Production Facility known as the BuLels Solar 1 PV Energy Facility to be located approximately 20 km north East of Orkney, NW Province
321169	Barry Millsteed	21/06/2015	PIA Desktop	Palaeontological Heritage Impact Assessment Report on the Site of a Proposed Solar Power Production Facility known as the BuLels Solar 2 PV Energy Facility to be located approximately 20 km north East of Orkney, NW Province
321170		17/06/2015	Archaeological Specialist Reports	Archaeological Scoping Report for the Proposed BuLels Solar 2 SEF, Klerksdorp, North West Province

336090	Johnny Van Schalkwyk	01/05/2015	Heritage Impact Assessment Specialist Reports	Cultural heritage assessment for the PROPOSED IKAGENG EXTENSION 13 ON PORTION 2 OF THE REMAINDER OF TOWN AND TOWNLANDS OF POTCHEFSTROOM 435IQ, NORTH WEST PROVINCE
5099	Udo Kusel	04/12/2006	AIA Phase 1	Cultural Heritage Resources Impact Assessment of Goudkoppie Klerksdorp North West Province
5100	Udo Kusel	25/06/2007	HIA Phase 1	Cultural Heritage Resources Impact Assessment on Portion 376 (A Portion of Portion 360) of the Farm Elandsheuwel 402 IP Klerksdorp
5195	Udo Kusel	15/02/2008	HIA Phase 1	Cultural Heritage Resources Impact Assessment of Portion 46 of the Farm Elandsheuwel 436 IQ (Portions Adjacent and to the West of Loopspruit), Tlkowe Local Municipality, North West Province
8402	Udo Kusel	11/12/2007	HIA Phase 1	Cultural Heritage Resources Impact Assessment of Holding 109 Wilkoppies Portion 430 (A Portion of Portion 59) of the Farm Elandsheuvel 402 IP Klerksdorp, North West Province

Other References

Beukes, N.J., 1987. Facies relations, depositional environments and diagenesis in a major early Proterozoic stromatolitic carbonate platform to basinal sequence, Campbellrand Subgroup, Transvaal Supergroup, southern Africa. Sedimentary Geology 54, 1-46.

Eriksson, P.G., Altermann, W., Hartzer, F.J., 2006. The Transvaal Supergroup and its pre-cursors. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 237-260.

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. Geological Society of southern Africa, Annexure to Volume LXXII. 72pp + 25 plates.

Zeh, A., Wilson, A.H., Gerdes, A., 2020. Zircon U-Pb-Hf isotope systematics of Transvaal Supergroup – Constraints for the geodynamic evolution of the Kaapvaal Craton and its hinterland between 2.65 and 2.06 Ga. Precambrian Research 345, 105760. https://doi.org/10.1016/j.precamres.2020.105760

Visual Impact Assessment

Blue Oak Energy, 2016. https://www.blueoakenergy.com/blog/glint-and-glare-studies-for-commercial-and-industrial-solar-

Chief Directorate National Geo-Spatial Information, varying dates. 1:50 000 Topographical Maps and Data.

CSIR, 2017. Delineation of the first draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment.

CSIR, 2015. The Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa.

DFFE, 2018. National Land-cover Database 2018 (NLC2018).

DFFE, 2021. South African Protected Areas Database (SAPAD_OR_2021_Q1).

DFFE, 2021. South African Renewable Energy EIA Application Database (REEA_OR_2021_Q1).

DEA&DP, 2011. Provincial Government of the Western Cape. Guideline on Generic Terms of Reference for EAPS and Project Schedules.

Department of Environmental Affairs and Tourism (DEA&T), 2001. Environmental Potential Atlas (ENPAT) for the Mpumalanga Province.

FAA, 2015. Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach.

Forge Solar PV Planning and Glare Analysis, 2019. Guidance and information on using Forge Solar analysis tools.

JAXA, 2021. Earth Observation Research Centre. ALOS Global Digital Surface Model (AW3D30).

Meister Consultants Group, 2014.

http://solaroutreach.org/wp-content/uploads/2014/06/Solar-PV-and-Glare-_Final.pdf

National Botanical Institute (NBI), 2004. Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)

Oberholzer, B. (2005). Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.

Pager Power Urban and Renewables, 2020. Solar Photovoltaic and Building Development – Glint and Glare Guidance.

The Environmental Impact Assessment Amendment Regulations. In Government Gazette Nr. 33306, 18 June 2010.

Social Impact Assessment

Census 2011 Community Profiles Database. Statistics South Africa.

CSIE, DME and Eskom. 2001. South African Renewable Energy Resource Database. Available from: www.csir.co.za/environmentek/sarerd/contact.html

IFC. (2007). Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets. International Finance Corporation: Washington.

Interorganizational Committee on Principles and Guidelines for Social Impact Assessment. US Principles and Guidelines – Principals and guidelines for social impact assessment in the USA. Impact Assessment and Project Appraisal, 21(3): 231-250.

National Development Agency (NDA). (2014). Beyond 10 years of unlocking potential. Available from: http://www.nda.org.za/?option=3&id=1&com_id=198 &parent_id= 186&com_task=1

National Energy Act (2008)

National Environmental Management Act 107 of 1998 (NEMA) National Development Plan (2030)

National Integrated Resource Plan South Africa (2010-2030)

South African LED Network (SA LED Network). (2010). Networking Practitioners Developing Local Economies. Available from: http://led.co.za/

State of the Environment Report (SOER). 2005. Northern Cape Province. Department of Tourism, Environment and Conservation. CSIR Environmental.

Statistics South Africa. (2014). Education: A Roadmap out of poverty? Available from: http://beta2.statssa.gov.za/?p=2566

Strategic Infrastructure Projects (SIPs) The Constitution Act 108 of 1996

UNEP, 2002. EIA Training Resource Manual. 2nd Ed. UNEP.

United Nations Economic and Social Commission for Asia and the Pacific (UN). (2001). Guidelines for Stakeholders: Participation in Strategic Environmental Management. New York, NY: United Nations.

Vanclay, F. 2003. Conceptual and methodological advances in Social Impact Assessment. In Vanclay, F. & Becker, H.A. 2003. The International Handbook for Social Impact Assessment. Cheltenham: Edward Elgar Publishing Limited.

White Paper on Energy Policy of the Republic of South Africa (1998) White Paper on Renewable Energy of the Republic of South Africa (2003).