MAPHAHA PROJECTS
AND INVESTMENTS

Maphaha Projects and Investments (Pty) Ltd
99 Bushypark, Mashamba, 0942
Sedzani Mulaudzi
Tell: 076 560 8193
Fax: 0864714904
Email: sedzani@mukhadakhomu.com

DRAFT

BASIC ASSESSMENT REPORT

FOR

THE PROPOSED SOLAR FARM AT THE FARM KWAGGAFONTEIN 216 JR PORTION OF PORTION 0 IN KWAGGAFONTEIN WITHIN THEMBISILE HANI LOCAL MUNICIPALITY IN MPUMALANGA PROVINCE.

PREPARED BY: MAPHAHA PROJECTS AND INVESTMENT (PTY) LTD

APPLICANT: IMVUNULO INVESTMENT (PTY) LTD

ERF 2075 Phola, Witbank, 2233
CELL: 063 061 4483
EMAIL: aaron@saamfox.co.za

JULY 2022

Contents

APPENDICES

DOCUMENT CONTROL

Client:	Imvunulo Investment (Pty) Ltd.
Report Title:	BASIC ASSESSMENT REPORT FOR THE PROPOSED SOLAR FARM AT THE FARM KWAGGAFONTEIN 216 JR PORTION OF PORTION 0 IN KWAGGAFONTEIN WITHIN THEMBISILE HANI LOCAL MUNICIPALITY IN MPUMALANGA PROVINCE.
Report No:	II-MPI_0012022SF
Version:	1.0
Date issued:	
PreparedBy:	Sedzani Mulaudzi
Reviewed by:	Nkhangweni Mulaudzi

Summary of where requirements of Appendix 1 of the 2014 NEMA EIA Regulations (as amended, GN R326) are provided in this BA Report

APPENDIX 1	YES / NO	SECTION IN BA REPORT
Objective of the basic assessment process 2) The objective of the basic assessment process is to, through a consultative process- a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context; b) identify the alternatives considered, including the activity, location, and technology alternatives; c) describe the need and desirability of the proposed alternatives; d) through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine (i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and (ii) the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; and e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to- (i) identify and motivate a preferred site, activity and technology alternative; (ii) identify suitable measures to avoid, manage or mitigate identified impacts; and (iii) identify residual risks that need to be managed and monitored.	**Yes**	**Section A of the report includes the Introduction, legislative review, alternatives assessment and needs and desirability** **Section D includes impact assessments undertaken**
Scope of assessment and content of basic assessment reports		

3) (1) A basic assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include: (a) details of: (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	**Yes**	**Section A.2**
(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; (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	**Yes**	**Section A.3**
(c) a plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale; or, if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	**Yes**	**Section A.3**
(d) a description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for; and a description of the activities to be undertaken including associated structures and infrastructure;	**Yes**	**Section A.8**
(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; and (ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	**Yes**	**Section A.8**
(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;	**Yes**	**Section A.10**
(g) a motivation for the preferred site, activity and technology alternative;	**Yes**	**Section A.9**
(h) A full description of the process followed to reach the proposed preferred alternative within the site, including - (i) details of all the alternatives considered;	**Yes**	**Section A.9**
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	**Yes**	**Section C**
(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in	**Yes**	**Section C (to be updated following review of draft report)**

which the issues were incorporated, or the reasons for not including them;		
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	**Yes**	**Section A.9**
(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	**Yes**	**Section A.9**
(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;		
(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;		
(viii) the possible mitigation measures that could be applied and level of residual risk;		
(ix) the outcome of the site selection matrix;		
(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and		
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	**Yes**	**Section A.9**
(j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be avoided, managed or mitigated;	**Yes**	**Section D**

(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;	**Yes**	**Section D**
(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;	**Yes**	**Section E**
(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr;	**Yes**	**Section D**
(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;	**Yes**	**Section E**
(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	**Yes**	**Please refer to each specialist study included in Appendix C**
(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;	**Yes**	**`Section E**
(q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post	**N/A**	
(r) an undertaking under oath or affirmation by the EAP in relation to - (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties; and	**Yes**	**Appendix E**
(s) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	X	N/A

(t) any specific information that may be required by the competent authority; and	X	N/A
(u) any other matters required in terms of section 24(4)(a) and (b) of the Act.	X	N/A
2) Where a government notice gazetted by the Minister provides for the basic assessment process to be followed, the requirements as indicated in such a notice will apply.	X	N/A

SECTION A: INTRODUCTION, PROJECT DESCRIPTION AND LEGISLATIVE REVIEW

A.1 Introduction

Imvunulo Investment (Pty) Ltd is proposing to develop 8 MW Solar Photovoltaic (PV) Facilities and associated electrical infrastructure (including a 22 kV cable trenches from PV Facility to the Eskom Kwaggafontein Substation). The proposed project is located on portion 0 of the farm Kwaggafontein 216 JR and the connection points to the Eskom Kwaggafontein Substation on the very same farm. The proposed project is approximately 11 km east of Kwaggafontein Mall and within Thembisile township within the Thembisile Hani Local Municipality, Mpumalanga Province.

A.2 Project Team

In accordance with Regulation 12 (1) of the 2014 NEMA EIA Regulations (as amended), the Applicant has appointed Maphaha Projects and Investments (Pty) Ltd (MPI) to undertake the BA Processes in order to determine the biophysical, social and economic impacts associated with undertaking the proposed development.

The BA is being managed by the Environmental Assessment Practitioner (EAP), Sedzani Mulaudzi. Sedzani has more than 8 years' working experience in environmental management and the consulting industry and managing various account clients, she understands the South African Regulatory System, and can advise client with due diligence on their environmental regulatory requirements and offer a solution driven service to their project life cycle . She is equipped with exceptional project management and coordination skills, which especially enhances the service she offers clients within the environmental permitting system.

Her key focus is environmental management and compliance with extensive experience in the environmental industry. Project Management and Coordination of projects form a critical component of her duties, which include project planning, initiation of projects, client, authority and stakeholder consultation and timeframe management.

Her interest lies in a client advisory capacity, being involved during pre-project development and assist the client in adding value to develop the project in an environmental sustainable manner, considering client costs and liabilities, as well as considering the implication of environmental authorisation conditions and requirements on project deliverables.

Her involvement in projects has spanned over the project life cycle from Prospecting Right applications, Mining Permit, Mining Right applications, Basic Assessment reporting ,Environmental Management Plans, Scoping Reports, Environmental Impact Assessment reports and Authorisations.

A.3 Project overview

A.3.1 General Overview

Table A3.1 Location characteristics

PV Plant location characteristics	
City / Town	Kwaggafontein
Region	Mpumalanga
Country	South Africa
Latitude	-25.30 °
Longitude	+28.96 °
Altitude	1393.21 m a.m.s.l.
Time zone	UTC +2

Figure A.1.1 Project location

Figure A.1.2 Project location: closer view in the region

The proposed Solar PV facilities will be developed with a possible maximum installed capacity of 8 MW of electricity from PV solar energy. Solar PV facility will contain an on-site substation that will connect to the Eskom Kwaggafontein Substation via 22 kV cable trenches. The locality of the project is shown Figure A.2 below.

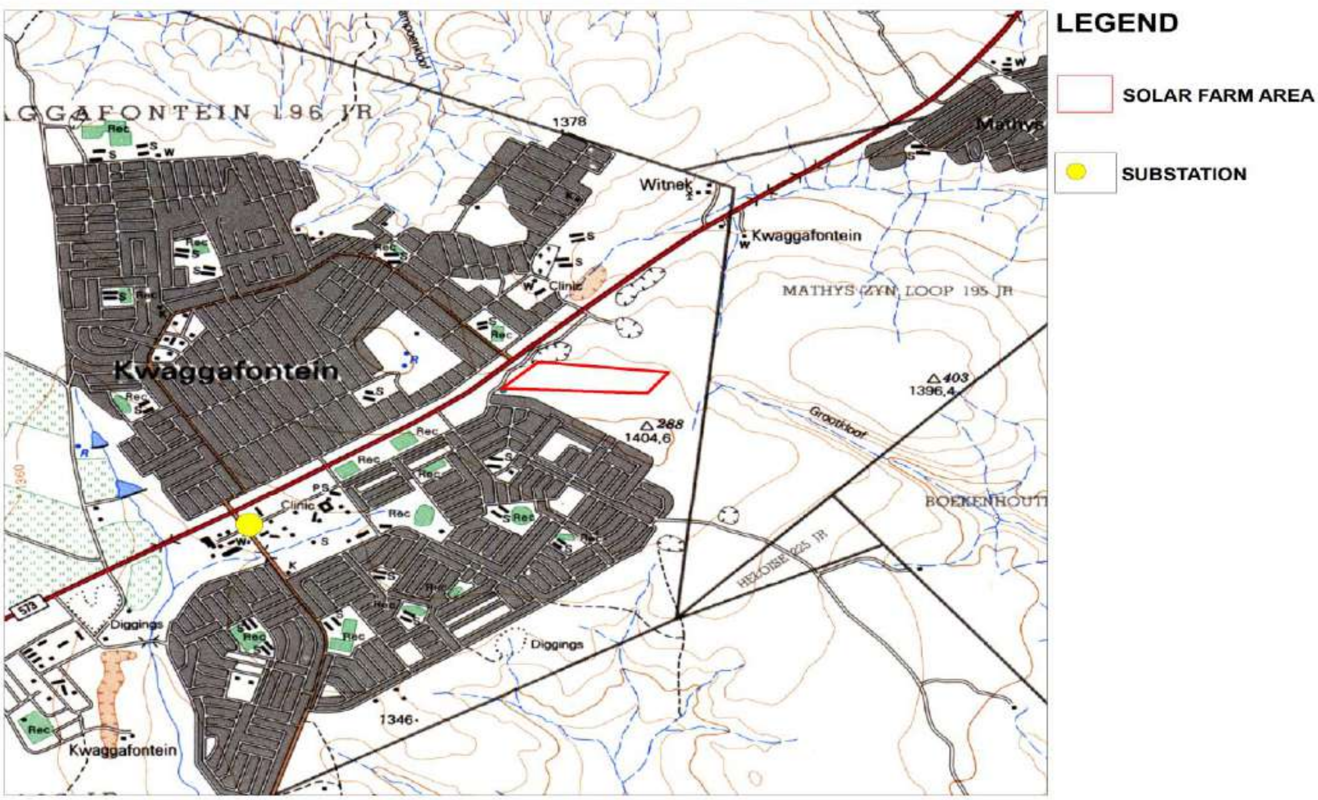


Figure A.2. Project locality map

A.3.2 Imvunulo-Kwaggafontein PV project

Table A3.2 Location of the overall Activity.

Name:	Kwaggafontein 216 JR portion of portion 0
Application area (Ha)	20 ha
Magisterial district:	Thembisile Hani Local Municipality within Nkangala District
Distance and direction from nearest town	Approximately 11 kilometres East of Kwaggafontein
21 digit Surveyor General Code for each farm portion	T0JR00000000021600000

Table A3.3 Coordinates of the overall activity

Latitudes	Longitudes
25:17:58.0118 S	28:57:41.8205 E
25:18:12.4082 S	28:57:56.6552 E
25:18:18.3064 S	28:57:50.5900 E
25:18:06.9027 S	28:57:31.3788 E

A.4 Project description

The proposed solar facility will consist of the components listed below. The technical information on these components are also discussed within this sub-section. It is however important to note at the outset that the exact specifications of the proposed project components will be determined during the detailed engineering phase (subsequent to the issuing of an EA, should such an authorisation be granted for the proposed project) but that the information provided below is seen as the worst-case scenario for the project.

- **Project Components**
- Solar Field, comprising Solar Arrays with a maximum height of 10 m and maximum footprint of 20 hectares per project (detailed provided below), including the following:
  - PV Modules;
  - Single Axis Tracking structures (aligned north-south), Fixed Axis Tracking (aligned east-west), Dual Axis Tracking (aligned east-west and north-south), Fixed Tilt Mounting Structure or Bifacial Solar Modules (all options will be considered in the design);
  - Solar module mounting structures comprised of galvanised steel and aluminium; and
  - Foundations which will likely be drilled and concreted into the ground.
- Building Infrastructure
  - Offices (maximum height 7 m and footprint of 46.12 m^2);
  - Operational and maintenance control centre (maximum height 7 m and footprint 5 m^2);
  - Warehouse/workshop (maximum height 7 m and footprint 8 m^2);
  - Ablution facilities (maximum height 7 m and footprint 5 m^2);
  - 50 converter/Inverter stations (height from 2.5 m to 7 m (maximum) and footprint 10m^2);
  - On-site substation building (footprint 40.50m^2).; and
  - Guard Houses (height 3 m, footprint 4 m^2).

- Associated Infrastructure
  - 22 kV cable trenches to connect to the existing Eskom Kwaggafontein substation to be located within a corridor of approximately 300 m – 1000 m wide. The specific cable trenches will have a following specifications:
    - The servitude for the 22 kV cable trenches. The minimum depth at which medium voltage cables are placed is 700.0 mm. These cables are separated horizontally by 200.0 mm. The vertical separation between them is 200.0 mm. Vegetation clearance within the servitude will be undertaken in compliance with relevant standards and specifications.
    - Length from site to grid connection = approximately 500m.

- Associated electrical infrastructure at the Eskom Kwaggafontein Substation (including but not limited to feeders, Busbars, transformer bay and extension to the platform at the Eskom Kwaggafontein Substation);
- On-site substation;
- Internal 22 kV underground cables (either underground to maximum depth of 700.0 mm);
- Underground low voltage cables or cable trays (underground to maximum depth of 700.0 mm);
- Access roads. Maximum 4 m wide. Total Length of Internal Gravel and Perimeter Roads Length: Approximately 2691.56 m
- Internal gravel roads (width of 4 m);
- Fencing (at least 2 m high) - Access points will be managed and monitored by an appointed security service provider. The type of fencing will either be of palisade, mesh type or a fully electrified option;
- Panel maintenance and cleaning area;
- Stormwater channels (Details to be confirmed once the Engineering, Procurement and Construction (EPC) contractor has been selected and the design is finalised. A detailed stormwater management plan would need to be developed); and
- Temporary work area during the construction phase (i.e. laydown area of maximum 5 ha).

Additional specifications

The proposed 8 MW project includes a 22 kV cable trenches to the Eskom Kwaggafontein Substation. Basic Assessment Processes are being undertaken for the development of 8 MW facility and associated infrastructures.

A description of the key components of the proposed project is described below.

A.4.1 Solar facility

As noted above, the total footprint of the solar facility is estimated to be approximately 20 hectares (ha). This will include the development of the solar field and building and associated infrastructure, as detailed above. The exact number of solar panels arrays, confirmation of the foundation type and detailed design will follow as the development progresses but a preliminary site layout plan has been included in Appendix B of this report.

- **PV Modules**

The smallest unit of a PV installation is a cell. A number of cells form a module, and finally a number of modules form the arrays (Figure A.3).

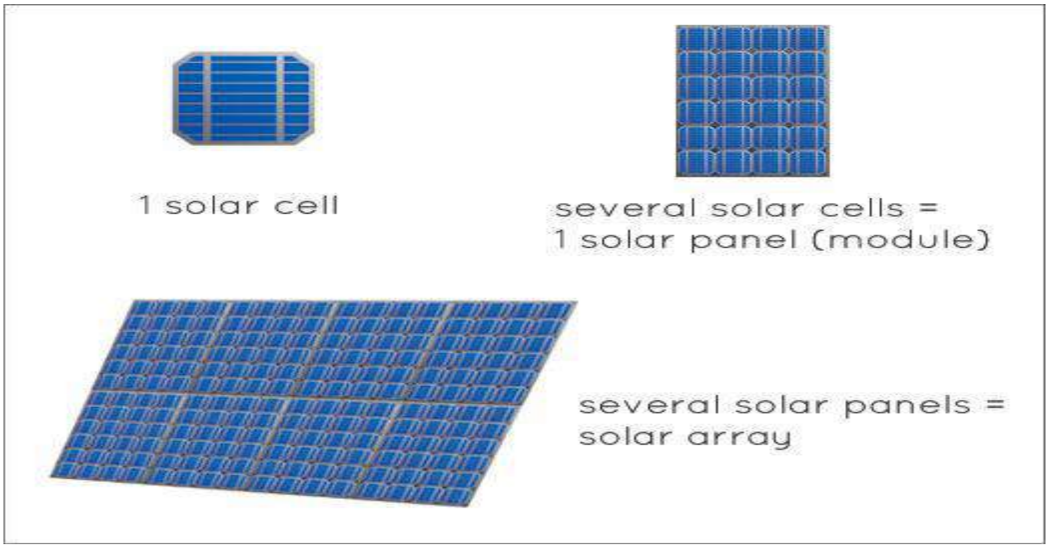


Figure A.3. Components of the Proposed PV Installation

Modules are arranged into strings that form the solar field, and in section sizes of approximately 40 x 5 m called tables and are installed on racks which are made of aluminium or galvanised steel. The arrays and racks will be founded into the ground through either steel or concrete towers (which will be confirmed during the detailed engineering phase), as shown in Figure A.4. The entire structure is not expected to exceed 10 m in height (measured from the ground), which is considered the worst-case. This system may be fixed, or may track the movement of the sun (either by adopting Fixed Axis Tracking, Single Axis Tracking, Dual Axis Tracking, Fixed Tilt Mounting Structures or Bifacial Solar Modules as explained above). All the arrays will be wired to converter/inverter stations that converts DC into AC.

Figure A.4. PV Technology

- **Electrical Infrastructure within the PV Facility**

As mentioned above, the solar arrays are typically connected to each other in strings, which are in turn connected to inverters that convert DC to AC. The strings will be connected to the inverter stations by low voltage underground (internal) DC cables or cable trays. Power from the converter/inverter station will be collected in medium voltage transformers through underground (internal) AC cables, cable trays or AC cables which are pole-mounted depending on voltage level and site conditions.

The inverter stations will in turn be connected to the proposed on-site substation, via medium voltage (33 kV) internal underground cables, which will increase the voltage and transmit the power produced via a 22 kV cable trenches into the national grid system via the Eskom Kwaggafontein Substation.

- **Roads**

The proposed project site can be accessed via an existing R573 provincial road. The existing access routes will be considered in the design of the facility and have been included in the proposed project. The R573 is 6 m wide and falls within a 45 m road reserve. This Provincial Road is designed for minimum daily traffic exceeding 1000 vehicle units.

Internal roads extending approximately 4 m wide will be constructed within the project footprint of the proposed PV plant. A perimeter road will also be constructed along the boundary of the proposed PV plant, which will extend approximately 2.5 m wide.

Overall, the proposed internal roads, the existing provincial access road, the perimeter roads will have a maximum length of 2691.56m in total.

- **Panel maintenance and cleaning area**

During the operational phase, the accumulation of dust on solar panels generally negatively influences the productivity of solar facilities. As such the panels require regular cleaning.

- **Stormwater, Waste and Municipal Services**

Stormwater channels will be constructed on site to ensure that stormwater run-off from site is appropriately managed. Water from these channels will not contain any chemicals or hazardous substances, and will be released into the surrounding environment based on the natural drainage contours.

Imvunulo Investment has confirmed that a stormwater analysis is being done for the site to inform the layout and design. In particular, it is important to verify that the proposed on-site substation is not located in an area of stormwater accumulation, as this would disrupt substation operation. A storm water management plan will be implemented during the construction and operation of the facility. The plan will ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan will include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures promote the dissipation of storm water run-off. These actions are incorporated into the EMPr.

- **Building Infrastructure**

The solar field will require on-site buildings, including an operational and maintenance control centre, offices, warehouse/workshop (for storage of equipment), ablution facilities, converter stations, on-site substation and substation building, laydown areas and security enclosures. Dimensions for these are provided above.

A.4.2 Electrical infrastructure to Support the PV Facility

An on-site substation will also be constructed to support the PV facility. The on-site substation building is expected to extend approximately 12 m in height, with a maximum footprint of 0.04 ha.
As noted above, the on-site substation is proposed to be connected via a 22 kV cable trenches to the Eskom Kwaggafontein substation. The electrical infrastructure includes:

- 22 kV cable trenches to connect to the existing Eskom Kwaggafontein substation;
- Gravel service road of up to 4 m width; and
- Associated electrical infrastructure at the Eskom Kwaggafontein Substation (including but not limited to feeders and busbars).

The photovoltaic panel arrays will be connected to each other in strings and the strings connected to inverter stations by low voltage underground direct current cables. Power from the inverter will be transformed from low to medium voltage (22kV) at the medium voltage transformers. Power from the inverters is collected in medium voltage transformers through alternating current cables, which may be buried or pole-mounted depending on voltage level and site conditions. The electric power is then transported to a proposed 22kV existing Eskom Kwaggafontein substation, via medium voltage underground cables (22kV). Cables and trenches required for underground cables will remain along internal roads and already disturbed areas as far as possible.

The line will consist of either self-supporting suspension structures or guyed monopoles. The self-supporting towers will have standard pad and plinth foundations. The guyed monopoles will consist of a central plinth for the tower masts. The stay wires will entail dead-man anchor/stay plate anchor foundations. Insulators will be used to connect the conductors to the towers. The span lengths are estimated to range between 200 m and 300 m. Exact Specifications will be confirmed during the detailed design phase.

A.4.3 Additional infrastructure

The types of materials that will need to be transported to site during the construction phase include the following:

Materials and equipment transported to the site comprise of:

- Building materials (concrete aggregates, cement and gravel);
- Construction equipment such as piling rigs and cranes;
- Solar panels (panels and frames); and
- Transformer and cables.

The following is anticipated:

A. Building materials comprising of concrete materials for strip footings or piles will be transported using conventional trucks which would adhere to legal limits listed above.
B. Solar Panels and frames will probably be transported in containers using conventional heavy vehicles within the legal limits. The number of loads will be a function of the capacity of the solar farm and the extent of the frames (the anticipated number of loads are discussed below).
C. Transformers will be transported by abnormal vehicles.

One (1) single axel truck will come to site on a daily basis during the construction phase (i.e. over a period of 4 months). In addition to this, 1 light load trucks will come from and go to site on a daily basis during the construction phase (i.e. over a period of 8 months). In terms of workers accessing the site, the worst case estimate is that the 1000 workers (345 skilled and 655 unskilled, the maximum estimate) will need to come to site on a daily basis. It is however highly unlikely that all 1000 workers would need to be on site simultaneously. It is assumed that workers would commute using both personal vehicles and buses. This would amount to an estimated 4 buses and 6 personal vehicles per day to and from site once in the morning and once in the afternoon.

During the operational phase, fewer materials will need to be transported to site. Trips will also be generated for the transportation of staff during the construction and operational phases. One (1) single axle truck will come from and go to site every quarter, 1 grader/digger every year to clear roads and 2-3 bakkies/1-tonner to and from site on a daily basis. For water supply (if water is sourced from the municipality), the current estimate is that 2 trips per month will be made by a water truck.

A.4.4 Main Equipment

The main equipment used to convert the solar energy to electricity is:

- Photovoltaic modules, which convert the solar radiation into direct current.
- The single-axis tracker, which supports and orients the PV modules to minimize the angle of incidence between the incoming sun rays and the PV modules surface during the day.
- String inverters, which convert DC from solar field to AC.
- Power Transformers, which raise the voltage level from low to medium.
- Power Stations, which hold the necessary equipment to convert the DC power to AC.

The electrical configuration of the PV plant can be seen in Figure A5.

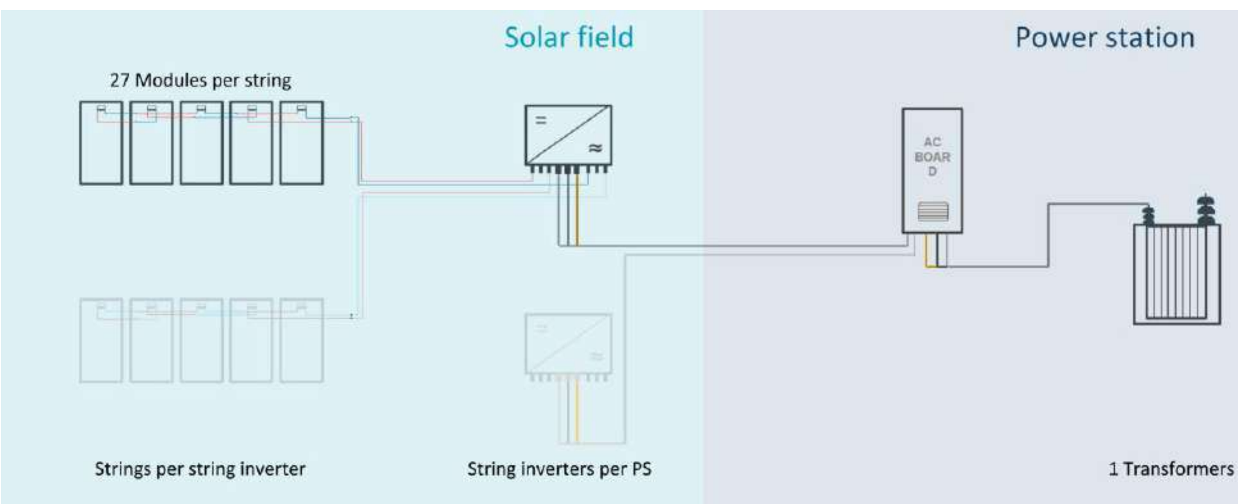


Figure A5: Simplified electrical configuration diagram

A.4.4.1 Photovoltaic module

The selected photovoltaic module is the JAM72S10-410/MR/1500V Monofacial model, manufactured by JA Solar. It has a peak power of 410.0 W, and the technology of the cells is Si-mono.

The features of the photovoltaic module are shown in Table A4.4.1.

Table A4.1. Photovoltaic module characteristics

Photovoltaic module characteristics	
Main characteristics	
Module model	JAM72S10-410/MR/1500V
Manufacturer	JA Solar
Technology	Si-mono
Type of module	Monofacial
Maximum voltage	1500 V
Standard test conditions (STC)	
Peak power	410.0 W
Efficiency	20.46 %
MPP voltage	41.4 V
MPP current	9.92 A
Open circuit voltage	50.1 V
Short circuit current	10.45 A
Temperature coefficients	
Power coefficient	-0.354 %/°C
Voltage coefficient	-0.305 %/°C
Current coefficient	0.044 %/°C
Mechanical characteristics	
Length	2015.0 mm
Width	996.0 mm
Thickness	0.04 mm
Weight	22.7 kg

An example picture of a Monofacial Si-mono module is shown in Figure A6.

Figure A6. Example of a Monofacial Si-mono photovoltaic module

A.4.4.2. Single axis N-S tracker

The PV solar modules will be mounted on North-South oriented one-axis solar trackers, integrated on metallic structures combining galvanized steel and aluminium parts, forming a structure fixed to the ground. An example of a single-axis tracker is shown in Figure A7.

Figure A7: An example of a single-axis tracker

Single-axis trackers are designed to minimize the angle of incidence between the incoming sun rays and the photovoltaic panel plane of array. The tracking system consists of an electronic device capable of following the sun through the day. The main features of the tracking system are summarized in Table A4.4.1.2.

Table A4.2. Main characteristics of the single-axis trackers

Single-axis tracker characteristics	
Model	STi-H1250
Manufacturer	STi Norland
Technology	Linked row
Configuration	1V
Tracking angle limits	+55 / -55 °
Number of modules per row	54 modules (maximum 63 modules)
Pitch distance	5.0 m
Minimum ground clearance	1.0 m
Designed for	MONOFACIAL modules
Motor gap	1000.0 mm
Torque beam gap	0.0 mm
Gap between modules in the axis direction	0.0 mm
Gap between modules in the pitch direction	0.0 mm

A.4.4.3. String inverter

The inverter converts the direct current produced by the photovoltaic modules to alternating current. It is composed of the following elements:

- One or several DC-to-AC power conversion stages, each equipped with a maximum power point tracking system (MPPT). The MPPT will vary the voltage of the DC array to maximize the production depending on the operating conditions.
- Protection components against high working temperatures, over or under voltage, over or under-frequencies, minimum operating current, mains failure of transformer, anti-islanding protection, protection against voltage gaps, etc. In addition to the protections for the safety of the staff personnel.

In Figure A8 a commonly used photovoltaic inverter for utility-scale PV plants is shown.

Figure A8. Example of string photovoltaic inverter

Figure A9: Typical String Inverter installation

The main characteristics of the selected inverter are shown in Table A4.4.1.3.

Table A4.3. Inverter characteristics

Inverter characteristics	
Main characteristics	
Inverter model	SUN2000-185KTL-H1@40C
Inverter type	STRING
Manufacturer	Huawei Technologies
Maximum DC to AC conversion efficiency	98.86 %
Input side (DC)	

MPPT search range	500 - 1500 V
Maximum input voltage	1500 V
Output side (AC)	
Rated power	185.0 kVA
Power at 30 C (datasheet)	185.0 kVA
Power at 50 C (datasheet)	175.0 kVA
Output voltage	800 V
Output frequency	50 Hz

Table 4.4. Inverters

Inverters	Quantity	Input Strings	Power AC	Power DC	DC/AC ratio
SUN2000-185KTL-H1@40C	46	20	185 kW	221 kW	1.197
SUN2000-185KTL-H1@40C	4	18	185 kW	199 kW	1.077

A.4.4.4. Power transformer

The power transformer raises the voltage of the inverter AC output to achieve a higher efficiency transmission in the power lines of the photovoltaic plant. An example of a power transformer is shown in Figure A10.

Figure A10. Example of power transformer to be installed inside the "indoor power station" in Figure A11 on the next page

Table A4.5. Power transformer characteristics

Power transformer characteristics	
Rated power	1850.0 kVA
Voltage ratio	0.8/22.0kV
Cooling system	ONAN
Tap changer	2.5%, 5%, 7.5%, 10%
Short circuit (Xcc)	0.08

A.4.4.5. Power Station

The power stations or transformer stations are indoor buildings or containers. The voltage of the energy collected from the solar field is increased to a higher level to facilitate the evacuation of the generated energy.

The power transformers will be housed in the power station.
An example of an Indoors power station is shown in Figure A11.

Figure A11. Example of an Indoors power station (40ft container)

The power station shall be supplied with medium voltage switchgears that include one transformer protection unit, one direct incoming feeder unit, one direct outcoming feeder unit and electrical boards. Particularly, for the first power station of each MV line, a direct incoming unit will not be installed. The main features of the default power station are shown in Table A4.4.1.6.

Table A4.6. Power station characteristics

Power station characteristics	
Number of transformers	1
Voltage ratio	0.8/22.0kV
Service	Indoors

Table A4.7. Power stations

Power stations	Quantity	Num Inverters	Power AC	Power DC	DC/AC ratio
1	4	10	1.85 MW	2.214 MW	1.197
2	1	10	1.85 MW	2.125 MW	1.149

A.4.4.6. Medium Voltage Substation

The medium-voltage (22kV) substation is the location where the project will connect to the Eskom grid. Since power from the PV field will be stepped-up to 22kV by the Power Transformers (4.4.4) and the Power Stations (4.4.5) the Medium Voltage Substation will contain Medium-voltage switchgear, tariff metering systems and the Power Plant Controller and backup power generation for the control systems. The following Figure (A12) shows a typical medium-voltage substation:

Figure A12: MV Substation (typical)

Figure A13: MV substation (inside)

A.5 PV Plant Sizing

A.5.1. Electrical configuration

The photovoltaic generator array consists of photovoltaic modules connected in serial and parallel associations. This configuration is defined by the module and inverter technical features, the power system requirements, and the meteorological conditions of the specific location in South Africa.

The methodology used to define the electrical configuration consists of sizing the strings of modules, electrical junction boxes (if present), wiring and inverters to find an electrical configuration that satisfies the DC/AC ratio goal. Some of the design criteria considered were:

- Reaching the maximum DC voltage possible, staying below the maximum rated voltage of the photovoltaic modules, 1500 V. This is done to minimize the DC power transmission losses.
- The photovoltaic generator array (DC field) is oversized with respect to the rated power of the AC system, to maximize the energy yield.

The main features of the electrical configuration are shown in Table A9.

Table A9. Electrical configuration characteristics

Electrical configuration characteristics	
Plant rated power	9.3 MWac
Plant peak power	11.0 MWdc
DC/AC Ratio	1.19
Modules per string	27

The medium voltage network connecting the power stations to the substation operates at 22.0 kV. It is composed of 1 medium voltage branches.

A.5.2. Electrical Cabling Design

The goal when calculating the characteristics of the electrical wiring is to minimize the cable lengths and sections. The sections are selected according to the IEC 60364-5-52 and IEC 60502-2 standards.
When selecting a cable cross section, the current carrying capacity, the voltage drop, and the short circuit current were considered. The maximum allowed voltage drop was 1.5% for the DC side, and 0.0% for the AC cables of the MV network.

A 35mm^2 earthing cable is used for the low voltage and medium voltage trenches, while a 50 mm^2 earthing cable is used in the case of the power stations.

A summary of the selected cable sections and their installation method is shown in Table A10.

Table A10. Summary of the selected cable sections

Section	Conducting material	Insulating material	Installation type
Strings to Inverter			
4 mm2	Cu	XLPE	Fastened to structure
Inverter to PS			
185 mm2	Al	XLPE	Buried in trench
120 mm2	Al	XLPE	Buried in trench
PS to MV switchgears			
630 mm2	Al	XLPE	Buried in trench

A.5.3. Civil works

Some of the parameters considered for the civil works required to build the photovoltaic plant are shown in Table A11.

Table A11. Civil works

Civil works	
Pitch distance	5.0 m
Distance between consecutive rows	0.5 m
Road width (dirt road)	4.0 m
LV trench maximum section	0.4 m2
MV trench maximum section	1.2 m2

For the design of the PV plant under study, roads of 4.0 m have been used. These roads run a total distance of 2691.56 m.

Road ditches used for drainage and for channelling water are placed on one side of the roads.

A total perimeter of 1757.94 m of chain link fence surrounds the different areas of the PV plant. The fence has at least 2.0 m of height and 3.0 m between posts. For every 50.0 m of fence, a light post of 4.0 m of height and a microwave barrier system are installed. For every 100.0 m of fence, a video camera post of 6.0 m of height is installed.

Low voltage cables from string inverters to the Power Stations have been directly buried in trenches. Various rows of cables may be included inside the same trench. Low voltage and medium voltage trenches are separated.

The minimum depth at which the low voltage cables are placed is 600.0 mm. These cables are horizontally in touch. The vertical separation between the low voltage cables is 50.0 mm.

A simplified trench cross section of the LV trenches is shown in Figure A14.

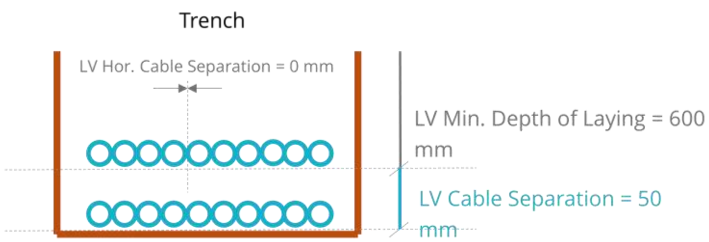


Figure A14. Simplified LV trench cross section

The minimum depth at which medium voltage cables are placed is 700.0 mm. These cables are separated horizontally by 200.0 mm. The vertical separation between them is 200.0 mm.

A simplified trench cross section of the MV trenches is shown in Figure A15.

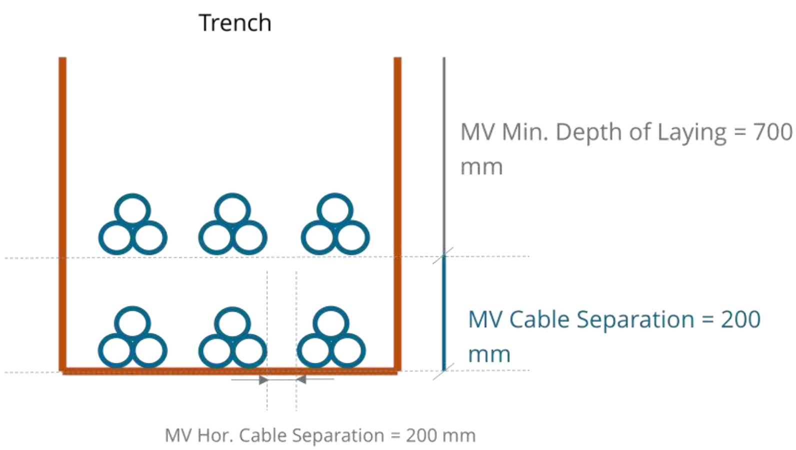


Figure A15. Simplified MV trench cross section

The offset horizontal space between the cable rows and the trench boundaries is 50.0 mm.
The section of the trenches used in the design are shown in Table A12, along with the total trench length and volume for each type.

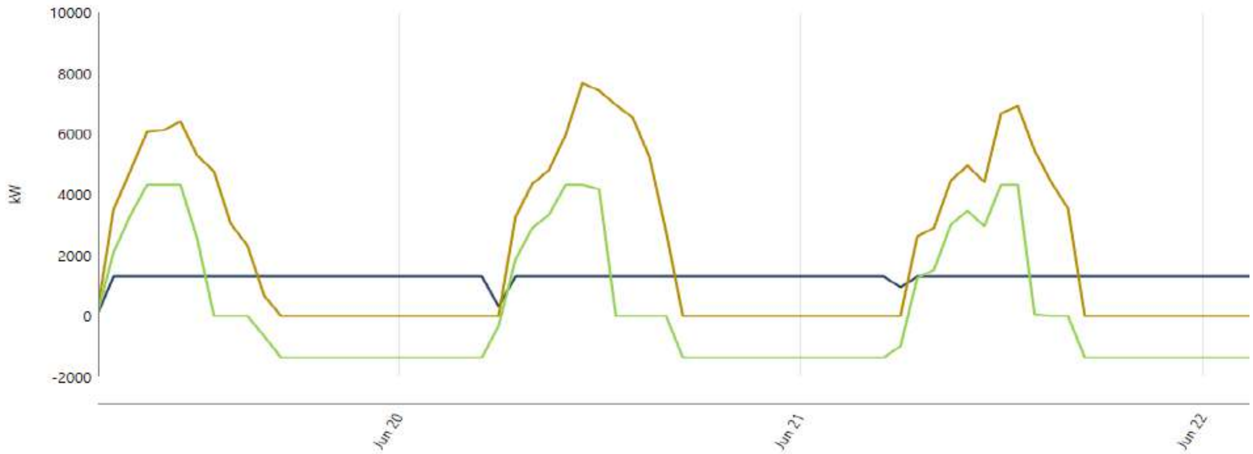
Table A12. Trench cross sections

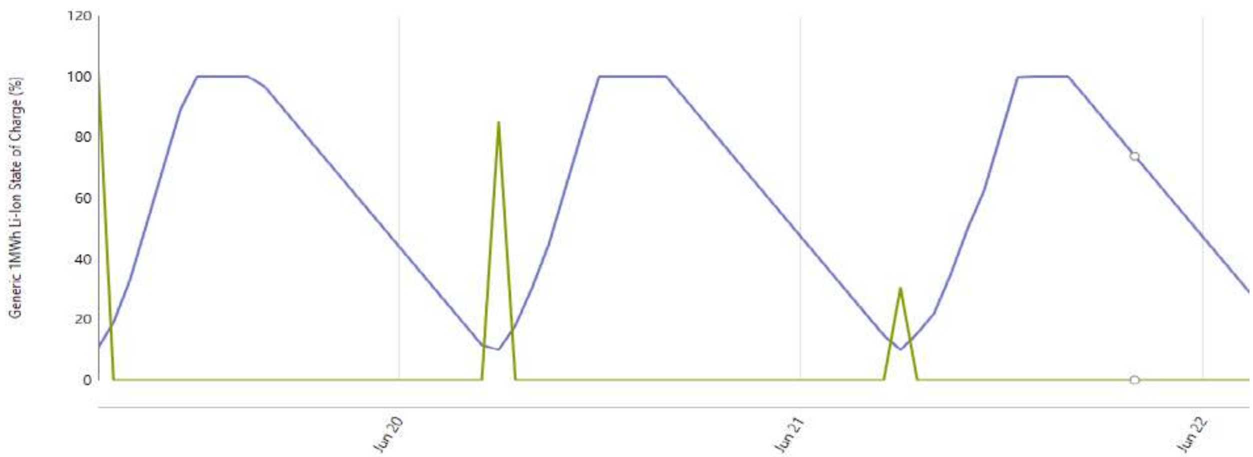
Trench type	Cross section	Length	Volume
Low voltage trench	400.0 x 1000.0 mm	2481.25 m	992.5 m3
Medium voltage trench	800.0 x 1000.0 mm	1062.04 m	849.63 m3
Medium voltage trench	800.0 x 1500.0 mm	2.0 m	2.4 m3

A.5.4. Battery Energy Storage System

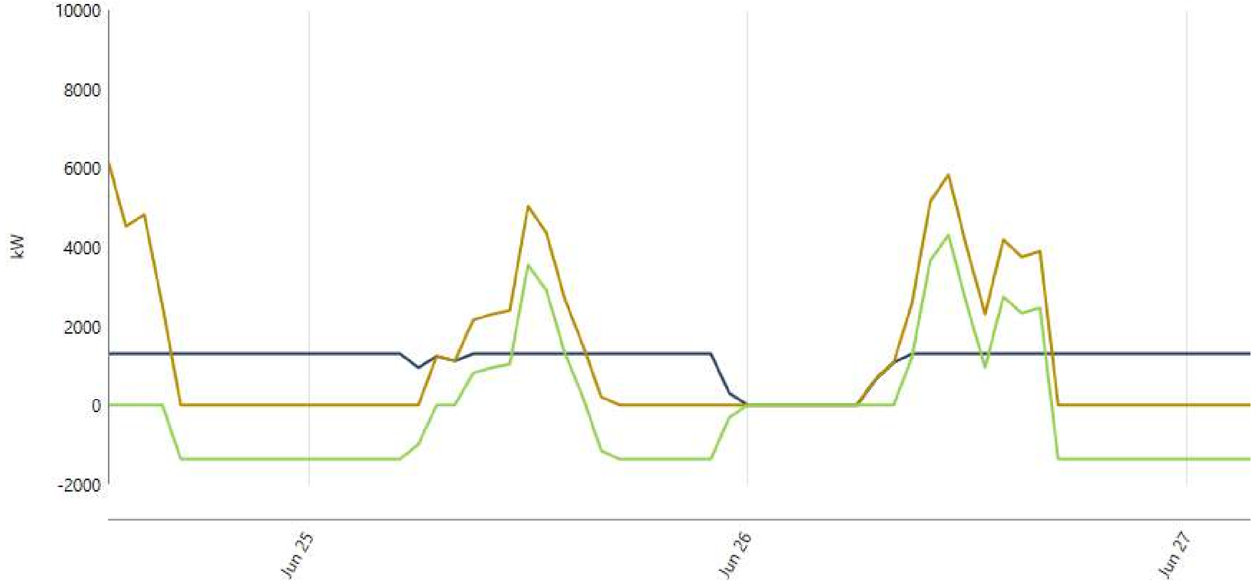
The Client's requirements are that the project provides a Net Dependable Capacity (NDC) over a 24-hour period. Should the solar resource during a typical day not be sufficient to support the NDC and keep the BESS charged, Eskom shall be used to charge the batteries to maintain the NDC.

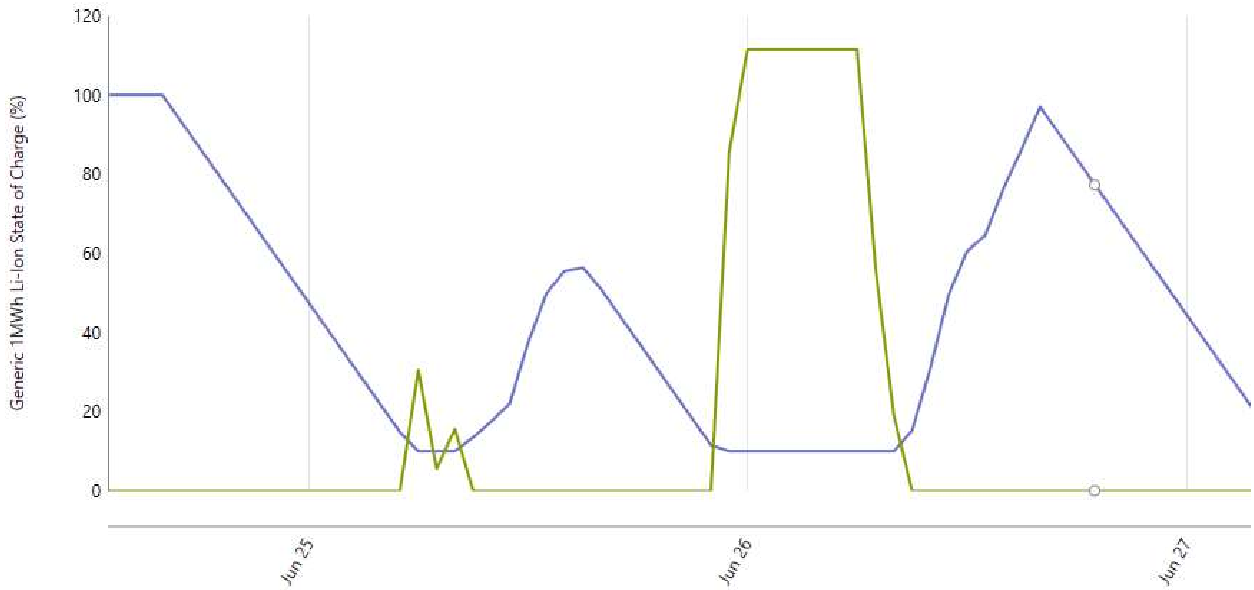
The Maximum annual capacity shortage indicates the number of days per annum, as a percentage, that the solar resource will not be adequate to maintain NDC and keep the BESS charged. Regarding the cost components shown, for each 100kW of NDC increase, the costs increase an average of 23% for 5% annual capacity shortage, and 16% for 10% annual capacity shortage. The following graphs indicate typical daily NDC supply, BESS charging state, and solar PV generation for the 1.3MW NDC example:



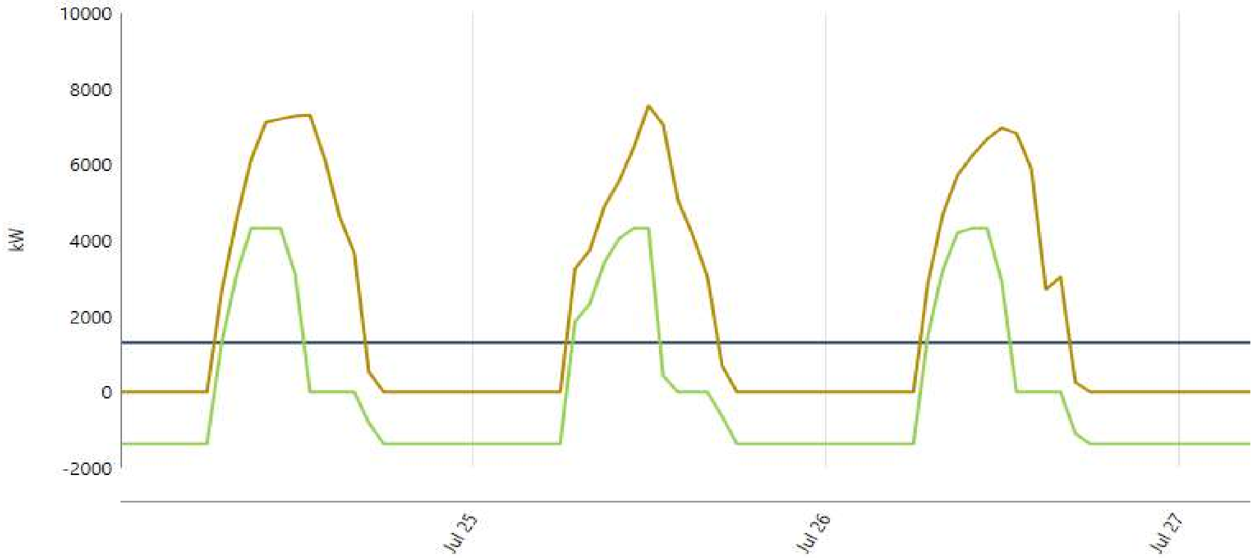


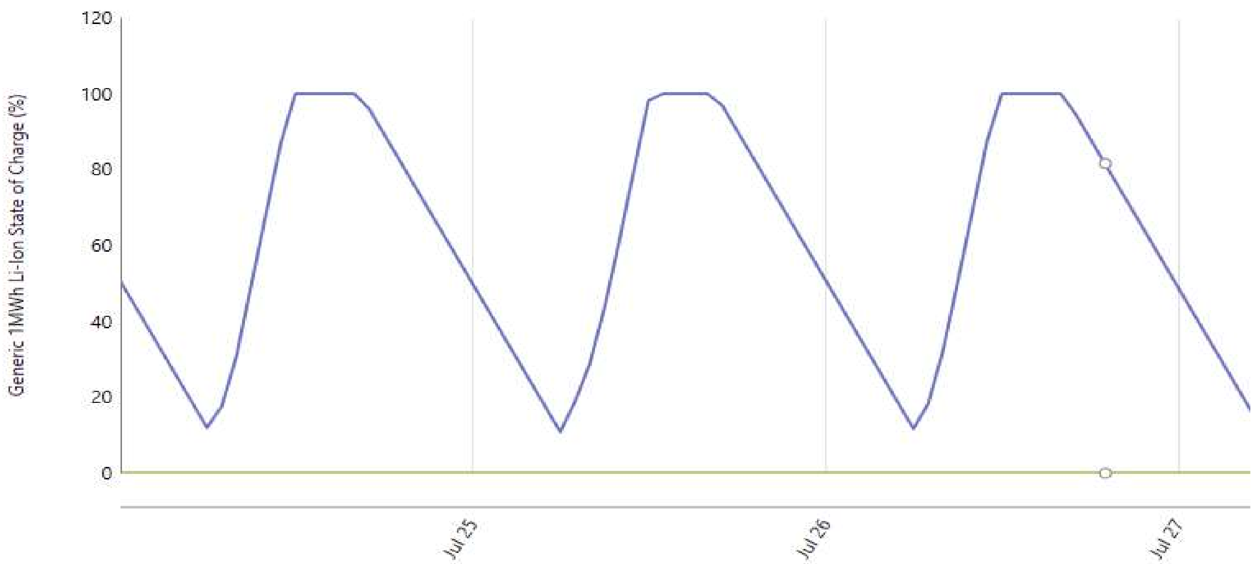
In the above example (Jun 20-22 in the simulation) solar resource (orange) is shown along with BESS input power (green) and State-of-Charge (blue). NDC is shown in dark blue, and maintains 1.3MW. The BESS state-of-charge flattens out due to over supply of solar PV power. The BESS was set to not discharge to levels lower than 10%.



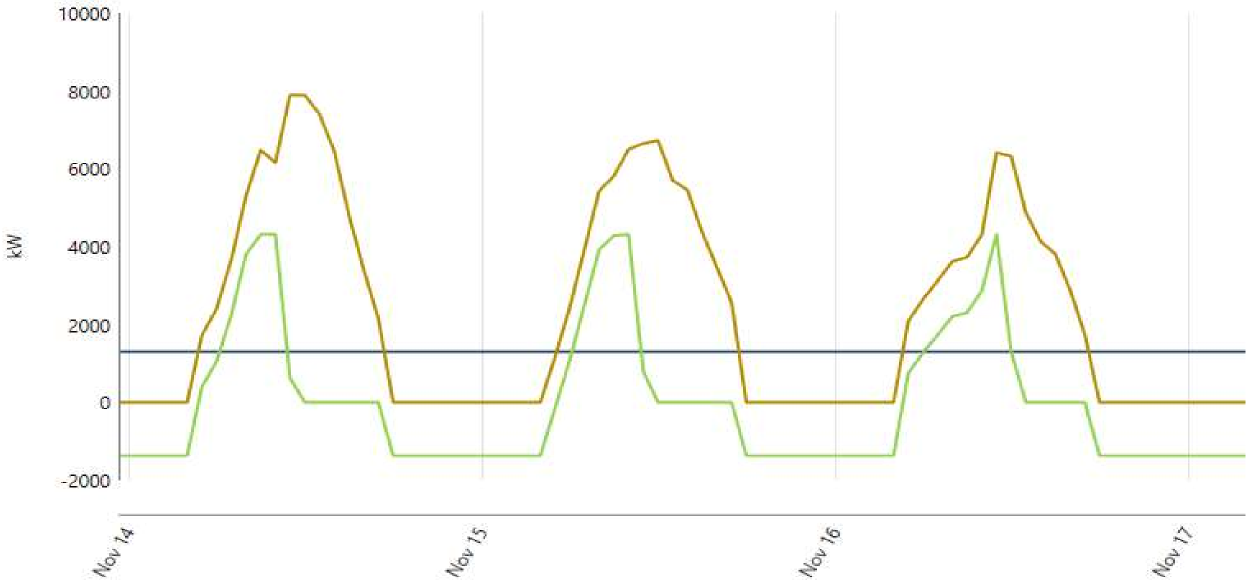


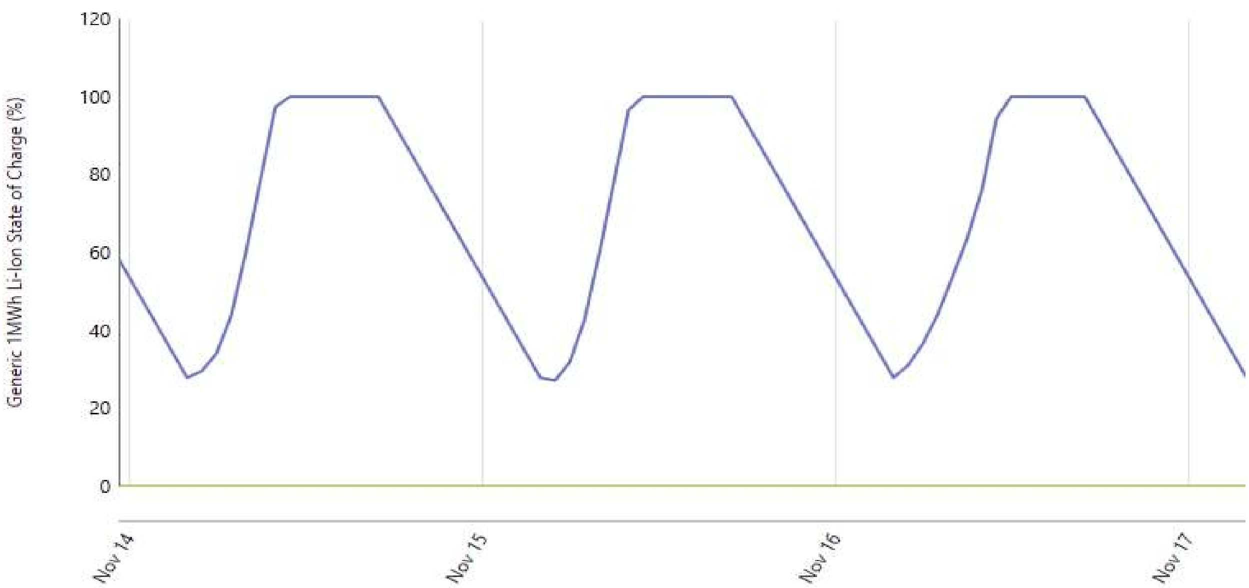
In the above example, operation during cloudy days are shown. Following a day of low irradiation (orange) it is clear that the BESS is not sufficiently charged to maintain NDC throughout the following evening, therefore unmet electrical load (green) is 100%.





In the above example plots from the simulations nominal operation is indicated. BESS reaches 100% state-of-charge whereas NDC is maintained.





In the final example, during summer, an over-supply of irradiation has the consequence of not enough storage capacity to capture all available power. During these times, the Power Plant Controller may be set to output more to the Grid should it be needed.

A.5.5 Project equipment lifespans

Equipment	Expected Lifespan	Comments
Solar PV modules	>25 years	Tier 1 PV modules are guaranteed to generate 80% of power at 25-year age. Depending on the project financial model, it is possible that the project can continue generating power beyond the 25-year mark.

Solar PV inverters	20-25 years	String inverters can be replaced should it be necessary. Equipment track records around the world has shown that inverter units are extremely reliable and often never require replacement. Central inverters can continue working for many years with adequate maintenance as required by the manufacturer.
Solar PV Tracker units	>25 years	Solar tracker units can continue working for as long as they are maintained properly (greased, aligned, etc.)
BESS	>10 years	Accelerated aging tests have shown that BESS units last beyond the expected 10-year lifespan. High operating temperatures especially causes decreased lifespan. It is recommended that the Maintenance Reserve Account allow for replacement of battery units (cells, at least since some manufacturers allow individual cell replacement, e.g. Tesla).
Transformers	>50 years	Power transformers are reliable if designed correctly, especially for intermittent renewable energy generation with its associated power quality issues, such as heating due to circulating harmonics.
Cables	>50 years	XLPE cables (30 years) do not last as long as PILC cables (50 years) but it is uncommon to require complete replacement of an entire run of cable—therefore XLPE cable may only require additional joints and repairs to last as long as PILC cable.

A.6 Overview of the Project Development Cycle

The project can be divided into the following three main phases:

- Construction Phase;
- Operational Phase; and
- Decommissioning Phase.

Each activity undertaken as part of the above phases may have environmental impacts and, where applicable, has therefore been assessed by the specialist studies (summarised in Section D and full studies included Appendix C of this BA Report).

A.6.1 Construction Phase

The construction phase will take place subsequent to the issuing of an EA from the DEFF and a successful bid in terms of the REI4P (i.e. the issuing of a Power Purchase Agreement (PPA) from the Department of Mineral Resources and Energy (DMRE)). The construction phase for the proposed project is expected to extend 7 to 8 months.

The main activities that will form part of the construction phase are:

- Removal of vegetation for the proposed infrastructure;

- Excavations for infrastructure and associated infrastructure;
- Establishment of a laydown area for equipment;
- Stockpiling of topsoil and cleared vegetation;
- Creation of employment opportunities;
- Transportation of material and equipment to site, and personnel to and from site; and
- Construction of the solar field, 22 kV cable trenches and additional infrastructure.

A.6.2 Operational Phase

The following activities will occur during the operational phase:

- The transmission of electricity generated from the proposed solar facility to the Kwaggafontein Substation via 22 kV cable trenches; and
- Maintenance of the solar field.

During the life span of the project (approximately 25 years), on-going maintenance will be required on a scheduled basis.

A.6.3 Decommissioning Phase

The main aim of decommissioning is to return the land to its original, pre-construction condition. Should the unlikely need for decommissioning arise (i.e. if the actual solar facility becomes outdated or the land needs to be used for other purposes), the decommissioning procedures will be undertaken in line with the EMPr and the site will be rehabilitated and returned to its pre-construction state.

A.7 Socio-economic

A.7.1 Employment during construction

It is difficult to specify the actual number of employment opportunities that will be created at this stage. During the construction phase, both skilled and unskilled temporary employment opportunities will be created. It is difficult to specify the actual number of employment opportunities that will be created at this stage; however between 300 and 345 skilled and 600 and 655 unskilled employment opportunities are expected be created during the construction phase. It should be noted that the employment opportunities provided in this report are estimates and is dependent on the final engineering design and the REI4P Request for Proposal provisions at that point in time.

A.7.2 Employment during operations

Approximately 5 skilled and 5 unskilled employment opportunities will be created over the 25 year lifespan of the proposed facility. These unskilled jobs will be linked to services such as panel cleaning, maintenance and security.

A.7.3 Socio-economic investment and development

The Applicant will ultimately own the project, if successful, and will compile an Economic Development Plan which will be compliant with REI4P requirements and will inter alia set out to achieve the following:

- Create a local community trust or similar (as required by REI4P) which has an equity share in the project life to benefit historically disadvantaged communities;
- Initiate a skills development and training strategy to facilitate future employment from the local community; and
- Give preference to local suppliers for the construction of the facility.
- Support local community upliftment projects and entrepreneurship through socio-economic and enterprise development initiatives.

A.8 Service Provision: Water, Sewage, Waste and Electricity Requirements

Imvunulo Investment will consult with the municipality in order to confirm the supply of services (in terms of water, waste removal, sewage and electricity) for the proposed project. The municipality will be consulted as part of the 30-day public review period of this report and the confirmation services provision will be included in the Final BA Report. However, it must be noted that should the municipality not have adequate capacity for the handling of waste, provision of water and sewage handling provisions available; then Imvunulo Investment will make use of private contractors to ensure that the services are provided. Imvunulo Investment will also ensure that adequate waste disposal measures are implemented by obtaining waste disposal slips for waste removed from site (in line with the EMPr, included in Appendix F of this BA Report).

An outline of the services that will be required are discussed below.

A.8.1 Water Usage

During the construction phase, the current proposal is to truck water to site via municipal water supply. It is estimated that 1 trip will be made by the water truck every 2 days. In total, this adds up to 96 trips by the water truck over a period of 8 months.

During the operational phase for water supply, the current estimate is that 2 trips per month will be made by a water truck. At this stage, no water is planned to be abstracted from or discharged to any surface water or ground water systems.

A.8.2 Sewage or Liquid Effluent

The proposed project will require sewage services during the construction and operational phases. Low volumes of sewage or liquid effluent are estimated during both phases. Liquid effluent will be limited to the ablution facilities during the construction and operational phases. Portable sanitation facilities (i.e. chemical toilets) will be used during the construction and operational phases, which will be regularly serviced and emptied by a suitable (private) contractor on a regular basis. The waste water will be transported to a nearby Waste Water Treatment Works for treatment. Due to the remote location of the project site; a conservancy tank or septic tank system could be used on site, which is expected to be serviced by the municipality. Due to the remote locality of the farm, sewage cannot be disposed in the municipal waterborne sewage system.

A.8.3 Solid Waste Generation

The quantity of waste generated will depend on the construction phase, which is estimated to extend 12 to 14 months. However, it is estimated that approximately 50m^3 of waste will be generated every month during the construction phase. During the construction phase, the following waste materials are expected:

- Packaging material, such as the cardboard, plastic and wooden packaging and off-cuts;
- Hazardous waste from empty tins, oils, soil containing oil and diesel (in the event of spills), and chemicals;
- Building rubble, discarded bricks, wood and concrete;
- Domestic waste generated by personnel; and
- Vegetation waste generated from the clearing of vegetation.

Solid waste will be managed via the EMPr during the construction and operational phases (Appendix F of the BA Report), which incorporates waste management principles. During the construction phase, general waste will be collected and temporarily stockpiled in skips in a designated area on site and thereafter removed, emptied into trucks, and disposed at a registered waste disposal facility on a regular basis by an approved waste disposal Contractor (i.e. a suitable Contractor). In addition, a skip will be placed on site and any damaged or broken PV panels (i.e. those not returned to the supplier) will be stored in this skip. A specialist waste management company will be commissioned to manage and dispose of this waste.

Any hazardous waste (such as contaminated soil as a result of spillages) will be temporarily stockpiled (for less than 90 days) in a designated area on site (i.e. placed in leak-proof storage skips), and thereafter removed off site by a suitable service provider for safe disposal at a registered hazardous waste disposal facility.

Waste disposal slips and waybills will be obtained for the collection and disposal of the general and hazardous waste. These disposal slips (i.e. safe disposal certificates) will be kept on file for auditing purposes as proof of disposal. The waste disposal facility selected will be suitable and able to receive the specified waste stream (i.e. hazardous waste will only be disposed of at a registered/licenced waste disposal facility). The details of the disposal facility will be finalised during the contracting process, prior to the commencement of construction. Where possible, recycling and re-use of material will be encouraged. Waste management is further discussed in the EMPr (Appendix F of this BA Report).

During the operational phase after construction, the facility will produce minor amounts of general waste (as a result of the offices). Waste management is discussed in the EMPr (Appendix F of this BA Report).

A.8.4 Electricity Requirements

In terms of electricity supply for the construction phase, the developer will be provided with auxiliary supply from already existing Eskom infrastructure. The exact location of this source as well as the route for provision of such supply is still to be determined by Eskom. During the operational phase, the will not have any electricity requirements as the project itself will transmit and distribute electricity.

A.9 Applicable legislation

The scope and content of this BA Report has been informed by the following legislation, guidelines and information series documents (Table A.3). It is important to note that the specialist studies included in Appendix C of this BA Report also include a description of the relevant applicable legislation.

Table A.3.4 Legislation Applicable to the Proposed Project

Title of legislation, policy or guideline	Applicability to the Proposed Project	Administering Authority	Date
NEMA (Act 107 of 1998, as amended)	The proposed project will require the implementation of appropriate environmental management practices.	National DEFF	19 November 1998
NEMA EIA Regulations published in GN R982, R983, R984 and R985, and as amended on 7 April 2017 in GN R326, R327, R325 and R324	These Regulations provide the procedures that need to be followed for the BA Process.	National DEFF	8 December 2014
NEMA EIA Regulations published in Government Notice R983 and R985, and as amended on 7 April 2017 in GN R327 and R324	These Regulations contain the relevant listed activities that are triggered, thus requiring a BA. Please refer to Section A (7) of this BA Report for the complete list of listed activities.	National DEFF	8 December 2014 and amended on 7 April 2017
Section 24(5)a and (b) of the NEMA, of the procedure to be followed in applying for EA for large scale wind and solar PV energy development activities identified in terms of Section 24(2)(1) of the NEMA when occurring in geographical areas of strategic importance	BA process is therefore required for this project	National DEFF	26 February 2021
National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA)	General and hazardous waste will be generated during the construction phase, which will require proper management.	National DEFF	6 March 2009
National Environmental Management: Waste Amendment Act (Act 26 of 2014)	General and hazardous waste will be generated during the construction phase, which will require proper management.	National DEFF	2 June 2014
National Environmental Management: Air Quality Act (Act 39 of 2004)	The proposed stockpiling activities, including earthworks, may result in the unsettling of, and temporary exposure to, dust. Appropriate dust control methods will need to be applied.	National DEFF	19 February 2005
Water Services Act (Act 108 of 1997)	Water will be required during the construction and decommissioning phases of the proposed project, for consumption purposes, earthworks and grassing etc. Water will also be required from the municipality for panel cleaning during the operational phase.	National Department of Water Affairs	1997

Hazardous Substances Act (Act 15 of 1973)	During the proposed project, fuel and diesel will be utilised to power vehicles and equipment. In addition, potential spills of hazardous materials could occur during the relevant phases.	Department of Health	1973
National Forests Act (Act 84 of 1998)	Protected Tree species are listed under the National Forests Act No. 84 of 1998. In terms of a part of section 15(1) of Act No. 84 of 1998, 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, except under a license granted by the Minister. The Ecological Impact Assessment Specialist Study notes that listed species that may be encountered on site include Lysimachia arvensis, Erigeron bonariensis, Dettrichia viscsa greuter, Prosopos glandulosa torr and Boscia mossambicensis klotzsch, agave, Combtetum molle, Richardia scabra, and Branchpodium retusum beauw. If any protected species are found on site during the search and rescue or construction, the Provincial Department of Agriculture, Forestry and Fisheries will be contacted to discuss the permitting requirements. It is unlikely that an application for the "clearing of a natural forest", as defined within the Act, will be required on the site in question.	DAFF	1998
National Water Act (NWA) (Act 36 of 1998)	Wetlands or riparian zones is excluded from developments unless these developments are authorised by the Department of Human Settlements, Water and Sanitation (DHSWS)	Department of Water and Sanitation	1998

	for water uses which are defined in Section 21(c) or Section 21 (i). General Authorisation apply in terms of Section 39 of the National Water Act (Act No. 36 of 1998) for water uses as defined in Section 21(c) or Section 21(i) (Department of Water and Sanitation Notice 509 of 2016). This general authorisation replaces the need for a water user to apply for a licence in terms of the National Water Act (Act 36 0f 1998) provided that the water use is within limits and conditions of this General Authorisation. A General Authorisation does not apply to any development within a distance of 500 m upstream or downstream from the boundary (outer edge) of any wetland (General Notice 1199, Government Gazette No. 32805 of 2009; Replacement General Authorisation in terms of Section 39 of the National Water Act). The Ecological Impact Assessment Specialist Study notes that the National Water Act controls activities in and around water resources, as well as the general management of water resources, including abstraction of groundwater and disposal of water. Authorisation for changes in land use, up to 500 m from a defined water resource / wetland system will require at the minimum the compilation of a risk assessment and depending upon outcome, an application for use under a General Authorisation or a Water Use Licence from the DHSWS. The proposed development does not intrude into de facto wetland or riparian areas and therefore it is submitted that a Water Use Licence will not be		

	required. This will be confirmed with the DHSWS.		
Integrated Environmental Management (IEM) guideline series published by DEFF (various documents dated from 2002 to present)	The IEM Guideline series provides guidance on conducting and managing all phases and components of the required BA and PPP, such that all associated tasks are performed in the most suitable manner.	National DEFF	2002 - present
National Heritage Resources Act (Act 25 of 1999)	The proposed project does not require a permit in terms of the National Heritage Resources Act (Act 25 of 1999).	National Department of Arts and Culture	1999
Conservation of Agricultural Resources Act (Act 43 of 1983)	The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983) has categorised a large number of invasive plants together with associated obligations of the land owner. Invasive plant species that should be removed or maintained only under certain commercial situations are identified in terms of the CARA. This Act will be applicable to the project if and where such plants arise within or adjacent to the project area. Notably most listed alien invasive species are propagated and driven by the disturbance of land during and following construction.	National Department of Agriculture	1983
National Environmental Management: Biodiversity Act (Act 10 of 2004)	This Act serves to control the disturbance and land utilisation within certain habitats, as well as the planting and control of certain exotic species. The Ecological Impact Assessment Specialist Study notes that the proposed development, taking place in the identified Mixed Bushveld environment, may not necessitate any particular application for a change in land use from an ecological perspective. In addition, the planting and management of exotic plant species on route, if and where	National DEFF	September 2004

	required, will be governed by the Alien and Invasive Species (AIS) regulations, which were gazetted in 2014. These regulations compel landowners to manage exotic weeds on land under their jurisdiction and control.		
Subdivision of Agricultural Land Act (Act 70 of 1970)	An application for the change of land use (re-zoning) for the development on agricultural land will be lodged by the Applicant for approval in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA) as required. A servitude for the proposed power facility will need to be registered on the affected farm portions. Servitude requirements also need to be discussed between the Applicant and Eskom.	Republic of South Africa	1970

A.9.1 Description of the listed activities associated with the proposed project

Section 24(1) of the NEMA states: "In order to give effect to the general objectives of integrated environmental management laid down in this Chapter, the potential impact on the environment of listed activities must be considered, investigated, assessed and reported to the competent authority charged by this Act with granting the relevant environmental authorization." The reference to "listed activities" in Section 24 of the NEMA relates to the regulations promulgated in GN R326, R327, R325 and R324, dated 7 April 2017. The relevant GN published in terms of the NEMA collectively comprise the NEMA EIA Regulations listed activities that require either a BA, or Scoping and EIA be conducted. As noted previously, due to the project size, the proposed project requires a BA Process.

The Application for EA for this BA Process will be submitted to the DEFF together with this Draft BA Report, which makes reference to all relevant listed activities forming part of the proposed development.

Table A.4 below provides a list of the applicable listed activities associated for the proposed project in terms of Listing Notice 1 (GN R 327), Listing Notice 2 (GN R325) and Listing Notice 3 (GN R324) in terms of the 2014 NEMA EIA Regulations (as amended).

Table A.4. Applicable Listed Activities

Listed activity as described in GN R 327, 325 and 324	Description of project activity that triggers listed activity
GN R.327 Activity 1: The development of facilities or infrastructure for the generation of electricity from a renewable resource where— (i) the electricity output is more than 10 megawatts but less than 20 megawatts; or (ii) the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare; excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs— (a) within an urban area; or (b) on existing infrastructure.	The proposed solar PV Project site is approximately 20ha extent, which is in excess of the 1 ha threshold. The proposed Project is located outside an urban area and will not occur on existing infrastructure but on vacant land.
GN R 327: Activity 12 (ii) (a) (c): The development of: (i) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- a) within a watercourse; b) in front of a development setback; or c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding- (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;	The proposed solar PV facility will be constructed on portion 0 of the farm Kwaggafontein 216 JR, approximately 11 km east of Kwaggafontein Mall and within Thembisile township within the Thembisile Hani Local Municipality, Mpumalanga Province. Hence the proposed project will take place outside of an urban area. The proposed 8 MW Solar PV facility will entail the construction of building infrastructure and structures (such as the solar field, offices, workshop, ablution facilities, on-site substation, laydown area and security enclosures etc.). The infrastructure and structures are expected to exceed a footprint of 100 m^2.

(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; (ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared..	
GN R.327 Activity 14: The development and related operation of facilities or 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 Battery Energy Storage System (BESS) components forming part of this Facility will require temporary storage and handling of dangerous goods (greater than $80m^3$ but not exceeding $500m^3$), should the BESS require onsite assembly. In addition, fuel, cement and chemical storage onsite will be greater than $80m^3$ but not exceeding $500m^3$.
GN R.327 Activity 19: The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving- a) will occur behind a development setback; b) is for maintenance purposes undertaken in accordance with a maintenance management plan; c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	The proposed project may entail the excavation, removal and moving of more than $10m^3$ of soil, sand, pebbles or rock from the nearby watercourses. The proposed project may also entail the infilling of more than $5m^3$ of material into the nearby watercourses. Construction of the internal gravel access road and/or the potential construction of infrastructure within drainage features may require the removal of material. Details of the infilling of and excavations from the drainage features will be confirmed during the detailed design phase.
GN R.327 Activity 27: The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	The non-linear infrastructure components of the development footprint (buildable area) is approximately 20ha (subject to finalisation based on technical, final design and environmental requirements). As part of this buildable area, infrastructure such as the onsite substation, operations building, workshop, stores, the BESS facility etc. will have individual footprints of 1ha.

GN R.327 Activity 28: 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	The proposed project will take place outside of an urban area. It is understood that the land is currently not used for any purposes. The proposed 8 MW solar PV facility which is considered to be a commercial/industrial development, will have an estimated footprint of approximately 20 ha. The proposed project will also entail the construction of an on-site substation and cables trenches. This will constitute infrastructure with a physical footprint of more than 1 ha.
GN R 327: Activity 56 (i): The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre: (i) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.	In terms of access, the proposed project site can be accessed via an existing gravel road (an unnamed farm road) and the existing Transnet Service Road (private). Both access routes will be considered and included in the proposed project. The existing gravel road (an unnamed farm road) can be accessed from the R573 Provincial Road. The unnamed farm road is believed to be about 4 m wide. This farm road, however, will need to be upgraded and widened by more than 4m (where required). Exact specifications of the widening and upgrading of the unnamed farm gravel road will be confirmed during the detailed design phase.
GN R 324: Activity 4: The development of a road wider than 4 metres with a reserve less than 13,5 metres. f. Mpumalanga i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding disturbed areas; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas identified in terms of an international convention; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ff) Core areas in biosphere reserves; or (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas, where	Internal roads required by the Facility will be 4m wide, and exceed 1km in length. Where required for turning circle/bypass areas, however, internal roads may be up to 20m to allow for larger component transport. The exact values will be confirmed once final designs have been provided. Similarly, roads required for the Facility will be located within, and will require vegetation clearance or disturbance within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA).

such areas comprise indigenous vegetation; or ii. Inside urban areas: (aa) Areas zoned for use as public open space; or (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.	
GN R 324: Activity 10: 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. **f. Mpumalanga** i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas identified in terms of an international convention; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ff) Core areas in biosphere reserves; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, where such areas comprise indigenous vegetation; or (hh) Areas within a watercourse or wetland, or within 100 metres of a watercourse or wetland; or ii. Inside urban areas: (aa) Areas zoned for use as public open space; or (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.	The Battery Energy Storage System (BESS) components forming part of this Facility will require temporary storage and handling of dangerous goods where combined capacity will not exceed 500m^3 but individual component capacities will be between 30 - 80m^3, should the BESS require onsite assembly. In addition, fuel, cement and chemical storage onsite will not exceed a combined capacity of 500m^3, but individual component capacities will be between 30 - 80m^3. Furthermore Similarly, storage contemplated above will be located within, and will require vegetation clearance or disturbance within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA).
GN R 324: Activity 18: The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.	In terms of access, the proposed project site can be accessed via an existing gravel road (an unnamed farm road) and the existing Transnet Service Road

f. Mpumalanga i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas identified in terms of an international convention; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ff) Core areas in biosphere reserves; or (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; or ii. Inside urban areas: (aa) Areas zoned for use as public open space; or (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.	(private). Both access routes will be considered and included in the proposed project. The existing gravel road (an unnamed farm road) can be accessed from the R573 Provincial Road. The unnamed farm road is believed to be about 4m wide. This farm road, however, will need to be upgraded and widened by more than 4m (where required). Exact specifications of the widening and upgrading of the unnamed farm gravel road will be confirmed during the detailed design phase.

A.10 Project Background

A.10.1 Background

The proposed PV project is situated on the portion of portion 0 of the farm Kwaggafontein 216 JR. The preferred site will extend approximately 20 ha. As previously noted, the site is located approximately 11 km east of Kwaggafontein mall in Thembisile Hani Local Municipality in the Mpumalanga Province. Figure A10.1 provides a locality map of the proposed project area within a regional setting.

Figure A.10.1: Proposed Project Area in relation to the region

Table A.10.1: EA Applications for Solar PV facilities within 50 km of the proposed Imvunulo-Kwaggafontein project

No	EIA Reference No	Classification	Status of application	Distance from proposed area (km)
1	12/12/20/2576	Solar PV	Approved	22

A.11 Description of Alternatives

This section discusses the alternatives that have been considered as part of the BA Process. Sections 24(4) (b) (i) and 24(4A) of the NEMA require an Environmental Assessment to include investigation and assessment of impacts associated with alternatives to the proposed project. In addition, Section 24O (1)(b)(iv) also requires that the Competent Authority, when considering an application for EA, takes into account "where appropriate, any feasible and reasonable alternatives to the activity which is the subject of the application and any feasible and reasonable modifications or changes to the activity that may minimise harm to the environment".

Therefore, the assessment of alternatives should, as a minimum, include the following:

- The consideration of the no-go alternative as a baseline scenario;
- A comparison of the reasonable and feasible alternatives; and
- Providing a methodology for the elimination of an alternative.

Compliance with Regulation 3 (1) (h) (i) of Appendix 1 of the 2014 NEMA EIA Regulations (as amended) is discussed below. Regulation 2 (e) of Appendix 1 of the 2014 NEMA EIA Regulations (as amended) states:

- The objective of the basic assessment process is to, through a consultative process, and through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to (i) identify and motivate a preferred site, activity and technology alternative; (ii) identify suitable measures to avoid, manage or mitigate identified impacts; and (iii) identify residual risks that need to be managed and monitored.

A.11.1 No-go Alternative

The no-go alternative assumes that the proposed project will not go ahead i.e. it is the option of not constructing the proposed solar PV facility and associated infrastructure. This alternative would result in no environmental impacts on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report. The following implications will occur if the "no-go" alternative is implemented:

- No benefits will be derived from the implementation of an additional land-use;
- No additional power will be generated or supplied through means of renewable energy resources by this project at this location. The proposed 8 MW facility is predicted to generate approximately 22 GW/h per year which could power 10 000 households;

- The "no go" alternative will not contribute to and assist the government in achieving its proposed renewable energy target of 26 630 MW by 2030 (for Wind, Solar PV and Concentrated Solar Power);
- Electricity generation will remain constant (i.e. no additional renewable energy generation will occur on the proposed site) and the local economy will not be diversified;
- There will be lost opportunity for skills transfer and education/training of local communities;
- The positive socio-economic impacts likely to result from the project such as increased local spending and the creation of local employment opportunities will not be realised; and
- The local economic benefits associated with the REI4P will not be realised, and socio-economic contribution payments into the local community trust will not be realised.

Converse to the above, the following benefits could occur if the "no-go" alternative is implemented:

- Only the agricultural land use will remain;
- No destruction of habitat will occur;
- No change to the current landscape will occur;
- No impacts to the cultural heritage will occur;
- No destruction of fossils will occur;
- No avifaunal collisions will occur due to the establishment of the project; and
- No additional traffic will be generated.

As outlined in Section D of this report, the majority of the negative impacts identified as part of this assessment can be reduced to lower significance with the implementation of mitigation measures. There will be a positive social impact from a social upliftment perspective. These include benefits to the local community via employment opportunities (moderate significance) and the development of locally-owned industries to support construction related activities (low significance).

Hence, while the "no-go" alternative will not result in any negative environmental impacts; it will also not result in any positive community development or socio-economic benefits. It will not assist government in addressing climate change, reaching its set targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country. Hence the "no-go" alternative is not a preferred alternative.

A.11.2 Land-use Alternatives

A.11.2.1 Agriculture

At present the proposed site is zoned for agricultural land-use, and is mainly used for livestock grazing. As noted in Section B of this report, agricultural potential is uniformly low across the preferred and alternative sites and the choice of placement of the proposed facility on the farm therefore has minimal influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the site. None of the potential impacts identified have been rated with a high significance with the implementation of mitigation measures. It is important to re-iterate that the economic benefits to the farmer associated with the proposed Solar PV Facility are likely to be more significant than that of the current agricultural activities on site and these two land uses (agriculture and renewable energy generation) can potentially both be undertaken on site. Hence, agricultural land use is not a preferred alternative.

A.11.2.2 Renewable Energy Alternatives

The Integrated Resource Plan for South Africa for the period 2019 to 2030 (referred to as "IRP2019") proposes to secure 26 630 MW of renewable energy capacity by 2030 (for Wind, Solar PV and Concentrated Solar Power – excluding Hydropower and Pumped Storage). The DMRE subsequently entered into a bidding process for the procurement of 3725 MW of renewable energy from IPPs by 2016 and beyond to enable the Department to meet this target. On 18 August 2015, an additional procurement target of 6300 MW to be generated from renewable energy sources was added to the REI4P for the years 2021 - 2025, as published in Government Gazette 39111. The additional target allocated for wind energy, solar PV energy, and solar CSP energy is 3040 MW, 2200 MW, and 600 MW respectively.

In order to submit a bid, the proponent is required to have obtained an EA in terms of the EIA Regulations as well as several additional authorisations or consents. It has been determined that even though the current processes will enable renewable energy to be fed into the national grid, the REI4P does have certain inefficiencies. To this end, the National DEFF, in discussion with the DMRE, was mandated by MinMec to undertake a SEA to identify the areas in South Africa that are of strategic importance for Wind and Solar PV development. The Phase 1 Wind and Solar PV SEA is in support of the Strategic Infrastructure Plan (SIP) 8, which focuses on the promotion of green energy in South Africa. The SEA aimed to identify strategic geographical areas best suited for the roll-out of large scale wind and solar PV energy projects. The key objective of the SEA was to enable strategic planning for the development of large scale wind and solar PV energy facilities in a manner that avoids or minimises significant negative impact on the environment while being commercially attractive and yielding the highest possible social and economic benefit to the country – for example through strategic investment to lower the cost and reduce timeframes of grid access.

A.11.3 Technology Alternatives

A.11.3.1 Solar Panel Types

Only the PV solar panel type was considered in the BA. Due to the scarcity of water in the proposed project area and the large volume of water required for Concentrated Solar Power (CSP), this technology is not deemed feasible or sustainable and will not be considered in the BA. This is the main difference between PV and CSP technology that led to the selection of PV as the preferred solar panel technology. Furthermore, CPV technology therefore requires a larger development footprint to obtain the same energy output as PV technology, and it requires active solar tracking to be effective. Furthermore, as noted above, in Government Gazette 39111 published on 18 August 2015, no additional procurement target was allocated for CPV. In terms of the IRP2019, 300 MW capacity is already installed for CSP; and an additional 300 MW has been allocated for 2019. This means that the need and desirability of CSP is not as evident and justified compared to PV.

A.11.3.2 Mounting System

Solar panels can be mounted in various ways to ensure maximum exposure of the PV panels to sunlight. The main mounting systems that will be considered as part of the design are:

- Single axis tracking systems;

- Fixed axis tracking systems;
- Dual axis tracking systems; and
- Fixed Tilt Mounting Structure.

A.11.3.3 Cable Trenches

The photovoltaic panel arrays will be connected to each other in strings and the strings connected to inverter stations by low voltage underground direct current cables. Power from the inverter will be transformed from low to medium voltage (22kV) at the medium voltage transformers. Power from the inverters is collected in medium voltage transformers through alternating current cables, which may be buried or pole-mounted depending on voltage level and site conditions. The electric power is then transported to a proposed 22kV onsite substation complex, via medium voltage underground cables (22kV). Cables and trenches required for underground cables will remain along internal roads and already disturbed areas as far as possible.

A.11.4 Site Alternatives

The preferred site within the Mpumalanga was selected based on national level consideration. On a site specific (local) level, the site was deemed suitable due to all the site selection factors (such as land availability, distance to the national grid, site accessibility, topography, current land use and landowner willingness) being favourable.

The site selection criteria considered by the Applicant are discussed in detail below Table A.5.

Table A.5. Site selection factors and suitability of the site

FACTOR	SUITABILITY OF THE SITE
Land Availability	Portion of portion 0 of the farm Kwaggafontein 216 JR is of a suitable size for the proposed project. The land available to develop at the preferred site for the solar farm extends approximately 20 ha, however only an estimated 20 ha will be required for the proposed project.
Distance to the Grid	The proposed project will be located approximately 500m from the Eskom Kwaggafontein Substation.
Site Accessibility	The proposed project site can be accessed via R573 provincial road. Internal gravel roads will be constructed as part of the proposed project.
Current Land Use	Agriculture - Grazing
Landowner Willingness	The landowner has signed consent for the use of the land for the proposed projects. This is considered an important aspect of the proposed project in terms of its viability (i.e. this will limit potential appeals during the decision-making process, as the landowner is willing and supportive of the proposed projects being undertaken on the farm).

Furthermore, from an impact and risk assessment perspective, the implementation of a solar PV project on the farm Kwaggafontein 216 JR will result in fewer risks in comparison to its implementation at alternate sites within the Mpumalanga (i.e. regions with similar irradiation levels). The following risks and impacts will be likely in this case:

- There is no guarantee that suitable land will be available for development of a solar PV facility. Site geotechnical conditions, topography and ready access to a site might not be suitable, thus resulting in negative environmental implications and reduced financial viability.
- There is no guarantee that the current land use of alternative sites will be flexible in terms of development potential, for example the agricultural potential for alternative sites might be higher and of greater significance.
- There is no guarantee of the willingness of other landowners to allow the implementation of a solar facility on their land and if the landowners strongly object, then the project will not be feasible.
- There is no guarantee that other sites within the Mpumalanga will be located close to existing or proposed electrical infrastructure to enable connection to the national grid. The further away a project is from the grid, the higher the potential for significant environmental and economic impacts.

The main determining points for Imvunulo-Kwaggafontein Solar was to find suitable, developable land in one contiguous block to optimise design, minimise costs, and minimise sprawling development and impact footprints. In addition, the proximity to the Eskom Kwaggafontein Substation was a major determinant for identifying suitable sites for the proposed development.

Given the site selection requirements associated with solar energy facilities and the suitability of the land available on the farm Kwaggafontein 216 JR, therefore no other site alternatives were considered.

A.11.5 Location (Layout) Alternatives

As an initial step, the Applicant consulted with the National Web-Based Screening Tool to seek a baseline description of the environmental sensitivities within the proposed site. This guided the Applicant to select the best initial larger footprint and electrical infrastructure corridor within the proposed site from an environmental sensitivities perspective. The larger area was then assessed by the specialists, which lead to the identification of the preferred layouts.

A.10.6 Concluding Statement for Alternatives

Based on the above, the preferred activity is the development of a renewable energy facility on site using solar PV as the preferred technology. In terms of the preferred location of the site, the farm Kwaggafontein 216 JR is preferred. The location (layout) of the activity has been informed by the outcomes of the specialist assessments and technical feasibility. The preferred layout is further discussed in Section D of this report.

A.12 Needs and desirability

Renewable energy has become a viable and economical source of electricity generation and represents a sustainable alternative to fossil fuels. In addition to being an inexpensive source of electricity, wind and solar energy developments participate to the reduction of air pollution and to the mitigation of climate change while contributing to industrial development and job creation. The transition to clean, sustainable and safe energy use is important for South Africa which is one of the top 20 largest emitters of greenhouse gases in the world and the largest in Africa. The South African Government's commitment to roll-out renewable energy development is evolving through the Integrated Resource Plan (IRP2019) and the Renewable Energy Independent Power Producer Procurement Programme (REI4P). As stated by the Department of Energy, solar energy is the most readily accessible resource in

South Africa and one of the highest in the world with average annual 24-hour global solar radiation of 220 W/m2 compared with 150 W/m2 for parts of the USA and 100 W/m2 for Europe5.

In line with the national energy target of electricity generation through renewable energy the proposed development is thus needed and desirable, if developed in a manner that limits negative impact on the environment while creating social and economic benefits to the country.

It is an important requirement in the EIA Process to review the need and desirability of the proposed project. Guidelines on Need and Desirability were published in the Government Gazette of 20 October 2014. These guidelines list specific questions to determine need and desirability of proposed developments. This checklist is a useful tool in addressing specific questions relating to the need and desirability of a project and assists in explaining that need and desirability at the provincial and local context. Need and desirability answer the question of whether the activity is being proposed at the right time and in the right place. Table A.6 includes a list of questions based on the DEFF's Guideline to determine the need and desirability of the proposed project. It should be noted this table was informed by the outcomes of the BA Process.

Table A.6. The Guideline on the Need and Desirability's list of questions to determine the "Need and Desirability" of a proposed project

NEED	
Question	**Response**
1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area)?	
1.1. How were the following ecological integrity considerations taken into account?: 1.1.1. Threatened Ecosystems, 1.1.2. Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure, 1.1.3. Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs"), 1.1.4. Conservation targets, 1.1.5. Ecological drivers of the ecosystem, 1.1.6. Environmental Management Framework, 1.1.7. Spatial Development Framework, and 1.1.8 Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.).	**The environmental sensitivities present on site were assessed within the ecological impact assessment undertaken as part of this BA Process.** **The specialist identified all ecological sensitive areas on site that would need to be avoided by the proposed development, as well as how to suitably develop within these areas so that the ecological integrity of the areas is maintained (refer to Section D and Appendix C).** **A sensitivity map produced based on the input obtained from the various specialist studies is included in Section B and D of this Report, as well as in Appendix B.**
1.2. How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	**The environmental sensitivities present on site were assessed within the ecological impact assessment undertaken as part of this BA Process. The specialist identified all ecological sensitive areas on site that would need to be avoided by the proposed development, as well as how to suitably develop within these areas so that the ecological integrity of the areas is maintained (refer to Section D and Appendix C).** **A sensitivity map produced based on the input obtained from the various specialist studies is included in Section B and D of this Report, as well as in Appendix B.** **Measures to avoid, remedy, mitigate and manage impacts are included within the compiled Environmental Management Programme (EMPr), included as Appendix F of the Report, which forms part of this BA Report.**

1.3. How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	**This development has the potential to impact on the ecology of the area, this includes impacts on the natural vegetation, biodiversity, sensitive habitats and ecosystem function. The overall impact to ecology is considered to be of low (negative) impact significance (Refer to Section D). Measures to avoid, remedy, mitigate and manage impacts are included within the compiled EMPr, which forms part of this BA Report.**
1.4. What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether; what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	**The description of the potential waste generation is included in Section A of this BA Report (this Section). It is not anticipated that a significant amount of waste will be generated.** **The EMPr includes measures to avoid, remedy, mitigate and manage impacts are included within the compiled EMPr (Appendix F), which forms part of this BA Report.**
1.5. How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	**This project requires water during the construction and operational phases. Currently, the proposal is to source this from the municipality (confirmation from the municipality is currently pending and will be sought as part of the review of the Draft BA Report).**
1.6. How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts? 1.6.1. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)	**The proposed project aims to harness the sun's light for the generation of electricity. This project is seen as a source of 'clean energy' and reduces the dependence on non-renewable sources, such as coal fired power plants. The proposed development is located in Mpumalanga area where wind and solar PV energy development is being incentivised from resource, socio-economic and environmental perspectives. For more information refer to the Alternatives section included in Section A of this report (this section) for an outline of the suitability of this activity.**

1.6.2. Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources of the proposed development alternative?) 1.6.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?	
1.7. How were a risk-averse and cautious approach applied in terms of ecological impacts?: 1.7.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)? 1.7.2. What is the level of risk associated with the limits of current knowledge? 1.7.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	**The precautionary approach has been adopted for this assessment, i.e. assuming the worst-case scenario will occur and then identifying ways to mitigate or manage these impacts.** **Refer to Appendix C of this report for the complete specialist studies. These studies outline the assumptions and limitations that were applicable to the respective studies.** **The risk associated with the limits in knowledge is considered to be low.**
1.8. How will the ecological impacts resulting from this development impact on people's environmental right in terms following: 1.8.1. Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts? 1.8.2. Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	**Refer to Section D and Appendix C for the specialist studies undertaken. The overall negative impact to the environmental right of people in terms of social and visual impacts are considered to be low. In addition, the social assessment found that the employment opportunities created would be considered a moderate positive impact.**
1.9. Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	**The overall low significance (post mitigation) rating of identified negative impacts, and having regard to the nature of such impacts, and the status quo socio-economic conditions present in the Thembisile Hani Local Municipality; the socio-economic benefits of the project appear to outweigh its impacts. Should the mitigation measures be implemented as prescribed in this assessment; it was recommended by the specialist that the proposed development be awarded EA.**
1.11. Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?	**Thembisile Hani Local Municipality Integrated Development Plan (IDP) (2019-2022) identifies renewable energy as a key economic sector within its Local Economic Development (LED) plan. The inclusion of renewable**

	energy as a key sector not only plays to the natural strengths of the area (i.e. good solar irradiation levels), but also appears to be aimed at bringing parity between the existing employment sectors by providing much needed growth within the local construction and electricity employment sectors. The proposed activity therefore does not compromise any of the objectives set within IDP (2019-2022). The proposed project will also be supportive of the IDP's objective of creating more job opportunities. **The ecological study found (Appendix C) that there are "limited habitats of ecological significance or value on the site in question".**
1.11. Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	**Refer to the Alternatives section included in Section A of this report (this section) for an outline of the suitability of this activity.**
1.12. Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	**Refer to Section D of this BA Report.**
2.1. What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	
2.1.1. The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area	**Thembisile Hani Local Municipality Integrated Development Plan (IDP) (2019-2022) identifies renewable energy as a key economic sector within its LED plan. The inclusion of renewable energy as a key sector not only plays to the natural strengths of the area (i.e. good solar irradiation levels), but also appears to be aimed at bringing parity between the existing employment sectors by providing much needed growth within the local construction and electricity employment sectors.** **The proposed activity therefore does not compromise any of the objectives set within IDP (2019-2022). The proposed project will also be supportive of the IDP's objective of creating more job opportunities. Even though this solar facility will not provide the municipality directly with electricity, the energy produced by the facility will feed into the national grid. The IDP identifies lack of or inadequate employment, as**

	well as lack of reliable electricity supply as some of the societal challenges reported by communities in Kwaggafontein. The proposed project will create job opportunities and economic spin offs during the construction and operational phases (if an EA is granted by the DEFF). It is estimated that between 300 and 345 skilled and 600 and 655 unskilled employment opportunities are to be created during the construction phase. Approximately 5 skilled and 5 unskilled employment opportunities will be created over the 25 year operational lifespan of the proposed facility. **It should however be noted that employment during the construction phase will be temporary, whilst being long-term during the operational phase.** **Therefore, the proposed solar facility would help to address the need for increased electricity supply (on a national level) while also providing advanced skills transfer and training to the local communities and creating contractual and permanent employment in the area.**
2.1.2. Spatial priorities and desired spatial patterns (e.g. need for integration of segregated communities, need to upgrade informal settlements, need for densification, etc.),	**N/A the proposed project is located within a rural area and the site is zoned for agricultural use.**
2.1.3. Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.)	**The proposed project site is currently being used for agricultural purposes, predominantly grazing. Should the proposed project proceed, approximately 250 ha of the land will be developed on and it is not expected that this will significantly threaten the agricultural activities present on site.** **All agricultural impacts of the proposed development are assessed as being of low or very low significance.**
2.1.4. Municipal Economic Development Strategy ("LED Strategy").	**Thembisile Hani Municipality Draft Integrated Development Plan (IDP) (2019 - 2022) states that an opportunity exists to utilise solar energy more widely and lessen the dependence on wood and fire. This opportunity has been identified because not all people within the municipal area have access to electricity. Therefore, the proposed solar energy facility would help to address the need for increased electricity supply while also providing advanced skills transfer and training to the**

	local communities and creating contractual and permanent employment in the area.
2.2. Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area? 2.2.1. Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	**Socio-Economic impact has been discussed in Section D**
2.3. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	
2.4. Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long term? Will the impact be socially and economically sustainable in the short- and long-term?	
2.5. In terms of location, describe how the placement of the proposed development will:	
2.5.1. result in the creation of residential and employment opportunities in close proximity to or integrated with each other,	**Socio-Economic impact associated with the creation of employment opportunities that could be created by the solar facility has been discussed in Section D**
2.5.2. reduce the need for transport of people and goods,	**Not applicable. This is a renewable energy project proposal.**
2.5.3. result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport),	**Not applicable. This is a renewable energy project proposal.**
2.5.4. compliment other uses in the area,	**The preferred project site is currently being used for agricultural purposes, predominantly grazing. Should the proposed project proceed, approximately 20 ha of the land will be developed on and it is not expected that this will significantly threaten the agricultural activities present on site.**
2.5.5. be in line with the planning for the area,	
2.5.6. for urban related development, make use of underutilised land available with the urban edge,	**Not applicable. The proposed project is located within a rural area and the site is zoned for agricultural use.**
2.5.7. optimise the use of existing resources and infrastructure,	**The proposed project will connect to the existing Eskom Kwaggafontein Substation and will make use of existing access roads as far as possible.**
2.5.8. opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	**This project is a renewable energy project and not related to bulk infrastructure expansion.**

2.5.9. discourage "urban sprawl" and contribute to compaction/densification,	**Socio-Economic impact discussed in Section D for management measures on how to manage the impact associated with the "disruption of local social structures as a result of the construction work force and in-migration of job seekers".**
2.5.10. contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	**N/A the proposed project is located within a rural area and the site is zoned for agricultural use.**
2.5.11. encourage environmentally sustainable land development practices and processes,	**Based on the findings of this BA, the proposed project would not have a significant ("high") negative impact on the receiving environment, with the implementation of suitable mitigation measures (Section D) and will therefore not go against sustainable land development practices and processes. In addition, the proposed project will be designed according to relevant national specifications and standards which are regarded as best practice in the renewable energy sector.**
2.5.12. take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	**Refer to the Alternatives section included in Section A of this report (this section) for an outline of the selection and suitability of this activity.**
2.5.13. the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential),	**Refer to the Socio-Economic impact assessment discussed in Section D. In addition, as noted in this section of the report, the Applicant will ultimately own the project and, if successful, will compile an Economic Development Plan which will be compliant with REI4P requirements and will inter alia set out to achieve the following:** • **Create a local community trust or similar (as required by REI4P) which has an equity share in the project life to benefit historically disadvantaged communities;** • **Initiate a skills development and training strategy to facilitate future employment from the local community; and** • **Give preference to local suppliers for the construction of the facility.** • **Support local community upliftment projects and entrepreneurship through socio-economic and enterprise development initiatives.**
2.5.14. impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	**The impact to heritage resources will be low (negative) significance.**

2.5.15. in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	**Several solar facilities (refer to Section D for an outline of the renewable energy project proposed) are proposed in the Mpumalanga area, which lends itself potentially to a renewable energy development area.**
2.6. How were a risk-averse and cautious approach applied in terms of socio-economic impacts?	
2.6.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	**Refer to the Socio-Economic impact discussed in Section D**
2.6.2. What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	
2.6.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	
2.7. How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	
2.7.1. Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	**Refer to the Socio-Economic impact discussed in Section D**
2.7.2. Positive impacts. What measures were taken to enhance positive impacts?	
2.8. Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	
2.9. What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	
2.10. What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	
2.11. What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	

2.12. What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	
2.13. What measures were taken to:	
2.13.1. ensure the participation of all interested and affected parties,	**The Public Participation Process (PPP) for the proposed Solar PV Facility that will be undertaken is included in the BA Report (Appendix D) and summarised in Section C. This BA Report will be released for a 30-day commenting period to all the relevant authorities and stakeholders. Various methods will be employed to notify potential Interested and Affected Parties (I&APs) of the proposed project, namely, through an advert, site notices on site and in Kwaggafontein and public meeting.** **The BA process has taken cognisance of all interests, needs and values espoused by all interested and affected parties. Opportunity for public participation will be provided to all I&APs throughout the BA process in terms of the 2014 EIA Regulations, as amended.**
2.13.2. provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	
2.13.3. ensure participation by vulnerable and disadvantaged persons,	
2.13.4. promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	
2.13.5. ensure openness and transparency, and access to information in terms of the process,	
2.13.6. ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,	
2.13.7. ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein was promoted.	
2.14. Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	**Refer to the Socio-Economic impact assessment discussed in Section D**
2.15. What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	**An EMPr has been developed to address health and safety concerns. An Environmental Control Officer will be appointed to monitor compliance.**
2.16. Describe how the development will impact on job creation in terms of, amongst other aspects:	
2.16.1. the number of temporary versus permanent jobs that will be created,	**Refer to the social impact assessment discussed in Section D**
2.16.2. whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),	
2.16.3. the distance from where labourers will have to travel,	

2.16.4. the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits),	
2.16.5. the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	
2.17. What measures were taken to ensure:	
2.17.1. that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment,	**Legislation, policies and guidelines, which could apply to impacts of the proposed project on the environment, have been considered. The scope and content of this BA Report has been informed by applicable integrated environmental management legislation and policies. This has been included in Section A of this BA Report.**
2.17.2. that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	**The Public Participation Process (PPP) for the proposed Solar PV Facility that will be undertaken is included in the BA Report (Appendix D) and summarised in Section C. This BA Report will be released for a 30-day commenting period to all the relevant authorities and stakeholders. Various methods will be employed to notify potential I&APs of the proposed project, namely, through an advert, site notices on site and in Kwaggafontein and public meeting.** **The BA process has taken cognisance of all interests, needs and values espoused by all interested and affected parties. Opportunity for public participation will be provided to all I&APs throughout the BA process in terms of the 2014 EIA Regulations, as amended.**
2.18. What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	**The outcomes of this BA process and the associated conditions of the EA (should it be received) will serve to address this question.**
2.19. Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	**The proposed mitigation measures included in the EMPr and summarised in Section D of this report have been informed by the specialist studies undertaken and this includes a detailed assessment of the environment as well as the impacts associated with the proposed development. Solar energy facilities can be dismantled and completely removed from the site leased for the development and do not permanently prevent alternative land-uses on the same land parcel. Based on material and socio-economic terms, and measured to the value of the best alternative that is not chosen, the proposed project will result in positive opportunity costs.**

2.20. What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	**The EMPr of this proposed project must form part of the contractual agreement and be adhered to by both the contractors/workers and the applicant.**
2.21. Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	**Refer to the Alternatives section included in Section A of this report (this section) for an outline of the selection and suitability of this activity.**
2.22. Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	**Refer to Section D of this report for a summary of the cumulative impacts.**

SECTION B: DESCRIPTION OF THE AFFECTED ENVIRONMENT

This section of the BA Report provides a broad overview of the affected environment for the proposed Imvunulo-Kwaggafontein project and the surrounding region. The receiving environment is understood to include biophysical, socio-economic and heritage aspects which could be affected by the proposed development or which in turn might impact on the proposed development.

This information is provided to identify the potential issues and impacts of the proposed project on the environment. The information presented within this chapter has been sourced from:

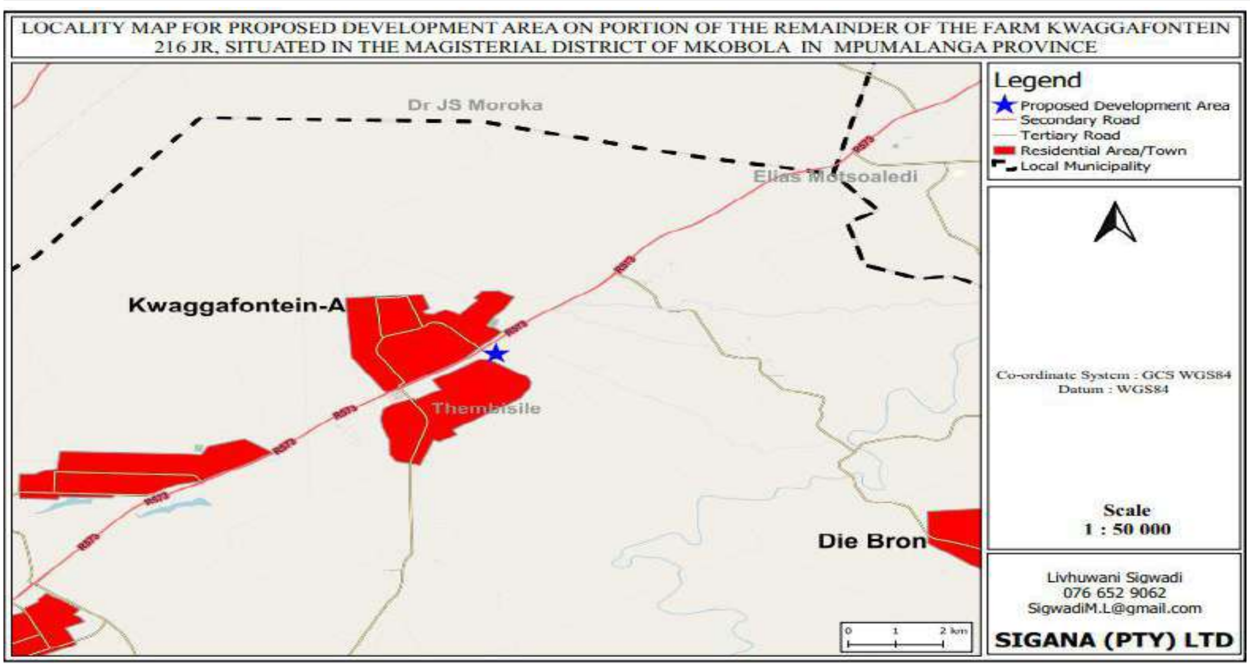
- Preliminary scoping input from the specialists that form part of the project team;
- Review of information available on the South African National Biodiversity Institute (SANBI) Biodiversity Geographical Information System (BGIS) and Agricultural Geo-Referenced Information System (AGIS); and
- Thembisile Hani Local Municipality IDPs.

It is important to note that this chapter intends to provide a broad overview and does not represent a detailed environmental study. Detailed descriptions of the preferred project site focused on significant environmental aspects of this project are provided in the relevant specialist studies (Appendix C).

B.1 Background

The proposed PV project is situated on the portion of portion 0 of the farm Kwaggafontein 216 JR. The preferred site will extend approximately 20 ha. As previously noted, the site is located approximately 11 km east of Kwaggafontein mall in Thembisile Hani Local Municipality in the Mpumalanga Province. Figure B.1 provides a locality map of the proposed project area within a regional setting.

Figure B.1. Locality Map for Imvunulo-Kwaggafontein within a regional setting



B.2 Preliminary Sensitivity Screening

Based on the preliminary sensitivity screening undertaken for the site, the proposed project area does not fall within any threatened ecosystems, National Protected Areas, National Protected Area Expansion Strategy (NPAES) Focus Areas or areas of conservation planning. This information has been confirmed in the Ecological Impact Assessment (Appendix C).

B.3 Biophysical Environment

B.3.1 Climatic Conditions

The rainfall varies between 111 mm and 3 mm per annum. Kwaggafontein normally receives about 42 mm of rain per year, with most rainfall occurring mainly during summer. The chart below shows the average rainfall values for Kwaggafontein per month. It receives the lowest rainfall (3mm) in July and August and the highest (111 mm) in January. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Kwaggafontein range from 19°C in June to 29°C in January. The region is the coldest during June when the mercury drops to 3°C on average during the night. Consult the chart below for an indication of the monthly variation of average minimum daily temperatures. Figure B.1 below is an indication of the rainfall and Figure B.2 indicates the temperature conditions in Kwaggafontein.

Figure B.1: Climatic conditions for Kwaggafontein

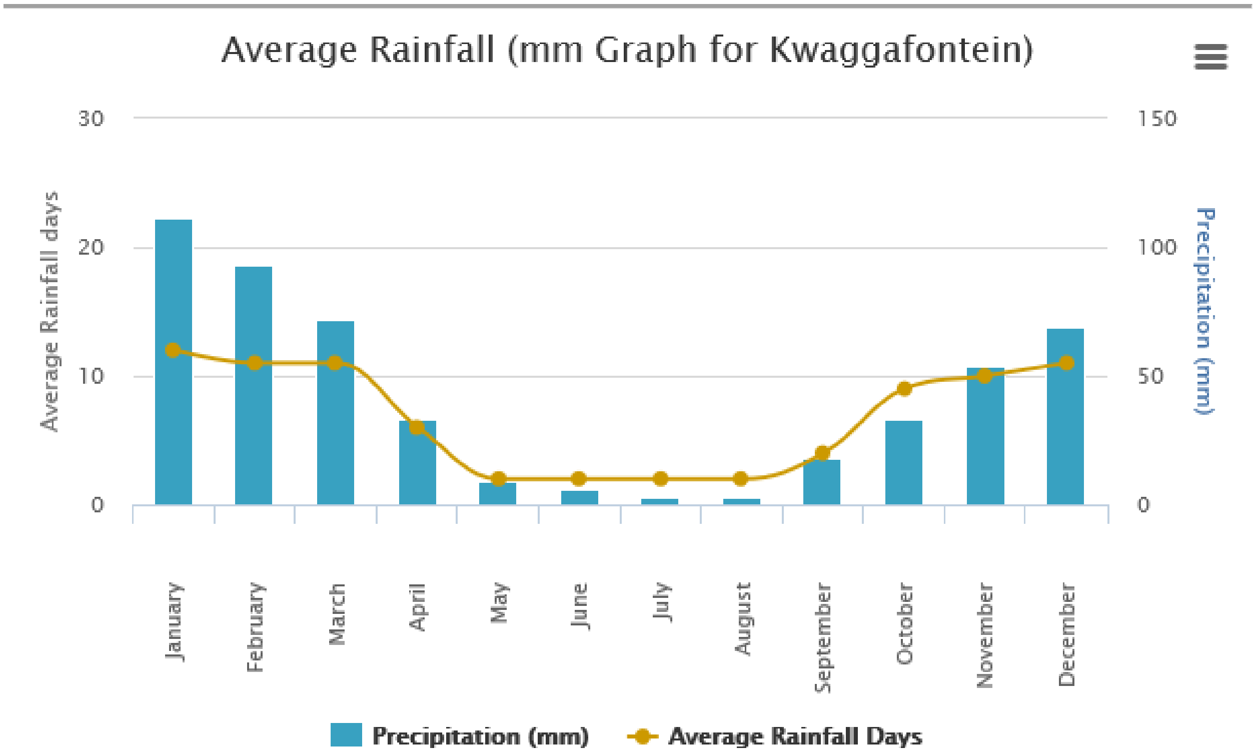
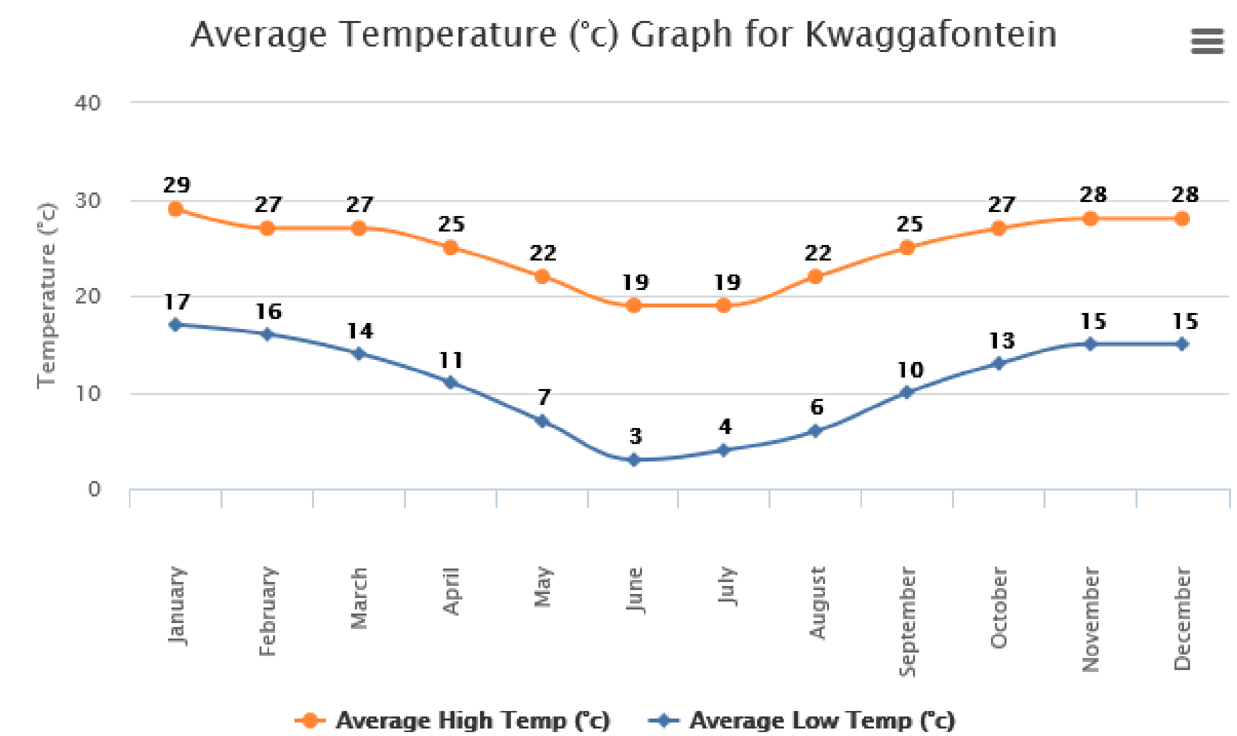


Figure B.2: Temperature conditions for Kwaggafontein,



B.3.2 Land Uses and Land Cover

The proposed site is located in Kwaggafontein which is a fairly large townships. Access is gained directly from the R573 provincial road. There are Eskom distribution powerlines located within the site. During site assessment, a pond of water was observed within the development area and littering or dumping of waste building materials was observed.

B.3.3 Soils, geology and terrain conditions

According to the information provided in the Geotechnical report, the proposed solar farm site at Kwaggafontein is located on the Rashoop Granophyre Suite which forms the base of the Bushveld Complex Igneous intrusion. The site soils comprise generally deeply weathered (>3m) residual soils overlain by a layer of sandy colluvium (Figure B3). A north-west south-east trending fault is indicated on the published map, just north of the site. The area is not underlain by dolomitic or other carbonaceous rocks prone to sinkhole or doline formation. The regional topography comprises generally flat terrain. No unstable natural slopes were noted at the solar farm site.

Figure B3: The sandy cover soils at Kwaggafontein

The cover soils (to around 1.0m) are likely to be suitable as topsoil cover material and probably suitable as layer above the geo-membrane. The residual material may potentially be suited as clay material in the design for the base and cover of the sites.

B.3.4 Ecology (flora and fauna)

The site falls within the vegetation type Central Sandy Bushveld sensu Mucina and Rutherford (2006). This vegetation type is characterised by tall deciduous trees Terminalia sericea and Burkea Afrikana in deep sandy soils. Low rocky soils contain Combretum species and Acacia, Ziziphus and Euclea are found on flats and slopes. This vegetation unit is classified as 'Vulnerable' since very little of the area has been preserved, and is threatened by rural communities, alien vegetation and erosion (Mucina and Rutherford, 2006).

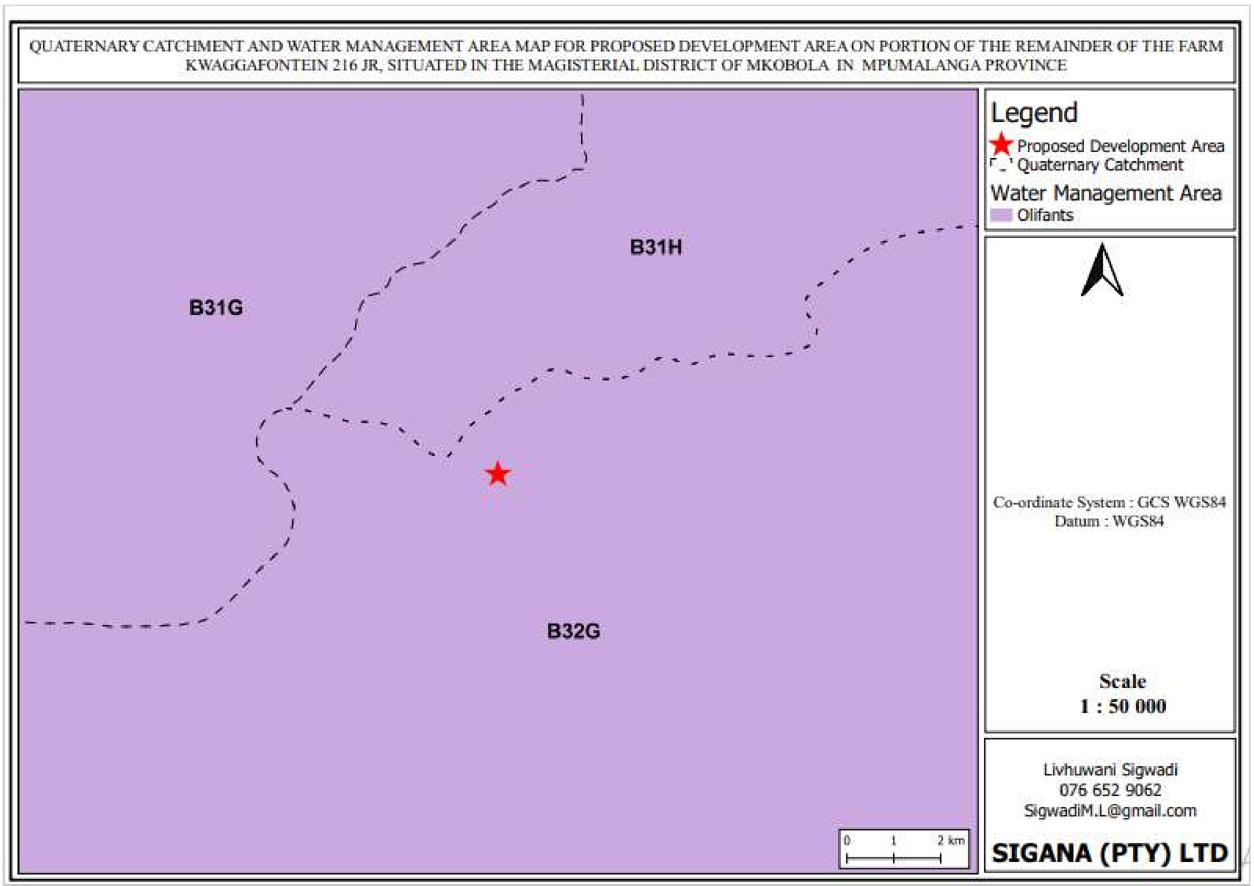
Plant species richness and density is likely to be affected by the roads andsolar farm activities on the site. The impacted nature of the site, together with the expanse of transformed vegetation surrounding the site lead to the suggestion that the study site is not regionally ecologically important. It is not likely to be a refuge to sensitive plant species.

With regards to the fauna species it must be noted that landfill sites have the potential to attract and negatively affect fauna. During site assessment, no species or specialised habitats were observed in the proposed area. A specialised bird habitat was observed in an area adjacent to the proposed site. Workers on and visitors to sites should not enter surrounding habitats, be supplied with adequate ablution facilities, but be made aware of and avoid disturbing any threatened species that might visit the site.

B.3.5 Drainage and Hydrological conditions

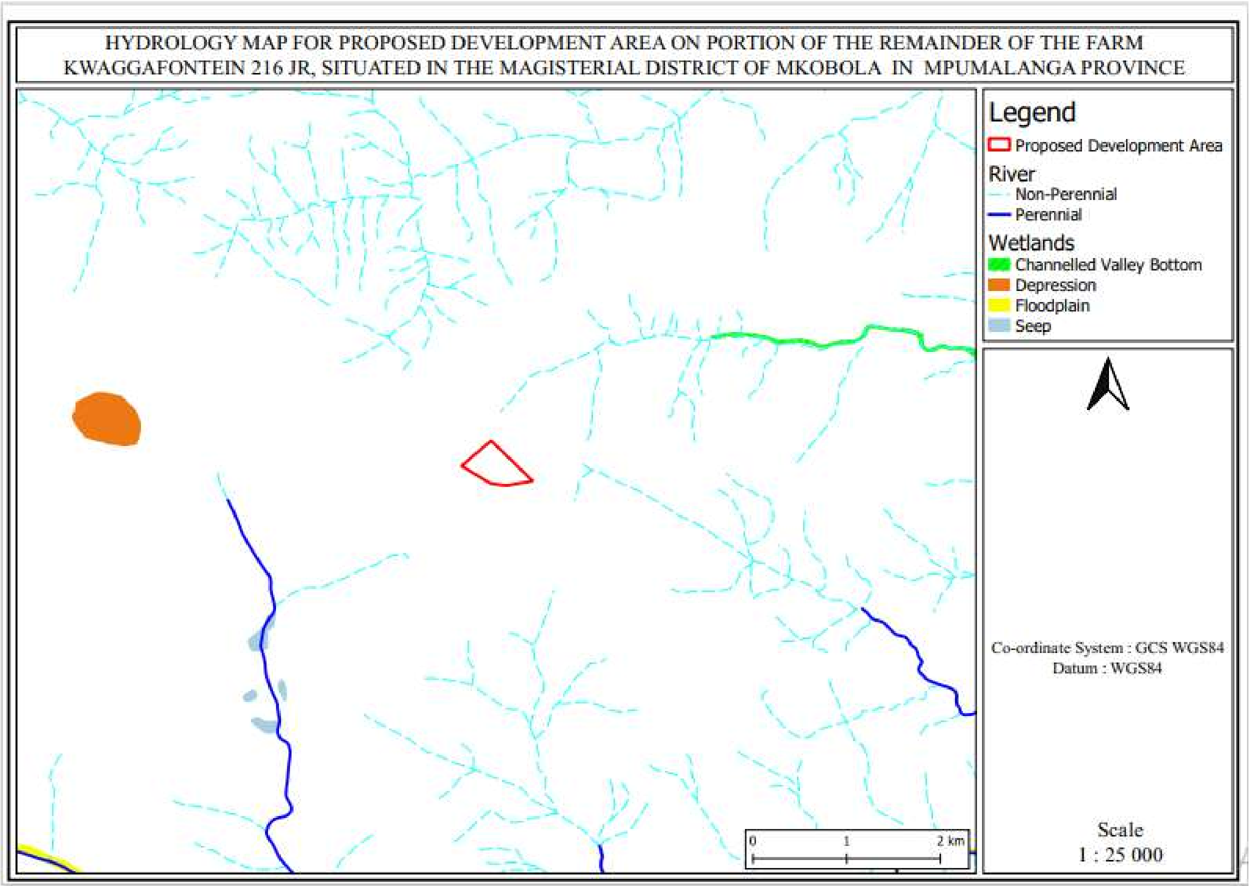
The region is characterised by flat expanse in which terrestrial vegetation growth is limited due to farming activities. No riparian or wetland habitat occurs in the immediate area.
Figure B4 below indicates the water resource management classification associated with the Project area. The Project area falls within the Olifants Water Management Area (WMA). The quaternary catchment is B32G. There is a pond of water within the proposed development area and the proposed development area act as the catchment of non-perennial rivers.

Figure B4: Catchment and Water Management Area



As confirmed on the Figure B5 below that the proposed project will not physically affect both Perennial and Non-perennial river since both cut outside the area of proposed. No wetland will also affected by proposed project since they are lies far from the exact area of the proposed. Therefore the proposed project will be conducted without any harm to the local streams and wetland.

Figure B5: Hydrology within the project area



B.3.6 Socio economic conditions

Thembisile Hani Local Municipal area is well served with electricity with more than 98% of the community having access to electricity. The municipality does not have an electricity license to distribute electricity. Eskom is both the electricity service authority for electricity infrastructure and house connections while the Municipality is responsible for street lighting and public lighting.

Public lighting is one of the strategies used to reduce crime and is a responsibility of the municipality. The municipality has high mast lights, midblock lights and street lights at different villages. These have proven to be insufficient as there is still a huge backlog in different villages. There is a huge backlog for the repair and maintenance of existing high mast lights and street lights, but this is nonetheless manageable and there is continuous improvement.

B.3.7 Heritage and Cultural Features

No any cultural and heritage feature identified within the boundaries of the site. However, Should unexpected / unknown features or artefacts of heritage value be exposed during excavation, those should be appropriately dealt with in environmental planning for the development.

B.3.8 Roads and Traffic Conditions

The proposed solar farm site is easily accessible and is located in Kwaggafontein townships. The R573 road forms the main access onto the site. This road is known for its business and high amount of traffic during the morning and afternoon peak hours. Public transport vehicles (such as Putco buses) use this road for transporting of commuters to and from work every day.

Traffic levels on the access road and residential areas are high and will likely cause noise impacts even during the operation phase of the project. Precautions should be taken with regards to the increase in traffic levels during the construction and the operational phase of the solar farm site. It must be noted the Mpumalanga Department of Public Works, Roads and Transport has been included as one of the interested and affected party in this project.

SECTION C: PUBLIC PARTICIPATION

C.1 Introduction to the Public Participation Process

This section provides an overview of the tasks undertaken during the BA, with a particular emphasis on providing a clear record of the Public Participation Process (PPP) to be followed.

The PPP for these BA Process is driven by a stakeholder engagement process that includes inputs from authorities, I&APs, technical specialists and the project proponent. Guideline 4 on "Public Participation in support of the EIA Regulations" published by the former Department of Environmental Affairs and Tourism (DEFFT) in May 2006, states that public participation is one of the most important aspects of the EA Process. This stems from the requirement that people have a right to be informed about potential decisions that may affect them and that they must be afforded an opportunity to influence those decisions. Effective public participation also improves the ability of the Competent Authority (CA) to make informed decisions and results in improved decision-making as the view of all parties are considered.

An effective PPP could therefore result in stakeholders working together to produce better decisions than if they had worked independently. The DEFFT guideline states the following in terms of PPP:

- "Provides an opportunity for I&APs, EAPs and the CA to obtain clear, accurate and understandable information about the environmental impacts of the proposed activity or implications of a decision;
    - Provides I&APs with an opportunity to voice their support, concern and question regarding the project, application or decision;
    - Enables an applicant to incorporate the needs, preferences and values of affected parties into its application;
    - Provides opportunities for clearing up misunderstanding about technical issues, resolving disputes and reconciling conflicting interests;
    - Is an important aspect of securing transparency and accountability in decision-making; and
    - Contributes toward maintaining a health, vibrant democracy."

To the above, one can add the following universally recognised principles for public participation:

- Inclusive consultation that enables all sectors of society to participate in the consultation and assessment processes;
- Provision of accurate and easily accessible information in a language that is clear and sufficiently non-technical for I&APs to understand, and that is sufficient to enable meaningful participation;
- Active empowerment of grassroots people to understand concepts and information with a view to active and meaningful participation;
- Use of a variety of methods for information dissemination in order to improve accessibility, for example, by way of discussion documents, meetings, workshops, focus group discussions, and the printed and broadcast media;
- Affording I&APs sufficient time to study material, to exchange information, and to make contributions at various stages during the assessment process;

- Provision of opportunities for I&APs to provide their inputs via a range of methods, for example, via briefing sessions, public meetings, written submissions or direct contact with members of the BA team.
- Public participation is a process and vehicle to provide sufficient and accessible information to I&APs in an objective manner to assist I&APs to identify issues of concern, to identify alternatives, to suggest opportunities to reduce potentially negative or enhance potentially positive impacts, and to verify that issues and/or inputs have been captured and addressed during the assessment process.

At the outset it is important to highlight two key aspects of public participation:

- There are practical and financial limitations to the involvement of all individuals within a PPP. Hence, public participation aims to generate issues that are representative of societal sectors, not each individual. Hence, the PPP will be designed to be inclusive of a broad range of sectors relevant to the proposed project.
- The PPP will aim to raise a diversity of perspectives and will not be designed to force consensus amongst I&APs. Indeed, diversity of opinion rather than consensus building is likely to enrich ultimate decision-making. Therefore, where possible, the PPP will aim to obtain an indication of trade-offs that all stakeholders (i.e. I&APs, technical specialists, the authorities and the development proponent) are willing to accept with regard to the ecological sustainability, social equity and economic growth associated with the project.

The key steps in the PPP for the BAs are described below. This approach is structured in line with the requirements of Chapter 6 (PPP) of the 2014 NEMA EIA Regulations (as amended, i.e. GN R326).

The BA Processes commenced in July 2022, whereby the specialist studies were commissioned and the BA Reports were compiled. The BA Reports are currently being released to I&APs, Stakeholders and Organs of State (including the National DEFF) for a 30-day comment period. The Applications for EA are to be submitted to the National DEFF at the same time as the BA Reports.

C.2 Landowner written consent

Regulation 39 (1) of the 2014 NEMA EIA Regulations (as amended) states that *"if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land".*

Regulation 39 (2) of the 2014 NEMA EIA Regulations (as amended) further states that *"sub-regulation (1) does not apply in respect of: (a) linear activities; (b) activities constituting, or activities directly related to prospecting or exploration of a mineral and petroleum resource or extraction and primary processing of a mineral or petroleum resource; and (c) strategic integrated projects as contemplated in the Infrastructure Development Act, 2014".*

The proposed solar PV and onsite substation component of the projects constitute a non-linear activity, and landowner consent is therefore required for the following land portions:

Project	Affected Farm Portion(s)
Imvunulo-Kwaggafontein solar PV	Kwaggafontein 216 JR portion of portion 0

Written consent has been obtained from the landowner of the above farm portion (i.e. Ndzundza Somphalali Traditional Council), on which the non-linear infrastructure is proposed to be located. The written consent has been included as an appendix to the Application for EA, which will be submitted to the DEFF for consideration, together with the BA Reports for comment. The proposed access road and associated infrastructure are constituted as linear developments; hence written consent is not legally required in terms of Regulation 39 of the 2014 NEMA EIA Regulations (as amended).

C.3 Advertisement and Site Notice Board

- **Newspaper Advertisement:**

Regulation 41 (2) (c) of the 2014 NEMA EIA Regulations (as amended) requires the placement of a newspaper advertisement in one local newspaper. In line with this, in order to notify and inform the public of the proposed projects, to invite I&APs to register on the project database, as well as to inform I&APs of the release of the BA Reports for comment, the BA Processes have been arranged to be advertised in one local newspaper at the commencement of the 30-day comment period for the BA Reports. Specifically, the advertisements have been arranged to be placed in the The Sowetan newspaper.

Proof of placement of the newspaper advertisements will be included in Appendix D of the finalised BA Report.

- **Site Notice Board:**

Regulation 41 (2) (a) of the 2014 NEMA EIA Regulations (as amended) requires that a notice board providing information on the project and BA Process is fixed at a place that is conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of the site where the application will be undertaken or any alternative site. To this end, notice boards were placed at the entrance of the farn Kwaggafontein 216 JR and at the Local Municipality Offices in Kwaggafontein.

A copy of the notice boards is included in Appendix D of this BA Report. Proof of placement of the notice boards will be included in the finalised BA Report.

C.4 Determination of Appropriate Measures

Refer to the section below which provides a detailed outline of the measures taken to include all potential I&APs, stakeholders and Organs of State during the BA Process (as required by Regulations 41 (2) (e), 41 (6) and 41 (2) (b) of GN R326, in terms of the 2014 NEMA EIA Regulations (as amended)).

In terms of Regulation 41 (2) (e) of GN R326, at this stage of the assessment process no persons have been identified as desiring but unable to participate in the process. Therefore, no alternative methods have been agreed to by the competent authority.

In line with Regulation 41 (2) (b) of GN R326 and prior to the commencement of the BA Process (and advertising the EA Process in the local print media), an initial database of I&APs (including key stakeholders and Organs of State) was developed for the combined BA Processes. This was supplemented with input from the EAP and the Project Applicant. Appendix D of this BA Report contains a detailed copy of the I&AP database which indicates interaction with I&APs, key stakeholders and all I&APs that have been added to the project database. In line with Regulation 41 (2) (b) of the 2014 NEMA EIA Regulations, the database includes the details of the following:

- Landowners of the affected farm portions;
- Landowners of the neighbouring adjacent farm portions;
- The municipal councillor of the ward in which the proposed projects will be undertaken;
- The municipality which has jurisdiction in the area (i.e.Thembisile Hani Local Municipality and Nkangala District Municipality);
- Relevant Organs of State that have jurisdiction in respect of any aspect of the activity; and
- Any other party as required by the competent authority.

The above stakeholders, Organs of State and I&APs will accordingly receive written notification of the commencement of the BA Processes and release of the BA Reports for comment.

While I&APs have been encouraged to register their interest in the project from the start of the process, following the public announcements, the identification and registration of I&APs is ongoing for the duration of the study. Stakeholders from a variety of sectors, geographical locations and/or interest groups are expected to show an interest in the proposed project, for example:

- Provincial and Local Government Departments;
- Local interest groups, for example, Councillors and Rate Payers associations;
- Surrounding landowners;
- Farmer Organisations;
- Environmental Groups and NGOs; and
- Kwaggafontein communities and structures.

As per Regulation 42 of the GN 326, in terms of the electronic database, I&AP details will be captured and automatically updated as and when information is distributed to or received from I&APs. This ongoing record of communication is an important component of the PPP. It must be noted that while not required by the regulations, those I&APs proactively identified at the outset of the BA Process will remain on the project database throughout the process and will be kept informed of all opportunities to comment and will only be removed from the database by request.

C.5 Approach to the PPP

In terms of Regulation 41 (6) of GN R326 the section below outlines the PPP for this assessment in order to provide potential I&APs, Stakeholders and Organs of State access to information on the project and the opportunity to comment at the various stages of the assessment process. It should be noted that no deviations from the PPP have been requested.

C.5.1 BA Report Phase - Review of the BA Report

As noted above, the BA Reports for the proposed solar PV project are currently being released to I&APs, Stakeholders and Organs of State for review. The section below summarises the PPP for the review of the BA Reports.

- Database Development and Maintenance: In line with Regulation 41 (2) (b) of GN R326, an initial database of potential I&APs was developed for the BA Process, and will be updated throughout the process. Refer to Section C (4) for additional information.

- Site Notice Board: As noted in Section C (3) above, notice boards were placed for the proposed projects. A copy of the notice boards is included in Appendix D of this BA Report.
- Letter to I&APs: Written notification of the availability of the BA Reports will be sent to all I&APs and Organs of State included on the project database through email and postage (where email addresses are not available). The letter will be written in English, and will include notification of the 30-day comment period for the BA Reports. Proof of email, as well as copies of the Letter 1 and emails sent will be included in Appendix D of the finalised BA Report (which will be submitted to the DEFF for decision-making).

- Advertisements to Register Interest: An advertisement will be placed in The Sowetan for the release of the BA Reports for comment. A copy of this advertisement will be included in Appendix D of the finalised BA Report.

- 30-day Comment Period: As noted above, potential I&APs, including authorities and Organs of State, are to be notified via emails, of the 30-day comment and registration period within which to submit comments on the BA Reports and/or to register on the I&AP database.

- Availability of Information: The BA Reports will be made available and distributed to ensure access to information on the project and to communicate the outcome of specialist studies. Copies of the reports will be placed at the Kwaggafontein local library for I&APs and Stakeholders to access for viewing. Key authorities will be provided with a hard copy and/or electronic (disc) copy of the report of the BA Reports via courier. Proof of courier (i.e. waybills) will be included in Appendix D of the finalised BA Report.

- Comments Received: A key component of the BA Process is documenting and responding to the comments received from I&APs and the authorities. Copies of all comments received during the review of the BA Reports will be included in Appendix D of the finalised BA Report and in the Comments and Response Report.

C.5.2 Compilation of finalised BA Reports for Submission to the DEFF

- Following the 30-day commenting period of the BA Reports and incorporation of the comments received into the reports, the finalised BA Reports (i.e. hard copies and electronic copies) will be submitted to the DEFF in line with Regulation 19 (1) (a) of the 2014 NEMA EIA Regulations (as amended). In line with best practice, I&APs on the project database will be notified via email (where email addresses are available) of the submission of the finalised BA Reports to the DEFF for decision-making.

- The BA Reports that are submitted for decision-making will include proof of the PPP that will be undertaken to inform Organs of State, Stakeholders and I&APs of the availability of the BA Reports for the 30 day review (as explained above).
- The DEFF will have 57 days (from receipt of the finalised BA Reports) to either grant or refuse EA (in line with Regulation 20 (1) of the 2014 NEMA EIA Regulations (as amended)).

C.5.3 Environmental Decision-Making

- Environmental Decision-Making and Appeal Period - Subsequent to the decision-making phase, if an EA is granted by the DEFF for the proposed projects, all registered I&APs, Organs of State and stakeholders on the project database will receive notification of the issuing of the EA and the appeal period. The 2014 NEMA EIA Regulations (as amended) (i.e. Regulation 4 (1)) states that after the Competent Authority has a reached a decision, it must inform the Applicant of the decision, in writing, within 5 days of such decision. Regulation 4 (2) of the 2014 NEMA EIA Regulations (as amended) stipulates that I&APs need to be informed of the EA and associated appeal period within 14 days of the date of the decision. All registered I&APs will be informed of the outcome of the EA and the appeal procedure and its respective timelines. The distribution of the EA (should such authorisation be granted by the DEFF), as well as the notification of the appeal period, will include a letter to be sent via email to all registered I&APs, Stakeholders and Organs of State (where email addresses are available) on the database. The letter will include information on the appeal period, as well as details regarding where to obtain a copy of the EA.

C.6 Issues raised by I&APs and comments and response report

Issues raised by I&APs during the release of the BA Reports will be captured in the finalised BA Reports, together with responses to the comments from the project team.

C.7 Commenting Authorities identified

- Nkangala District Municipality
- Thembisile Hani Local Municipality
- Mpumalanga Tourism and Park Agency
- Department of Mineral Resources and Energy
- Department of Water Affairs
- Department of Rural Development and Land Reform
- South African Heritage and Resources Agency
- Mpumalanga Department of Public Works, Roads and Transport
- Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs
- Departments of Agriculture Forestry and Fisheries

SECTION D: IMPACT ASSESSMENT

This section includes a summary and anticipated significance of the potential direct, indirect and cumulative impacts that are likely to occur as a result of the planning and design phase, construction phase, operational phase, decommissioning phase, in line with the requirements of the 2014 NEMA EIA Regulations (as amended).

D.1 Approach to the BA: Methodology of the Impact Assessment

The identification of potential impacts includes impacts that may occur during the construction, operational and decommissioning phases of the proposed development. The assessment of impacts includes direct, indirect as well as cumulative impacts. In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed projects is well understood so that the impacts associated with the projects can be assessed. The process of identification and assessment of impacts includes:

- Determining the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Determining future changes to the environment that will occur if the activity does not proceed;
- Develop an understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken.

The impact assessment methodology has been aligned with the requirements for BA Reports as stipulated in Appendix 1 (3) (1) (j) of the 2014 NEMA EIA Regulations (as amended), which states the following:

"A BA Report must contain the information that is necessary for the Competent Authority to consider and come to a decision on the application, and must include an assessment of each identified potentially significant impact and risk, including –

(i) cumulative impacts;
(ii) the nature, significance and consequences of the impact and risk;
(iii) the extent and duration of the impact and risk;
(iv) the probability of the impact and risk occurring;
(v) the degree to which the impact and risk can be reversed;
(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and
(vii) the degree to which the impact and risk can be mitigated".

As per the DEFFT Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- **Cumulative impacts** are 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. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

In addition to the above, the impact assessment methodology includes the following aspects:

Nature of impact/risk - The type of effect that a proposed activity will have on the environment.

Status - Whether the impact/risk on the overall environment will be:

- Positive - environment overall will benefit from the impact/risk;
- Negative - environment overall will be adversely affected by the impact/risk; or
- Neutral - environment overall not be affected.

Spatial extent – The size of the area that will be affected by the impact/risk:

- Site specific;
- Local (<10 km from site);
- Regional (<100 km of site);
- National; or
- International (e.g. Greenhouse Gas emissions or migrant birds).

Duration – The timeframe during which the impact/risk will be experienced:

- Very short term (instantaneous);
- Short term (less than 1 year);
- Medium term (1 to 10 years);
- Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).

Consequence – The anticipated consequence of the risk/impact:

- Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
- Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
- Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
- Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or
- Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).

Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):

- High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);
- Moderate reversibility of impacts;
- Low reversibility of impacts; or
- Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).

Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):

- High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);
- Moderate irreplaceability of resources;
- Low irreplaceability of resources; or
- Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

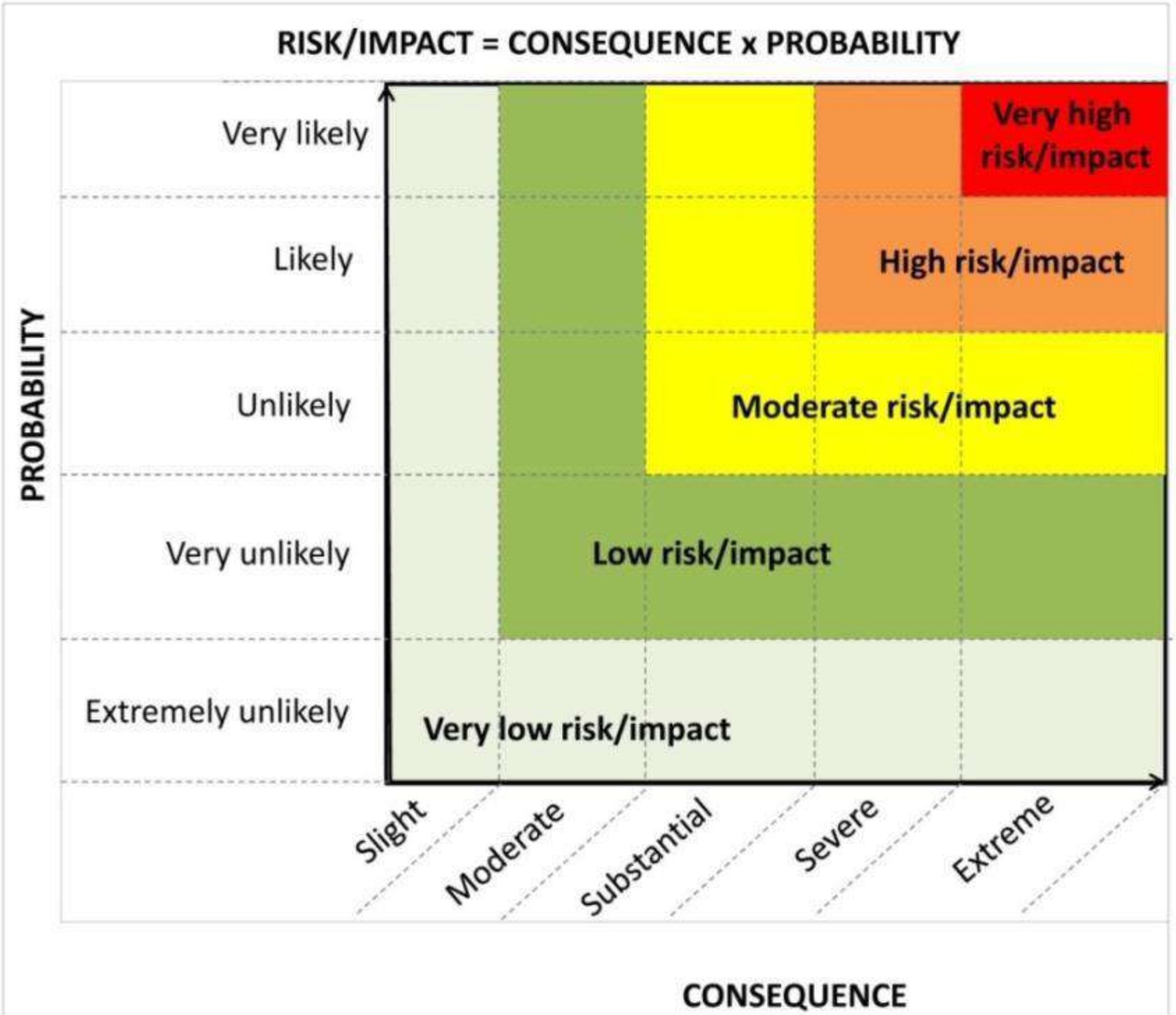
Using the criteria above, the impacts are further assessed in terms of the following:

Probability – The probability of the impact/risk occurring:

- Extremely unlikely (little to no chance of occurring);
- Very unlikely (<30% chance of occurring);
- Unlikely (30-50% chance of occurring)
- Likely (51 – 90% chance of occurring); or
- Very Likely (>90% chance of occurring regardless of prevention measures).

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D.1). This approach incorporates internationally recognised methods from the Intergovernmental Panel on Climate Change (IPCC) (2014) assessment of the effects of climate change and is based on an interpretation of existing information in relation to the proposed activity, to generate an integrated picture of the risks related to a specified activity in a given location, with and without mitigation. Risk is assessed for each significant stressor (e.g. physical disturbance), on each different type of receiving entity (e.g. the municipal capacity, a sensitive wetland), qualitatively (very low, low, moderate, high, and very high) against a predefined set of criteria (i.e. probability and consequence):

Figure D.1. Guide to assessing risk/impact significance as a result of consequence and probability.



Significance – Will the impact cause a notable alteration of the environment?

- Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
- Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
- Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);
- High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and
- Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).

With the implementation of mitigation measures, the residual impacts/risks will be ranked as follows in terms of significance:

- Very low = 5;
- Low = 4;
- Moderate = 3;
- High = 2; and
- Very high = 1.

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- Low;
- Medium; or
- High.

Impacts have been collated into the EMPr (Appendix F of the BA Report) and these include the following:

- Quantifiable standards for measuring and monitoring mitigatory measures and enhancements (as applicable). This includes a programme for monitoring and reviewing the recommendations to ensure their ongoing effectiveness.
- Identifying negative impacts and prescribing mitigation measures to avoid or reduce negative impacts. Where no mitigatory measures are possible this is stated.
- Positive impacts and augmentation measures have been identified to potentially enhance positive impacts where possible.

Other aspects to be taken into consideration in the assessment of impact significance are:

- Impacts are evaluated for the construction and operational phases of the development. The assessment of impacts for the decommissioning phase is brief, as there is limited understanding at this stage of what this might entail. The relevant rehabilitation guidelines and legal requirements applicable at the time will need to be applied;
- Impacts have been evaluated with and without mitigation in order to determine the effectiveness of mitigation measures on reducing the significance of a particular impact;
- The impact evaluation has, where possible, taken into consideration the cumulative effects associated with this and other facilities/projects which are either developed or in the process of being developed in the local area; and
- The impact assessment attempts to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are used as a measure of the level of impact.

D.2 Assessment of environmental risks and impacts

The issues and impacts presented in this Section have been identified via the environmental status quo of the receiving environment (environmental, social and heritage features present on site - as discussed in Section B of this BA Report) and input from specialists that form part of the project team. The specialist studies undertaken to inform this BA has been summarised in this section. It should be noted that unless otherwise stated, impacts identified and their associated significance are deemed to be negative.

Please refer to Appendix C of this report for the full specialist studies undertaken (including the Terms of Reference for each study). All proposed mitigation measures have been carried over into the project's EMPr, included in Appendix F of this report.

D.2.1 Visual

D.2.1.1 Visual Assessment

Given the relatively featureless nature of the study area, the only sensitive visual features is neighbouring residential area, which is some distance away. Other local features in the landscape, such as the existing Eskom Kwaggafontein Substation, power lines are visual intrusions that have already altered the landscape character of the area.

The cumulative visual impact significance of the project, as well as the other proposed and approved solar farms within 30 km radius, was considered to be moderate before the implementation of mitigation measures and low with mitigation. For the cable trenches component, significance of cumulative impacts was rated as low both with and without mitigation. During the decommissioning phase, for the PV facility, the significance was rated as very low, assuming mitigation. The reasons for this are the remoteness of the subject area and the featureless nature of the landscape.

D.2.1.2 Impact Assessment

The potential impacts identified during the visual assessment are listed below:

Construction Phase

- Potential effect of dust and noise from trucks and construction machinery during the construction period, and the effect of this on residents and visitors to the area, particularly users of the main arterial routes, (R573), to the site.
- Potential visual effect of haul roads, access roads and stockpiles on the exposed landscape.

Operational Phase

- Potential visual intrusion of solar arrays and related infrastructure and the impact on receptors, including residents and visitors in the area.
- Potential visual impact of an industrial type activity on the rural or wilderness character of the area.

Decommissioning Phase

- Potential visual effect of any remaining structures, platforms and disused roads on the landscape.

D.2.1.3 Impact Assessment

Impact Assessment Table for the Construction Phase (Solar Energy Facility)

Construction Phase														
Direct Impacts														
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level	
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)			
Dust and noise from construction	Visual effect on rural character	Negative	Site	Short-term	Substantial	Very likely	High	Low	Implement management actions as per the EMPr	Moderate	Low	4	Medium	
Visual intrusion of site works	Visual impact on residents and visitors	Negative	Site	Short-term	Substantial	Very likely	High	Low	Suitably locate the construction site camp	Moderate	Low	4	Medium	

Impact Assessment Table for the Operational Phase (Solar Energy Facility)

Operational Phase														
Direct Impacts														
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level	
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)			
Introduction of solar arrays and infrastructur	Visual impact on receptors	Negative	Local	Long-term	Substantial	Very likely	High	Low	Locate substation and buildings in an unobtrusive area. Keep access roads	Moderate	Low	4	High	
	Visual intrusion	Negative	Local	Long-term	Substantial	Very likely	High	Low		Moderate	Low	4	High	

e in the landscape	on rural landscape								narrow. Manage lighting and signage.					

Impact Assessment Table for the Decommissioning Phase (Solar Energy Facility)

Decommissioning Phase														
Direct Impacts														
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level	
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)			
Visual effect of remaining structures, platforms and disused roads	Visual impact on receptors	Negative	Local	Long-term	Substantial	Very likely	High	Low	Structures to be demolished or recycled. Platforms and access roads to be ripped/ regraded. Disturbed areas to be revegetated or returned to grazing pasture.	Moderate	Very Low	5	High	
	Visual intrusion on rural landscape	Negative	Local	Long-term	Substantial	Very likely	High	Low		Moderate	Very Low	5	High	

Cumulative Impact Assessment Table (Solar Energy Facility)

Cumulative Impacts (Construction, Operational and Decommissioning Phases)														
Direct Impacts														
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level	
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)			
Introduction of additional solar energy farm	Cumulative visual impacts transform	Negative	Local	Long-term	Substantial	Very likely	High	Low	Cluster solar energy farms in low sensitivity areas.	Moderate	Low	4	High	

	the rural landscape													

Impact Assessment Table for the Construction Phase (cable trenches)

Construction Phase														
Direct Impacts														
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level	
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)			
Introduction of access tracks and site works	Visual effect on rural character and receptors	Negative	Local	short-term	Sight	Very likely	High	Low	• If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. • Access roads kept as narrow as possible. • Implementation of management actions	Very Low	Very Low	5	Medium	

									are per the EMPr.					

Impact Assessment Table for the Operational Phase (cable trenches)

Operational Phase Phase														
Direct Impacts														
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level	
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)			
Introduction of pylons into the landscape	Visual impact on receptors	Negative	Local	Long-term	Moderate	Very likely	High	Low	Maintenance of cable trenches	Low	Low	4	High	
	Visual intrusion on rural landscape	Negative	Local	Long-term	Moderate	Very likely	High	Low		Low	Low	4	High	

Impact Assessment Table for the Decommissioning Phase (cable trenches)

Decommissioning Phase														
Direct Impacts														
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level	
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)			
Visual effect of remaining structures, platforms and disused roads	Visual impact on receptors	Negative	Local	Long-term	Moderate	Very likely	High	Low	trenches removed. Roads ripped/ regraded. Disturbed areas revegetated.	Low	Very Low	5	High	
	Visual intrusion on rural landscape	Negative	Local	Long-term	Moderate	Very likely	High	Low		Low	Very Low	5	High	

D.2.1.4 Concluding statement

Key visual management actions include locating the substation and other buildings, as well as construction camps, in an unobtrusive position in the landscape away from public roads. The arid landscape is particularly fragile and therefore new access roads and disturbance generally should be kept to a minimum for both the proposed Solar Energy Facility.

There are no fatal flaws from a visual perspective arising from the proposed project, and given the marginal nature of agriculture in the area, the renewable energy project is probably an inherently suitable land use that should receive authorisation, provided the mitigations are implemented.

D.2.2 Ecology

D.2.2.1 Ecological Assessment

- Terrestrial Ecology

The proposed site is located within the natural vegetation with little disturbance by livestock (cattle). The proposed site is characterised by grasses, shrubs and scattered alien plant. The proposed power plant is freely drained, structureless soils can be defined based on their soil depth, Soil Drainage, erodibility, and natural fertility. Depth of the soil profile is from the top to the parent material or bedrock. This type of soil can be classified as a restricted soil depth. A restricted soil depth is a nearly continuous layer that has one or more physical, chemical, or thermal properties.

The proposed power plant area is dominated by Mixed Bushveld. Mixed Bushveld represents a variety of plant communities, with many variations and transitions. The vegetation varies from a dense, short bushveld to a rather open tree savanna. On shallow soil Combretum apiculatum dominates, together with Acacia caffra, Dichrostachys cinerea, Lannea discolour, Sclerocarya birrea and various Grewia species. The grazing is sweet, and the herbaceous layer is dominated by the grasses Digitaria eriantha, Schmidtia pappophoroides, Anthephora pubescens, Stipagrostis uniplumis and various Aristida and Eragrotis species. On deeper and more sandy soil, Terminalia sericea dominates, with Ochna pulchra, Grewia flava, Peltophorum africanum and Burkea africana often prominent. The grass sward is scanty with Eragrostis pallens andPerotis patens characteristic. The structure of this vegetation type is determined by fire and grazing.

- Fauna

According to the desktop study, there are no bird species in the proposed area. During site assessment, no bird species or specialised bird habitats were observed in the proposed area. A specialised bird habitat was observed in an area adjacent to the proposed site.

D.2.2.2 Impact Assessment

A number of direct, indirect and cumulative impacts on the localised and broader ecology of the region can be identified as a consequence of the proposed development being implemented, as seen below:

Construction Phase:

- Alteration of habitat structure and composition;
- Ousting (and recruitment) of various fauna;
- Changes in the geomorphological state of the upper drainage lines (i.e. changes to surface drainage patterns) due to construction activities leading to change in plant communities and general habitat structure, within the site and immediately adjacent to it;
- Increased electrical light pollution, leading to changes in nocturnal behavioural patterns of fauna;
- Exclusion or entrapment of (in particular) large fauna, on account of the fencing of the site;
- Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points;
- Changes in subsurface water resources;
- Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities; and
- Exotic weed invasion.

Operational Phase:

- Continued alteration of habitat structure and composition on account of continuing low level anthropogenic impacts, such as “shading of vegetation” from arrays.;
- Ousting (and recruitment) of various fauna on account of long term changes in the surrounding habitat/environment;
- Changes in the geomorphological state of drainage lines on account of long term climatic changes and the concomitant change in the nature of the catchment arising from the land use change;
- Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities. Such changes will be related to the long term activities on site, but are likely to be negligible; and
- Exotic weed invasion as a consequence of regular and continued disturbance of site.

Decommissioning Phase:

- A reversion to the present seral stage, where continued grazing by livestock and herbivory by game will arise;
- A reversion of present faunal population states within the study area;
- Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment; and
- Exotic weed invasion as a consequence of abandonment of site and cessation of weed control measures.

Cumulative Impacts:

- Extensive alteration of habitat structure and composition over an extensive and wide area;
- Changes in fauna through exclusion of certain species and beneficiation of others over an extensive and wide area;
- Increased change in the geomorphological state of drainage lines on account of long term and extensive change in the nature of the catchment;

- The continued and cumulative loss of habitat at a landscape to regional level, with a particular impact on avifaunal behaviour.
- Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment; and
- Exotic weed invasion as a consequence of regular and continued disturbance across an extensive area of site.

D.2.2.3 Impact Assessment Table

CONSTRUCTION PHASE													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat	Habitat and species loss	Negative	Site	Long-term	Substantial	Very likely	High	Low	-Detailed design and incorporation of habitat and features -Plant rescue operation -Exotic weed control -The maintenance of vegetation and avoidance of the "blading" or clearance. -Consideration of the siting and layout of the temporary construction site and worker camp	Low	Very low	4	High
Abstraction from subsurface aquifers may have a significant impact on plant water relations.	Water volume and ecological change	Negative	Local	Long term	Slight	Very likely	High	Low	Alternative water resources to be utilized	Very low	Very low	5	High

The introduction of water to site by import may alter the availability of water to plants within the site and may lead to changes in habitat form and structure around areas that receive such import.	Change in plant water relations	indeterminate	Local	Long term	Slight	Very likely	High	Low	None identified	Very low	Very low	5	High
Alteration of surface water quality that lead to change in water chemistry	Water quality change and general pollution of resource	Negative	Local	Short term	Slight	Very likely	High	Low	Avoidance of significant sculpting of land and maintenance of the general topography of site. Placement of energy dissipaters within minor drainage lines to reduce velocity of flow through such features	Very low	Very low	5	Medium
Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points.	Habitat change and alteration in fauna and faunal behaviour	Negative	Site	Long term	Moderate	Likely	High	Low	Ripping of compact soils when and where extensive compaction arises	Low	Low	4	Medium
Increased Electrical Light Pollution (ELP), leading to changes in	Changes in faunal behaviour	Negative	Local	Long term	Moderate	Very likely	High	Low	Reduce level of lighting and placement of lighting to be judiciously considered	Low	Very low	5	High

nocturnal behavioural patterns amongst fauna									at time of implementation				
Exclusion or entrapment of in particular large fauna, on account of the fencing of the site.	Animal mortalities	Negative	Site	Local	Slight	Very likely	High	Low	Ensure that the live electrical fence wire is not placed at ground level. Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence	Very low	Very low	5	High

Indirect impact assessment table for the Construction Phase

CONSTRUCTION PHASE													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		

The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat	Habitat and species loss	Negative	Local	Long-Term	Substantial	Likely	Mode rate	Low	-Detailed design and incorporation of habitat and features -Plant rescue operations -Exotic weed control -The maintenance of vegetation and avoidance of "blading" or clearance. -Consideration of the siting and layout of the temporary construction site and worker camp.	Moderate	Low	4	High
Alteration of surface drainage patterns on account of construction activities leading to change in plant communities and general habitat structure	Habitat change through changes in topographic drivers	Negative	Local	Short term	Moderate	Likely	High	Low	-Undertaking and completion of earthworks and road construction outside of the high rainfall period (if possible). -Avoidance of significance sculpting of land and maintenance of the general topography of the site. -Placement of energy dissipaters (such as stone levees or similar) within minor drainage lines to reduce velocity of flow through such features. -Maintenance of a high level of housekeeping on site	Low	Very Low	5	High

									during the construction phase. -Inspection of drainage features immediately outside of the footprint of the proposed PV facility and undertake removal of solid waste and litter on a regular basis.				
Alteration of surface water quality that lead to change in water chemistry	Water quality change and general pollution of resource	Negative	Local	Short term	Slight	Likely	High	Low	-Exclusion of major drainage lines from the development footprint. -Avoidance of significant sculpting of land and maintenance of the general topography of site. -Placement of energy dissipaters within minor drainage lines to reduce velocity of flow through such features. -Maintenance of a high level of housekeeping on site during the construction phase. -Inspection of drainage features immediately outside of the footprint of the proposed PV facility and removal of litter and solid waste on a regular basis.	Very low	Very low	5	Medium

Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points.	Habitat change and alteration in fauna and faunal behaviour	Negative	Local	Long term	Slight	Likely	High	Low	Ripping of compact soils when and where extensive compaction arises	Very low	Very low	5	Medium
Increased ELP, leading to changes in nocturnal behavioural patterns amongst fauna	Changes in faunal behaviour	Negative	Local	Long term	Slight	Likely	High	Low	-Provision of critter paths within fencing should be considered in the design. -Promote and support faunal presence and activities within the proposed PV facility, where applicable.	Very low	Very low	5	High
Exclusion or entrapment of in particular large fauna, on account of the fencing of the site.	Animal mortalities	Negative	Local	Long term	Slight	Likely	High	Low	-Ensure that live electrical fence wire is not placed at ground level. -Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence	Very low	Very low	5	High

Direct Impact assessment table for the Operational Phase

OPERATIONAL PHASE													
As pe ct/ Im pa ct	N at ur	St at us	Sp ati al	D ur ati	C on se qu	Pr ob ab	R ev	Irr ep	Po te nti al Mi tig ati	Significance of Impact and Risk		Ranking of	Confidence Level

										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)	Residual Impact/ Risk	
Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the PV facility	Habitat and species loss	Negative	Site	Long-Term	Moderate	Very likely	High	Low	-Provision of critter paths within the fencing should be considered in the design. -Promote and support faunal presence and activities within the proposed PV facility	Low	Low	4	High
Increased shading, as a consequence of the PV arrays, will lead to changes in plant water relations and possible changes in plant community structures within the site.	Habitat change and species loss	Neutral	Site	Long-Term	Slight	Likely	High	Low	None identified	Very low	Very low	5	High
Changes in meteorological factors at a local scale, on account of the	Uncertainty in relation to change	Neutral	Site	Long-Term	Slight	Likely	High	Low	None identified	Very low	Very low	5	High

PV array are likely to arise													
Abstraction of groundwater for the cleaning of the PV panels, as well as for operational use, will alter the state of subsurface water resources	Water quantity changes with possible impact on habitat	Negative	Local	Very short term	Substantial	Likely	Moderate	Moderate	-Preferential use of recycled water sources for operational phase requirements (instead of groundwater). -The prudent use of surface water resources. -Adopt "dry" cleaning methods, such as dusting and sweeping the site before washing down. -Increased monitoring of the impact of dust generation and implement a more judicious cleaning protocol. -Low level and ongoing cleaning of PV panels over time to reduce demand on aquifers.	Moderate	Low	4	High
The fencing of the site, possibly with electric fencing, is likely to impact on faunal behaviour, leading to the exclusion of certain species	Animal mortality	Negative	Site	Long term	Moderate	Likely	High	Low	-Ensure that the live electrical fence wire is not placed at ground level. -Conduct regular (daily) inspections of the fence line to address any animals that may be affected by electric fence.	Low	Very low	5	High

and possible mortalities													

Indirect Impacts for the Operational Phase

OPERATIONAL PHASE													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the PV facility	Habitat and species loss	Negative	Site	Long-Term	Substantial	Very likely	Low	Low	-Provision of critter paths within the fencing should be considered in the design. -Promote and support faunal presence and activities within the proposed PV facility	Moderate	Low	4	High
Increased shading, as a consequence of the PV arrays, will lead to changes in plant water relations and possible changes in	Habitat change and species loss	Negative	Local	Short term	Slight	Likely	High	Low	None identified	Very low	Not Applicable	5	High

plant community structures within the site.													
Abstraction of groundwater for the cleaning of the PV panels, as well as for operational use, will alter the state of subsurface water resources	Water quality change and general pollution of resource	Negative	Local	Short term	Substantial	Likely	Moderate	Moderate		Moderate	Low	4	High

Cumulative Impact assessment table for the Construction Phase

CONSTRUCTION PHASE													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat	Habitat and species loss	Negative	Local to Regional	Long-Term	Substantial	Very likely	Moderate	Low	-Detailed design and incorporation of habitat and features -Plant rescue operations -Exotic weed control -The maintenance of vegetation and avoidance of the "blading" or clearance.	Moderate	Low	4	High

									-Consideration of the siting and layout of the temporary construction site and worker camp.				
Alteration of surface water quality that leads to change in water chemistry	Changes in drainage patterns and water quality	Negative	Regional	Long term	Moderate	Likely	Moderate	Moderate	-Avoid construction during the rainy season (if possible and practical). -Avoidance of significance sculpting of land and maintenance of the general topography of the site including the avoidance of major drainage lines. -Placement of energy dissipaters (such as stone levees or similar) within minor drainage lines to reduce velocity of flow through such features -Apply good site management and solid waste management outside of site (within the immediate vicinity)	Moderate	Low	4	Medium
Changes in sub surface water resources may arise	Effects upon ground water resources	Negative	Regional	Long term	Substantial	Likely	Moderate	Moderate	-Identify off site water resources -Use of recycled water -Identify or consider alternative cleaning	Moderate	Low	4	Medium

									methods for the PV panels				
Changes in edaphics on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species	Habitat alteration	Negative	Regional	Long term	Moderate	Likely	High	Low	Ripping of compact soils when and where extensive compaction arises	Low	Low	4	Medium
Increased ELP	Faunal behavioural change	Negative	Regional	Long term	Slight	Likely	High	Low	Review the placement of lighting on the site.	Very Low	Very Low	5	Medium
Exclusion or entrapment of in particular large fauna, on account of the fencing of the site	Animal mortality	Negative	Regional	Long term	Slight	Likely	High	Low		Very Low	Very Low	5	Medium

Cumulative Impact assessment table for the Operational Phase

OPERATIONAL PHASE													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		

Alteration of ecological processes on account of the exclusion of certain fauna, inherent to the functional state of the land within the proposed PV facility	Habitat and species loss	Negative	Regional	Long-Term	Substantial	Very likely	Low	Low		Moderate	Low	4	High
Increased shading, as a consequence of the PV arrays, will lead to changes in plant water relations and possible changes in plant community structures within the site.	Exposed soil susceptible to erosion	Negative	Site	Medium-Term	Moderate	Likely	High	Low	None identified	Low	Not Applicable	4	High
Abstraction of groundwater for the cleaning of the PV panels, as well as for operational use, will alter the state of subsurface water resources.	Changes in water resource quantity and perhaps quality	Negative	Regional	Long term	Severe	Likely	Moderate	Low	-Preferential use of recycled water for operational phase requirements (instead of groundwater). -The prudent use of surface water resources. -Adopt “dry” cleaning methods, such as dusting and sweeping of the site before wash down. -Increased monitoring of the impact of dust	High	Moderate	3	Medium

									generation and implement a more judicious cleaning protocol. -Low level and ongoing cleaning of the PV panels over time to reduce demand on aquifers.				
Cable trenches, as well as subtle changes in habitat are likely to result in the alteration of avian behaviour	Changes in faunal behaviour	Negative	Site	Long term	Slight	Likely	High	Low	None identified	Very low	Not Applicable	5	High
As a large area of land will be affected by multiple PV facilities, it is evident that any mortalities and injury associated with electrocution from fencing may be compounded	Cumulative change in faunal populations	Negative	Regional	Long term	Moderate	Likely	High	Low	Management of potential sources of electrocution – electric fences	Low	Very Low	5	High

Decommissioning Phase Impact assessment table

DECOMMISSIONING PHASE												
As pe ct/ Im pa ct	N at ur	St at us	Sp ati al	D ur ati	C on se qu	Pr ob ab	R ev	Irr ep	Po te nti al Mi tig ati	Significance of Impact and Risk	Ranking of	Confidence Level

										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)	Residual Impact/ Risk	
A reversion to the present seral stage, where continued grazing by livestock will arise	Habitat and species change	Neutral	Site	Long-Term	Moderate	Very likely	Low	Low	None identified	Low	Not Applicable	4	Medium
A reversion of present faunal population states within the study area	Habitat and species population change	Neutral	Site	Long-Term	Moderate	Likely	High	Low	None identified	Low	Not Applicable	4	Medium
Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment	Surface hydrology change	Neutral	Local	Long term	Moderate	Very likely	High	Low	None identified	Low	Not Applicable	4	Moderate
Exotic weed invasion as a consequence of abandonment of site and cessation of weed control measures	Habitat change	Negative	Local - Regional	Long term	Substantial	Very likely	High	Low	Weed control and land management	Moderate	Low	4	High

D.2.2.4 Concluding statement

It is in the opinion of the specialist that with the implementation of the above, the proposed Imvunulo-Kwaggafontein Solar Facility which entails the establishment of some 20 ha of modules and support infrastructure on the site in question, is a suitable land use for the area in question and as such should be sanctioned by the relevant authority.

Little ecological impact is likely to arise from the proposed development should the recommended development footprint be employed, however the implementation of certain mitigation measures, as contained in the EMPr and presented above, (including floral and faunal management) should also be incorporated into the approval of the application.

D.2.3 Socio-Economic

D.2.3.1 Socio-economic assessment

Thembisile Hani is characterized by a large rural component and high unemployment; the area is isolated and has a very narrow economic base. The north-western regions of the District are characterized by subsistence farming and rural residential uses. According to the District IDP, the initiation of community farming projects is necessary to enhance the agricultural sector in this area and to address the high poverty levels. The IDP also states that the mining activities in the south of the region and especially in the Thembisile Hani Municipality should be enhanced, to contribute to job creation for poor and unskilled workers and communities.

The lack of housing has been highlighted as one of the key challenges facing communities during many community outreach meetings. A housing survey conducted in 2009 indicated a huge backlog in housing delivery. Many people within the municipality live in informal houses (mud houses and shacks) which are either too old to be inhabited or a structurally weak and are thus vulnerable to being destroyed by bad weather (storm/rain during the summer). The housing survey revealed that there was a housing backlog of about 9764 units, and there are currently no recent statics to gauge whether or not this backlog has increased or subsided.

To adequately address the skills shortage and literacy, the municipality needs to undertake an audit of skills or lack thereof in the municipality as identified skills needs within its communities, the municipality would stock of what direction it wants to follow in terms of technology and economic development the municipality would influence learners in pursuit particular field that are in line with its plan. Currently the issues raised by communities are:

- lack of skill agencies around schools
- limited skill among educators to implement new curriculum
- in adequate support for ABET

Ward councillors and their ward committees can assist in identifying this shortage. Once these skills or lack thereof have been audited, the municipality would therefore need to approach the relevant government institutions to assist addressing problem areas.

The Local Economic Development (LED) Forum was established in June 2014 with local stakeholders within the municipal area, mines in the vicinity of the municipality and sector departments in the province. The LED forum is assisting the LED unit in developing strategic objectives of the municipality and in identifying projects deemed appropriate for the economic development. The LED forum sits quarterly per annum. The forum has endorsed the reestablishment of working groups (sub-committees). These working groups are:

(a) Industrialization, mining and manufacturing, b. SMME`s and Cooperatives, c. Rural Development, Agriculture and Tourism, d. Transport and logistics, e. Infrastructure and Spatial Development, f. Skills Development).

The forum was reestablished in 2019.
These working groups are aimed at developing research and reporting their recommendations to the broader LED forum which will in turn report to council.

According to the Census 2011 statistics a total number 36 141 people are unemployed in Thembisile and only 61 611 are employed.

About 97 744 people are economically active (employed or unemployed but looking for work), and of these, 37% are unemployed. Of the 48 741 economically active youth (15 – 34 years) in the area, almost half (49, 4%) are unemployed. The unemployment rate in the municipality is currently standing at 37% with the female population accounting for most of the unemployment status. The loss of jobs and the decline in new job opportunities in neighboring urban areas such as Witbank, Middelburg and Pretoria exacerbate the unemployment rate.

D.2.3.2 Impact Assessment

Construction/ Operational Phase

- Disruption of local social structures;
- Increased risky social behaviour;
- Increased burden on existing social and bulk services;
- Unrealistic expectations regarding local job creation and housing;
- Limited employment created during the construction and operational phases;
- Development of locally-owned support industries to respond to construction-related activities; and
- Human development via the proposed Economic Development Plan.

Decommissioning Phase

- Job losses

Cumulative Impacts

- Cumulative impact 1: Exacerbated in-migration of job seekers; and
- Combined impact of multiple Economic Development Plans.

D.2.3.3 Impact Assessment

Impact Assessment Table for the Construction and Operational Phase

CONSTRUCTION AND OPERATIONAL PHASE													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Impact 1: Influx of workforce and job seekers	Disruption of existing social structures	Negative	Local	Medium to Long-term	Substantial	Likely	Low	Moderate	None	Moderate	Moderate	3	Medium
Impact 2: Influx of workforce and job seekers	Increases in social deviance	Negative	Local	Medium-term	Substantial	Likely	Low	Moderate	-No construction workers should be allowed to sleep at the construction site. -The construction workforce should receive HIV awareness training prior to the commencement of construction. -HIV and TB testing and counselling should be made available to the construction workforce free of charge. This can be achieved in collaboration with the	Moderate	Low	4	Medium

									local clinic or treatment initiatives like Right to Care (http://www.righttocare.org) which provides HIV and TB testing on-site via mobile clinics. -Local (within the immediate project area) HIV infection rates/ARV treatment loads must be monitored (annually) through close interaction with the local clinic. Should infections and treatment loads increase at a rate greater than the anticipated rate of increase; the Developer (or his appointed agent) must re-evaluate its HIV awareness training, take corrective action where necessary, and repeat said training.				
Impact 3: Influx of workforce and job seekers	Increased burden on bulk services and social infrastructure	Negative	Local	Short-term	Moderate	Likely	Moderate	Moderate	None	Low	Low	4	Medium
Impact 4: Expectations created regarding	Increased frustration in the	Negative	Local	Medium to long-term	Moderate	Likely	Moderate	Moderate	-The Applicant, or Contractor, must engage the local community (within the immediate project	Low	Very Low	5	Medium

possible employment	local commu nity								area) on the nature, duration, number and availability of employment opportunities well in advance of any construction activities taking place. It is recommended that existing social structures be utilised for such interaction, and that the process be commenced once EA has been granted. -The Contractor should establish an employment desk at the construction site to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates. -The existence of the employment desk, and the relevant procedures associated with the selection and appointment of workers must be				

									communicated to the local community. -It is strongly suggested that every effort should be made to employ local residents.				
Impact 5: Limited local employment	Socio-economic benefits	Positive	Local	Long-term	Substantial	Very likely	n/a	n/a	-The Contractor should establish an employment desk at the construction site to facilitate employment-related queries, and maintain a register of applicants which reflects their respective expertise, skill level and contact/residential details. Whenever planned or ad hoc employment is considered, the register should be consulted to identify appropriately qualified candidates. -The existence of the employment desk, and the relevant procedures associated with the selection and appointment of workers must be communicated to the local community. -It is strongly suggested that every effort should be made to employ local residents.	Moderate	Moderate	3	High

Impact 6: Economic Development Plan	Contribute to local employment, local spending and human capacity development	Positive	Local	Long-term	Substantial	Very likely	n/a	n/a	-The proponent should engage with local NGOs, CBOs and local government structures to identify and agree upon relevant skills and competencies required in the Kwaggafontein community. -Such skills and competencies should then be included in the Economic Development Plan -Where possible, align Economic development Plan with Local Municipality's IDP	Moderate	Moderate	3	High
Impact 7: Development of locally owned support industries	Socio-economic benefits	Positive	Local	Long-term	Moderate	Very likely	n/a	n/a	None	Low	Low	4	High
DECOMMISSIONING PHASE													
Direct Impacts													
Impact 8: Decommissioning of the facility	Job losses	Negative	Local	Long-term	Substantial	Very likely	Moderate	Moderate	-The proponent should comply with relevant South African labour legislation when retrenching employees -Imvunulo Investment should also implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning	Moderate	Low	4	High

									-All project infrastructure should be decommissioned appropriately and thoroughly to avoid misuse.				

Cumulative Impact Assessment Table

CUMULATIVE IMPACTS (CONSTRUCTION, OPERATIONAL AND DECOMMISSIONING PHASES)													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Cumulative impact 1: Exacerbated in-migration	Disruption of social structures	Negative	Local	Medium to long-term	Substantial	Unlikely	Low	Moderate	N/A	Moderate	Moderate	3	Medium
Cumulative impact 2: Implementation of multiple Economic Development Plans	Contribute to local employment, local spending and human capacity development	Positive	Local	Long-term	Substantial	Unlikely	n/a	n/a	N/A	Moderate	Moderate	3	Medium

D.2.3.4 Concluding statement

It should be accepted that the development of the proposed project is likely to result in some form of negative social impact to the local community. However, such a negative impact needs to be weighed against the potential benefit likely to result from the same development. Given the overall low to moderate significance of potential negative impacts associated with the project, as compared to the overall medium significance positive impact of the project; it can be concluded that the prospective socio-economic benefits of the proposed project outweighs the socio-economic losses/impacts.

D.2.4 Traffic

D.2.4.1Traffic Assessment

The traffic generation estimates detailed below have been determined based on a single solar energy facility and the associated electrical infrastructure (collector substation and transmission line).

- **Construction Phase**

Single axle trucks: one per day for 4 months. Light load trucks: one per day will come to site during the construction phase (i.e. for a period of 8 months).

In terms of water supply, the current proposal is to truck water to site via municipal water supply. It is estimated that 1 trip will be made by the water truck every 2 days. In total, this adds up to 96 trips by the water truck over a period of 8 months. The volume of water usage will be 170m3 / month during construction.

- **Operational Phase**

One single axle truck will come from and go to site every quarter and One grader/digger every year to clear roads, etc. 2-3 Bakkies/1-tonners will come and go to the site per day. The lifetime of the project is 25 years which means that the total amount of trips would be 7 200 over this period. For water supply, the current estimate is that 2 trips per month will be made by a water truck. The volume of water usage during operation will be 60m3 / semi-annually or quarterly depending on condition of PV modules.

- **Decommissioning Phase**

As per the construction phase, a single axle trucks: one per day for 4 months. Light load trucks: one per day will come to site during the decommissioning phase. The decommissioning phase usually takes 12 months (i.e. over a period of 8 months).

D.2.4.2 Impact Assessment

The traffic impacts that will be generated by the proposed facility are detailed below. The impacts will largely occur during the construction phase of the project, since this is when the highest amount of traffic will be generated by the proposed facility.
The impacts identified and further assessed are:

- Increase in traffic generation.
- Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads.
- Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment.
- Decrease in quality of surface condition of the roads.
- Cumulative impact of traffic generation of three projects and related projects.

D.2.4.3 Impact Assessment Table

CONSTRUCTION AND DECOMMISSIONING PHASES													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Traffic generation	Increase in traffic	Negative	Regional	Short term	Moderate	Very likely	Yes	Replaceable	-Should abnormal loads have to be transported by road to the site, a permit needs to be obtained from the PGMP Department of Public Works, Roads and Transport. -Ensure that roadworthy and safety standards are implemented at all time for all construction vehicles. -Plan trips so that it occurs during the day but avoid construction vehicles movement on the regional road during peak time (06:00-10:00 and 16:00-20:00).	Low	Low	4	Medium
	Accidents with pedestrians, animals and other drivers	Negative	Local	Long term	Extreme	Likely	No	High irreplaceability	-Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established	High	Moderate	3	Medium

	on the surrounding tarred/gravel roads								and fences (such as Animex fences) installed, if needed to direct animals to safe road crossings. -Adhere to all speed limits applicable to all roads used. -Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the R573 Provincial Road to ensure safe entry and exit.				
	Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment	Nega-tive	Local	Medium term	Moderate	Unlikel y	Yes	Repl ace-able	-Implement management strategies for dust generation e.g. apply dust suppressant on the exposed areas and stockpiles. -Postpone or reduce dust-generating activities during periods with strong wind. -Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased. -Ensure that all construction vehicles are roadworthy and respect the vehicle safety standards	Moderate	Low	4	Medium

									implemented by the Project Developer. -Avoid using old and noisy construction equipment and ensure equipment is well maintained.				
	Change in quality of surface condition of the roads	Positive	Local	Long term	Slight	Likely	Yes	Repl ace-able	-Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage; -Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles; and -A Road Maintenance Plan should be developed for the section of the R573 Road that will be used to addresses the following: - Grading requirements; - Dust suppressant requirements; - Drainage requirements; - Signage; and - Speed limits.	Low	Low	4	Medium
OPERATIONAL PHASE													

Traffic gene-ration	Increase in traffic	Nega-tive	Region al	Short term	Slight	Very likely	High	Repl ace-able	-Adhere to requirements made within Transport Traffic Plan; -Limit access to the site to personnel; and -Ensure that where possible, staff members carpool to site.	Very low	Very low	5	Medium
	Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads	Nega-tive	Local	Long term	Extreme	Likely	No	High irrep lace-abilit y	-Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences installed, if needed to direct animals to safe road crossings. -Adhere to all speed limits applicable to all roads used. -Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the R573 Road to ensure safe entry and exit.	High	Moderate	3	Medium
	Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment	Nega-tive	Local	Medium term	Moderate	Unlikel y	Yes	Repl ace-able	-Implement management strategies for dust generation e.g. apply dust suppressant on the exposed areas and stockpiles; -Limit noisy maintenance/operatio	Moderate	Low	4	Medium

									nal activities to daytime only.				
	Change in quality of surface condition of the roads	Positive	Local	Long term	Slight	Likely	Yes	Repl ace-able	Implement requirements of the Road Maintenance Plan.	Low	Low	4	Medium
CUMULATIVE IMPACTS													
Traffic genera-tion	Increase in traffic	Nega-tive	Region al	Long term	Moderate	Very likely	High	Repl ace-able	n/a	Low	Low	4	Medium

D.2.4.4 Concluding statement

Based on the assessment of the potential impacts that can be associated with the traffic to be generated during the construction, operation and decommissioning phases of these projects, the overall impact from traffic generation is deemed to be low when implementing suitable mitigation measures. The highest traffic will be generated during the construction phase.

SECTION E: RECOMMENDATION OF PRACTITIONER

This BA Report has investigated and assessed the significance of potential positive and negative direct, indirect and cumulative impacts associated with the proposed ImvunuloKwaggafontein project, (to the Eskom Kwaggafontein Substation) and associated Infrastructure. No negative impacts have been identified within this BA that, in the opinion of the EAP who has conducted this BA Process, should be considered "fatal flaws" from an environmental perspective, and thereby necessitate substantial re-design or termination of the project.

Section 24 of the Constitutional Act 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 prevents pollution and ecological degradation; promotes conservation; and secures ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." Based on this, this BA was undertaken to ensure that these principles are met through the inclusion of appropriate management and mitigation measures, and monitoring requirements. These measures will be undertaken to promote conservation by avoiding the sensitive environmental features present on site and through appropriate monitoring and management plans (refer to the EMPr in Appendix F of this BA Report).

It is understood that the information contained in this BA Report and appendices is sufficient to make a decision in respect of the activity applied for.

Alternatives

As noted above, in Section A of this report, the preferred activity on site was determined to be the development of a renewable energy facility on site using solar PV as the preferred technology. In terms of the preferred location of the site, the farm is Kwaggafontein 216 JR portion of portion 0 and the connection points to the Eskom Kwaggafontein Substation. Based on the specialist studies undertaken for this project, as well as initial screening via the National Web-Based Screening Tool, a preferred layout for the solar PV facility was determined. No features on site that have been identified to be no-go areas.

Need and desirability of the project

The development of solar energy is therefore important for South Africa to reduce its overall environmental footprint from power generation (including externality costs), and thereby to steer the country on a pathway towards sustainability. On a municipal planning level, the proposed project supports the objectives of Thembisile Hani Local Municipality's IDP (2017-2022) to enhance economic sector within its LED plan by creating more job opportunities.

Impact assessment findings

The proposed project is considered to have an overall low negative environmental impact and an overall low positive socio-economic impact (with the implementation of respective mitigation and enhancement measures). It is recommended that the proposed project receive EA if the recommended mitigation measures are implemented. Taking into consideration the findings of the BA Process, it is the opinion of the EAP, that the project benefits outweigh the costs and that the project will make a positive contribution to sustainable infrastructure development in the Thembisile Hani region. Provided that the specified mitigation measures are applied effectively, it is recommended that the proposed project receive EA in terms of the EIA Regulations promulgated under the NEMA.

Conditions to be included in the EA

In order to ensure the effective implementation of the mitigation and management actions, an EMPr has been compiled and is included in Appendix F of this BA Report. The mitigation measures necessary to ensure that the project is planned and carried out in an environmentally responsible manner are listed in this EMPr. The EMPr includes the mitigation measures noted in this report and the specialist studies. The EMPr is a dynamic document that should be updated as required and provides clear and implementable measures for the proposed project. Listed below are the main recommendations that should be considered (in addition to those in the EMPr and BA Report) for inclusion in the EA (should such authorisation be granted by the DEFF):

- **Visual**
  - Locate the substation and other buildings, as well as construction camps, in an unobtrusive position in the landscape away from public roads.

- **Heritage**
  - If any palaeontological or archaeological material or human burials are uncovered during the course of development, then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

- **Ecology**
  - The applicant should, during the construction and operations of the project assume responsibility for the management of fauna within the site and surrounds, as well as the incorporation of "wildlife" porosity into fence lines and the implementation of measures on the energised fence line to avoid mortalities to wildlife.
  - General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources should be set in place.

- **Socio-economic**
  - From a social impact perspective, it is of the opinion that the proposed project should be authorised by the competent authority, and no specific conditions of authorisation are recommended.

- **Traffic**
  - Should abnormal loads have to be transported by road to the site, a permit needs to be obtained from the PGMP Department of Public Works, Roads and Transport.
  - Ensure that roadworthy and safety standards are implemented at all time for all construction.
  - Adhere to all speed limits applicable to all roads used.
  - Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the R573 Road to ensure safe entry and exit.
  - Implement management strategies for dust generation e.g. apply dust suppressant on the exposed areas and stockpiles.
  - Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage.
  - Ensure that road network is maintained in a good state for the entire operational phase.

SEDZANI MULAUDZI

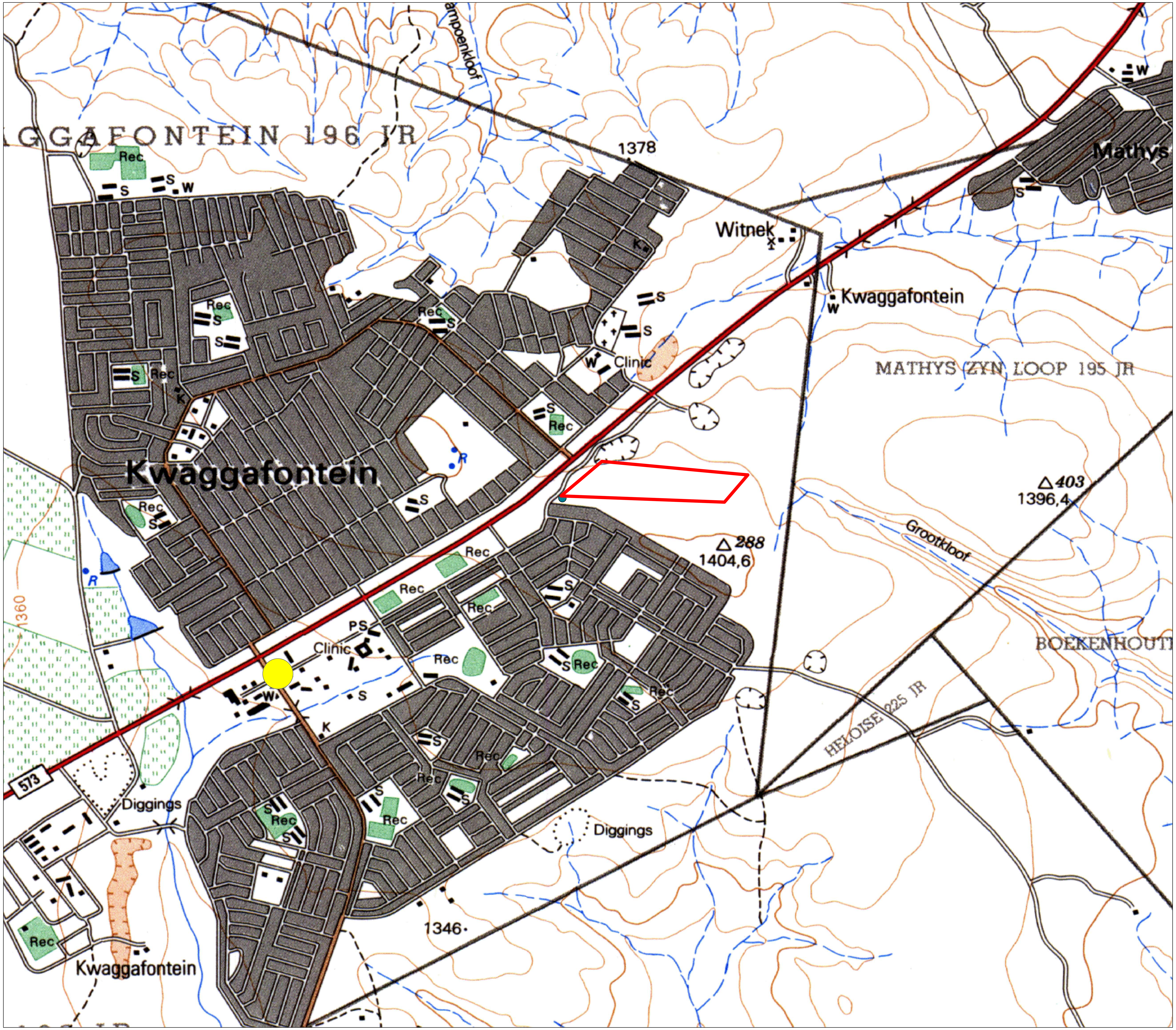
Name of the EAP

Signature of the EAP

12/07/2022

Date

APPENDIX A: LOCALITY MAP

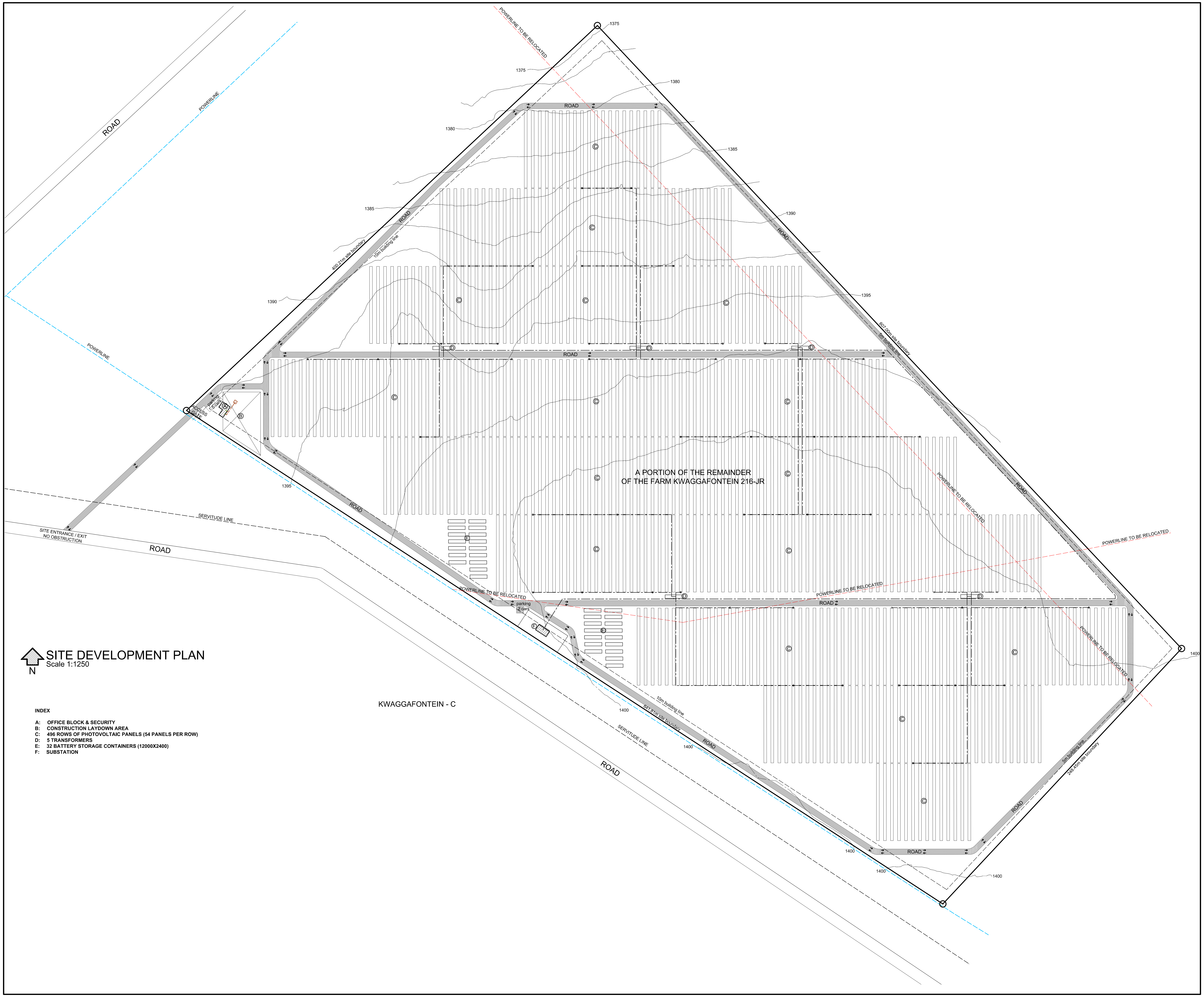


LEGEND

SOLAR FARM AREA

SUBSTATION

APPENDIX B: SITE LAYOUT PLAN



SITE DEVELOPMENT PLAN

N

Scale 1:1250

INDEX

- A: OFFICE BLOCK & SECURITY
- B: CONSTRUCTION LAYDOWN AREA
- C: 496 ROWS OF PHOTOVOLTAIC PANELS (54 PANELS PER ROW)
- D: 5 TRANSFORMERS
- E: 32 BATTERY STORAGE CONTAINERS (12000X2400)
- F: SUBSTATION

ZONING PERMISSIONS

Zoning:	Agricultural - with special consent for renewable energy
Coverage:	20%
Floor area ratio:	As-approved
Height:	3 Storeys
Building lines:	10m Street 5m all other sides
Parking:	No parking requiremen

AREA SCHEDULE

Proposed new office block:	46.12 sq.m
Proposed new substation:	40.50 sq.m
TOTAL BUILDING AREA:	86.62 sq.m
Site area:	20 Hectare
Coverage:	0.043 %
Floor area ratio:	0.00043
Height:	1 Storey

client signature: date

engineer's signature: date

WITBANK OFFICE
Proffice Building, First Floor, Unit 19
23 Corridor Crescent,
Benfleur Ext. 11
Witbank (Emalahleni), 1035
Tel. (013) 653 6375
Fax. (013) 653 6376
Email: prlbdesigns@gmail.com
Website: www.prlbdesigns.co.za
P.O. Box 41538, Reyno Ridge, 1049
REG NO: CK 2005/070492/23

PRETORIA OFFICE
The Village Office Park, First Floor
Block D, Cnr Glenwood Road &
Oberon Avenue, Faerie Glen
Pretoria (Tshwane), 0081
Cell. 072 170 6410
Fax. 086 604 2173
Email: letitia@prlbdesigns.co.za

project description

SITE DEVELOPMENT PLAN FOR RENEWABLE ENERGY PLANT ON A PORTION OF THE REMAINDER OF THE FARM KWAGGAFONTEIN 216-JR FOR IMVENULO INVESTMENT (Pty) Ltd

drawing description

SITE DEVELOPMENT PLAN

REVISIONS

W.O. No.	DAT.	DESCRIPTION
00	2022-05-04	issued to client for comment

RESPONSIBLE PERSON		DATE
DESIGNED	LDS WARNICH	22/05
DRAWN	LDS WARNICH	22/05
CHECKED	L Badenhorst-v.Zyl	22/05
SIGNATURE		

ARCHITECTURAL PROFESSIONAL
L. BADENHORST-VAN ZYL
SACAP: ST0360 SAIAT: 70535

drawing no. **1893/SDP/01** revision **00**

APPENDIX C: SPECIALIST STUDIES

ECOLOGICAL ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT

FOR

THE PROPOSED SOLAR PLANT ON REMAINING EXTENT OF THE FARM KWAGGAFONTEIN 216 JR SITUATED IN THE MAGISTERIAL DISTRICT OF MKOBOLA IN MPUMALANGA

Competent Authority:

agriculture, rural development, land & environmental affairs

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

Environmental Impact Management

Corner Rosemead and Ryan Road

Witbank

1035

Tel: 013 692 5843

Environmental Assessment Practitioner:

SIGANA

Enviro & Construction

A: 13 Elaspense Street, Duvha Park

Witbank

1034

T: 076 652 9062

E: sigwadim.l@gmail.com

Prepared for:

Imvunulo Investment

ERF 2075 Phola

Witbank

2233

CELL: 063 061 4483

EMAIL: admin@saamfox.co.za

Declaration of Independence

I, Livhuwani Sigwadi in my capacity under Sigana Enviro and Construction, hereby declare that:

- ✓ Act as an independent consultant;
- ✓ Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998);
- ✓ Commitment to disclose any material information to the competent authority that has or may have the potential to influence the decision of the competent authority or of the competent authority the objectivity of any required report, plan or document in terms of the National Act of 1998 on Environmental Management (Act No. 107 of 1998);· Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- ✓ Based on information provided by the proponent of the project to me and in addition to the findings and the information obtained during the course of this study were presented and conclusion to the best of my professional ability within the associated document;
- ✓ The right to change aspects related to the present investigation should be reserved through on-going research and/or further work in this field, further information becomes available

Author:

Livhuwani Sigwadi an expertise on: Environmental Management (incl. compliance monitoring & auditing), Mining and Geology (incl. resource estimation and grade control), Geohydrology, Environmental Law, Waste Management, Water Management (incl. water licence auditing), ISO 14001, & Project Management.

Signature of the author

Sigana Enviro & Construction Pty Ltd

Name of company

11/03/2022

Date:

Table of Contents

List of Figures

List of Tables

1 Introduction

Imvunulo Investment has appointed Sigana Enviro and Construction as an independent Environmental Assessment Practitioner (EAP) to conduct an environmental impact assessment (EIA) for the proposed project in accordance with the EIA Regulations of the National Environmental Management Act, 1998 (Act No.107 of 1998) as amended on 7 April 2017. (NEMA). An ecological study is required due to the nature of the potential impacts of the proposed development on the local ecology.

This is necessary to determine the presence of ecologically significant species, habitats, or wetland areas within the proposed project footprint that may be impacted by the proposed development. Proposed mitigation and management measures must also be recommended in accordance with the NEMA (Act 107 of 1998) mitigation hierarchy in order to attempt to reduce/alleviate the identified potential impacts.

A desktop study was done to have available relevant information and a site visit was conducted to assess the presence and distribution of ecologically sensitive species and habitats at the proposed sola establishment site. The proposed site is located within the natural vegetation with little disturbance by livestock (cattle). The proposed site is characterised by grasses, shrubs and scattered alien plant.

1.1 Project Location and Description

The proposed development area is located on the remaining extent of the Farm Kwaggafontein 216 JR situated in the Magisterial District of Mkobola in Mpumalanga (see Figure 1). The site covers an extent of 21 Ha and is situated about 11 km east of Kwaggafontein Mall and within Thembisile township. The proposed development site can be accessed via the R573.

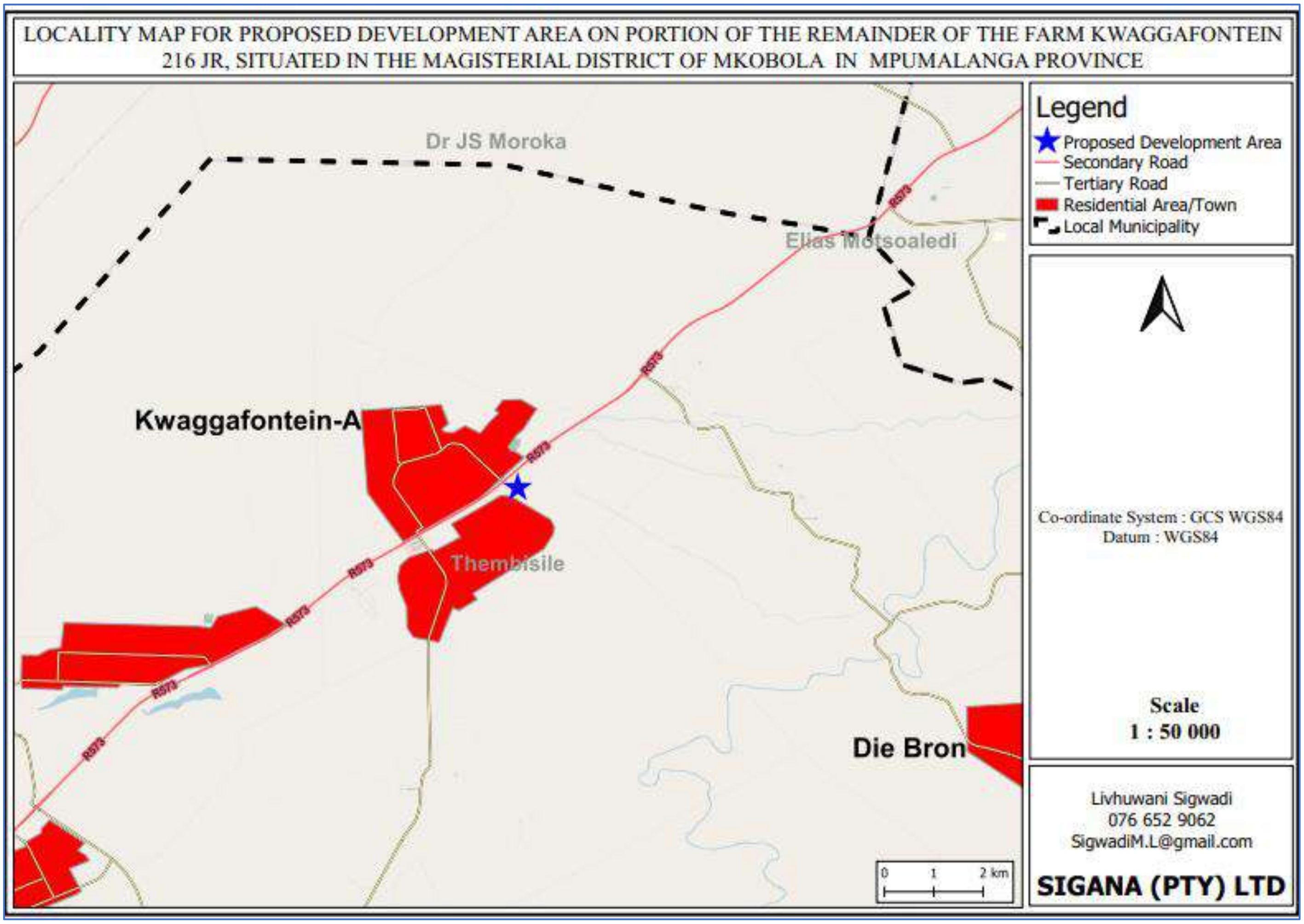


Figure 1: Proposed project location

2 Assessment Objective

The main objectives for this investigation are limited to an ecological assessment that aims to:

- Determine the general ecological state of the proposed project area.
- Examine and demarcate environmentally sensitive and critical areas.
- Ascertain the potential impacts of the proposed project on the environment and its associated fauna and flora.
- Map the environmentally sensitive and critical areas with regards to the proposed project.
- Identify and document protected or Red Data Listed fauna or flora species on site.
- Provide mitigation measures to avoid or prevent environmental impacts.
- Compile ecological assessment report with findings, recommendations and maps of the sensitive areas or no-go areas.

3 Assessment Rationale

South Africa is a country rich in natural resources and splendor, with some of the world's highest biodiversity. Aside from the pure aesthetic value that our biodiversity and natural resources provide, they also play an important positive role in our national economy. While continuous economic development and progress is a key national focus area that serves as a cornerstone in the socioeconomic improvement of society and the livelihoods of communities and individuals, the preservation and management of the integrity and sustainability of our natural resources is also critical to achieving this goal.

As a result, socioeconomic development and progress cannot be completely stifled in order to ensure environmental conservation; rather, solutions and compromises must be explored in order to achieve the need for socioeconomic development without unduly jeopardizing the needs of environmental conservation.

To accommodate the needs of both, a sustainable and responsible balance must be maintained. Our natural resources must be used and managed in an adequate, sustainable, and responsible manner. Finding the necessary balance between socioeconomic development and environmental conservation should thus be a top priority during any proposed development process.

In order to ensure sustainability, various environmental legislation in South Africa provides for the protection of our natural resources as well as the functionality of ecological systems. The National Environmental Management: Biodiversity Act (Act 10 of 2004), the National Forests Act (Act 84 of 1998), the Conservation of Agricultural Resources Act (Act 43 of 1983), the National Water Act (Act 36 of 1998), and framework legislation such as the National Environmental Management Act are examples of such acts (Act 10 of 2004). As a result, an Ecological Impact Assessment of the proposed project area was carried out in order to determine and quantify the effects of the development on the natural environment in the area.

4 Baseline Environment

4.1 Climate

Kwaggafontein has the semi-arid climate prevailing. It is warm to hot all year round and trees don't grow here because of the drought. It consists mainly of sand with grasses and sometimes shrubs. The average annual temperature for Kwaggafontein is 24° degrees and there is about 395 mm of rain in a year. It is dry for 219 days a year with an average humidity of 56% and an UV-index of 5.

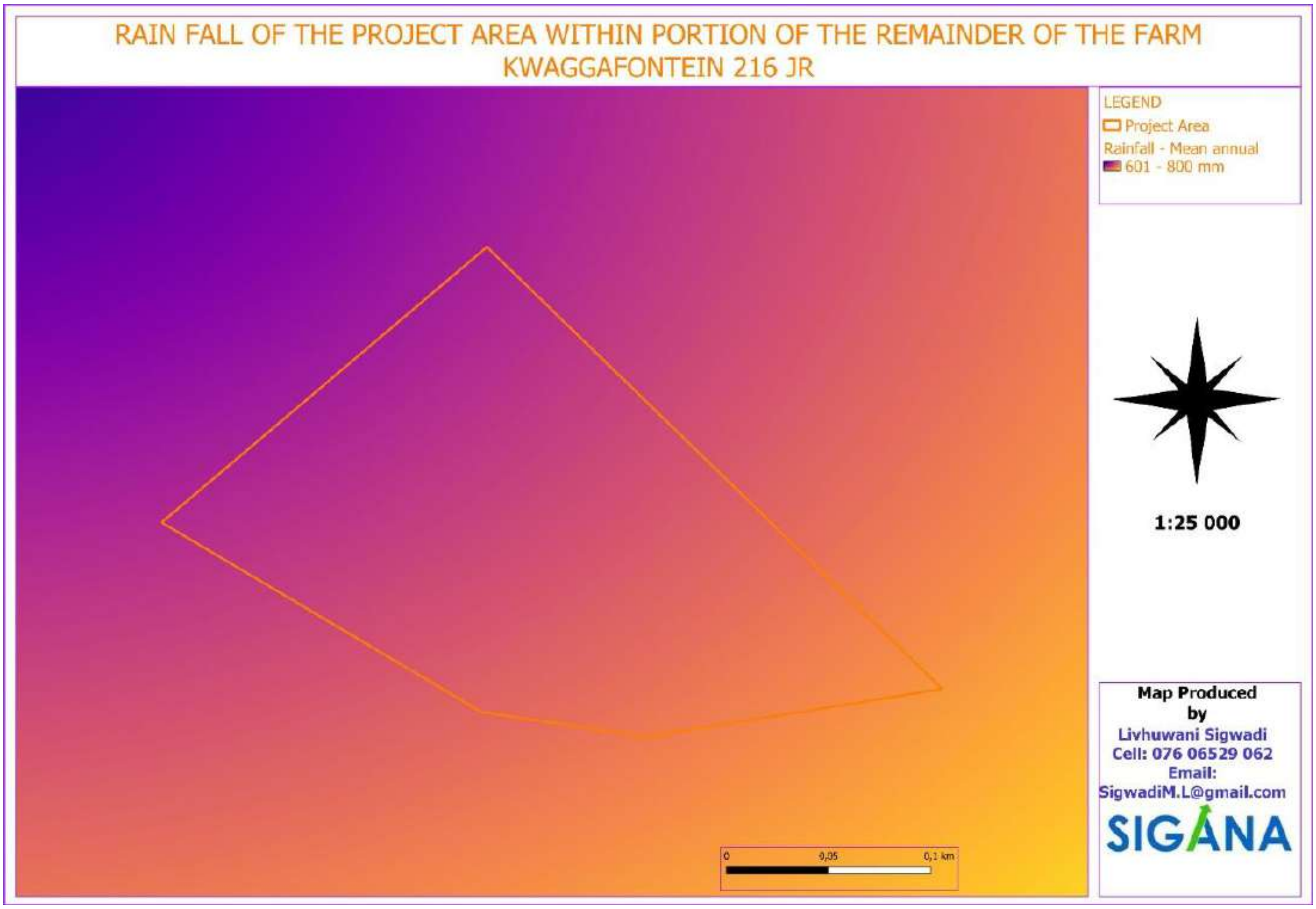


Figure 2: Mean annual rainfall within the project area

4.2 Hydrology and Catchment

South Africa's water resources are divided into quaternary catchments, which are the country's primary water management units (DWAF 2011). In a hierarchical classification system, a quaternary catchment is a fourth order catchment below the primary catchments. The primary drainages are further classified as Water Management Areas (WMA) and Catchment Management Agencies (CMA) (CMA). In accordance with Section 5 subsection 5(1) of the National Water Act, 1998, the Department of Water and Sanitation (DWS) has established nine WMAs and nine CMAs as outlined in the National Water Resource Strategy 2 (2013). (Act No. 36 of 1998). The purpose of establishing these WMAs and CMAs is to improve water governance in various regions of the country, to ensure a fair and equal distribution of the Nations water resources, while making sure that the resource quality is sustained.

Figure 3 indicates the water resource management classification associated with the Project area. The Project area falls within the Olifants Water Management Area (WMA). The quaternary catchment is B22G. There is a pond of water within the Proposed development area and the proposed development area act as the catchment of non-perennial rivers.

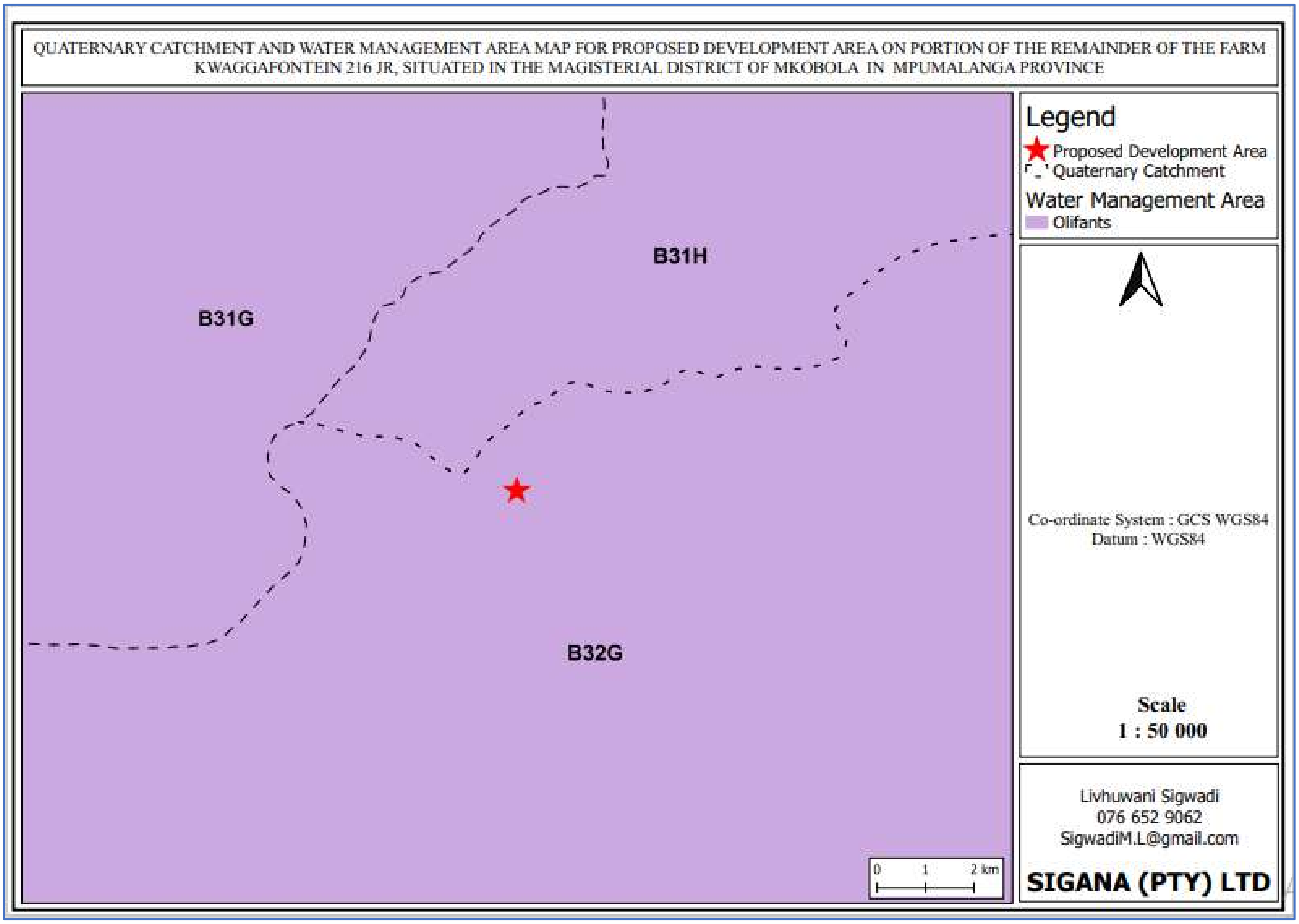


Figure 3: Catchment and Water Management Area

As confirmed on the Figure 4 below that the proposed project will not physically affect both Perennial and Non-perennial river since both cut outside the area of proposed. No wetland will also affected by proposed project since they are lies far from the exact area of the proposed. Therefore the proposed project will be conducted without any harm to the local streams and wetland.

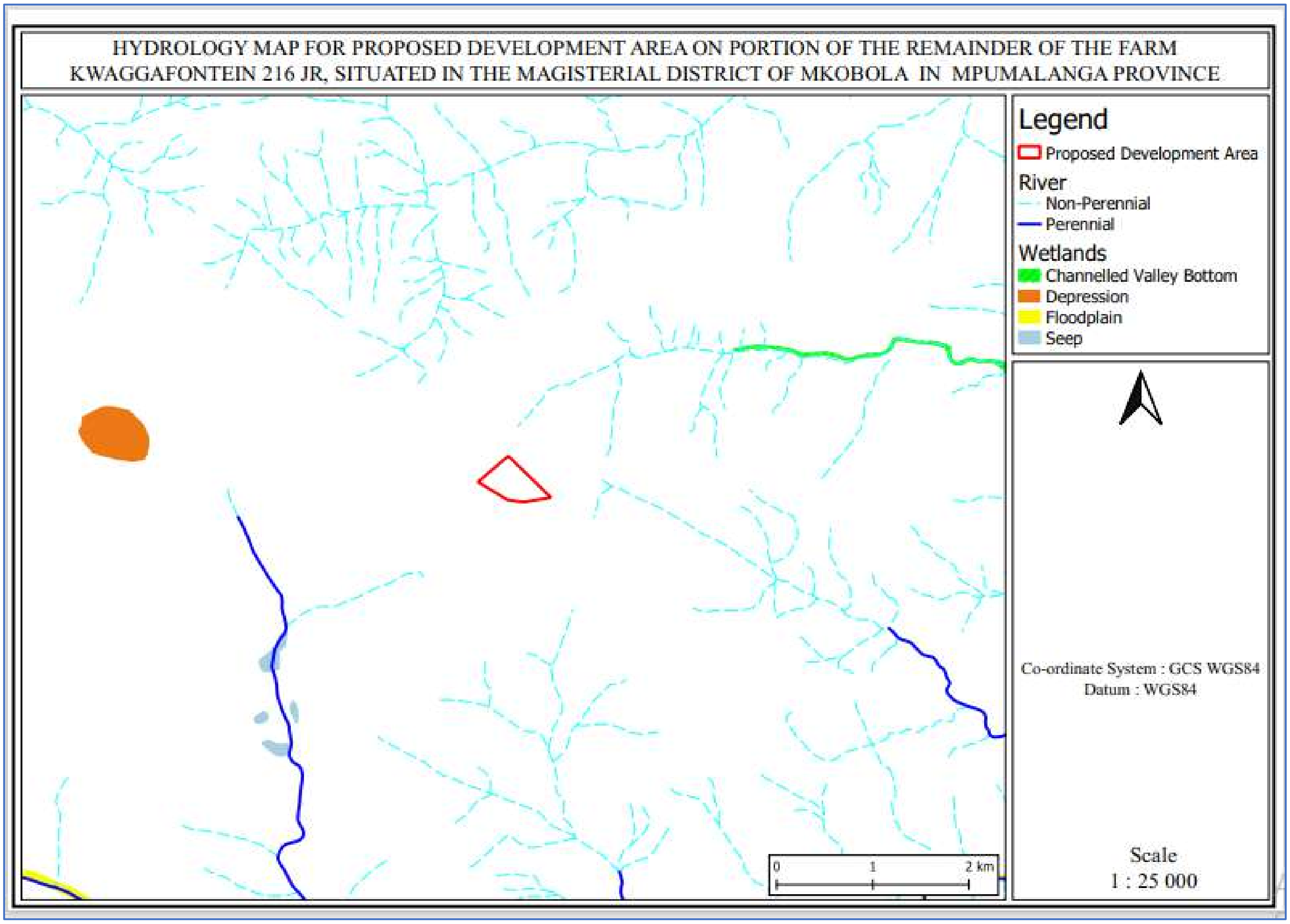


Figure 4: Hydrology within the project area

4.3 Soil

Freely drained, structureless soils.

The proposed power plant is freely drained, structureless soils can be defined based on their soil depth, Soil Drainage, erodibility, and natural fertility.

Soil depth

Depth of the soil profile is from the top to the parent material or bedrock. This type of soil can be classified as a restricted soil depth. A restricted soil depth is a nearly continuous layer that has one or more physical, chemical, or thermal properties.

Soil Drainage

Soil drainage is a natural process by which water moves across, through, and out of the soil because of the force of gravity. The soils in the proposed area have an excessive drainage due to the soils having very coarse texture. Their typical water table is less than 150.

Erodibility

Erodibility is the inherent yielding or non-resistance of soils and rocks to erosion. The freely drained structureless soils have high erodibility. A high erodibility implies that the same amount of work exerted by the erosion processes lead to a larger removal of material.

Natural Fertility

Soil fertility refers to a soil's ability to support agricultural plant growth, i.e., to provide plant habitat and result in consistent and high-quality yields. The soil contains some nutrients by nature, which is known as 'inherent fertility.' Nitrogen, phosphorus, and potassium are essential plant nutrients for normal crop growth and yield. The soil in the proposed area is low in natural fertility.

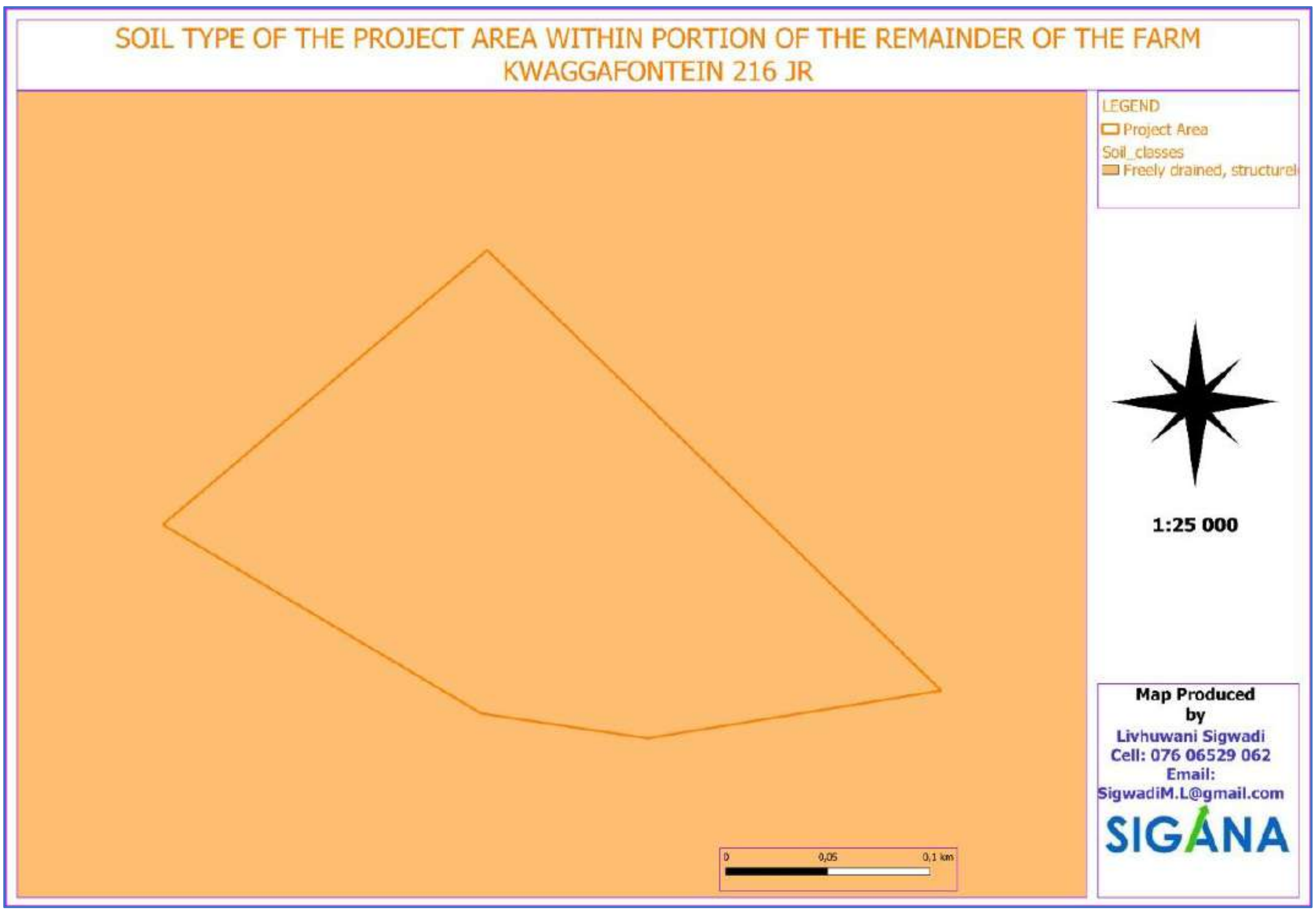


Figure 5: Soil type within the proposed project

4.4 Vegetation

The proposed power plant area is dominated by Mixed Bushveld. Mixed Bushveld represents a variety of plant communities, with many variations and transitions. The vegetation varies from a dense, short bushveld to a rather open tree savanna. On shallow soil Combretum apiculatum dominates, together with Acacia caffra, Dichrostachys cinerea, Lannea discolour, Sclerocarya birrea and various Grewia species. The grazing is sweet, and the herbaceous layer is dominated by the grasses Digitaria eriantha, Schmidtia pappophoroides, Anthephora pubescens, Stipagrostis uniplumis and various Aristida and Eragrotis species. On deeper and more sandy soil, Terminalia sericea dominates, with Ochna pulchra, Grewia flava, Peltophorum africanum and Burkea africana often prominent. The grass sward is scanty with Eragrostis pallens andPerotis patens characteristic. The structure of this vegetation type is determined by fire and grazing (Van Rooyen & Bredenkamp, 1998).

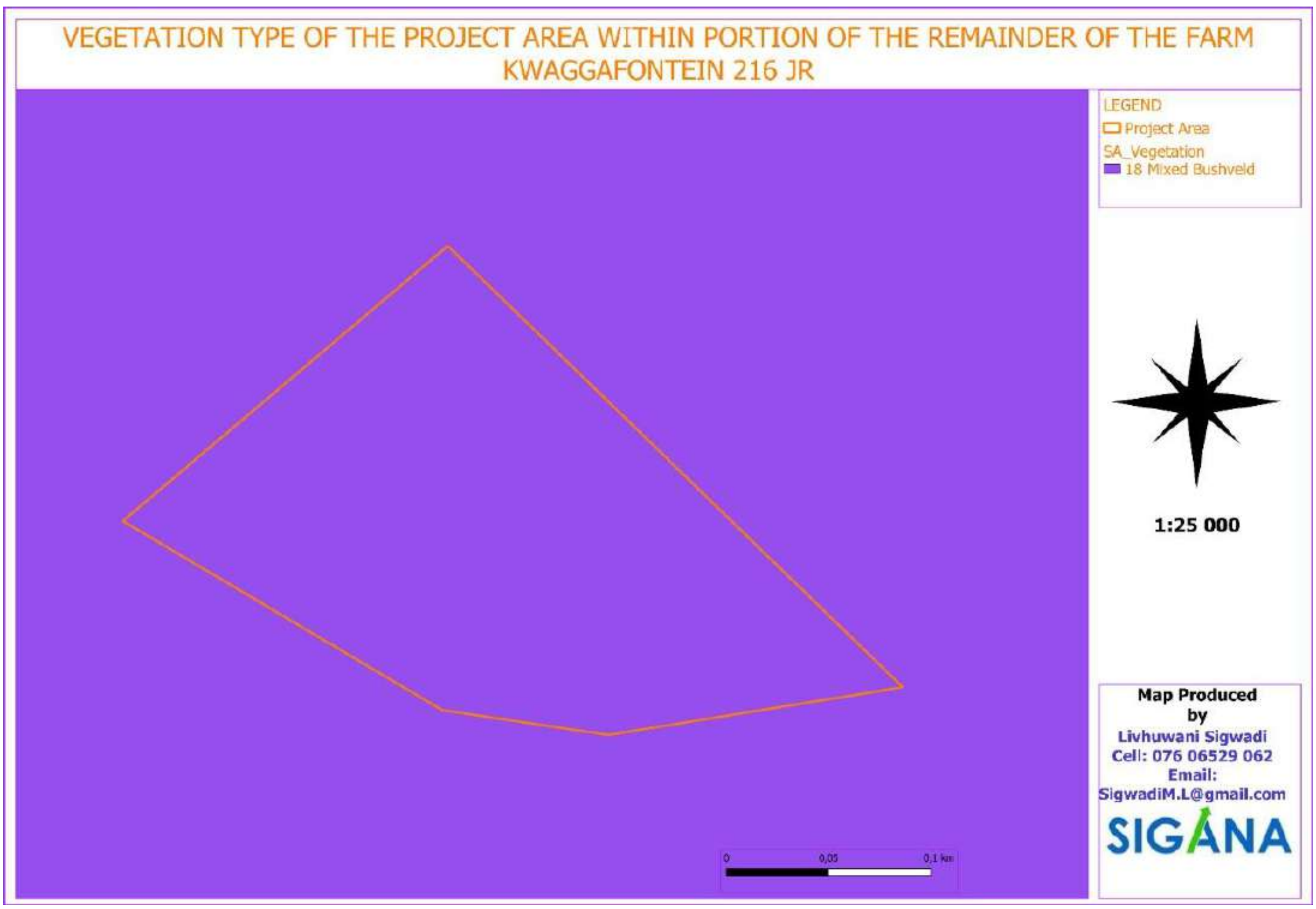


Figure 6: vegetation type within the project area

4.5 Land Capability

The Land capability classification is one of several agricultural interpretation classifications. Like the other interpretation groups, the land capability categorization starts with a single soil mapping unit that serves as the system's foundation. There are three types of land capability: grazing, arable, and wilderness. This classification classifies the potentials and limitations of arable soils for the sustained production of typical farmed crops that do not require specialist site conditioning or site treatment. The proposed solar plant site is in an arable area with moderate potential.

Figure 7: Land capability map

4.6 Land Use

4.6.1 Degraded unimproved (natural) grassland

Are areas that have never been ploughed, reseeded or heavily fertilized. They are semi-natural habitats, which have developed as a result of sustained grazing, and they support a wide range of associated plant and animals.

4.6.2 Urban / Built-up

Refers to the aspects of surroundings, which have been constructed by humans, as opposed to the natural environment. It encompasses not only buildings, but also the man-made spaces between buildings, such as parks, as well as the infrastructure that supports human activity, such as transportation networks, utility networks, flood defenses, telecommunications, and so on. Make certain that the resource quality is maintained.

4.6.3 Degraded, Forest and Woodland

Forest degradation occurs when forest ecosystems lose their capacity to provide important goods and services to people and nature.

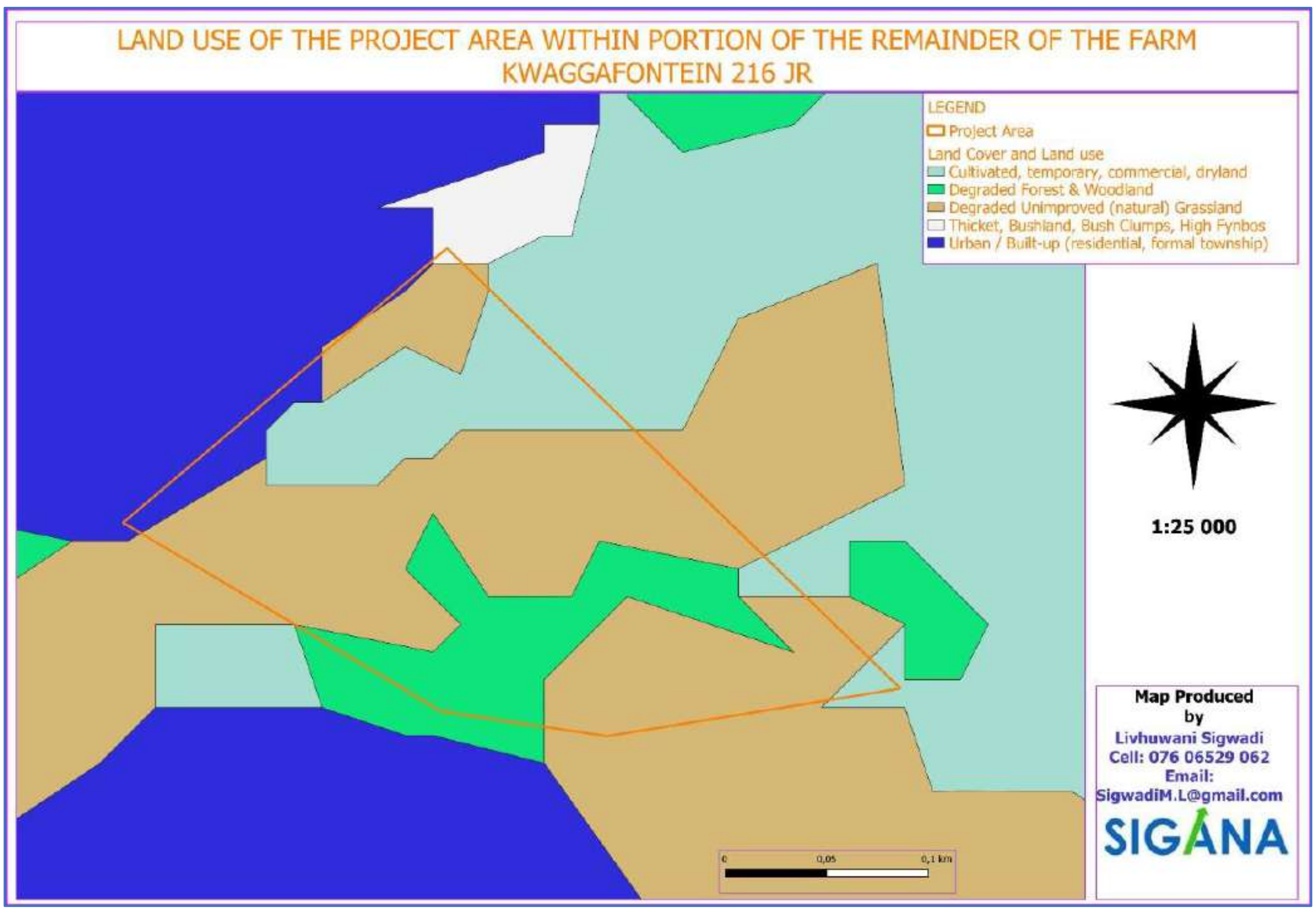


Figure 8: Land use map

5 Legislative Context

South African Constitution 108 of 1996

The Constitution is the supreme law of the land and includes the Bill of Rights which is the cornerstone of democracy in South Africa and enshrines the rights of people in the country. It includes the right to an environment which is not harmful to human health or well-being and to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures.

National Environmental Management Act (Act 10 of 2004).

This is a fundamentally important piece of legislation and effectively promotes sustainable development and entrenches principles such as the 'precautionary approach', 'polluter pays' principle, and requires responsibility for impacts to be taken throughout the life cycle of a project NEMA provides the legislative backing (Including Impact Assessment Regulations) for regulating development and ensuring that a risk-averse and cautious approach is taken when making decisions about activities.

EIA regulations

New regulations have been promulgated in terms of Chapter 5 of NEMA and were published on 7 April 2017 in Government Notice No. R. 326. Development and land use activities which require Environmental Authorisation in terms of the NEMA EIA Regulations, 2017, are in Listing Notice 3 (GG No. R.324, LN3) identified via geographic areas with the intention being that activities only require Environmental Authorisation when located within designated sensitive areas. These sensitive/geographic areas were identified and published for each of the nine (9) Provinces.

National Environmental Management: Biodiversity Act No 10 of 2004 (NEMBA)

The Biodiversity Act provides listing threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected (Government Gazette, 2011). The main purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction and includes the prevention of further degradation and loss of structure, function and composition of threatened ecosystems.

Conservation of Agricultural Resources Act 43 of 1967

The intention of this Act is to control the over-utilisation of South Africa's natural agricultural resources, and to promote the conservation of soil and water resources and natural vegetation. The CARA has categorised a large number of invasive plants together with associated obligations of the landowner, including the requirement to remove categorised invasive plants and taking measures to prevent further spread of alien plants.

National Forest Act 84 of 1998

The protection, sustainable management and use of forests and trees within South Africa are provided for under the National Forests Act (Act 84 of 1998).

National Environmental Management: Protected Areas Act 57 of 2003

This Act provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. It also seeks to provide for the sustainable utilization of protected areas and to promote participation of local communities in the management of protected areas.

Mpumalanga Nature Conservation Act (10 of 1998)

To consolidate and amend the laws relating to nature conservation within the province and to provide for matter connected therewith.

United Nations Convention to Combat Desertification

South Africa has responded to the UN Convention to Combat Desertification by developing a National Action Plan. The aim of the NAP is to implement at current and future policies that affect natural resource management and rural development, and establish partnerships between government departments, overseas development agencies, the private sector and NGOs.

Convention on Biological Diversity

Countries are to rehabilitate or restore degraded ecosystem through the formulation of appropriate strategies and plans.

The Convention of Biological Diversity (Rio de Janeiro, 1992).

The purpose of the Convention on Biological Diversity is to conserve the variability among living organisms, at all levels (including diversity between species, within species and of ecosystems). Primary objectives include (i) conserving biological diversity, (ii) using biological diversity in a sustainable manner and (iii) sharing the benefits of biological diversity fairly and equitably.

6 Methodology and Assessment

6.1 Desktop Study

A desktop survey was conducted, during which maps, and other aerial images, reports, and photography were reviewed to assemble background information on the different features of and vegetation present in the proposed project are. The site was assessed between 28 February 2022 to 2 March 2022 to record the present features and species.

6.2 Site Assessment

A site visit was undertaken on the 1st of March 2022 to assess the site-specific ecological state, current land-use, identify potential sensitive ecosystems and identify plant species associated with the proposed project activities. The site visits also served to identify potential impacts of the proposed development, and its impact on the surrounding ecological environment. During site assessment, a pond of water was observed within the development area and littering or dumping of waste building materials was observed.

6.3 Mpumalanga Biodiversity Sector Plan

Following the site visit, an ecological sensitivity analysis of the site was conducted using the Mpumalanga Biodiversity Sector Plan (MBSP), which shows that the proposed project falls within the Ecological Support Areas (Green color), Other Natural Areas (Brown color), and Heavily modified or moderately modified categories (Blue light). The ecological sensitivity of the various units identified in the sensitive analysis procedure was rated using the following scales:

Critical Biodiversity Area: Irreplaceable

Irreplaceable CBAs are the most important biodiversity areas in the Province, outside of the protected area network. This sub-category comprises those CBAs considered essential for meeting biodiversity targets to ensure the persistence of species and the functioning of ecosystems. Such areas are often at risk of being lost due to their remaining extent already being near to or lower than the required biodiversity target. For example, the only known nesting sites for certain highly threatened bird species, or areas of high connectivity value which are at high risk of being disrupted (i.e. critical corridor linkages in the landscape). If Irreplaceable CBAs suffer any further loss of habitat or ecological function, it is likely that the biodiversity targets will not be met and species losses and breakdown of ecological functioning will take place.

- CBA: Irreplaceable (100% irreplaceable): Identified in Marxan, with a common value cost surface and a BLM of zero.
- CBA: High Irreplaceability (80-100% irreplaceable).

- CBA: Critical linkages: These are areas of the natural landscape that represent the only remaining and highly constrained linkages which, if lost, would result in the disruption of the corridor network as a whole (i.e. they are 'pinch points' in the corridor). These areas are vital for maintaining the linkage and ecological integrity of the corridor and its associated biodiversity-related processes. Critical Linkages were identified using Circuits cape.
- Critically Endangered Threatened Ecosystems (gazetted threatened ecosystems).

Critical Biodiversity Area: Optimal

The CBA Optimal areas (previously known as Important & Necessary in the MBCP) are those that represent the best localities (from a potentially larger selection of available planning units) that are most optimally located to meet biodiversity targets and satisfy other criteria defined by the Marxan design or cost layers. These areas have a less than 80% irreplaceability (or frequency selection score). This is classified as the "Best" solution in Marxan, which means that it is the most spatially efficient and, thus, the best solution for meeting biodiversity targets while avoiding high-cost areas. Despite having a lower Irreplaceability value (or selection frequency score) than the CBA Irreplaceable category, these areas collectively represent the smallest area required to meet the biodiversity targets. There may be options to meet the biodiversity targets elsewhere, but these will require more land or may lead to increasing conflict between competing land uses.

Ecological Support Areas (ESAs)

Ecological support areas are not required to meet biodiversity targets, but they do play an important role in supporting the ecological functioning of critical biodiversity areas or in the generation or delivery of important ecosystem services. They promote landscape connectivity and adaptability to climate change. ESAs must be kept in at least an ecologically functional state.

Other Natural Areas (ONA)

These are natural areas that have not been chosen to meet biodiversity pattern or ecosystem process targets, or to help Critical Biodiversity Areas function. Despite this, they do have 'value.' ONAs frequently retain much of their natural character and can help to maintain viable species populations and natural ecosystem functioning, as well as provide important ecological infrastructure and ecosystem services. However, they are not prioritized for immediate conservation action in the MBSP unless CBAs or ESAs are lost or impacting activities within the ONAs have a negative impact on other areas.

Modified ('Transformed')

Modified areas (also known as 'transformed' areas in other literature, including the MBCP) are those that have lost a significant proportion (or all) of their natural biodiversity and in which ecological processes have broken down (in some cases irreversibly) as a result of biodiversity-incompatible land-use practices such as ploughing, surface hardening, mining, cultivation, and the construction of houses or other built infrastructure. Nonetheless, these areas may contain small fragments of natural habitat, such as patches or strips of natural vegetation that survive between planted fields or small, natural open spaces in cities. These disconnected fragments are frequently biologically depleted, highly vulnerable to damage, and have a low likelihood of survival, despite the fact that they may retain some residual biodiversity value and ecological function. They are not generally considered a priority for conservation action unless they contain unique features that demand it.

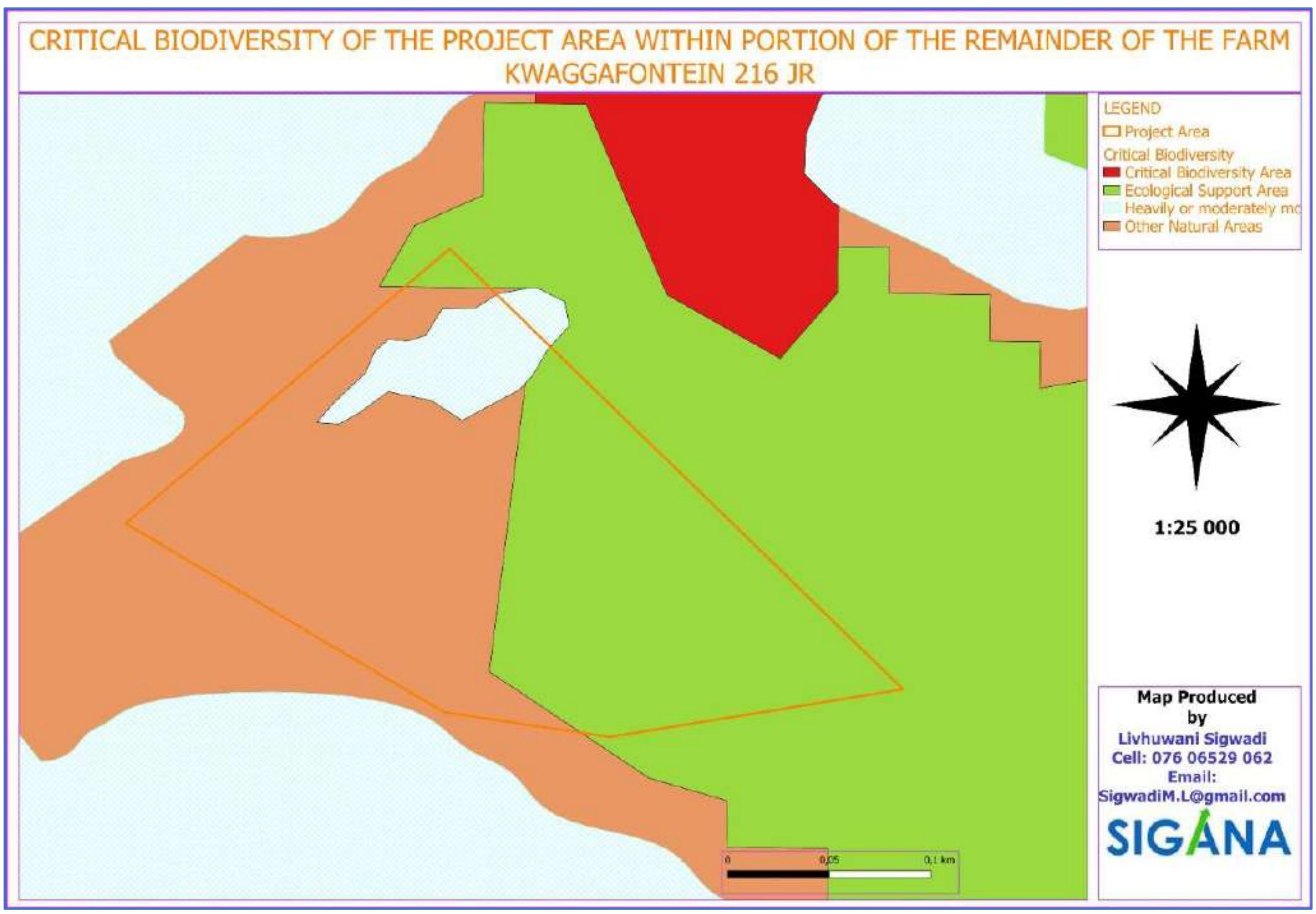


Figure 9: Critical biodiversity map

6.3 Present Ecological Status

The current (present) ecological condition (state) of the watercourse or wetland prior to any additional developments or impacts from the proposed project is referred to as the Present Ecological State (PES). To determine the current state or status (integrity) of the identified wetlands (and other watercourses) in the study area, the PES Method (DWA, 2005) was used. The methodology is based on the modified Habitat Integrity approach developed by Kleynhans (1996, 1999). (Table 3). The criteria for assessing the habitat integrity of wetlands and other watercourses are shown in Table 3, and Table 4 describes how the scores for the various attributes are assigned. These criteria were chosen under the assumption that anthropogenic modification of the criteria and attributes listed under each chosen criterion can be considered the primary causes of a wetland's ecological integrity.

Table 1: Wetland Integrity Categories (Kleynhans CJ.1999)

Category	Mean Score	Description
A	>4	Unmodified, natural condition.
B	>3 to 4	Largely natural with few modifications, but with some loss of natural habitats.
C	>2,5 to 3	Moderately modified, but with some loss of natural habitats
D	2 to 2,5	Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred
E	>0	Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
F	0	Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat

Table 2: PES of wetlands in the study area

HGM Unit	Description of Wetland types	Overall PES
HGM 1	Depression wetland	C

Wetland Present Ecological State (PES) assessments have been undertaken for each HGM unit identified that may potentially be affected by the proposed activities. All wetlands identified were found to be Moderately modified (C).

6.4 Ecological Importance and Sensitivity

All wetlands, rivers, their flood zones and their riparian areas are protected by law and no development is allowed to negatively impact on rivers and river vegetation. The vegetation in and around rivers and drainage lines play an important role in water catchments, assimilation of phosphates, nitrates and toxins as well as flood attenuation. Quality, quantity and sustainability of water resources are fully dependent on good land management practices within the catchment. All flood lines, riparian zones and wetlands along with corresponding buffer zones must be designated as sensitive.

The Ecological Importance and Sensitivity (EIS) assessment was undertaken to rank water resources in terms of:

- **Ecological Importance and Sensitivity (EIS)** – considers the presence of Red Data species, populations of unique species, importance for migration, breeding and feeding sites for species, the protection status of the wetland and vegetation type/s present, the diversity of habitat types, the regional context of ecological integrity of the wetland, and the sensitivity of the wetland to changes in hydrology and water quality.
- **Hydro-functional importance** – considers the ecosystem services the wetland provides in terms of flood attenuation, stream-flow regulation water quality enhancement, sediment trapping, phosphate, nitrate and toxicant assimilation, erosion control, and carbon storage.
- **Direct human benefit importance** - considers the subsistence uses and cultural benefits of the wetland system.

Water resources which have high values for one or more of these criteria may thus be prioritised and managed with greater care due to their ecological importance (for instance, due to biodiversity support for endangered species), hydrological functional importance (where water resources provide critical functions upon which people may be dependent, such as water quality improvement) or their role in providing direct human benefits (Rountree, 2010).

Table 3: Scoring System Used for the EIS Assessment (modified from DWAF, 1999 and used in Rountree et al., 2013)

Wetland Importance and Sensitivity Categories	Range of IS Scores
Very high (A) Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4
High (B) Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3
Moderate (C) Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2
Low/marginal (D) Wetlands that is not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1

Table 4: The determined ecological importance and sensitivity classes of the wetland units that will be affected by the current proposed development (DWAF, 1999).

HGM Unit	Description of Wetland Types	EIS score
HGM 1	Depression wetland	0.4

On the basis of this assessment, each of the criteria above were scored and categorized on a scale from 0 to 4 and assigned a category, according to that indicated in Table 4. The overall IS of the wetland was derived from the highest of the three main criteria (EIS, hydro-functional importance or direct human benefit importance). The wetland within the development area falls within Category D which is Low/marginal (>0 and <1)

7 Assessment Results

The assessment of the flora was carried out on 1st of March 2022. Proposed Solar Power Plant extent and its surroundings were assessed, and individual species of plants observed during the assessment were recorded. The field trips were conducted in summer. Observations were backed up by a photographic record. In view of the small site and the site visit undertaken, the procedure proposed for this study was satisfactory in order to provide a general overview and assessment of the plant diversity and assemblies that occur on the site. This methodology allows for sufficient information to be collected to make the necessary inferences as to the ecological status of the receiving environment and to assess the potential impacts that may be imparted as a result of the proposed activities, as well as the provision of rehabilitation recommendations and landscape management plans.

Figure 10: Types of vegetation in an area

7.1 Vegetation on-site

During site assessment, it was found that the proposed area is covered with Mixed Bushveld. Mixed Bushveld represent natural or untransformed grassland. The floral species identified in this community include Lysimachia arvensis, Erigeron bonariensis, Dettrichia viscsa greuter, Prosopos glandulosa torr and Boscia mossambicensis klotzsch, agave, Combtetum molle, Richardia scabra, and Branchpodium retusum beauw.

Sensitivity aspects:

- The open grassland has an ecological functioning of medium to high as it is a grazing area for livestock.
- The suitability of this community for red data/protected species is considered low and red data species were not recorded during site assessment.

Table 5: Vegetation found within the development area

Family	Genus	Species	Common name
Primulaceae	Lysimachia	Lysimachia arvensis	Scalet pimpernel
Compositae	Erigeron	Erigeron bonariensis	Argentine fleabane
Compositae	Dettrichia	Dettrichia viscsa greuter	False yellowhead
Leguminosae	Prosopis	Prosopos glandulosa torr	Honey mesquite
Capparaceae	Boscia	Boscia mossambicensis klotzsch	Broad-leaved sherpards tree
Cembretaceae	combretum	Combtetum molle	Velvet bush willow
Compositae	Pseudogna phalium	Pseudogna phalium stramineum	Cotton-batting plant
Poaceae	Cymbopogon	Cymbopogon citratus stapf	West indian lemongrass
Solanaceae	Solanum	Solunum incanum	Bitter apple
Poaceae	Branchpodium	Branchpodium retusum beauw	Romose false-brome
Poaceae	Hyparrhenia	Hyparrhenia hirta	South African bluestem
Rubiaceae	Richardia	Richardia scabra	Mexican clover
Spindaceae	Dodonae	Dodanaea viscosa	Florida hopbush
Rubiaceae	Vangveria	Vinguera infausta burch	Medlar
Saliceae	Salix	Salix repens	Creeping willow
Santalaceae	santalum	Santalum album	Sandalwood
Compositae	Tagetes	Tagetes minuta	Mexican marigold
Asteraceae	Conyza	Conyza canadensis	Horseweed
Adoxaceae	viburnum	Viburnum plicatum thunb	Japanese snowball
Solanaceae	Datura	Datural stramonium	Moon flower
Compositae	flaveria	Flaveria bidentis	Speedy-weed
Euphorbiaceae	Ricinus	Ricinus communis	Castor-oil-plant
Xanthorrhoaceae	Aloe	Aloe polyphylla pillans	Spiral aloe
Leguminosae	Acacia	Acacia sieberiana	Wattle
Asparagaceae	Agave	Agave macroacantha zucc	Parry’s agave

7.2 Plant Species of Concern

During the desktop study, no plant species of concern/Red Plant Species were found to be associated with the proposed site. During the site assessment, no plant species of concern/Red Plant Species were encountered on site.

7.3 Alien Invasive plants

Declared weeds and invaders have the potential to dominate or replace the herbaceous layer of natural ecosystems, altering the structure, composition, and function of natural ecosystems for the invaders and alien plant species identified on site). All of these transformers must be eradicated and controlled through an eradication and monitoring program. Some invasive plants may degrade ecosystems by excluding native plant species through superior competitive abilities (Henderson, 2001). The following problem plant categories exist, according to the Alien and Invasive Species regulations published in accordance with Section 97(1) of the NEMBA:

Category 1a plants are high-priority emerging species requiring compulsory control. All breeding, growing, moving, and selling are banned.

Category 1b plants are widespread invasive species controlled by a management programme.

Category 2 plants are invasive species controlled by area. Can be grown under permit conditions in demarcated areas. All breeding, growing, moving, and selling are banned without a permit.

Category 3 plants are ornamental and other species that are permitted on a property but may no longer be planted or sold.

Table 6: Declared weed within the proposed development area

Scientific Name	**Common Name**
Erigeron bonariensis	Argentine fleabane
Hyparrhenia hirta	South African bluestem
Flaveria bidentis	Speedy-weed
Richardia scabra	Mexican clover

7.4 Avi-fauna

Birds are considered good ecological indicators, since their presence or absence are indicative of whether the ecosystem is functioning properly or not. Bird communities and ecological conditions are linked to land cover; as the land cover changes, the types of bird species in the area also change. According to the desktop study, there are no bird species in the proposed area. During site assessment, no bird species or specialised bird habitats were observed in the proposed area. A specialised bird habitat was observed in an area adjacent to the proposed site.

8 Ecological Impact Assessment

8.1 Impacts on vegetation and listed or protected plant species resulting from construction activities

Mitigation measures:

- Preconstruction walk-through of the facility in order to locate species of conservation concern that can be avoided or translocated as well as comply with the provincial permit conditions.
- Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas.
- Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
- All construction vehicles should adhere to clearly defined and demarcated roads. no off-road driving to be allowed outside of the construction area.
- Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.

8.2 Risk of Alien Plant Invasion

Mitigation measures:

- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
- The recovery of the indigenous grass layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas.
- Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented.
- Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

8.3 Increased Erosion Risk

Mitigation measures:

- Dust suppression and erosion management should be an integrated component of the construction approach.
- Disturbance near to drainage lines or the pan should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas.
- Regular monitoring for erosion problems along the access roads and other cleared areas.
- Erosion problems should be rectified on a regular basis.
- Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.
- A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.

8.4 Direct Faunal Impacts

Mitigation measures:

- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.
- Any fauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- If trenches need to be dug for water pipelines or electrical cabling, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.

9 Cumulative Impacts Assessment

This section aims to address Section 2 of the NEMA's requirement to consider cumulative impacts as part of any environmental assessment process. According to the EIA Regulations (2017), cumulative impacts "mean the past, current, and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that may not be significant in and of itself, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities." Cumulative effects can be additive, interactive, sequential, or synergistic. EIAs have traditionally failed to address such impacts, owing largely to the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires coordinated institutional arrangements;
- Complexity - dependent on numerous fluctuating influencing factors which may be completely independent of the controllable actions of the proponent or communities;
- Project level investigations are ill-equipped to deal with broader biophysical, social and economic considerations.

For the purposes of this report, "Cumulative Impact" is defined as the sum of impacts over time that can be attributed to the operation of the proposed project itself, as well as the overall effects on the ecosystem of the proposed project Area that can be attributed to the proposed project and other existing and planned future projects.

Table 7: Cumulative impacts ratings

	Valued Ecosystem Components	Rationale for Inclusion / Exclusion	Level of Cumulative Effect
Construction Phase			
Terrestrial and Biodiversity Wetland	Habitat loss owing to clearing of vegetation	Clearing of vegetation in the vicinity of the proposed Solar Plant footprint. This will necessitate the partial destruction of habitat with a low or medium sensitivity.	-Medium
	Loss of vegetation within 500 m from the wetlands outside the footprint proposed for the developments.	The wetlands near the site, all of which have buffer zones (50 m) that are not included in the proposed footprint, are important as part of a stepping stone biodiversity corridor system in the larger area.	- Low
	Increase in construction vehicles	The construction of solar power plants will have little impact on long-distance transportation routes' current traffic volumes. The	- Low

		likelihood of local traffic being adversely affected by construction traffic is thought to be extremely low. The construction of solar power plants will have a significant positive impact on the surrounding towns' communities. Because the solar power plants will be built for a short period of time, the effects on the surrounding area will be temporary. Because the project is so short in duration, all of the effects are completely reversible. The significance of the aforementioned impacts is low because they are only temporary and last for a short period of time.	
	Direct Faunal Impacts	The displacement of resident avifauna due to	- Low

		increased disturbance, as well as potential collisions with PV panels resulting in injury or loss of avian life, is regarded as a cumulative impact.	
	Risk of Alien Plant Invasion	Within 500m of the site, there are wetland areas and buffer zones designated as no-go zones for development in the proposed development layout. Alien invasive plant species infest previously cleared areas, occupying habitat that is then inaccessible to indigenous species. Invasive alien species may then spread from these "source" areas to nearby wetlands.	
	Impacts of employment opportunities, business opportunities and skills	The establishment of additional solar power projects in the area has the	+ Medium

	development	potential to have a significant positive cumulative impact, particularly in terms of the creation of a number of socio-economic opportunities for the region, which can lead to positive social benefits. The positive cumulative effects include job creation, opportunities for skill development and training, and downstream business opportunities. The cumulative benefits to the local, regional, and national economies from employment and service procurement are greater.	
Operational Phase			
	Emissions and pollutants into air, water and soil	When solar plants are operational, their overall emissions and pollutants are kept to a minimum.	- Low

		Cumulative effects on soil pollution may occur during the operational phase. Rubble or waste could cause unwanted pollutants to infiltrate the soil. Spilling petroleum fuels and unwanted chemicals onto soils that infiltrate these soils could lead to soil pollution, and if this occurs at several solar plants in an area, the cumulative effect could be harmful to the local environment.	
	Fragmentation of corridors of particular conservation concern	If any other projects in the area are approved, there is a real risk of landscape fragmentation and corridor loss. Only a small portion of the wetland is located within the proposed development footprint. Much of the wetland is within the	- Low

		footprint's 500m buffer. Otherwise, there are no indications of any linked or steppingstone corridors of special conservation importance at the site.	
	Establishment of alien invasive plant species at cleared areas.	Within 500m of the site, there are wetland areas and buffer zones designated as no-go zones for development in the proposed development layout. Alien invasive plant species infest previously cleared areas, occupying habitat that is thenqp1 x inaccessible to indigenous species. Invasive alien species may then spread from these "source" areas to nearby wetlands.	High
		Decommission Phase	
	Generation of waste	An increase in the demand for municipal services could	- Low

		have a significant cumulative impact on the availability of landfill space.	
	Visual Intrusion	The decommissioning of the PV plant and 132kV power line, combined with farming activities and people using the existing gravel roads adjacent to the site, may increase the cumulative visual impact. The main considerations will be dust control and housekeeping.	- Low

10 Conclusion and Recommendations

All management / mitigation measures identified for the impacts associated with the proposed development must be and implemented during the relevant phases of the proposed Solar Power Plant. Specific mitigation measures and recommendations that should be incorporated into the EA (if granted) include:

- All necessary permitting and authorisations must be obtained prior to the commencement of any construction activities.
- A suitably qualified ECO must be appointed prior to the commencement of the construction phase.
- The site must be ground truthed by an experienced botanist, prior to vegetation clearance, to ensure that no populations of restricted range species will be lost. If it is found that there are populations that will be affected, then the infrastructure (pylons) must be moved to avoid these areas.
- A comprehensive Search and Rescue for fauna and flora should be conducted prior to vegetation clearance.
- An Erosion Management Plan must be developed prior to the commencement of construction activities in order to mitigate the unnecessary loss of topsoil and runoff

11 References

DWAF, 1999. Determining the Ecological Importance and Sensitivity (EIS) and Ecological Management Class (EMC). Version 1.0. 24 September 1999.

DWAF. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Pretoria: Department of Water Affairs and Forestry.

Kleynhans, CJ.1999. A procedure for the determination of the ecological reserve for the purposes of the national water balance model for South African River. Institute of Water Quality Studies, Department of Water Affairs & Forestry, Pretoria

Kotze, D.C., Marneweck, G.C., Batchelor, A.L., Lindley, D.C., and Collins, N.B. 2007. A Technique for rapidly assessing ecosystem services supplied by wetlands. Mondi Wetland Project.

Rountree, M.W., H. Malan and B. Weston (editors). 2012. Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). Joint Department of Water Affairs/Water Research Commission Study

Rutherford MC, Mucina L. Introduction. In: Mucina L, Rutherford MC,editors. The vegetation of South Africa, Lesotho and Swaziland. Pretoria: South African National Biodiversity Institute, 2006; p. 384–385

Van Rooyen, N. & Bredenkamp, GJ. 1996. Mixed Bushveld. In: Vegetation of South Africa, Lesotho and Swaziland, (eds.) A.B. Low & A.G. Rebelo. Department of Environmental Affairs and Tourism, Pretoria

22 Sagittarus avenue Reyno
Ridge, Mpumalanga,
eMalahleni, 1035

GEOTECHNICAL INVESTIGATION FOR DEVELOPMENT OF A SOLAR FARM.

Kwaggafontein 216-JR, Thembisile Hani Local Municipality

PREPARED FOR:
Imvunulo
Investments

ERF 2075 Phola
2233

eMalahleni,

Mpumalanga

BAVINCE GROUP
BGJ-002-22
DATE:
March 2022

EXECUTIVE SUMMARY

This report presents the results of Phase 1 geotechnical investigation for the proposed enrolment of a Solar Farm within the area of Kwaggafontein 216-JR.

The study area is predominately covered by granite of the Rashoop Granophyre suit of the Bushveld Complex and Surrounded by the Lebwa granite suit. The investigations involved field inspections, a review of available data, a comprehensive test pit excavation, soil profiling, in-situ testing, the sampling of disturbed samples, testing of soil materials, and reporting finding of the geotechnical investigation.

Upon conducting fieldwork, analyzing soil profiles and laboratory tests, and gathering geological and hydrogeological during site investigation, the site was classified as two geotechnical Site Class Zones, namely, Zone A: C1 site is considered as developable with areas that may need precautionary or certain remedial measures. Zone B falls within possible floodlines (rivers, wetlands, wet areas), that traverse the site and might not be developable. A Hydrologist should be appointed to determine floodlines of the site.

In general, the site is underlain by material suitable for both uses as a selected layer and subbase according to TRH14 Guidelines (1987).

The implementation of an efficient surface drainage system is recommended around all structures and along all roads throughout the project area. Suitable measures must be implemented to mitigate the possible rising damp challenges.

It is recommended that a competent person inspect all foundation trenches before construction to identify and evaluate any soil characteristics in variance with that found during this investigation.

Foundation recommendations and minimum precautionary measures are also included in the report. It was concluded that with exception of areas where floodlines could have an adverse impact on the site, most of the site is considered to be developable.

A Phase 2 geotechnical investigation is required to confirm the delineation of the classification zones.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

DOCUMENT APPROVAL RECORD

FUNCTION	NAME	DATE	PRACTICE No. (SACNASP)	SIGNATURE
Site Investigation and report compilation	Mamphwe Vhutshilo Vincent	29/03/30	126969	

RECORD OF REVISIONS AND ISSUES REGISTER

Date	Revision	Description	Issued to	Issue Format	No. Copies	Signature
	1			Hard copy	1	

General limitations:
1. The investigation has been conducted in accordance with generally accepted engineering practice, and the opinions and conclusions expressed in the report are made in good faith based on the information at hand at the time of reporting.
2. The contents of this report are valid as of the date of preparation. However, changes in the condition of the site can occur over time as a result or either natural processes or human activity. In addition, advancements in the practice of geotechnical engineering and changes in applicable practice codes may affect the validity of this report. Consequently, this report should not be relied upon after an eclipsed period of one year without a review by this firm for verification of validity.
3. Unless otherwise stated, the investigation did not include any specialist studies, including but not limited to the evaluation or assessment of any potential environmental hazards or groundwater contamination that may be present.
4. The investigation is conducted within the constraints of the budget and time and therefore limited information was available. Field observations where conducted solely by Ba Vince Group field team, and not the author of this report. The nature and extent of variations across the site may not become evident until the time of construction. Possible variations could affect the proposed project adversely, and it may be necessary to revaluate recommendations in this report. Therefore, it is recommended that Ba Vince Group be retained to provide specialist geotechnical engineering services during construction in order to observe compliance with the design concepts, specifications and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to commencement of construction. Any significant deviation from the expected geotechnical conditions should be brought to the author's attention for further investigation.
5. The assessment and interpretation of the geotechnical information and the design of structures and services and the management of risk is the responsibility of the appointed engineer.

INTRODUCTION AND TERMS OF REFERENCE

BACKGROUND

Imvunulo Investments plans to develop a Solar Farm in the Kwaggafontein 216-JR within Thembisile Hani Local Municipality.

This report details the outcome of surficial soils investigations conducted for the enrolment of a township development.

TERMS OF REFERENCE

Ba Vince Group (Pty) Ltd was appointed by Imvunulo Investments to conduct a Phase 1 geotechnical investigation for the proposed enrolment of a Solar Farm within Kwaggafontein 216-JR.

According to Project Status provided by the Client, solar panels classify as **minor structures**[1], are due for enrolment across the area of Kwaggafontein 216-JR in Thembisile Hani Local Municipality.

The study area falls within Ward 29 of the Thembisile Hani Local Municipality. The number of solar panel units approved for enrolment was not indicated in the project status provided by the Client. The project is a solar farm development on a site of approximately 20 ha. The extent of the site is therefore limited to the existing boundary of the village as per the boundaries provided by the Client (see Appendix A).

The geotechnical investigation conducted included test pit excavations, soil profiling and sampling, and laboratory testing. The geotechnical investigations were carried out to assess the geotechnical conditions of the site for the proposed development of new residential structures. It also includes slope stability assessments by mapping existing geology observed on the slopes, joint sets, recording toppling failures, wedge failures, circular failure, and sliding of blocks along joint planes.

OBJECTIVE

The purpose of the report is to present findings from the Geotechnical investigation, discuss anticipated geotechnical constraints that may impact the proposed development, provide recommendations on foundation designs and precautionary measures for the planned solar panel units, and subdivide the site into geotechnical (soil) Site Class. The report also provides recommendations for earthworks, drainage, the suitability of the *in-situ* soils for road and pavement construction as well as for pipe bedding.

The geotechnical information gathered in this investigation can be used for planning, construction costing, and preliminary architectural detailing.

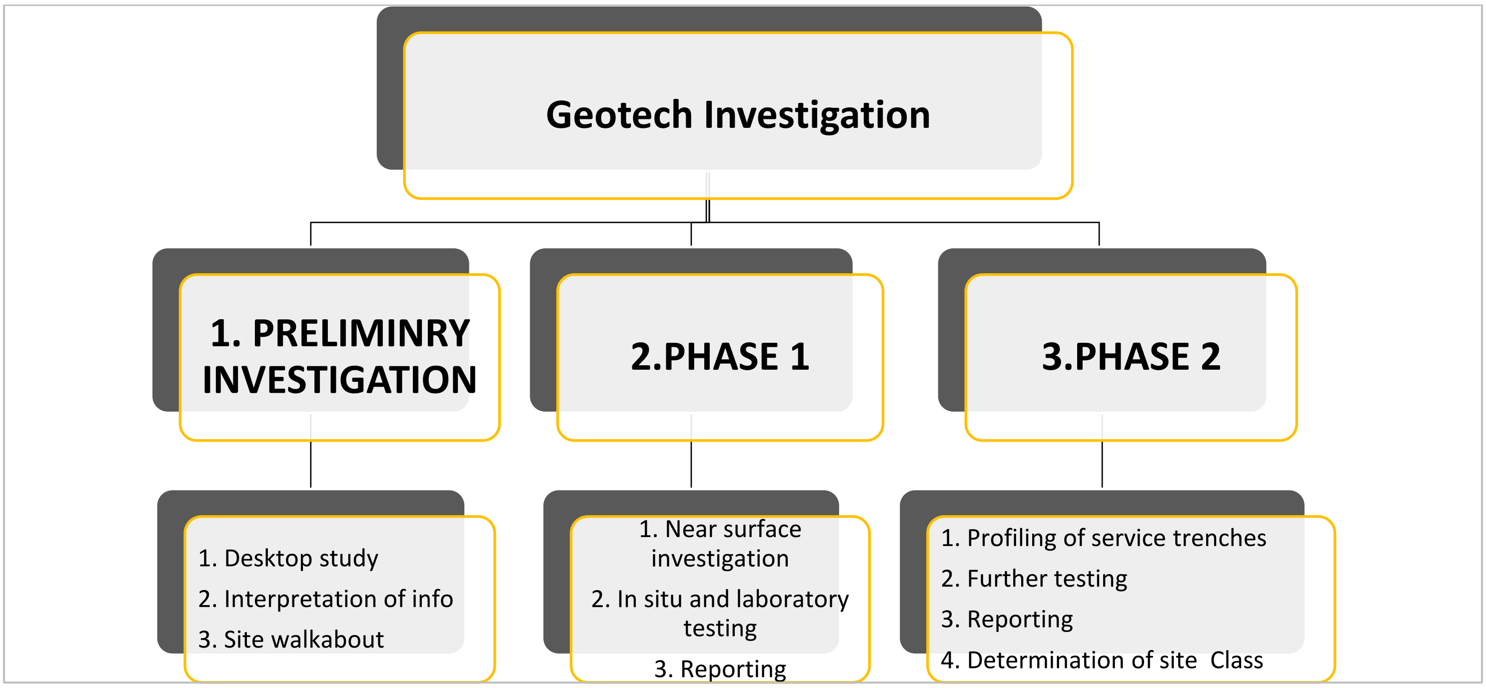
METHODOLOGY

Geotechnical investigations are implemented in three phases, namely:

1. Preliminary
2. Phase 1
3. Phase 2

[1]The Geotechnical Division of SAICE – "Site Investigation Code of Practise"

The process is outlined below:



Based on the proposed approach above, the investigation was conducted in phases as per GFSH – 2 guidelines, which involves:

Preliminary Phase

Desk study (gathering and assimilation of available data, e.g. existing reports, maps, etc.) followed by a walkover survey & discussion on the intended purpose of the land.

Phase 1 Geotechnical Site Investigation

- Conduct a detailed geotechnical site investigation involving an in-situ evaluation of the ground profile to a minimum depth of 3.0m or to refusal, sampling, laboratory testing and analysis of physical and chemical properties of all representative soil horizons which can be expected to influence improvements to the land relating to subsidy housing development.
- Penetrometer testing (where necessary);
- In situ testing and disturbed and undisturbed sample testing; and
- Preparation of a comprehensive report.

Phase 2 Geotechnical Site Investigation

- Profiling service trenches to establish further profiles that will result in a villagelayout drawing which confirms the delineation of the zones on-site resulting in the confirmation of classification of each individual erf.
- Preparation of a comprehensive report.

At the end of each phase, the report is submitted to NHBRC for review and approval.

AVAILABLE INFORMATION

The following sources of information were utilized:

- Site boundary provided by Client.

- Geological maps: 2008 Geology of South Africa 1:80 000
- 2528BB Topographical Map 1: 50 000.
- Site Layout.
- Basecamp (Software used for extracting site coordinates from GPS device).
- Google Earth (2019).

Geotechnical investigations for residential developments comply with industry standards and code of practice, namely:

- SANS 634: Geotechnical investigations for township development.
- The NHBRC Home Building Manual. 2015 Edition.
- Generic Specification GFSH – 2 of the National Department of Housing, dated September 2002, entitled: Geotechnical site investigations for housing developments.
- SANS 1936 documents.
- The requirements of Section 12 of Act 95 of 1998 (Home Consumer Protection Measures Act).
- TRH 14 – Technical Recommendation for Highways.

DESCRIPTION OF ENVIRONMENT

SITE DESCRIPTION

The Farm Kwaggafontein 216-JRis located at about 2.3 km South-east of the Kwaggafontein mall, which falls under the jurisdiction of the Thembisile Hani Local Municipality. It is accessible via R573 regional road from the Kwamhlanga towards LimpopoThe central geographic position for the Farm Kwaggafontein 216 JR is roughly defined by the following coordinate (degrees-minutes-seconds, WGS84 datum plane): **Latitude: 25° 18’ 0541’’ S Longitude: 28° 57’ 41.79 E.**

Based on the existing boundary of the Farm Kwaggafontein 216 JR (see **Error! Reference source not found.**), the site has an area of approximate 20 hectares.

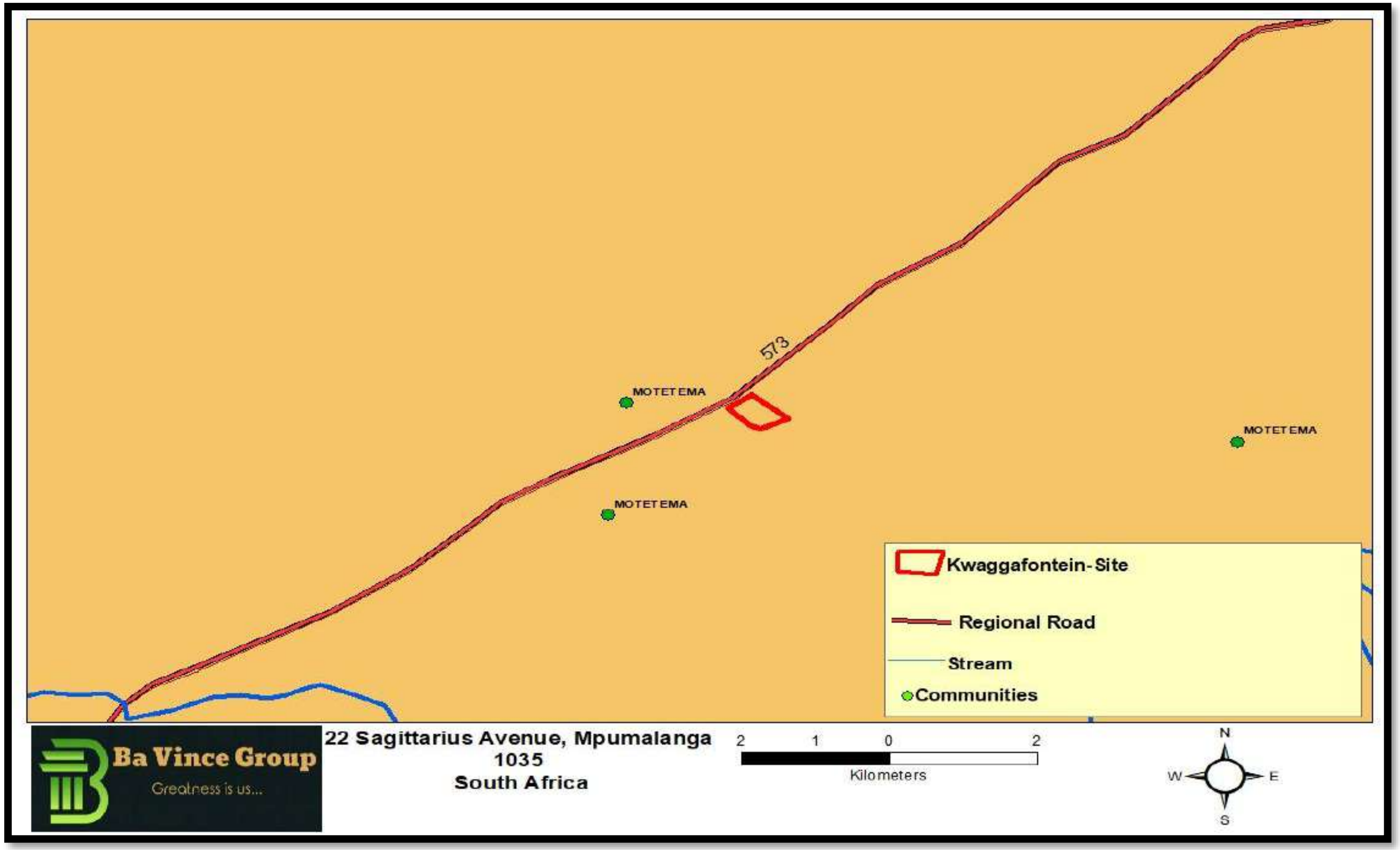


Figure 1: Locality Map of The Farm Kwaggafontein 216 JR

CLIMATE

The Farm Kwaggafontein 216-JR is in Kwamhlanga, Mpumalanga. Kwaggafontein lies ~ 1405m above sea level (asl) and has temperate highland. The yearly temperature is 28ºC, ~ 1.3% higher than South Africa's averages. Kwamhlanga receives ~ 373.32 millimetres of precipitation annually and records 121.11 rainy days.

The annual high temperature is 28º C and the annual low temperature is 27ºC. The warmest month in Kwaggafontein is Jan, the coldest is June and the wettest temperatures are recorded in July. In addition to this, the driest temperatures are recorded in June with humidity recorded as 69.66%.

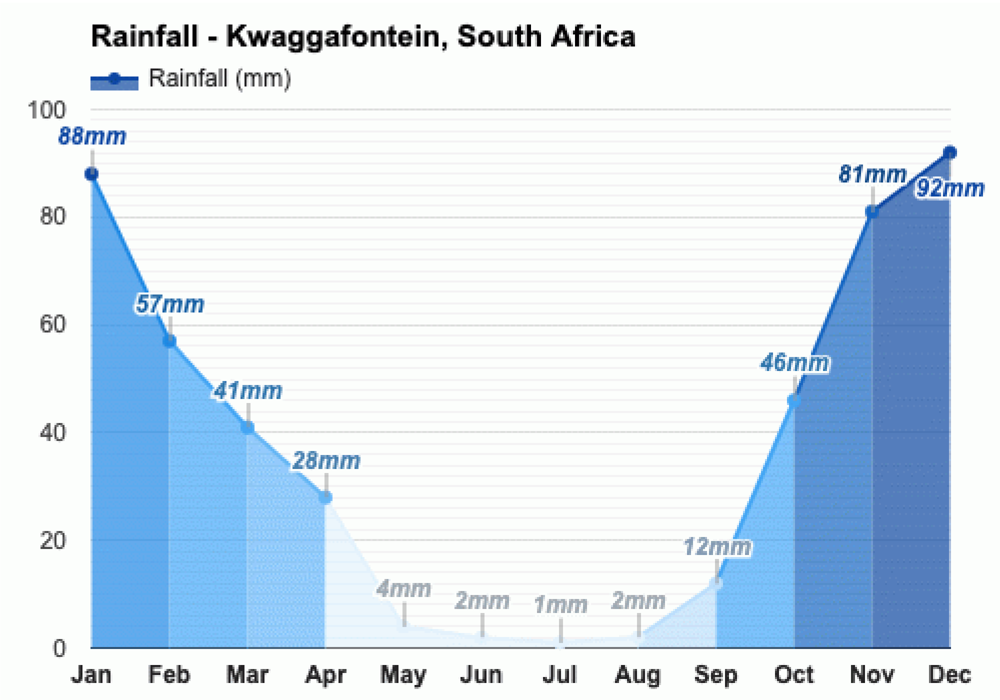


Figure 2:Climatic Data for Kwaggafontein, Mpumalanga Province

TOPOGRAPHY

Based on the 1:50 000 2528 BB topographic map The surface topography of the study area is characterized by relatively flat to gently sloping surfaces towards the east. The site is located on a maximum elevation of 1404 m and a minimum elevation of 1377m above mean sea level (AMSL). The area has an average elevation slope of 4.9%.

The site is drained through surface run-off into the non-perennial tributary of the marshes and its catchment located in the north of the project area. There are no proper drainage channels around the site that collects stormwater, hence this has a potential of collecting water on shallow topographic depressions and forming small, localized ponds.

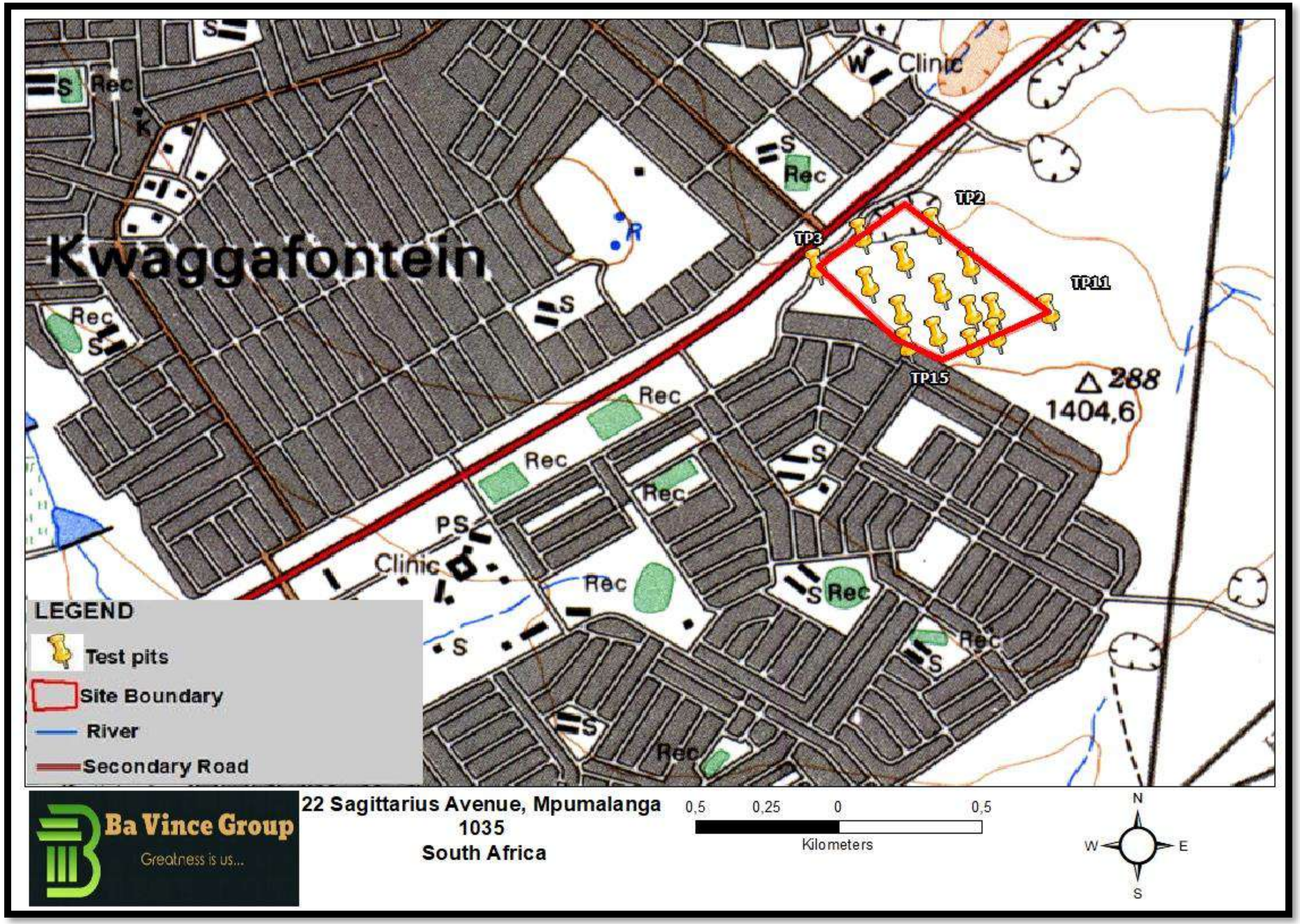


Figure 3: Topographical map of the study area the Farm Kwaggafontein 216 JR in Thembisile Hani Local Municipality.

SITE DESCRIPTION

VEGETATION

The site is associated with the Central sandy Bushveld Grassland Biome, the 2nd largest Biome in South Africa. It occupies approximately 28.4% of South Africa. This Biome is dominated by a layer of grass with trees in localised areas, but trees may not always be present (Rutherford *et.al*., 2006). Grasslands are associated with summer rainfall areas and found in the Highveld areas. At the time of the investigation, the natural vegetation of the study area is still present. (**Error! Reference source not found.**).

Figure 4: Vegetation observed within the extent of the project area.

INFRASTRUCTURE

The current land use across the extent of the project area is a community residential . The surrounding area outside the boundary of the site, comprises predominantly of residential housing structures, with scattered land uses, utilized as filling stations and community facilities. The main road is a tar road (R573) next to the farm boundary.

Existing houses were assessed for structural defects. No major structural defects were observed on site. Services observed on-site included overhead powerlines. No evidence of stormwater or sewer network was observed.

Figure 5:Existing structures and infrastructure in the study area.

Powerlines	**Types of structures on site**
	
Buried services **NONE OBSERVED ON SITE**	**Gravel roads within the site.** **NO GRAVEL ROAD OBSERVED**

Figure 5:Existing structures and infrastructure in the study area.

SERVICES LAYOUT

The Surveyor General diagram of the area under investigation is available and can be seen in Appendix A.

REGIONAL GEOLOGY

SITE GEOLOGY AND ANTICIPATED SOIL CONDITIONS

Site Geology

The regional geology of The Farm Kwaggafontein 216 JR is extracted from the published 1:80 000 Geological Series, Sheet Number 2008 Geology of South Africa. The site is covered by granites of the Drashoop Granophyre suiet of the Bushveld

Regional geology of the site is presented below in Figure 6 and summarized below in Table 1.

Table 1: Summary of the site's regional geology (2008 Geology of South Africa).

Period	Group/Fm	Lithology
Palaeeoproterozoic	Drasoop Granophyre	Granite

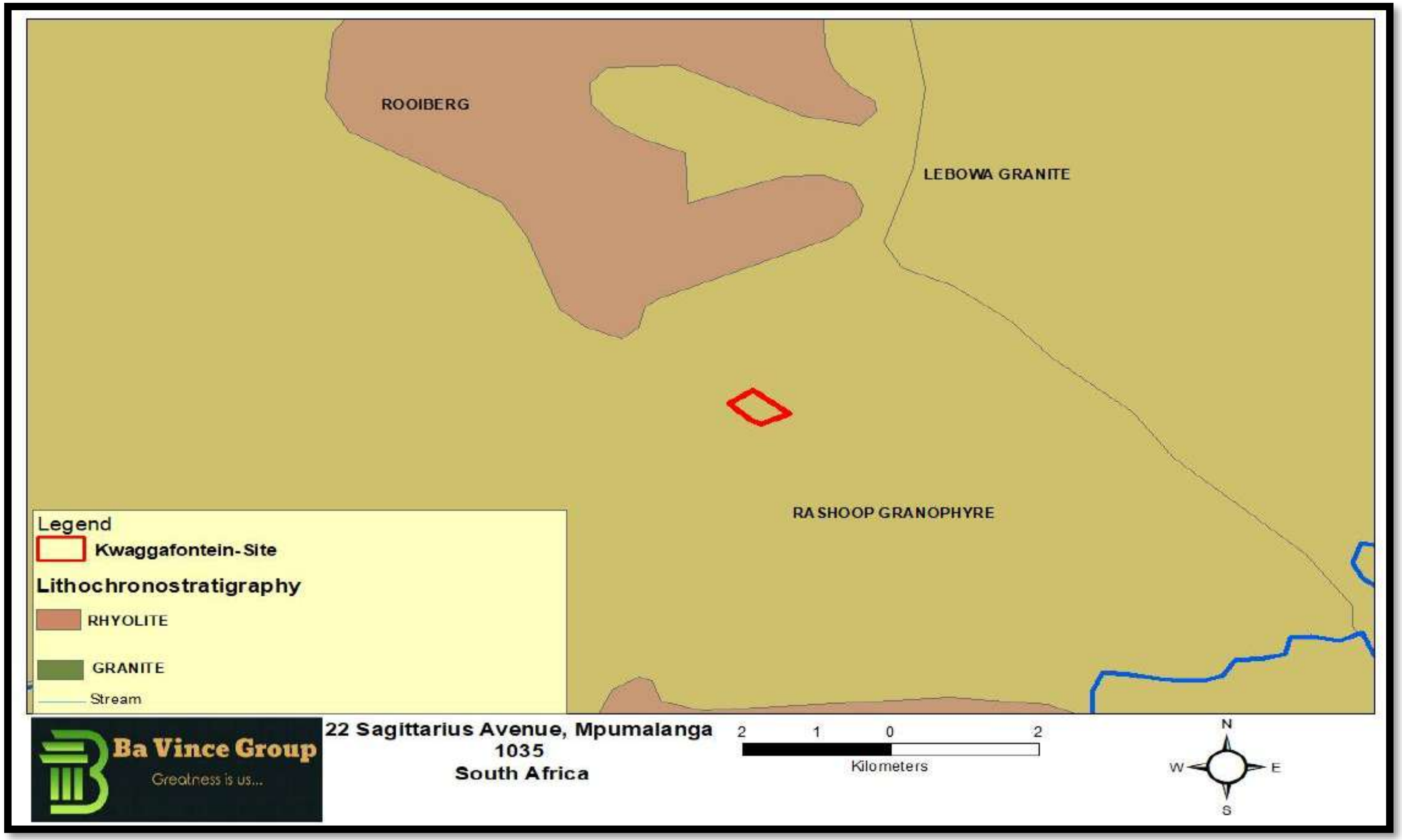


Figure 6: Regional Geology of the Farm Kwaggafontein 216 JR

Anticipated soil conditions

The soil type or texture of a residual soil can usually be predicted from a knowledge of the mineralogical composition of its parent material. The soil material derived from the decomposition of the bedrock has engineering properties summarized in Table 2 below.

Table 2: Engineering property of residual material

Rock Type (Geology Symbol)	• Granite
Expected Soil Profiles	Silty sand, , gravelly sand ; or sandy gravel; pebbles , cobbles
Engineering Properties	(a) Potentially collapsible grain structure present, thus medium to high collapse potential (b) Compressible soil (c) Silty sand with moderate to relatively high permeability (d) Uncompacted sands high erodibility. (e) Potentially heaving soil

8 FIELD INVESTIGATION

8.1. DESK STUDY

The investigation process commenced with a desk study where an evaluation of available information was conducted. The existing information may include:

- Existing geotechnical reports of the area and/or its surroundings.
- Geology maps, topographic maps, and aerial photography and satellite photography of the site.
- Site layout plans of the area.
- Location of test pits.

8.1.1. Model for selecting test positions

The approach for test pit location involved:

1. Obtaining site data and plotting site boundaries on Google Earth image.
2. Determining the extent of the site; and
3. Calculating the minimum number of test pits required according to GFSH-2 [2]
   The test pit positions were located in such a way as to cover land facets such as similar geology or low-lying areas, areas with potential problem soils.

[2]Generic Specification GFSH2

8.1.2. Field Reconnaissance

The desktop study process was followed by field reconnaissance investigation which mainly involved a walkover survey. The walkover survey was undertaken to develop a clearer perspective of the actual site conditions including the layout of the area, accessibility, geomorphology, geology, etc.

8.1.3. Geographical positioning of test holes to be excavated

A Garmin Geographical Positioning Systems (GPS) was used to locate the position of the test pits and the positions were marked on site.

8.1.4. Test pit investigation

A site investigation was carried out on the 3rd of March 2022. The investigation comprised of a walkover site inspection and followed by the excavation of a total number eleven (11) of fifteen (15) test pits with the aid of the CAT (TLB). These test pits were designated TP1 to TP15. The excavated test pits positions as presented in Figure 7.

The number of planned test pits was based on the size of the study area and uniformity of the geology underlying the area. The test pits were profiled and sampled according to guidelines for soil and rock logging in South Africa (2002).

The final excavation depth of test pits was achieved between 0.1 m and 1.6 m, upon refusal or slow progress of excavation of the TLB (Table 3). The test pits were loosely backfilled with the excavated material.

Test pit photographs and logs are attached in Appendix A.

Table 3: Kwaggafontein 216-JR coordinates of the test pits.

Test Pit no	Latitude	Longitude	Final depth (m)
TP1	25.6872ºS	30.03777°E	1.6
TP2	**Not excavated**		
TP3	25 .29973°S	28.95943 °E	0.34
TP4	25.30056°S	28.96096°E	0.47
TP5	25.30075°S	28.96296°E	OUTCROP
TP6	25.30085°S	28.95841°E	0.47
TP7	25.30223°S	28.96089°"E	0.45
TP8	25.30158°S	28.96213°E	OUTCROP
TP9	25.30226°S	28.96301°E	0.1
TP10	25.30215°S	28.96381°E	0.5
TP11	25.30212°S	28.96531°E	0.4
TP12	25.30303°S	28.96393°E	0.3
TP13	25.30321°S	28.96305°E	0.31
TP14	25.30318°S	28.96095°E	OUTCROP
TP15	25.30226°S	28.96081°E	0.28

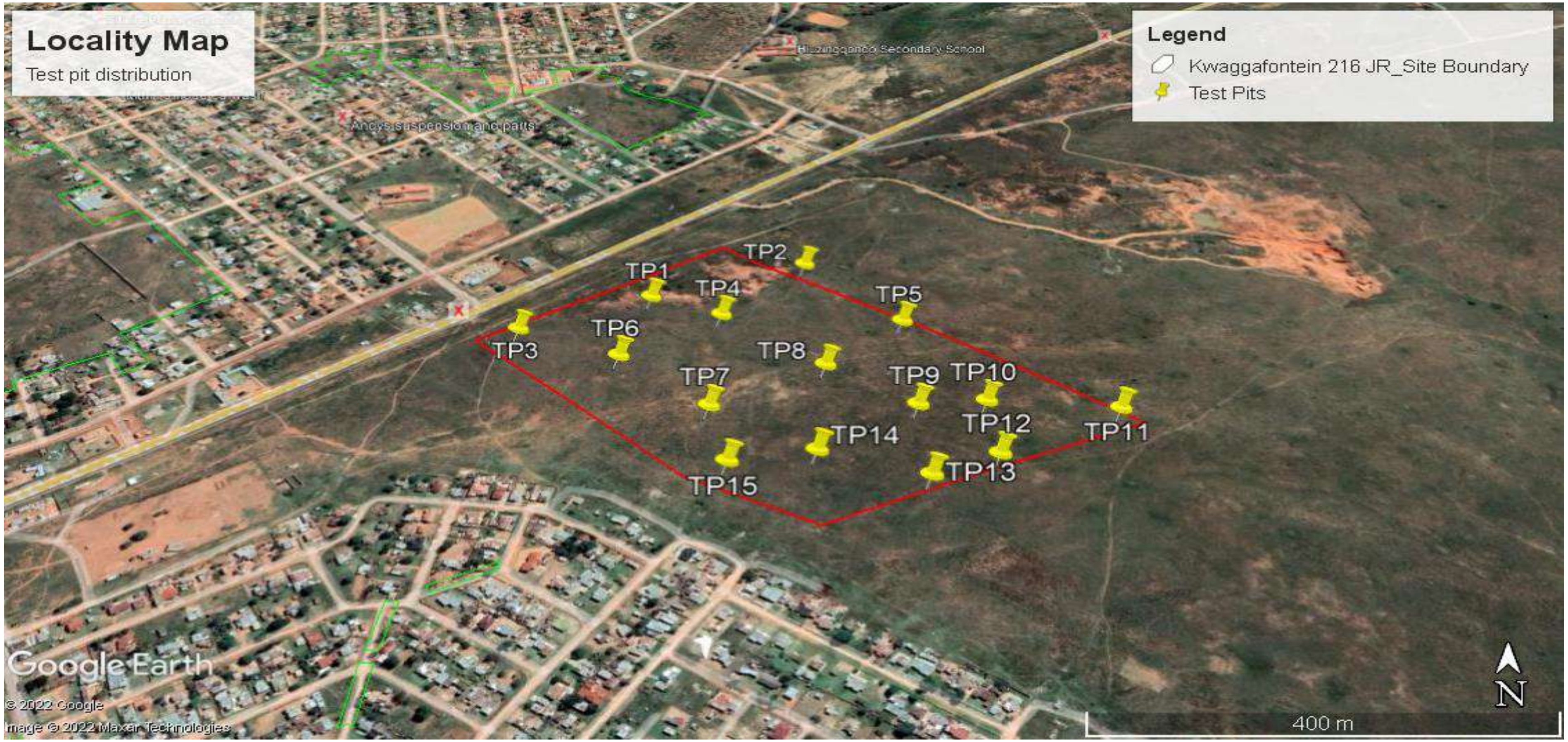


Figure 6: Kwaggafontein 216 JR test pits distribution.

8.1.5. Excavated test pit stability

The test pits side walls were excavated in a rectangular shape making use of the Tractor Loader Backhoe bucket to allow soil profiling and soil sampling. The sidewalls have generally vertical excavations, their slope can be said to occur at 1 m vertical 0 m horizontal for the period of the open excavation (slope 1:0 = vertical walls).

All the test pits exhibited stable sidewalls to the maximum depth of 1.6 m (Table 4). In this light, the sidewalls can be classified as semi-stable to stable. Precautionary measures should be taken to ensure the safety particularity during trenching to depths deeper than 1.5 m (as required by legislation).

Table 4: Kwaggafontein 216-JR Founding conditions as per test pits.

TP No	Imported soils	Transported	Residual soils	Rock	Refusal/slow progress	Water Seepage	Stable sidewalls
	m	m	m		m	Yes/No	Yes/No
1	0-0.6	-	0.6-1.6		Slow progress	No	Yes
2	-	-	-		-	-	-
3	-	0-0.2	-	0.2-0.34	Refusal	No	Yes
4	-	0-0.2	0.2-0.47	-	Slow progress	No	Yes
5	-	-	-	-	-	-	-
6	-	0-0.34	0.34-0.47	-	Refusal	No	Yes
7	-	0-0.4	0.4-0.45	-	Refusal	No	Yes
8	-	-	-	-	-	-	-
9	-	0 -0.1	-		Refusal	No	Yes
10	-	0-0.2	0.2-0.5	-	Refusal	No	Yes
11	-	0-0.1	0.1-0.4	-	Refusal	No	Yes
12	-	0-0.1	0.1-0.3	-	Refusal	No	Yes
13		0-0.21	0.21-0.31	-	Refusal	No	Yes
14	-	-	-	-	-	-	-
15	-	0-0.2	0.2-0.28	-	Refusal	No	Yes

8.1.6. Sampling

Soil horizons recorded within the soil profiles were sampled and submitted to Road laboratory, a SANAS accredited laboratory for foundation indicator testing including particle size distributions, Atterberg limits and chemical tests (pH & Electrical conductivity). CBR tests were conducted on the bulk disturbed soil samples. The laboratory tests were conducted to assist with the purpose of classification, description, and delineation of homogenous zones.

9 RESULTS

9.1. TERRAIN OBSERVATIONS

The study area has relatively homogenous geology with similar soil and vegetation type. The soil profiles encountered on-site are summarised below and the soil horizon data are presented below in Table 4:

9.1.1. Imported soil material

Localized portions of the project area are covered by dry to slightly moist loose silty sand with contaminated household rubble (TP1). This extends down to a maximum depth of 0.6 m with an average thickness of 0.6m.

9.1.2. Topsoil

Most of the project area is covered by a layer of transported material comprising silty to gravely sand with an intact structure, deemed to represent topsoil. The material exhibits loose to medium dense consistency and extends to depths of between 0.1and 0.4 m.

9.1.3. Residual

Residual material underlies topsoil in localised portions of the study area. The material generally exhibits intact structure and medium dense to dense consistency. It extends up to a maximum depth of 1.6 m

9.1.4. Soft Rock

The residual material grades into moderately weathered soft rock with depth. The rock is a light pink, massive, medium grained, moderately weathered, soft rock. Excavates as silty sandy gravel soils.

The generalised soil profile is shown below in Figure 8 and detailed test pit logs are attached in Appendix A.

Figure 7: Typical test pit profile as observed on site.

9.2. LABORATORY TEST RESULTS

9.2.1. Foundation indicators and CBR

Laboratory tests were scheduled on selected soil samples recovered from the site. Where material characteristics are similar between test pits, representative sampling of soil materials was selected from one test pit. The analyses of disturbed samples included the following:

- Particle size distribution,
- Atterberg Limits,
- Hydrometer,
- Maximum Dry Density (MOD ASSHTO),
- California Bearing Ration,
- Optimum Moisture Content,
- pH and Electrical Conductivity.

The detailed results of the laboratory analysis are given in Appendix A and an example of the results presented by the lab are shown in Table 5.

9.2.1.1. Foundation indicators results

Residual

The tested residual material has a clay content of between 2.3% and 5.9%, with a plasticity index (PI) that ranges from NP TO 5. As such, the material has a low potential expansiveness. This material classifies A-1-b (0), A-1-a(0) and A-2-4(0) , in terms of the US Highway classification and classifies as SM, and GM in terms of the USCS classification system. The grading modulus ranges from 1.32-2.23.

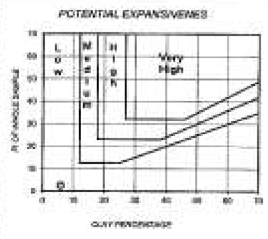
Table 5 Laboratory Results

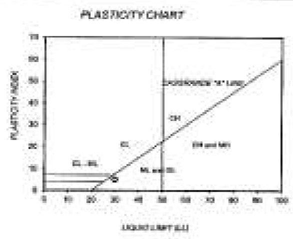
OUR REF : SC 00634
CLIENT : Da Vinci Group
PROJECT : Swaggafontein 216 JR

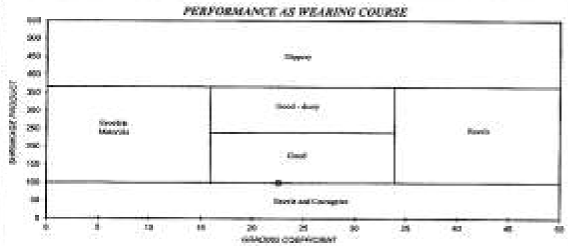
DATE RECEIVED : 14-Mar-22
POSITION : TP01
LAYER : 400-1600mm
SAMPLE No. : 0563
SAMPLE DESCRIPTION : Light Red Silty Gravelly Sand

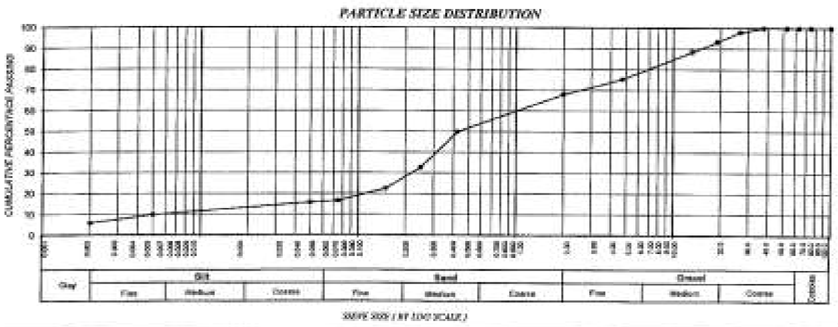
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		2.5
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	98
	20.0	93
	14.0	89
	5.00	75
	2.000	68
	0.425	50
	0.250	33
	0.150	23
	0.075	17
	50 µm	16
	5 µm	10
	2 µm	5.9
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	27
	0.425 - 0.250	26
	0.250 - 0.150	15
	0.150 - 0.075	9
	< 0.075	24
Effective size		0.006
Uniformity Coefficient		200.0
Curvature Coefficient		5.9
Oversize Index		0.0
Shrinkage Product		100.0
Grading Coefficient		22.6
Grading modulus		1.65
Atterberg Limits	Liquid Limit	30
	Plasticity Index	5
	Linear Shrinkage	2.0
	PI < 0.075	-
Unified Soil Classification		SM
U.S. Highway Classification		A-1-b (0)









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
5.9	10.7	51.3	32.0

Codes Explanation

LL	=	Liquid limit
CC	=	Compression Index = 0.2343 x [L.L %/100] x G_s - from Nagaraj and Murty (1985) [G_s assumed 2.65]
PI	=	Plasticity index:**< 425µm** : of fine fraction, **Total** : of total sample
NP	**=**	Non-plastic
SP	=	Slightly plastic
LS	=	Linear shrinkage percentage
Clay %	=	Mass percentage of material with particle size smaller than 2 µm
Act	=	Activity as defined by Skempton (1953) [Activity = P.I. of whole sample/Clay%]. Activity of 0-0.75 is inactive, 0.75-1.25 is normal and >1.25 is active.
Heave potential	=	Potential heave according to the method of Van der Merwe (1964, 1975) The figure in brackets states the percentage swell of the particular horizon as determined with the Weston (1979) method, using an assumed 50 kPa bearing pressure and natural moisture content of 10%.
pH/Cond.	=	Acidity and electrical conductivity of soil paste
Permeability	=	Permeability determined with Hazen's formula (Hazen, 1892) [$k = 100(d_{10})^2$]. Note that the formula is not applicable to clayey soils - i.e. the permeability of soils with > 10% clay cannot be accurately determined with this method.
Unified Class.	=	Unified classification according to the revised (1984) ASTM- standard
AASHTO-Class.	=	Association of American State Highway Technical Officials/ Public Roads Administration Classification

PRA nomenclature:

A-4	=	silty soils [fair to poor, road pavement, sub-grade rating]
A-2-4	=	silty or clayey gravel sand (PI<30) [excellent to good, road pavement, sub-grade rating]
A-2-7	**=**	Silty or Clayey Gravel and Sand (PI≥11) [good to fair, road pavement, sub-grade rating]
A-7-6	**=**	clayey soils (PI<30) [fair to poor, road pavement, sub-grade rating]
A-6	**=**	clayey soils (PI<30) [fair to poor, road pavement, sub-grade rating]
A-2-4	**=**	Silty or Clayey Gravel and Sand (PI≥11) [good to fair, road pavement, sub-grade rating]

A-2-6	**=**	silty or clayey gravel and sand (PI≥11) [excellent to good, sub-grade rating]
A-7-6	**=**	clayey soil (PI<30) [fair to poor, sub-grade rating]

Unified Soil Classification nomenclature:

SM	=	silty sands, sand-silt mixtures.
GM	=	silty gravel
GC	**=**	clayey gravel
SC	**=**	clayey sands
CL	**=**	**i**norganic clays of low-med plasticity, gravelly clays, sandy clays, silty clays, lean clays. (LL<50)
GM-GC	**=**	Silty clayey, gravel with sand.
SM-SC	**=**	Silty clayey, sand with gravel

9.2.1.2. Engineering Properties of Compacted Materials [California Bearing Ratio (CBR)]

Four (4) samples were collected on-site to determine the strength and response to compaction of the soil when used in compacted engineered fills. The samples were subjected to compaction tests in which the moisture-density relationship was established. California Bearing Ratio (CBR) tests were carried out to determine the suitability of the soils for use in soil mattresses. The material tested was sampled on residual material encountered on site.

Residual

The residual representative samples were subjected to CBR and MOD testing to determine their suitability to use during pavement construction or as general backfill. The material has a maximum swell value that ranges from 0.12-0.67 % with a CBR value of between 5 to 13 at 90 % Mod AASHTO compaction effort, increasing to between 18 to 55 at 100% Mod AASHTO compaction effort. This material recorded a maximum dry density between 1706-1819 kg/m^3 with an optimum moisture content that ranges from 9.1-15.4% at Modified AASHTO compaction effort. Based on the COLTO Guidelines, the sample classifies as G7, G9 and G10. quality material and is considered suitable for both uses as a selected layer and subbase according to TRH14 Guidelines (1987).

9.2.1.3. Conductivity and corrosivity

In situ soil samples were collected for soil chemistry tests (pH) and to determine the aggressiveness of the soil which can affect buried services and concrete foundations. The results of soil chemistry tests conducted are presented in Table 6.

The tested residual material comprises a pH of between 4.1 and 4.9 and a conductivity of between 7 and 21 mS/m.

Table 6: Results of corrosivity tests

Sample Number	Layer / Road	Temperature (°C) : Conductivity	Conductivity (mS/m)	Temperature (°C) : pH	pH Value
0560	TP06 (340-470mm)	25.0	21	25.0	4.1
0564	TP07	25.0	7	25.0	4.9
0565	TP10 (200-500mm)	25.0	7	25.0	4.4

The near-surface soils observed on-site are therefore expected to be generally corrosive. Table 7 below is provided to aid in the interpretation of pH and conductivity results modified after Duligal (1996).

Table 7: Influence of pH on the corrosiveness of soil

Soil conductivity			Potential of hydrogen	
Soil conductivity (µS/cm)	**Soil resistivity (Ohm.cm)**	**Corrosivity classification**	**pH**	**Potential Corrosiveness**
More than 500	0 – 2000	Extremely corrosive	7-8	Non-corrosive
250 – 500	2000 – 4000	Very corrosive	5-6 or 9-10	Mildly corrosive
200 – 250	4000 – 5000	Corrosive	3-4 or 11-12	Corrosive
100 – 200	5000 – 10000	Mildly corrosive	<3 or >12	Highly corrosive
Less than 100	>10000	Not generally corrosive		

10 EVALUATION OF GEOTECHNICAL PROPERTIES

One of the objectives of conducting a geotechnical site investigation is to characterize the site into site classes to give guidance on appropriate foundation loading and possible use as a construction material. The site classification characterizes the ground condition according to classes based on the severity of the anticipated differential movement. The site classifications in this instance are adopted from the NHBRC Home Building Manuals, SANS guidelines, SAICE code of practice, and SAIEG's guidelines for urban engineering investigations site classification units. These site classification parameters are adopted to obtain a basis for subdividing the site into various site classes and for appropriate foundation and material recommendations purposes across the site.

SANS recommendations were also used for the process of classifying the site. For planned development, the foundation recommendations are aligned with the single storey structures with a standard roof load. Geotechnical properties relevant to the development that were evaluated include:

- **Active soil –** Fine-grained soils (generally with high clay content) that change in volume in response to the change in moisture content. These soils may increase in volume (heave/swell) upon wetting and decrease in volume (shrink) upon drying out.
- **Collapsing settlement** – soils that exhibit sudden settlement under load when the soil is wetted.
- **Inundation –** areas that may be prone to flooding. These areas may occur near drainage channels such as rivers, streams, marshy areas, etc.
- **Consolidation settlement –** the vertical settlement or decrease in soil volume that occurs in soil under applied static load owing to the slow time-related reduction in the volume of the voids.
- **Compressible soils –** A soil whose bulk volume may gradually decrease with time when subjected to an applied load.
- **Excavatability –** areas where difficulty in excavation for either foundations or civil servicing may be experienced.
- **Groundwater table –** areas where a shallow groundwater table may be encountered.
- **Slope instability –** areas that may be susceptible to slope failures.
- **Problem soils –** areas that may occur in marshy zones, deep unconsolidated fills, and/or areas that may be underlain by dolomite related instabilities, etc.

Table 8: Residential site designation (adopted from the NHBRC Home Building Manual and the COP).

GEOTECHNICAL CATEGORY AND SITE CLASS DESIGNATION	GEOTECHNICAL CHARACTERISTICS
Active soils (heave/shrink) - (H) H H1 H2 H3	The expected range of total movement at the surface: < 5 mm 5 – 15 mm 15 – 30 mm > 30mm
Collapsible Soils – (C) C C1 C2	The expected range of total movement at the surface: < 5 mm 5 – 10 mm > 10 mm
Compressible soils (S) S S1 S2	The expected range of total movement at the surface: < 5 mm 5 – 15 mm > 15 mm
Excavation – (R) r1 r2 r3	 sub outcrop scattered outcrop and sub-outcrop outcrop, scattered outcrop and sub-outcrop
P – Problem soils	Dolomitic Areas, marshy areas, contaminated areas, abandoned borrow areas, landfill, mining subsidence and mine waste fill, shallow undermined areas, exploration pits.
Inundation and seepage – (W)	Wet area, drainage line, seepage zone

Table 8 above gives the basis of the soil site classification that was applied during the investigation. The table was adapted according to the site classification system detailed in the

NHBRC Home Building Manual, GFSH-2 document, SAIEG guidelines and the Code of Practice (COP) by the Joint Structural Division SAICE and IStructE. The designation for the excavatability class was further subdivided in this document to allow for various levels of difficulty in excavation.

Based on terrain types the GFSH-2 documents and the SAIEG guidelines subdivide areas that are earmarked for development according to Geotechnical Sub-Areas. These Geotechnical Sub-Areas indicate the development potential of the site with regards to various geotechnical, geological and geomorphological constraints. The GFSH-2 and SAIEG documents have identified three main Geotechnical Sub-Areas that are simplified in Table 11 below. These classifications appear with the site soil classifications as prefixes.

Table 9: Geotechnical Classification for Urban Development (adopted from the GFSH-2 and SAIEG)

Geotechnical Sub-Area	Definition
1	Areas recommended or favourable for the development
2	Areas where development can be considered with certain precautionary measures.
3	Areas that are not recommended for development

10.1. ACTIVE SOILS

10.1.1. Discussion

Active/expansive soils – soils that change in volume by expanding or shrinking as a result of the change in moisture content and are denoted as expansive soils (H) according to the SAICE/SAIGE site classes. The expansive soils can be classified as H1, H2, or H3 according to the severity of the predicted/anticipated volume change.

The site is underlain by transported soils (topsoil), residual material grading into soft rock granite.These materials were generally found exhibit low heaving potential .

10.1.2. Effect on the proposed development

From the site observations and laboratory results, the site is therefore considered to be inert.

10.2. ERODIBLE SOILS

10.2.1. Discussion

Erodible soils are soils affected by flowing water to physically remove particles from the exposed surface. Soil erodibility is an estimate of the ability of soils to resist erosion based on the physical characteristics of each soil. Silty sand encountered in the top horizon will exhibit some degree of erodibilty upon the removal of vegetation cover.

10.2.2. Effect on a proposed development

Basic surface water management should be sufficient to avoid concentrated water flow to successfully limit excessive soil erosion. This will be recommended, especially for the construction phases conducted during the wet season, to avoid concentrated water flow that is expected to result in erosion of the upper soil horizons and/or potential undercutting of structures.

Some of the water management methods may include but not limited to; construction of an apron slab or paved apron of nominal 5% slope around the building to direct water away from infiltrating directly below the foundation.

10.3. COMPRESSIBLE SOILS

10.3.1. Discussion

Consolidation settlement is the vertical settlement or decrease in soil volume that occurs in soil under an applied load owing to the time-related reduction in volume because of the dissipation of pore water.

Although no consolidation testing was conducted on the soil material, the material is generally comprised of loose to medium dense silty sands and as a result, it is anticipated to exhibit low compressibility potential. The site can be classified as **S** class according to (NHBRC) to accommodate the possibility of differential movement occurring due to the reduction in volume as a result of the dissipation of pore water.

10.3.2. Effect on the proposed development

From the site observations and laboratory results, the site is therefore considered to have minimal compressibility potential.

10.4. COLLAPSING SOILS

10.4.1. Discussion

Collapse settlement soils, denoted as **C**, are soils that have a potential for collapse and are commonly open-textured with a high void ratio. From the site observations it is therefore anticipated that the site will exhibit a medium to high collapse potential; **C1** according to SAICE and NHBRC soil site classification system.

10.4.2. Effect on the proposed development

The effects of the presence of collapsing in-situ soils could be mitigated by conventional compaction at the founding levels.

10.5. EXCAVATABILITY

10.5.1. Discussion

The ease of excavation is a critical financial factor when installing underground services and placement of foundations. This is of importance for urban development as increased costs are associated with installing services or foundations in areas where the difficulty is experienced with excavation.

The excavation characteristics of the different soil horizons have been evaluated according to the South African Bureau of Standards standardised excavation classification for earthworks (SABS – 1200D) and earthworks (small works – SABS 1200DA). In terms of this classification and the in-situ soil/rock consistencies as profiled, the relationships given below are generally applicable.

- “soft excavation” - very loose/very soft through to dense or stiff.
- “intermediate excavation” - very dense/very stiff through to very soft rock.
- “hard excavation” - soft rock or better.

10.5.2. Effect on the proposed development

<u>Foundation Excavations</u>

Excavations up to an average depth of 2.0 m should be possible throughout a substantial portion of the site for a TLB or a large (30 ton) excavator with a rock bucket to excavate into closely jointed soft rock biotite gneiss. The site can be classified as “**intermediate to hard excavation**”.

<u>Bulk services</u>

The site can be classified as “**intermediate to hard excavation”** for the installation of underground services.

The following additional comments on the excavation of service trenches apply:

- Trenches near the non-perennial streams may have to be dewatered, especially after heavy precipitation events.
- The sidewalls of deep excavations should preferably be shored to prevent injury or death due to sidewall failure.

10.6. FLOODLINES

10.6.1. Discussion

A 1:50 year flood line implies that an area below that line has a high probability of being flooded at least once in every fifty years. A similar contextual definition applies to the 1:100-year flood line.

By law, residential development below the 1:50 year flood line areas is prohibited. This is due to the risk of flooding leading to property damage, health and life hazards, inconveniences, etc. If in existence within the Village establishment limits, these areas could, however, be used for recreational purposes or other similar low-risk facilities.

Flood lines were not determined as part of this geotechnical investigation, however, confirmation for the floodline will be required.

10.6.2. Effect on the proposed development

A Competent Hydrologist should determine areas of the site that fall within the floodlines and wetlands as this will have an implication on the developable area of the site and could also have an impact on the cost of construction.

10.7. SLOPE STABILITY

The slope across the study area varies from a relatively flat to gently sloping topography, with the average slopes of less than 5%. Temporary shallow excavations are likely to be generally stable at near-vertical angles due to significant cohesion in the soils but deep excavations exceeding 1.5 m high should be assessed by the engineer and/or a geotechnical specialist, especially if a perched water table is encountered.

Deep excavations are recommended at the slope angle of 1 vertical is to 0.5 to 1.0 horizontal with a maximum slope angle at 1:1. Shoring, anchoring, and battering of upper topsoil is also recommended for deep cuttings.

10.8. UNSTABLE NATURAL SLOPES

10.8.1. Discussion

This refers to an area comprising unstable geological materials that can move either gradually (creep) or suddenly as a slump or a slide.

The risk of movement is determined by factors such as the nature of the slope (solid rock, transported materials), the gradient of the slope, the role of water, type and nature of vegetation cover, seismicity, and impact of human activities such as undermining of a slope.

10.8.2. Effects on the proposed development

Any unstable slopes that may be encountered across the study area should be assessed by a Competent Geotechnical Engineer for the proposed construction.

10.9. UNDERMINED GROUND

According to the Mineral Map and Geological Map of South Africa, the stratigraphy underlying the boundaries of this village is not known to host minerals of economic value.

10.10. GROUNDWATER

10.10.1. Discussion

No groundwater seepages were observed. However, it should be noted that the comments on perched groundwater conditions are based on observations made at the time of the investigation (March 2022). Variations on seepage conditions could occur due to seasonal changes and drainage conditions.

10.10.2. Effect on the proposed development

A shallow perched water table might form during the wet season which could require dewatering solutions during construction. Stringent stormwater management precautionary measures and stormwater infrastructure should for part of the proposed construction.

10.11. REGIONAL SEISMIC RISK

The regional seismic hazard in the study area can be defined as LOW, exhibiting a 10% probability of a seismic event with a peak ground acceleration that will exceed 0.32 G within 50 years (Figure 9).

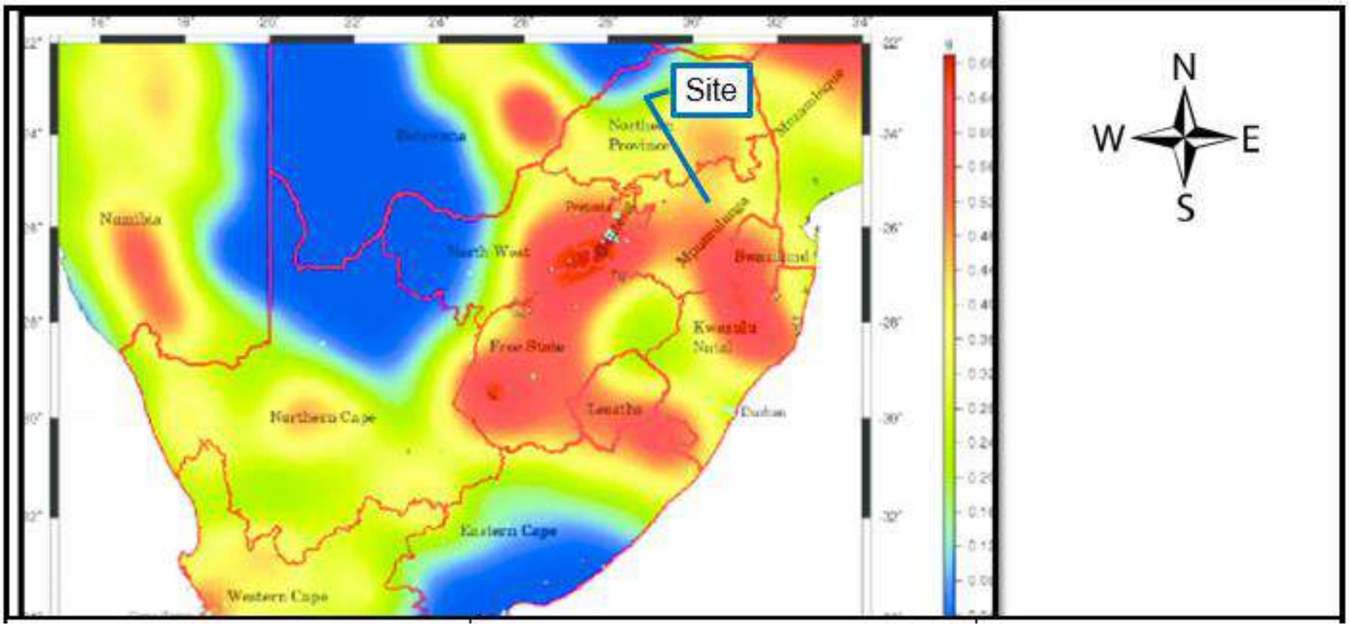


Figure 8: Seismic map of South Africa showing that the project area seismic hazard is low.

10.12. CORROSIVITY

Based on the laboratory test results the soils are generally corrosive. It is recommended that moderate precaution is undertaken when buried services are installed.

11 PRELIMINARY SITE CLASSIFICATION

The impact of the geotechnical constraints on housing development may be evaluated according to Table 10 which is a summary of the general geotechnical constraints relevant to housing development. The class column indicates the severity of the specific constraint for the site (SANS 634).

Table 10: Kwaggafontein 216-JR geotechnical constrains for Urban development.

Geotechnical constraint		Site Condition	Class
A	Collapsible soil	Any collapsible horizon or consecutive horizons with a depth of more than 750mm in thickness	2
B	Seepage	Permanent or perched water table more than 1.5m below ground surface	1
C	Active Soil	Low soil-heave potential anticipated	1
D	Highly compressible soil	moderate soil compressibility anticipated	1
E	Erodibility of soil	Low to medium erodibility due to dispersive character of loose uncontacted residual soils	1(2)
F	Difficulty of Excavation to 1.5m depth	The difficulty of Excavation to 1.5m depth due to presence of potential corestone within the weathered profile i.e. Rock or hardpan pedocretes between 10 and 40% of the total volume	1
G	Undermined ground	Undermining at a depth greater than 240m below surface (except where total extraction mining has not occurred)	1
H	Stability:(Dolomite & Limestone)	Possibly stable. Areas of dolomite overlain by Karoo rocks or intruded by sills. Areas of Black Reef rocks. Anticipated Inherent Risk Class I	1
I	Steep slopes	Between 2 and 6 degrees (all regions)	1

Geotechnical constraint		Site Condition	Class
J	Areas of unstable natural slopes	Low risk, except southern boundary	1
K	Areas subject to seismic activity	10% probability of an event less than 100cm/s^2 within 50 years	1
L	Areas subject to flooding	Low lying areas, areas the toe of the concave slopes and areas adjacent to the 1:50 year floodlines of an ephemeral tributary A "most favourable" situation for this constraint does not occur.	1

Key: Class: 1-Most favourable; 2-Intermediate and 3-Least favourable

Summary of constraints to be considered for development:

- Collapsible soil : 2A
- Erodible soils : 2E

11.1. CLASSIFICATION AND SITE ZONATION

Based on the NHBRC Manual (2015) site class designation, the distribution of the geotechnical layers identified during the investigation is the same both in areal coverage and vertical cross-section throughout the extent of the investigated area. In this regard, the entire project area is designated as NHBRC Site Class, Zone A: C1 line as shown in Figure 10.

Zone A: C1

This zone is predominantly characterized by transported soils underlain by residuals soils (silty clayey sand) with depth. The overall consistency of this material is dense (very dense in places) with isolated areas exhibiting a shallow or rock on surface (**R**). The overlying soils are expected to have low expansive and medium collapse potential with soil movement of between 5mm and 10 mm due to collapsible/consolidation settlement under light loading (i.e., under loads typically not exceeding 50 kPa).

Zone B: 3W

This zone depicts areas along existing wetlands. This area is inferred to be prone to flooding during or after prolonged heavy rainfalls.

In this light, the position of the 1: 100-year flood line and possibly wetland delineation in some areas of the project area must be determined and the boundaries of this zone be adjusted accordingly by a Competent Hydrologist.

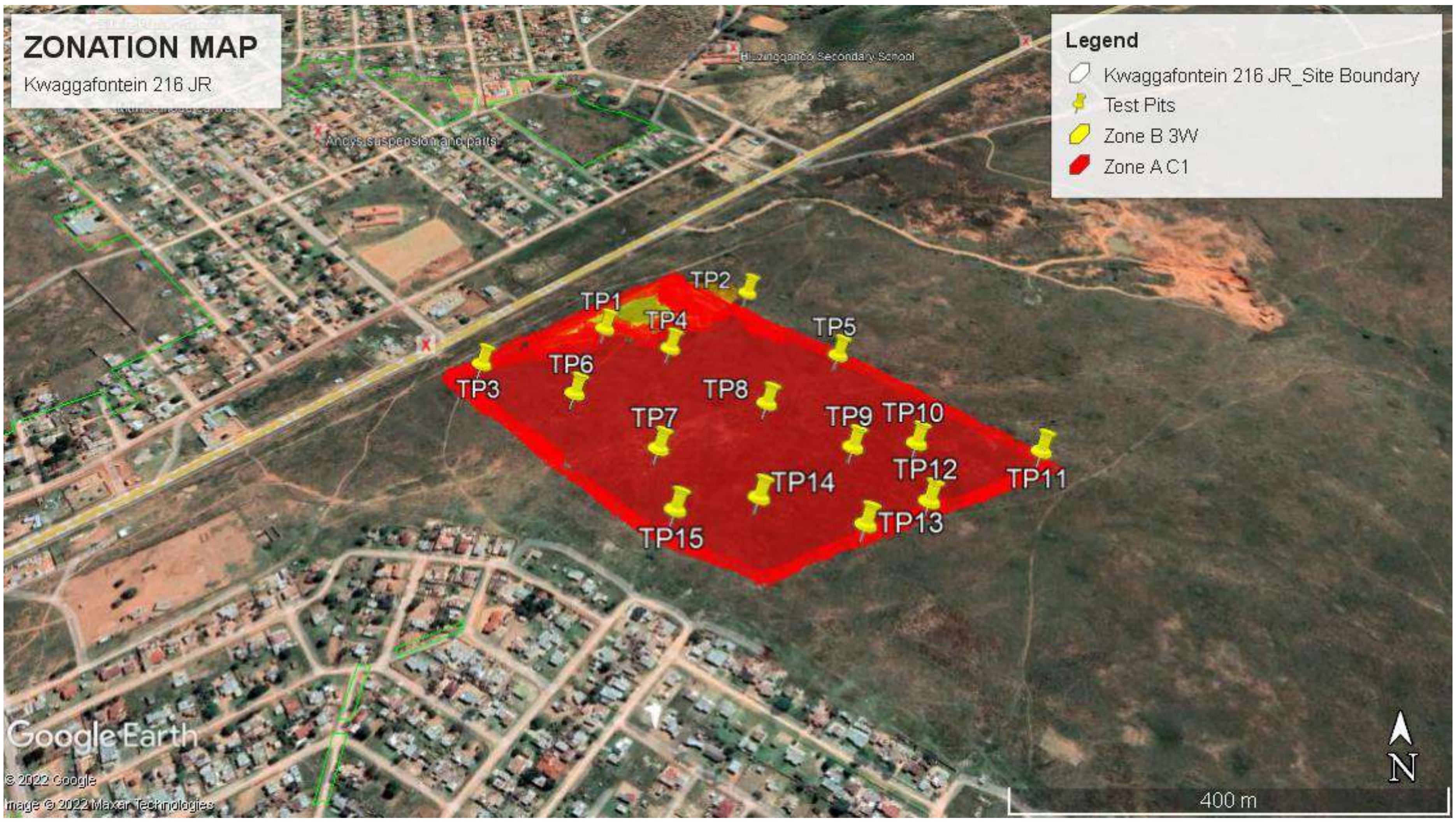


Figure 9: Zonation map of Kwaggafontein 216-JR

12 FOUNDATION CONSTRUCTION RECOMMENDATIONS AND SOLUTIONS

12.1. SANS STANDARDS

The foundation construction types are generally designed in accordance with South African National Standards. It is recommended that townships should be designed and constructed in accordance with SANS requirements.

- SANS 2001-CM2, Construction works – Part CM2: Strip footings, pad footings and slab-on-the ground foundations for masonry walling.
- SANS 10400-A, The application of the National Building Regulations – Part A: General principles and requirements.
- SANS 10400-B: 2012, The application of the National Building Regulations – Part B: Structural design.
- SANS 10400-J, The application of the National Building Regulations – Part J: Floors.
- SANS 10400-K, The application of the National Building Regulations – Part K: Walls.
- SANS 10400-H, The application of the National Building Regulation- Part H: Foundations.
- SANS 2001-CM2 and SANS 10400H, edi1, Construction works – Part CM2: Strip footings, pad footings and slab-on-the-ground foundations for masonry walling.

12.2. POTENTIAL LAND USE

12.2.1. Zone A (C1)

Geotechnical results indicate land can be used for the proposed development, as per recommended foundations and precautionary measures.

12.3. COMPETENT FOUNDING LEVEL AND ALLOWABLE BEARING PRESSURE

The loose to medium dense topsoil is considered to be potentially collapsible. This material is therefore considered unsuitable for use as founding layers, even for the proposed lightly loaded structures.

The medium dense to dense residual is considered to be competent founding levels with a design bearing pressure limited to 75 kPa. These levels were encountered at depths varying from 0.28 m to 1.6 m below the existing ground level.

12.4. FOUNDATION RECOMMENDATIONS

The following founding solutions are recommended considering the variable depth and properties of the soils encountered on site.

12.4.1. Zone A: C1

Option 1: Modified Normal

- Reinforced strip footings
- Articulation joints at some internal and all external doors
- Light reinforcement in masonry

- Site drainage and service and plumbing precautions
- Foundation pressure not to exceed 75 kPa

Option 2: Compaction of in-situ soils below individual footings

- Remove in-situ material below foundations to a depth and width of 1,5 times the foundation width or a suitable soil horizon and replace with material compacted to 93 % MOD AASHTO density at –1 % to +2 % of optimum moisture content
- Normal construction with light reinforcement in masonry
- Normal construction with drainage

Option 3: Soil raft

- Based on the variability in soil consistency encountered across the extent of the site (and possible corestones in the loose residual material) suitably designed reinforced raft foundations constructed within the upper in situ soils could be considered.

12.5. SLOPING SITES

On sloping sites steeper than 1:4 where landslip is not a consideration, the site shall be cut or backfilled (or both). The backfill will comprise of G7 or better material in-order to achieve good compaction. Compact the in-situ subgrade prior to backfill in layers, not greater than150 mm thickness, to 93% Mod AASHO density, at -1% to +2% of optimum moisture content. The density can be verified utilizing Nuclear density tester / Dynamic Cone Penetration test.

For erosion control, the backfill must be extended to at least 1 m beyond the footprint of the structure and has a side slope not steeper than 1:1 concerning the horizontal, and the slope of the fill is covered with a lightly compacted material, 90% Mod AASHTO density at -1% to +2% of optimum moisture content.

For final platform finishes, the external slope should be reduced to 1:2 in-order for the gradient to encourage drainage of stormwater and garden irrigation water to drain away from the structure.

The site may be terraced in conjunction with the requirements stipulated above in-order to reduce the extent of the excavation or fill, provided that at the change of elevation, the ground behind any step is adequately drained and the steps waterproof.

The subsurface drains that might be required to prevent the passage of moisture into the interior of the building footprint shall be designed by a Competent Person.

12.6. MATERIAL USAGE

<u>Residual</u>

The residual shale material is generally composed of slightly moist to moist, clayey to silty sand or gravelly sand. Based on the COLTO Guidelines, the sample classifies as G7, G9 & G10 quality material and is considered suitable for both uses as a selected layer and subbase according to TRH14 Guidelines (1987).

12.7. EARTHWORKS

Foundations should be constructed on a competent horizon. Where platforms are required, inert material (at least G7) should be used as compacted backfill provided the material complies with the requirements in SANS requirements.

Any uncontrolled fill is deemed unsuitable to carry loads and should be removed during site clearing and initial earthworks. The material should be replaced with inert material compacted in layers at optimum moisture content to the underside of foundations and surface beds.

Any constructed embankments exceeding 1.5 m, or as deemed necessary by the design engineers, must be stabilized utilizing retaining walls. Embankments should be adequately compacted and protected from erosion.

Old backfilled excavations (such as geotechnical test pitting) are likely to be encountered across the site and these should be cleaned out of all loose material and backfilled with appropriate gravel to densities not less than 95% mod AASHTO.

12.8. PRECAUTIONARY MEASURES

Precautionary measures for the area should include:

- Extensive site drainage and plumbing/service precautions.
- Cut off drains and subsoil drains at strategic locations for the shallow perched water table encountered during the investigation.
- Damp-proofing.
- The site must be graded to prevent ponding of stormwater.
- 1.5 m apron around the structures to prevent water ingress under the immediate area or the foundation.
- Walkways and driveways must be paved to allow easy access to the building during wet seasons.
- Planting of grass/lawn on the stands may be considered to prevent erosion.
- Care must be taken with foundation designs where foundations straddle different soil mediums such as dense horizons and loose soil.

13 CONCLUSIONS

Ba Vince Group (Pty) Ltd was requested by Imvunulo Investments to conduct a geotechnical investigation for the proposed enrolment of a Solar Farm within Village Kwaggafontein 216-JR in the Thembisile Hani Local Municipality.

The contour lines on the 2528 BB topographic map of the scale 1:50 000 show that the area is characterized by an average slope of 4.9% The area attains an elevation of approximately 1404m and 1377 m above mean sea level (a.m.s.l).

Eleven (11) of the Fifteen (15) test pits were excavated to depths of between 0.1 m and 1.6 m. The investigation revealed that the site is characterized by transported and residual soil encountered up to a depth of 1,6 m.

Excavation of shallow foundation and service trenches up to an average depth of 2.0 m is not possible utilizing a TLB-type light mechanical excavator (i.e., 'intermediate to hard class') across the project area.

Groundwater seepage was not observed. However, variations in seepage conditions could occur due to seasonal changes and drainage conditions. As a result, the suitable measures must be implemented to mitigate the possible rising damp across the entire site.

The entire site was classified as zone (Zone A: C1 and Zone B:3W) and is considered to be developable. It is recommended that a competent person inspect all foundation trenches before construction to identify and evaluate any soil characteristics in variance with that found during this investigation.

This report is based on point data (selected positions) collected during the fieldwork phase. This data was extrapolated across the study area. For this reason, site conditions may vary (for better or worse) from that present in this report. Trenches and excavations should, therefore, be overseen by a Competent Engineer to identify and assess any variance in the geotechnical character exposed in these trenches and provide final approval.

A detailed GFSH-2 Phase 2 site investigation is mandatory to be conducted to finalize NHBRC site class designations for each erf based on the results of this report.

14 REFERENCES

1. Architectural Services Department 2012 Edition-General specification for building
2. Bahrain Ministry of Housing May 2010: Standard specification for housing Projects-Part 1
3. Brink A.B.A. and Bruin R.M.H. 1990. Guidelines for Soil and Rock Logging in South Africa, 2nd Impression 2002, Proceedings, Geoterminology Workshop organised by AEG, SAICE and SAIEG.
4. Dewandel, B., Lachassagne, P., Wyns, R., Marechal, J.C. and Krishnamurthy, N.S. 2006. A generalized 3-D geological and hydrogeological conceptual model of Tonalite aquifers controlled by single or multiphase weathering. Journal of Hydrology.
5. Duligal, E., 1996. Significance of Soil Resistivity on Corrosivity, Duligal E. Unpublished report compiled for Africon
6. Geotechnical site investigations for housing developments. Project Linked Greenfield Subsidy Project Developments: Generic Specification GFS. September 2002.
7. Identification of problematic soils in Southern Africa – Technical notes for Civil and Structural Engineers PW2006/1. June 2007.
8. Jennings, J.E., Brink A.B.A and Williams A.A.B. 1973. Revised guide to soil profiling for civil engineering purposes in Southern Africa.
9. Matthys A. Dippenaar and J. Louis van Rooy. 2014. Review of engineering, hydrological and vadose zone hydrological aspects of the LanseriaTonalite, Goudplaats-Hout River Tonalite and Nelspruit Suite Tonalite (South Africa). Department of Engineering Geology, University of Pretoria.
10. Mucina, and Rutherford, M.C. 2011. Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
11. Partridge, T.C., Wood C.K. and Brink A.B.A. 1973. Priorities for urban expansion within the PWV metropolitan region. The primary of geotechnical constraints. South African Geographical Journal.
12. SANRAL (2010): Standard specification for Subsurface investigations.
13. SANS 10400-H: The application of the national building regulations — part H: Foundation
14. SANS 1936 Part 1-4 Development of dolomite land.
15. SANS 634. 2012. Geotechnical investigations for township development.
16. SANS code of Practice based on SANS 634 Geotechnical Investigations for Township Development.
17. The Geotechnical Division of SAICE – The Safety of Persons Working in Small Diameter Shafts and Test Pits for Geotechnical Engineering Purposes.
18. Weinert, H.H. 1980. The natural road construction materials of Southern Africa. Academia, Cape Town.

15 APPENDIX A

Test Pit Photographs

Soil Profiles

Laboratory Soil Testing Results

Maps

16 APPENDIX B

Site Boundaries as Determined By Client

VISUAL IMPACT ASSESSMENT AND SOCIAL IMPACT ARE IN PROGRESS

APPENDIX D: PPP

RESULTS FOR PUBLIC PARTICIPATION WILL BE INCLUDED ON THE FINAL BAR & EMPR AFTER THE LAPSING OF COMMENTING PERIOD.

APPENDIX E: EAP UNDERTAKING

UNDERTAKING BY THE EAP

UNDERTAKING in terms of Appendix 2 (Section 2i and 2j) of the Environmental Impact Assessment (EIA) Regulation, 2014 (as amended):

I, Sedzani Mulaudzi, the Environmental Assessment Practitioner (EAP) responsible for compiling this Basic Assessment Report (BAR) and Environmental Management Programme (EMPR), undertaken that:

- The information provided herein is correct;
- The comments and inputs from stakeholders and I&APs will be recorded and included in the Final BAR and EMPR;
- Any information and responses provided to stakeholders and I&APs by the EAP will be correct

Signed on the 12 day of July 2022

…………………………………………
Sedzani Mulaudzi
Maphaha Projects and Investments (Pty) Ltd

APPENDIX F: EMPR

Maphaha Projects and Investments (Pty) Ltd
99 Bushypark, Mashamba, 0942
Sedzani Mulaudzi
Tell: 076 560 8193
Fax: 0864714904
Email: sedzani@mukhadakhomu.com

DRAFT

ENVIRONMENTAL MANAGEMENT PROGRAMME

FOR

THE PROPOSED SOLAR FARM AT THE FARM KWAGGAFONTEIN 216 JR PORTION OF PORTION 0 IN KWAGGAFONTEIN WITHIN THEMBISILE HANI LOCAL MUNICIPALITY IN MPUMALANGA PROVINCE.

PREPARED BY: MAPHAHA PROJECTS AND INVESTMENT (PTY) LTD

APPLICANT: IMVUNULO INVESTMENT (PTY) LTD

ERF 2075 Phola, Witbank, 2233
CELL: 063 061 4483
EMAIL: aaron@saamfox.co.za

JULY 2022

Contents

DOCUMENT CONTROL

Client:	Imvunulo Investment (Pty) Ltd.
Report Title:	ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED SOLAR FARM AT THE FARM KWAGGAFONTEIN 216 JR PORTION OF PORTION 0 IN KWAGGAFONTEIN WITHIN THEMBISILE HANI LOCAL MUNICIPALITY IN MPUMALANGA PROVINCE.
Report No:	II-MPI_0012022SF
Version:	1.0
Date issued:	
PreparedBy:	Sedzani Mulaudzi
Reviewed by:	Nkhangweni Mulaudzi

A. PROJECT DESCRIPTION

A.1 Introduction

Imvunulo Investment (Pty) Ltd is proposing to develop 8 MW Solar Photovoltaic (PV) Facilities and associated electrical infrastructure (including a 22 kV cable trenches from PV Facility to the Eskom Kwaggafontein Substation). The proposed project is located on portion 0 of the farm Kwaggafontein 216 JR and the connection points to the Eskom Kwaggafontein Substation on the very same farm. The proposed project is approximately 11 km east of Kwaggafontein Mall and within Thembisile township within the Thembisile Hani Local Municipality, Mpumalanga Province.

A.2 Project overview

A.2.1 General Overview

Table A2.1 Location characteristics

PV Plant location characteristics	
City / Town	Kwaggafontein
Region	Mpumalanga
Country	South Africa
Latitude	-25.30 °
Longitude	+28.96 °
Altitude	1393.21 m a.m.s.l.
Time zone	UTC +2

Figure A.1.1 Project location

Figure A.1.2 Project location: closer view in the region

The proposed Solar PV facilities will be developed with a possible maximum installed capacity of 8 MW of electricity from PV solar energy. Solar PV facility will contain an on-site substation that will connect to the Eskom Kwaggafontein Substation via 22 kV cable trenches. The locality of the project is shown Figure A.2 below.

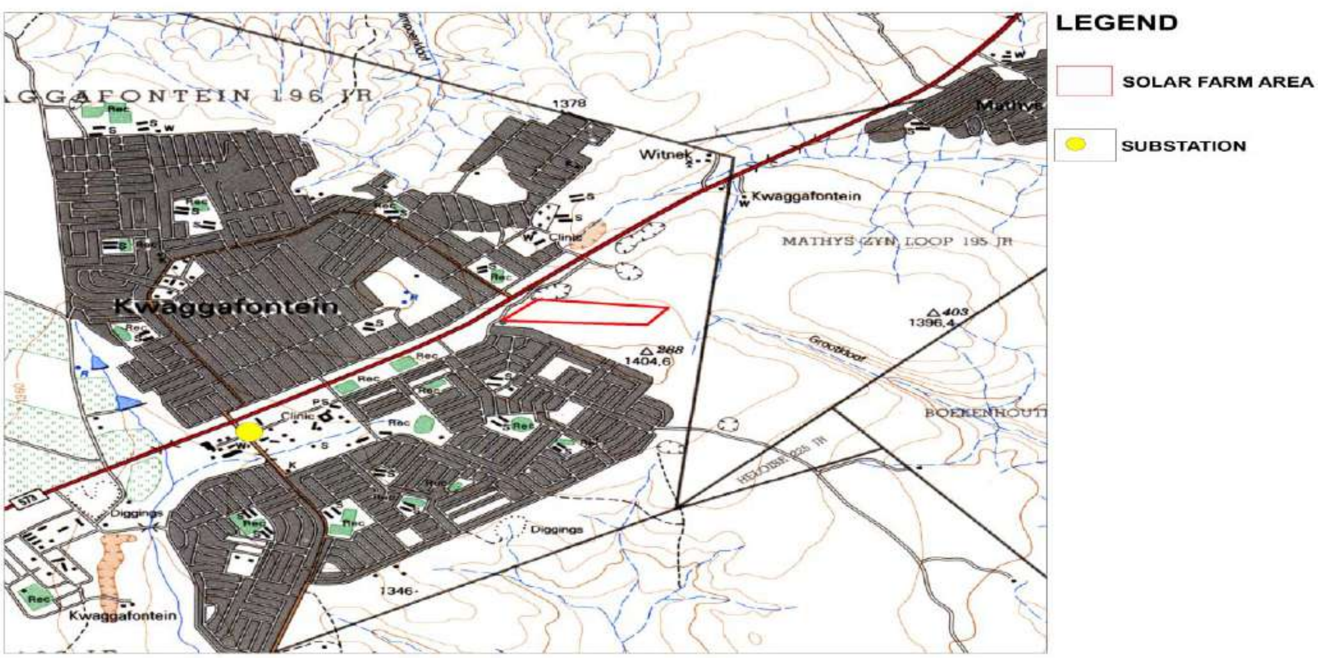


Figure A.2. Project locality map

B. EMPR LEGISLATIVE REQUIREMENTS

Appendix 4 of Regulation 326 of the 2014 EIA Regulations contains the required contents of an Environmental Management Programme (EMPr). The checklist below serves as a summary of how these requirements were incorporated into this EMPr.

Requirement	Description
Details of the EAP who prepared the EMPr; and; The expertise of the EAP to prepare an EMPr, including a curriculum vitae.	This EMPr was prepared by Sedzani Mulaudzi of Maphaha Projects and Investments who has more than 8 years' experience as an Environmental Assessment Practitioner. The CV of the EAP is attached in appendix I.
A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	This EMP covers all aspects of the project. • PV Arrays and Mounting Structures; • inverter stations; • on-site substation; • grid connection • auxiliary buildings, • electrical reticulation network (underground cabling) • internal road / track network; • access road; • perimeter fencing.
A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers	The Site Development Plan attached in Appendix A, No sensitive features has been identified.
A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all the phases of the development including – (i) Planning and design; (ii) Pre-construction activities; (iii) Construction activities; (iv) Rehabilitation of the environment after construction and where applicable post closure; and (v) Where relevant, operation activities.	Sections 1.3
A description and identification of impact management outcomes required for the aspects contemplated above.	Sections 4 -11

A description of the proposed impact management actions, identifying the way the impact management objectives and outcomes contemplated above will be achieved and must, where applicable include actions to – (i) Avoid, modify, remedy control or stop any action, activity or process which causes pollution or environmental degradation; (ii) Comply with any prescribed environmental management standards or practises; (iii) Comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.	Sections 4 -11
The method of monitoring the implantation of the impact management actions contemplated above.	Sections 4 – 11 and section 14
The frequency of monitoring the implementation of the impact management actions contemplated above.	Sections 4 – 11 and section 14
An indication of the persons who will be responsible for the implementation of the impact management actions.	Sections 4 – 11
The time periods within which the impact management actions must be implemented.	Sections 4 – 11 and section 14
The mechanism for monitoring compliance with the impact management actions.	Section 2 and 4-11
A program for reporting on compliance, considering the requirements as prescribed in the Regulations.	Section 2
An environmental awareness plan describing the way – (i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment.	Section 5.2
Any specific information that may be required by the competent authority.	None.

C.DFFE COMMENT ON EMPR

This Draft EMPr is submitted to the DFFE simultaneously to the I&AP review period. Any comments received by the DFFE will be incorporated into the final version submitted for approval.

1. INTRODUCTION

Maphaha Projects and Investments has been appointed by the Applicant, Imvunulo Investment (Pty) Ltd, as the independent Environmental Assessment Practitioner (EAP) responsible for compilation of the Environmental Management Programme (EMPr) for the proposed Imvunulo-Kwaggafontein solar PV project.

This EMPr is submitted in compliance with the National Environmental Management Act (NEMA, Act 107 of 1998, as amended).

The key purpose of this EMPr is to ensure that the remedial and mitigation requirements identified are implemented during the lifespan of the project (design to decommissioning). The EMPr is thus a management tool used to minimise and mitigate the potential environmental impacts, while maximising the benefits.

A detailed description of the proposed project and a description of the affected environment are provided in the Basic Assessment Report (BAR) which should be referred to where necessary.

1.1. APPROACH TO THE EMPR

This EMPr addresses the environmental management of the four key phases of the project, namely:

- The design and pre-construction phase;
- The construction phase;
- The operation phase; and
- The closure and decommissioning phase.

1.1.1. Pre-construction Phase

The pre-construction phase of the development refers to the final layout design considerations and the site preparation (fine-scale design and placement, survey of development site and associated infrastructure, demarcation of no-go areas, establishment of site camp and laydown area, vegetation clearing for establishment of internal road network).

1.1.2. Construction Phase

The construction phase of the development refers to the earthworks and the actual construction of the civil works (installation of the PV panel arrays, construction of internal roads, stormwater structures and auxiliary buildings and on-site substation), as well as the external infrastructure such as MV cable trenches, access roads and gate house. The construction phase will start with the perimeter fencing of the facility and will end with final landscaping and re-vegetation / rehabilitation of the site and surrounding areas.

1.1.3. Operation Phase

The operational phase commences once the facility starts providing power into the national grid (i.e., at Contractual Operation Date). There may be a stage where both construction and operation activities overlap i.e., occur on site at the same time. The operation phase included the monitoring and maintenance activities required for the efficient functioning of the facility (e.g., cleaning and repair of solar arrays, brush-cutting of vegetation etc.), as well as health and integrity of the surrounding environment (e.g., removal alien vegetation, management of erosion etc.).

1.1.4. Closure and Decommissioning Phase

Closure and decommissioning refers to the decommissioning of the panel arrays at the end of their operational lifespan or at the end of the term of the Power Purchase Agreement (PPA). For the purpose of this report, two possible scenarios are considered, namely:

- The re-use, repair &/ upgrade of the facility for alternative power generation;
- The total decommissioning of the solar facility.

1.2. PURPOSE

This EMPr is relevant to the proposed solar PV renewable energy project, and all listed and specified activities necessary for the realisation of this project.

1.3. OBJECTIVE

The objective of this EMPr is to prescribe project specific and generally accepted impact management outcomes and impact management actions associated with the development of the kwaggafontein solar PV project and associated infrastructure.

To ensure compliance with the EIA Regulation, the following overarching outcomes are applicable:

- To ensure the least possible damage to:
    - Existing infrastructure on and adjacent to the site;
    - Indigenous flora and fauna (biophysical environment); and
    - Water quality of surface and groundwater on and surrounding the site.
- To ensure that construction and development are undertaken with due consideration to all environmental factors; and
- Where such damage occurs, provision is made for re-instatement and rehabilitation.

1.4. SCOPE

The scope of this EMPr applies to all construction, operation and decommissioning requirements for the Kwaggafontein solar PV project. This EMPr applies to all listed and specified activities that are necessary for the realization of this project.

1.5. EMPR APPROVAL AND REVISIONS

This EMPr, once approved, is a legally binding document and contravention with this document constitutes a contravention with the Environmental Authorisation.

The plans annexed to this EMPr must be read in conjunction with this EMPr.

The EMPr may however require amendment at certain stages through the lifespan of the project. The incidences which may require the amendment of this document include:

- Changes in environmental legislation;
- Results of post-construction monitoring and audit;
- Per instruction from the competent authority; and
- Changes in technology and best practice principles.

It must be noted that any amendments to the EMPr actions that do not change the impact management outcomes or objectives may be immediately affected by the holder of the EA and submitted in the next environmental audit report submitted in terms of the regulations. Any amendments to the impact management outcomes need to be formally approved by the competent authority before they can be effected.

1.6. CONTRACTUAL OBLIGATIONS

This EMPr must be included in ALL tender and contract documentation associated with this project. It must be noted that this EMPr is relevant and binding not only on the activities associated with the construction of the PV project, but also for all associated infrastructure to be authorised as part of the EA.

1.7. ORGANISATIONAL STRUCTURE AND RESPONSIBILITIES.

In order to ensure effective implementation of the EMPr, it is necessary to identify and define the organisational structure for the implementation of this document.

The proposed organisational structure during construction is as follows:

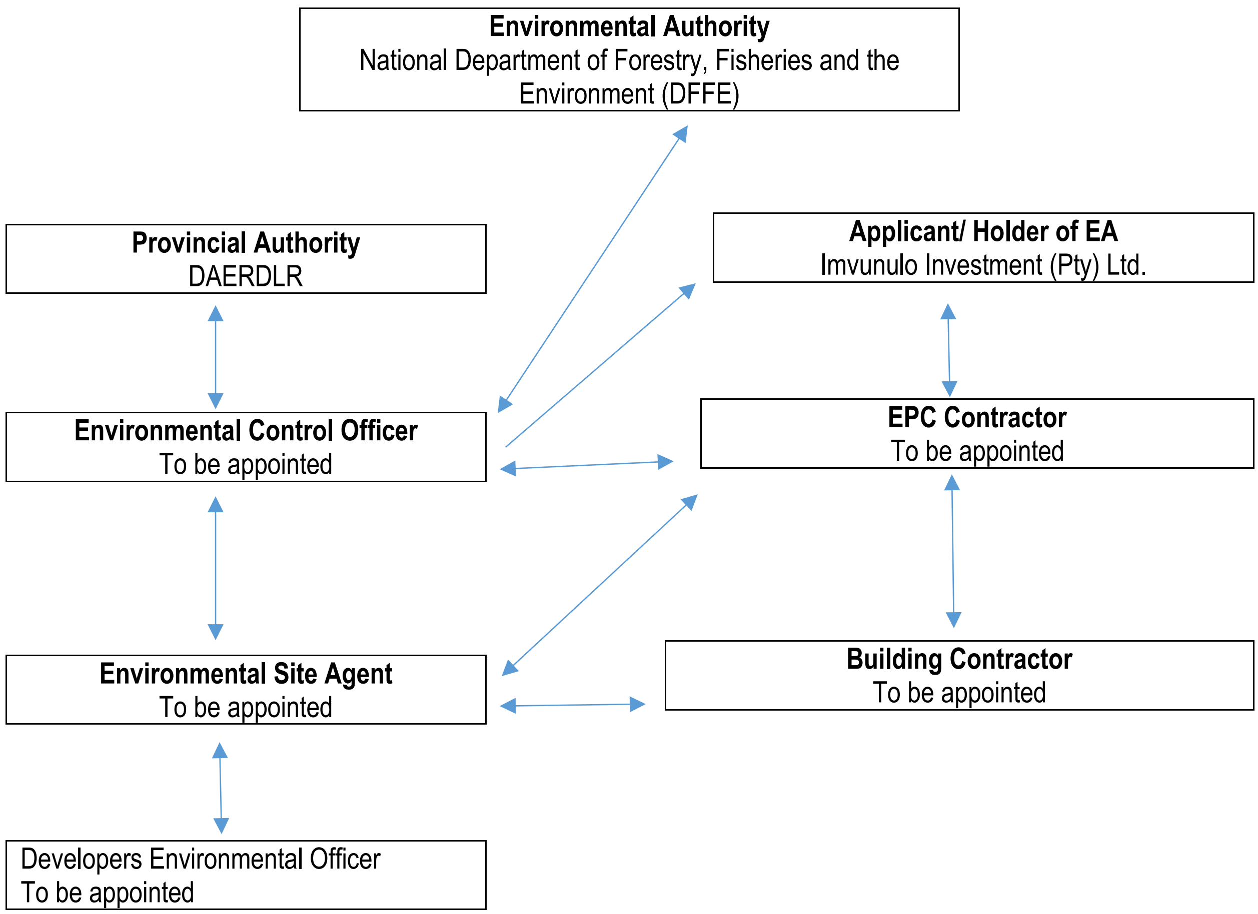


Figure 1: EMPr organisational structure during the construction phase

The proposed organisational structure during the operation of the facility is as follows:

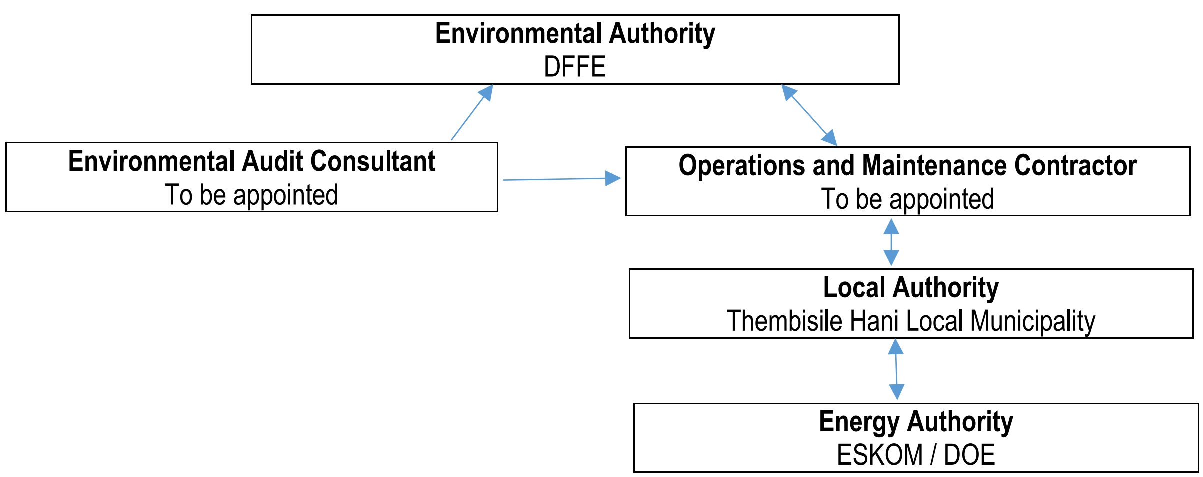


Figure 2: EMPr organisational structure during the operation phase.

Details regarding the roles and responsibilities of the various parties in these organisational structures are included in the table below.

The effective implementation of this EMPr is dependent on established and clear roles, responsibilities and reporting lines. This table below gives guidance to the various environmental roles and reporting lines,

Table 1: Guide to roles and responsibilities for implementation of an EMPr

Responsible Person(s)	Role and Responsibilities
Holder of the EA	<u>Role</u> The holder of the EA is ultimately accountable for ensuring compliance with the EMPr and any conditions of approval from the competent authority. An environmental control officer (ECO) must be contracted by the Project Developer to objectively monitor the implementation of the EMPr according to relevant environmental legislation. The holder of the EA is further responsible for providing and giving mandate to enable the ECO to perform responsibilities and must ensure that the ECO is integrated as part of the project team while remaining independent. <u>Responsibilities</u> - Ensure that all stipulations within the EMPr are communicated and adhered to by the EPC; - Issuing of site instructions to the EPC for corrective actions required; - Monitor the implementation of the EMPr throughout the project by means of site inspections and meetings. Overall management of the project and EMPr implementation; and - Ensure that periodic environmental audits are undertaken on the project implementation.
Principle Environmental Control Officer (ECO)	<u>Role</u> The Holder of the EA (SPV) must appoint an ECO in terms of EIA Regulation. The ECO must be independent of the holder of the EA and the EPC and have appropriate training and experience in the implementation of environmental management specifications. The primary role of the ECO is to act as an independent quality controller and monitoring agent regarding all environmental concerns and associated environmental impacts. In this respect, the ECO is to conduct monthly site inspections, attend regular site meetings, pre-empt problems and suggest mitigation and be available to advise on incidental issues that arise.

	The ECO is also required to prepare internal compliance audits (in the form of the monthly control report), verifying the weekly environmental checklists submitted by the ESA. The ECO provides feedback to the Holder of the EA and the competent authority regarding all environmental matters. The EPC and the holder of the EA are answerable to the Environmental Control Officer for non-compliance with the Specifications as set out in the EMPr. The ECO provides feedback to the holder of the EA, who in turn reports back to the EPC, as required. Issues of non-compliance raised by the ECO must be taken up by the holder of the EA and resolved with the Contractor as per the conditions of their contract. Decisions regarding environmental procedures, specifications and requirements which have a cost implication (i.e., those that are deemed to be a variation, not allowed for in the EMPr specification) must be endorsed by the Holder of the EA. <u>Responsibilities</u> The responsibilities of the ECO will include the following: - Be aware of the findings and conclusions of all EA conditions related to the development; - Be familiar with the recommendations and mitigation measures of this EMPr; - Manage and review all reporting undertaken by the ESA. - Be conversant with relevant environmental legislation, policies and procedures, and ensure compliance with them; - Undertake regular (at least monthly) and comprehensive site inspections / audits of the construction site according to the generic EMPr and applicable licenses in order to monitor compliance as required; - Compilation and administration of Environmental control reports to ensure that the environmental management measures are implemented and are effective; - Monitoring the performance of the Contractors and ensuring compliance with the EMPr and associated Method Statements; - In consultation with the holder of the EA order the removal of person(s) and/or equipment which are in contravention of the specifications of the EMPr and/or environmental licenses; - Liaison between the Holder of the EA, EPC contractor, authorities and other lead stakeholders on all environmental concerns; - Compile a monthly environmental control report highlighting any non-compliance issues as well as satisfactory or exceptional compliance with the EMPr; - Validating the weekly environmental checklists, which are to be prepared by the ESA; - Checking the ESA's record of environmental incidents (spills, impacts, legal transgressions etc.) as well as corrective and preventive actions taken;

	- Checking the EPC's public complaints register in which all complaints are recorded, as well as action taken; - Assisting in the resolution of conflicts; - In case of non-compliances, the ECO must first communicate this to the Senior Site Supervisor, who has the power to ensure this matter is addressed. Should no action or insufficient action be taken, the ECO may report this matter to the authorities as non-compliance - Maintenance, update and review of the EMPr; - Communication of all modifications to the EMPr to the relevant stakeholders - Review and approval contractors method statements.
Site Environmental Control Officer / Environmental Site Agent (ESA)	<u>Role</u> The Holder of the EA must appoint an independent ESA in terms of this EMPr. The ESA must be independent of the holder of the EA and the EPC, report directly to the ECO and have appropriate training and experience in the implementation of environmental management specifications. The primary role of the ESA is to act as a full-time independent quality controller and monitoring agent regarding all environmental concerns and associated environmental impacts. In this respect, the ECO is to conduct daily site inspections, attend regular site meetings, pre-empt problems and suggest mitigation and be available to advise on incidental issues that arise. The ESA is also required to undertake internal compliance audits (in the form of the weekly environmental checklist) and submit these to the ECO and the EPC contractor. The ESA provides feedback to the ECO, who in turn communicates with the holder of the EA and the competent authority regarding all environmental matters. Decisions regarding environmental procedures, specifications and requirements which have a cost implication (i.e., those that are deemed to be a variation, not allowed for in the EMPr specification) must be endorsed by the Holder of the EA. <u>Responsibilities</u> The responsibilities of the ESA will include the following: - Daily environmental monitoring - Be aware of the findings and conclusions of all EA conditions related to the development; - Be familiar with the recommendations and mitigation measures of this EMPr; - Report to the ECO. - Be conversant with relevant environmental legislation, policies and procedures, and ensure compliance with them;

	- Compilation and administration of weekly environmental checklists to ensure that the environmental management measures are implemented and are effective; - Monitoring the performance of the Contractors and ensuring compliance with the EMPr and associated Method Statements; - Environmental induction of all staff entering the site to perform duties; - Maintaining a record of environmental incidents (spills, impacts, legal transgressions etc.) as well as corrective and preventive actions taken; - Assisting in the resolution of conflicts; - Reporting non-compliances to the ECO; - Facilitate environmental training for all personnel on the site – this may range from carrying out the training, to reviewing the training programmes of the EPC contractor;
Developer / Contractor Environmental Officer (dEO)	<u>Role</u> The dEO is an in-house person working directly for the contractor / subcontractor. The dEOs will report to the Project Manager and are responsible for the day-to-day implementation of the EMPr, environmental monitoring and reporting, providing environmental input to the Project Manager and Contractor's Manager, liaising with contractors and the landowners as well as a range of environmental coordination responsibilities. <u>Responsibilities</u> - Be fully conversant with the EMPr; - Be familiar with the recommendations and mitigation measures of this EMPr, and implement these measures; - Ensure that all stipulations within the EMPr are communicated and adhered to by the Employees, Contractor(s); - Confine the development site to the demarcated area; - Conduct environmental internal audits with regards to EMPr and EA; - Assist the contractors in addressing environmental challenges on site; - Assist in incident management: - Reporting environmental incidents to developer and ensuring that corrective action is taken, and lessons learnt shared; - Assist the contractor in investigating environmental incidents and compile investigation reports; - Follow-up on pre-warnings, defects, non-conformance reports; - Measure and communicate environmental performance to the Contractor; - Conduct environmental awareness training on site together with ESA; - Ensure that the necessary legal permits and / or licenses are in place and up to date; - Acting as EPC Environmental Representative on site and work together with the ECO and ESA;
EPC Contractor **NB**: All references to the EPC	<u>Role</u>

contractor will include all subcontractors responsible for any tasks in respect of the development. All Environmental Management Actions allocated to the EPC contractor will apply equally to all sub-contractors responsible for any specific task	The Contractor or any relevant subcontractor appoints their own dEO and has overall responsibility for ensuring that all work, activities, and actions linked to the delivery of the contract are in line with the EMPr and that Method Statements are implemented as described. External contractors must ensure compliance with this EMPr while performing the onsite activities as per their contract with the Project Developer. The contractors are required, where specified, to provide Method Statements setting out in detail how the impact management actions contained in the EMPr will be implemented during the development of this facility. <u>Responsibilities</u> - project delivery and quality control for the development services as per appointment; - employ a suitably qualified person to monitor and report to the Project Developer's appointed person on the daily activities on-site during the construction period; - ensure that safe, environmentally acceptable working methods and practices are implemented, and that equipment is properly operated and maintained, to facilitate proper access and enable any operation to be carried out safely; - attend on site meeting(s) prior to the commencement of activities to confirm the procedure and designated activity zones; - ensure that contractors' staff repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained in EMPr, to the satisfaction of the ECO.

1.8. PROPOSED ACTIVITY

The BAR for the proposed Kwaggafontein solar PV facility assessed the following activities / components associated with the project.

- Solar Field, comprising Solar Arrays with a maximum height of 10m and maximum footprint of 20 hectares, including the following:
    - PV Modules;
    - Single Axis Tracking structures (aligned north south)
    - Solar module mounting structures comprised of galvanised steel and aluminium; and
    - Foundations which will likely be drilled and piled.

- Building Infrastructure
    - Offices;
    - Operational and maintenance control centre;
    - Warehouse/workshop;
    - Ablution facilities;
    - Inverter stations;

- On-site substation building.; and
- Guard Houses.

- Associated Infrastructure
  - 22kV powerline (underground from the on-site substation to the Eskom Kwaggafontein substation)
  - Internal 22kV underground cables;
  - Underground low voltage cables or cable trays;
  - Internal gravel roads;
  - Fencing
  - Panel maintenance and cleaning area;
  - Stormwater management structures; and
  - Temporary laydown area. To be rehabilitated on completion of construction permanent

It is envisioned that all required services (water, sewerage and waste) will be provided by the local municipality.

The main physical activities (i.e., those activities that need to be managed from an environmental perspective) that will form part of the construction phase are:

- Removal of vegetation for the proposed infrastructure;
- Excavations for infrastructure and associated infrastructure;
- Establishment of a laydown area for equipment;
- Stockpiling of topsoil and cleared vegetation;
- Transportation of material and equipment to site, and personnel to and from site;
- Construction of the solar field, cable trenches and additional infrastructure; and
- Rehabilitation of Disturbed areas.

The following main activities will occur during the operational phase:

- Generation of electricity to add to the national grid;
- Maintenance of the solar facility, including washing of panels;
- Management of the vegetation within the PV development; and
- Maintenance of the cable trenches

In the event of decommissioning, the main aim would be to return the land to its original, pre-construction condition. Should the unlikely need for decommissioning arise (i.e., if the actual SEF becomes outdated or the land needs to be used for other purposes), the decommissioning procedures will be undertaken in line with the EMPr and any legislation or guidelines relevant at the time and the site will be rehabilitated and returned to its pre-construction state. Possible decommissioning activities will include removing the infrastructure, and mechanisms to promote the re-growth of natural vegetation.

2. DOCUMENT CONTROL, REPORTING AND COMPLIANCE

To ensure accountability and effective implementation of the EMPr, a number of reporting systems, documentation controls and compliance mechanisms must be in place for all project infrastructure as a minimum requirement.

2.1. DOCUMENT CONTROL AND FILING

The holder of the EA is solely responsible for the upkeep and management of the official EMPr file. As a minimum, all documentation detailed below will be stored in the EMPr file. A hard copy of all documentation shall be filed, while an electronic copy may be kept where relevant. A duplicate file will be maintained by the ECO. The EMPr file must be on site and available at all times on request by the Competent Authority or other relevant authorities. The EMPr file will form part of any environmental audits undertaken as prescribed in the EIA Regulations.

2.2. DOCUMENTATION TO BE AVAILABLE

At the commencement of the project the following preliminary list of documents shall be placed in the EMPr file and be accessible at all times:

- Full copy of the signed EA from the Competent Authority in terms of NEMA, granting approval for the development;
- Copy of the EMPr;
- All method statements prepared by the EPC and submitted to the ECO for approval;
- All weekly checklists prepared by the Environmental Site Agent (ESA);
- All monthly ECO reports prepared by the ECO;
- Minutes and attendance register of environmental site meetings;
- Attendance registers of all environmental inductions;
- An up-to-date environmental incident log;
- A copy of all instructions or directives issued;
- A copy of all corrective actions signed off. The corrective actions must be filed in such a way that a clear reference is made to the non-compliance record; and
- Complaints register.

In compliance with condition of the EA, all the records relating to monitoring and auditing must be kept on site and made available for inspection to any relevant and competent authority.

2.3. WEEKLY ENVIRONMENTAL CHECKLIST

The ESA is required to complete a Weekly Environmental Checklist, the format of which will be determined by the ECO, with input from the EPC and the holder of the EA.

The ESA is required to sign and date the checklist, retain a copy in the EMPr file and submit a copy of the completed checklist to the EPC and the ECO on a weekly basis. The EPC must utilise the weekly checklists to initiate any corrective actions detailed therein.

2.4. MONTHLY ENVIRONMENTAL CONTROL REPORT

The ECO is responsible for compilation of the monthly ECO Report. The weekly checklists above will form the basis for the Monthly Environmental Control Reports and must be supplemented by the outcomes of the ECO inspection. The monthly Environmental Control Reports must be submitted to the following parties:

- The Competent Authority – Director Compliance Monitoring (in compliance with condition of the EA);
- The Provincial Conservation Authority;
- The DFFE' sub-directorate, Forestry;
- The SPV;
- The EPC; and
- All attendees of Environmental Site Meetings.

Copies of all completed Environmental Control reports must be attached as Annexures to the Environmental Audit Report as required in terms of condition of the EA.

2.5. ENVIRONMENTAL SITE MEETINGS

Minutes of the environmental site meetings shall be kept. The minutes must include an attendance register and will be attached to the Monthly Environmental Control Report that is distributed to attendees. Each set of minutes must clearly record "Matters for Attention" that will be reviewed at the next meeting.

2.6. METHOD STATEMENTS

The method statement will be done in such detail that the ECO is able to assess whether the contractor's proposal is in accordance with the EMPr. Commencement of any specific activity may not commence until such time as the method statement for that activity is approved by both the ECO and the project manager.

The method statement must cover applicable details with regard to:

- development procedures;
- materials and equipment to be used;
- getting the equipment to and from site;
- how the equipment/ material will be moved while on site;
- how and where material will be stored;
- the containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur;

- timing and location of activities;
- compliance/ non-compliance with the EMPr; and
- any other information deemed necessary by the ECOs.

Unless indicated otherwise by the ECO, the EPC shall provide the following method statements to the Project Manager no less than 14 calendar days prior to the commencement date of each activity:

- Site establishment – Site Camps, Lay-down or storage areas, satellite camps, infrastructure;
- Workshop or plant emergency maintenance;
- Drilling and Piling operations
- Handling, transport and storage of Hazardous Chemical Substance's;
- Vegetation management – Protected species relocation, site clearing, alien vegetation;
- Access management – Roads, gates, crossings etc.;
- Fire plan;
- Waste management – transport, storage, segregation, classification, disposal (all waste streams);
- Social interaction – complaints management, compensation claims, access to properties etc.;
- Water – use (source, abstraction and disposal), access and all related information, crossings and mitigation;
- Emergency preparedness – Spills, training, other environmental emergencies;
- Dust and noise management methodologies;
- Fauna interaction and risk management; and
- Heritage, Archaeology and Palaeontology management.

It is the prerogative of the ECO to request additional method statements for any other aspect of the proposed development.

The ESA and ECO shall monitor and ensure that the contractors perform in accordance with these method statements. A copy of all method statements must be kept on the EMPr file and appended to the Monthly ECO report on the month following their approval.

2.7. ENVIRONMENTAL INCIDENT LOG

The ESA is required to maintain an up-to-date and current Environmental Incident Log (environmental diary). The Environmental Incident Log is a means to record all environmental incidents and/or all noncompliance events.

An environmental incident is defined as:

- Any deviation from the listed impact management actions (listed in this EMPr) that is identified by the ESA or ECO (for example, a contractor's staff member littering or a drip tray that has not been emptied);
- Any environmental impact resulting from an action or activity by a contractor in contravention of the environmental stipulations and guidelines listed in the EMPr which as a single event would have a minor impact but which if cumulative and continuous would have a significant effect (for example no toilet paper available in the ablutions); and
- General environmental information such as road kills or injured wildlife.

The ESA must record all environmental incidents in the Environmental Incident Log. All incidents regardless of severity must be reported to the SPV. The Log is to be kept in the EMPr file (and appended to the monthly environmental control reports) and at a minimum the following will be recorded for each environmental incident:

- The date and time of the incident;
- Description of the incident;
- The name of the Contractor / subcontractor responsible;
- The significance of the incident must be noted;
- If the incident is listed as significant, a non-compliance notice must be issued, and recorded in the log;
- Remedial or corrective action taken to mitigate the incident; and
- Record of repeat minor offences by the same contractor or staff member.

2.8. NON-COMPLIANCE

In response to a significant incident, re-occurring incidents or unattended incidents, a non-compliance notice will be issued to the responsible contractor by the ECO via the SPV or Project Manager. The non-compliance notice will be issued in writing; a copy filed in the EMPr file and will at a minimum include the following:

- Time and date of the non-compliance;
- Name of the contractor responsible;
- Nature and description of the non-compliance;
- Recommended / required corrective action; and
- Date by which the corrective action to be completed.

The contractors shall act immediately when a notice of non-compliance is received and correct whatever is the cause for the issuing of the notice. Complaints received regarding activities on the development site pertaining to the environment shall be recorded in a dedicated register and the response noted with the date and action taken. The ECO should be made aware of any complaints. Any non-compliance with the agreed procedures of the EMPr is a transgression of the various statutes and laws that define the manner by which the environment is managed.

Failure to redress the cause shall be reported by the ECO to the Competent Authority for them to deal with the transgression, as it deems fit, including the issue of penalties as detailed in section 21 of this EMPr. The contractor is deemed not to have complied with the EMPr if, inter alia, there is a deviation from the environmental conditions, impact management outcomes and impact management actions as approved in the EMPr.

2.9 CORRECTIVE ACTION RECORDS

For each non-compliance notice issued, a documented corrective action must be recorded. On receiving a non-compliance notice from the ESA or ECO, the contractor's environmental officer will ensure that the corrective actions required take place within the stipulated timeframe. On completion of the corrective action the contractors Environmental Officer is to issue a Corrective Action Report in writing to the ECO.

If satisfied that the corrective action has been completed, the ECO are to sign-off on the Corrective Action Report and attach the report to the non-compliance notice in the EMPr file. A corrective action is considered complete once the report has been signed off by the ECO.

2.10 PHOTOGRAPHIC RECORD

A digital photographic record will be kept by the ESA. The photographic record will be used to show before, during and post rehabilitation evidence of the site as well as in cases of damages claims if they arise. Each image must be dated, include a co-ordinate and a brief description note attached. The ESA photographic record must form part of the weekly Environmental Checklists.

The EPC shall:

- Allow the ESA and ECO access to take photographs of all areas, activities and actions.

The ESA and ECO shall keep an electronic database of photographic records which will include:

- Pictures of all areas designated as work areas, site camp, development sites and storage areas taken before these areas are set up;
- All bunding and fencing;
- Road conditions and road verges;
- Condition of all farm fences;
- Topsoil storage areas;
- All areas to be cordoned off during construction;
- Waste management sites;
- Ablution facilities (inside and out);
- All completed corrective actions for non-compliances;
- All required signage;
- Photographic recordings of incidents;
- All areas before, during and post rehabilitation.

2.11 COMPLAINTS REGISTER

The ECO shall keep a current and up-to-date complaints register. The complaints register is to be a record of all complaints received from communities, stakeholders and individuals. The Complaints Record shall:

- Record the name and contact details of the complainant;
- Record the time and date of the complaint;
- Contain a detailed description of the complaint;
- Where relevant and appropriate, contain photographic evidence of the complaint or damage (ECO / ESA to take relevant photographs); and

- Contain a copy of the ECO's written response to each complaint received and keep a record of any further correspondence with the complainant. The ECO's written response will include a description of any corrective action to be taken and must be signed by the Contractor, ECO and affected party. Where a damage claim is issued by the complainant, the ECO shall respond as described in below.

2.12 CLAIMS FOR DAMAGES

In the event that a Claim for Damages is submitted by a community, landowner or individual, the ECO shall:

- Record the full detail of the complaint as described in above;
- The EPC will evaluate the claim and associated damage and submit the evaluation to SPV for approval;
- Following consideration by the SPV, the claim is to be resolved and settled immediately, or the reason for not accepting the claim communicated in writing to the claimant.

2.13 INTERACTIONS WITH AFFECTED PARTIES

Open, transparent and good relations with affected landowners, communities and regional staff are an essential aspect to the successful management and mitigation of environmental impacts.

The ECO shall:

- Ensure that all queries, complaints and claims are dealt within an agreed timeframe;
- Ensure that any or all agreements are documented, signed by all parties and a record of the agreement kept in the EMPr file;
- Ensure that telephone numbers to register complaints are made available to all landowners and affected parties; and
- Ensure that contact with affected parties is courteous at all times.

2.14 ENVIRONMENTAL AUDITS

Internal environmental audits of the activity and implementation of the EMPr must be undertaken in the form of the monthly environmental control reports. The findings and outcomes must be included in the EMPr file and submitted to the competent authority on a monthly basis.

At a minimum the monthly environmental control report is to cover the following:

- Weekly Environmental Checklists;
- Deviations and non-compliances with the checklists;
- Non-compliances issued;
- Completed and reported corrective actions;
- Environmental Monitoring;
- Results of Dust Fall out Monitoring;
- General environmental findings and actions; and

- Minutes of the Environmental Site Meetings.

In addition to the internal environmental audit (which takes place as part of the monthly environmental control report), an external audit must be undertaken:

- Within 1 year of commencement of construction activities.
- Within 3 months of commencement of operational activities.

These external audits cannot be undertaken by the ECO and must be undertaken by an external audit consultant.

Additional audits during the operational phase of the activity are to be done at the frequency determined in the regulations.

3. LEGISLATIVE AND POLICY FRAMEWORK

In terms of legislative provisions, this EMPr must satisfy:

- Section 24N of the NEMA, as amended;
- Appendix 4 of the NEMA EIA Regulations published in Government Notice No. R 326 of 7 April 2017. These regulations regulate and prescribe the content of the EMPr and specify the type of supporting information that must accompany the submission of the report to the authorities; and
- Gazetted generic EMPrs for the power line and substation infrastructure

Table 2: Compliance with Section 24N of NEMA

Requirements of Section 24N of NEMA	Reference in this EMPr?
2. The environmental management programme must contain information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts or objectives in respect of: - planning and design; - pre-construction and construction activities; - the operation or undertaking of the activity in question; - the rehabilitation of the environment; and - closure, if applicable;	Section 5,6 & 14 of this EMPr
Details of the person who prepared the environmental management programme; and the expertise of that person to prepare an environmental management programme;	Please refer to the summary page at the beginning of this report for these details.
A detailed description of the aspects of the activity that are covered by the	Section 1.8

environmental management programme;	
Information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);	Columns in Section 5,6 and 14 of the EMPr detail the monitoring responsibility.
Information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance;	Section 5, 6, 14 and 16
As far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and	Section 8
A description of the manner in which it intends to- - modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; - remedy the cause of pollution or degradation and migration of pollutants; and - comply with any prescribed environmental management standards or practices.	Section 1.2 to 1.4
3. The environmental management programme must, where appropriate- - set out time periods within which the measures contemplated in the environmental management programme must be implemented; - contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of polluted or extraneous water or ecological degradation which may occur inside and outside the boundaries of the operations in question; and - develop an environmental awareness plan describing the manner in which- - the applicant intends to inform his or her employees of any environmental risk which may result from their work; and - risks must be dealt with in order to avoid pollution or the degradation of the environment.	Sections 3 – 14 all contain the timeframes for the associated measures.
4. The Minister, the Minister responsible for mineral resources or an MEC may call for additional information and may direct that the environmental management programme in question must be adjusted in such a way as the Minister, the Minister responsible for mineral resources or the MEC may require.	Not applicable at this stage.
5. The Minister, the Minister responsible for mineral resources or an MEC may at any time after he or she has approved an application for an environmental authorisation approve an amended environmental management programme.	Not applicable at this stage.
6. The holder and any person issued with an environmental authorisation-	Throughout the EMPr

- must at all times give effect to the general objectives of integrated environmental management laid down in section 23; - must consider, investigate, assess and communicate the impact of his or her prospecting or mining on the environment; - must manage all environmental impacts - in accordance with his or her approved environmental management programme, where appropriate; and - as an integral part of the prospecting or mining, exploration or production operation, unless the Minister responsible for mineral resources directs otherwise; - must monitor and audit compliance with the requirements of the environmental management programme; - must, as far as is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and - is responsible for any environmental damage, pollution, pumping and treatment of polluted or extraneous water or ecological degradation as a result of his or her operations to which such right, permit or environmental authorisation relates.	
7. Notwithstanding the Companies Act, 2008 (Act No. 71 of 2008), or the Close Corporations Act, 1984 (Act No. 69 of 1984), the directors of a company or members of a close corporation are jointly and severally liable for any negative impact on the environment, whether advertently or inadvertently caused by the company or close corporation which they represent, including damage, degradation or pollution.	Section 1.7 details the responsibility of the Project Applicant.

Table 3: Compliance with Appendix 4 of the 2014 NEMA EIA Regulations (as amended on 7 April 2017)

Requirement	Description
Details of the EAP who prepared the EMPr; and; The expertise of the EAP to prepare an EMPr, including a curriculum vitae.	This EMPr was prepared by Sedzani Mulaudzi of Maphaha Projects and Investments who has more than 8 years' experience as an Environmental Assessment Practitioner. The CV of the EAP is attached in appendix I.
A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	This EMP covers all aspects of the project. • PV Arrays and Mounting Structures; • inverter stations; • on-site substation; • grid connection • auxiliary buildings, • electrical reticulation network (underground cabling) • internal road / track network;

	• access road; • perimeter fencing.
A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers	The Site Development Plan attached in Appendix A, No sensitive features has been identified.
A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all the phases of the development including – (vi) Planning and design; (vii) Pre-construction activities; (viii) Construction activities; (ix) Rehabilitation of the environment after construction and where applicable post closure; and (x) Where relevant, operation activities.	Sections 1.3
A description and identification of impact management outcomes required for the aspects contemplated above.	Sections 4 -11
A description of the proposed impact management actions, identifying the way the impact management objectives and outcomes contemplated above will be achieved and must, where applicable include actions to – (v) Avoid, modify, remedy control or stop any action, activity or process which causes pollution or environmental degradation; (vi) Comply with any prescribed environmental management standards or practises; (vii) Comply with any applicable provisions of the Act regarding closure, where applicable; and (viii) Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.	Sections 4 -11
The method of monitoring the implantation of the impact management actions contemplated above.	Sections 4 – 11 and section 14
The frequency of monitoring the implementation of the impact management actions contemplated above.	Sections 4 – 11 and section 14

An indication of the persons who will be responsible for the implementation of the impact management actions.	Sections 4 – 11
The time periods within which the impact management actions must be implemented.	Sections 4 – 11 and section 14
The mechanism for monitoring compliance with the impact management actions.	Section 2 and 4-11
A program for reporting on compliance, considering the requirements as prescribed in the Regulations.	Section 2
An environmental awareness plan describing the way – (iii) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and (iv) Risks must be dealt with in order to avoid pollution or the degradation of the environment.	Section 5.2
Any specific information that may be required by the competent authority.	None.

The table below lists the legislation that was considered in the preceding environmental assessment process, and which has been considered in the compilation of this EMPr.

Table 4: Legislation applicable to Kwaggafontein solar PV project.

Legislation
NATIONAL LEGISLATION
The Constitution of the Republic of South Africa
National Environmental Management Act (NEMA)
National Environmental Management: Biodiversity (Act 10 of 2004)
Conservation of Agricultural Resources Act – CARA (Act 43 of 1983):
The Subdivision of Agricultural Land, Act 70 Of 1970
National Water Act, No 36 of 1998
National Forests Act (No. 84 of 1998):
National Heritage Resources Act, 25 of 1998
National Energy Act (No. 34 of 2008)
PROVINCIAL LEGISLATION
Mpumalanga Nature Conservation Act, No. 10 of 1999
Nature and Environmental Conservation Ordinance, No 19 of 1974
Mpumalanga Provincial Spatial Development Framework (Spatial Planning and Land Use Management Act (SPLUMA) 2013, Act no 16 of 2013)
GUIDELINES, POLICIES AND AUTHORITATIVE REPORTS
Critical Biodiversity Areas

White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)
White Paper on the Energy Policy of the Republic of South Africa (1998)
Integrated Energy Plan (IEP), 2015
Integrated Resource Plan for Electricity (2010-2030)
National Development Plan 2030 (2012)
Strategic Infrastructure Projects (SIPs)
The Convention on the Conservation of Migratory Species of Wild Animals
Guidelines to minimise the impacts on birds of Solar Facilities and Associated Infrastructure in South Africa
Environmental Impact Assessment Guideline for Renewable Energy Projects
Sustainability Imperative

4. PRE-CONSTRUCTION PHASE– IMPACT MANAGEMENT OUTCOMES & ACTIONS

This section provides details on the pre-construction phase impact management outcomes and actions that are commonly applicable to the development of a PV Energy Facility and its associated infrastructure as well as management actions outlined by participating specialists, preceding environmental process and those that will be contained in the EA for the facility.

Each subsection includes an aspect identified for the development of a PV Energy Facility, and for each aspect a set of prescribed impact management outcomes and associated impact management actions have been identified.

The holder of the EA will ultimately be responsible to ensure the implementation of these outcomes and actions.

4.1 APPOINTMENT OF ENVIRONMENTAL CONTROL OFFICER AND ENVIRONMENTAL SITE AGENT

In compliance with EIA Regulation, the holder of the EA must appoint an independent Environmental Control Officer (ECO) for the construction phase of the Development.

Impact management outcome: Independent party to ensure that the mitigation/rehabilitation. measures and recommendations are implemented and to ensure compliance with the provisions of the approved EMPr

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• The ECO must be appointed prior to the commencement of any physical activities. • The ECO will be responsible for monitoring, reviewing and verifying compliance by the EPC Contractor with the environmental specifications of this EMPr and the conditions of the EA. • The appointed ECO must be independent of the EPC contractor and must be suitably qualified and have experience of	Holder of the EA	The holder of the EA to appoint independent ECO and ensure that ECO is suitably qualified and experienced.	ECO to be appointed prior to construction	ECO will undertake physical monitoring.	Monthly	The name and contact details of the appointed ECO to be submitted to the Director: Compliance Monitoring at DFFE.

environmental monitoring and control on similar scale projects. • The main responsibilities of the ECO include but are not limited to the following: - Facilitate the pre-construction environmental compliance workshop; - Management of the ESA; - Be fully knowledgeable of all the licences and permits issued to the site - Review, maintenance and update of the EMPr; - Liaison between the Project Proponent, Contractors, Authorities and other lead - stakeholders on all environmental concerns, including the implementation of the EMPr; - Compilation of monthly Environmental Control Report/s (ECR) to ensure compliance with the EMPr and authorisations. Reports should be submitted to the relevant authority on a monthly basis; - Monitor compliance with this EMPr; - Monitor compliance with the EA; - Monitor implementation of the mitigation and rehabilitation measures and recommendations referred to in the EA, preceding environmental assessment, participating specialists and this EMPr. - Recommend the issuing site instructions to the EPC contractor for corrective actions required; - ECO site inspections should be undertaken at least once a month to ensure compliance with the EMPr. The duration of these visits may be increased or decreased at the discretion of the ECO in consultation with the holder of the EA. The Environmental Site Agent as described below should be on site daily and be in communication with the ECO on a daily basis;						ECO to submit monthly Environmental Control Report to the Director: Compliance Monitoring at DFFE.

- Attendance of regular contractors site meetings; - Maintain a record of environmental incidents (e.g., spills, impacts, legal transgressions etc.) as well as corrective and preventative measures taken.						

In addition to the ECO, this EMPr requires the appointment of a full time independent Environmental Site Agent (ESA) for the duration of the construction period of the project (this ESA must be appointed in the pre-construction phase, prior to the commencement of construction activities).

Impact management outcome: To ensure independent full time environmental expertise on site to monitor and report on compliance

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• The ESA must be appointed prior to the commencement of any physical activities. • The ESA will be responsible for daily monitoring, reviewing and verifying compliance by the EPC Contractor with the environmental specifications of this EMPr and the conditions of the EA. • The appointed ESA must be independent of the EPC contractor and must be suitably qualified and have experience of environmental monitoring and control. • The main responsibilities of the ESA include but are not limited to the following: - To ensure compliance with the EMPr and EA; - The ESA is required to be on site daily, which may be reviewed by the ECO and holder of the EA as construction requirements dictate;	EPC Contractor	The EPC contractor to appoint independent ESA and ensure that ESA is suitably qualified and experienced.	ESA to be appointed prior to construction	ESA will undertake physical monitoring.	The ESA to monitor site daily and provide a formal report back weekly.	The name and contact details of the appointed ESA to be submitted to the Director: Compliance Monitoring at DFFE. Weekly Environmental Checklists to be provided to the EPC and the ECO.

- Undertaking environmental induction of all staff; - Attending all on site construction meetings (including, but not limited to, technical and progress meetings); - Providing the ECO with a weekly environmental checklist; - Developing and maintaining a detailed photographic site record throughout the construction phase of the project; - Maintaining file records of all method statements provided by the contractors; - Management and ensuring timeous and effective rehabilitation of the site; - Maintain a record of environmental incidents (e.g., spills, impacts, legal transgressions etc.) as well as corrective and preventative measures taken. This information must also be included in the weekly reports; - Maintain a public complaints register in which all complaints and action taken / responses must be recorded. - In the event that the ESA observes non-compliance that requires a "stop work" order, the ECO must immediately be informed and will request the holder of the EA to issue such an order if necessary. • The ESA must remain employed until all rehabilitation measures are completed.						

The ECO (i.e. the Principal ECO) must have a minimum of a tertiary level qualification in the natural sciences field, as well as at least 8 years' experience and proven competency as an ECO, with extensive experience on similar scale Developments.

The ESA (i.e. the Site ECO) must have a minimum of a tertiary level qualification, as well as at least 1 years' experience on similar scale developments and proven competency as an ECO.

4.2 PRE-CONSTRUCTION ENVIRONMENTAL COMPLIANCE WORKSHOP

It is a required action that a pre-construction environmental compliance workshop be undertaken before any construction commences on site.

Impact management outcome: To ensure that all senior contract staff members have an in-depth knowledge of the environmental requirements for the site in terms of the EA and EMPr.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• It is a required action that a pre-construction environmental compliance workshop be undertaken before any construction commences on site. This workshop can be combined with a site handover meeting but must take place before any activities take place on site and before any plant is moved onto site. • The purpose of this workshop is to ensure that all relevant senior personnel are familiar with the provisions of the EMPr, as well as the conditions of the EA. • The following people must be present at this Environmental Compliance Workshop: - The holder of the EA; - The ECO; - The EPC Contractor (including contract manager, site agent and foreman); - The sub-EPC contractor if appointed - The Electrical Contractor (including contract manager, site agent and foreman); - The Consulting Engineers (electrical, civil and structural, whichever applicable); and - Project and Asset Management. • Provision should be made in contract and tender documentation to attend a 6-hour workshop that will be chaired by the ECO.	Holder of the EA	The holder of the EA must arrange the invites to the workshop. ECO to present the workshop	Prior to Commencement of construction.	ECO	Once off.	ECO to issue minutes of the workshop, to be included in first monthly environmental control report.

5. CONSTRUCTION PHASE – IMPACT MANAGEMENT OUTCOMES AND ACTIONS

This section provides details on the construction phase impact management outcomes and actions that are commonly applicable to the development of a PV Energy Facility and its associated infrastructure as well as management actions outlined by participating specialists and those that will be contained in the EA for the facility.

Each subsection includes an aspect identified for the development of a PV Energy Facility, and for each aspect a set of prescribed impact management outcomes and associated impact management actions have been identified.

The holder of the EA is ultimately responsible to ensure the implementation of these outcomes and actions.

5.1 CONSTRUCTION PHASING

There are a number of important aspects of the construction phasing that must be implemented to ensure that the potential impact on the environment is kept to a minimum. The EPC contractor must consider the following requirements regarding phasing, when developing the construction programme. This construction programme must be approved by the by the holder of the EA with input from the ECO.

- The perimeter fence and road network to access the panel arrays should be established first and then all vehicular movement must be restricted to within this road network - This will minimise the impact of construction traffic on the undeveloped portion of the property. The only vehicles allowed to move off this road network are those needed to install the PV Mounting structures (i.e., Drills and Piling machines).
- Sites that will be temporarily disturbed by the construction activities (e.g., material loading, temporary storage, turning circles, etc.) must also be included in the road access network.

5.2 ENVIRONMENTAL AWARENESS AND TRAINING

It is a required action that the ESA, in consultation with the EPC, shall ensure that all construction workers receive an induction presentation, as well as ongoing environmental education and awareness, on the importance and implications of the EMPr, EA and the environmental requirements they prescribe.

The ESA must keep records of all environmental training sessions, including names, dates and the information presented. Details of the environmental induction are also to be included in the weekly environmental checklists and monthly environmental control reports.

Impact management outcome: All onsite staff are aware and understand the individual responsibilities in terms of this EMPr.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• All staff must receive environmental induction training prior to undertaking any activities on site; • The EPC contractor must provide 24h notice to the ESA to arrange a suitable time for the ESA to present the induction training; • Refresher environmental awareness training is available as and when required; • All staff are aware of the conditions and controls linked to the EA and within the EMPr and made aware of their individual roles and responsibilities in achieving compliance with the EA and EMPr; • The EPC contractor must erect and maintain information posters at key locations on site, and the posters must include the following information as a minimum: - Safety notifications; - Faunal Occurrences and risks; - Photographic plates of all listed and protected flora: - Hydrocarbon Spill management and correction and - Waste Management. • Environmental awareness training must include as a minimum the following:	EPC Contractor and ESA	ESA to present a preprepared environmental induction to all staff prior to them undertaking any activities on site. EPC to ensure that all environmental awareness posters are in place at a minimum of 2 locations on site and that these posters are maintained. ESA to attend toolbox talks at least once a week, where an environmental topic is presented (this topic should be linked to current environmental	Throughout construction period	ESA	Weekly as part of the weekly environmental checklist.	Signed environmental induction attendance registers to be appended to weekly environmental checklist and monthly environmental control report.

- Description of significant environmental impacts, actual or potential, related to their work activities; - Mitigation measures to be implemented when carrying out specific activities; - Environmental emergency preparedness and response procedures; - No Go Areas - Procedures to be followed when working near or within sensitive areas; - Wastewater management procedures; - Water usage and conservation; - Solid waste management procedures; - Sanitation procedures; - Fire prevention; - Faunal conflicts and - Vegetation management and protected & listed flora. • The EPC contractor must provide translation services to Ensure that the environmental induction be translated into the relevant languages.		concerns on the site at that particular stage)				

5.3 DEMARCATION OF NO-GO AREAS

All areas outside of the physical development footprint are to be demarcated as no-no go areas and access to these areas restricted. All construction activities must be restricted to demarcated areas to restrict the impact on sensitive environmental features. The impact management actions detailed below will help in achieving this end.

Impact management outcome: To ensure the protection of all the natural areas, sensitive features and buffer areas outside of the physical development Footprint

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• The exact footprint of the construction area, including panel foundations and all roads (including access, haul and internal roads which must make use of the final road layout) and infrastructure are to be surveyed and pegged before any physical construction commences on site. • In order to ensure effective demarcation of no-go areas, the construction of the perimeter fence should be the first activity that takes place on site. • All sensitive features as identified by specialists or ECO within the footprint must be demarcated for exclusion. • Appropriate signage is to be placed at all No-Go Areas • The contractor, in conjunction with the ECO, must walk the areas determined and mark the full extent of the area to be disturbed (allowing sufficient space for the construction activity); • All areas beyond these demarcated areas are considered as "no-go" areas; • Construction staff must be briefed as part of the environmental induction on the requirements regarding the no-go areas; and • Any protected trees or plants that are to remain within the development footprint are to be physically demarcated.	EPC Contractor	The EPC contractor to ensure that all no-go demarcations are in place and maintained for the duration of the contract. The ESA to ensure that compliance with the no-go policy forms part of the environmental induction. ESA to monitor compliance with no-go areas.	Survey and pegging to commencement of construction. Formal perimeter fence to be constructed in parallel to site establishment	ESA / ECO	Daily	Weekly environmental checklists. Monthly environmental control reports.

5.4 ESTABLISHMENT OF CONTRACTORS SITE CAMP AND TEMPORARY LAYDOWN AREA.

The position of the contractors site camp and temporary laydown area must as show in the approved site layout plan. It must be noted that the contractors site camp and laydown area are temporary areas for use during the duration of construction. These areas must be rehabilitated on completion of construction as detailed in section 5.20 below. A permanent laydown area not exceeding 1 Hectare may remain for the duration of the operational phase of the project.

Impact management outcome: To ensure that the high impact activities that typically take place in a contractor's site camp / laydown area are restricted to a predefined area that does not contain any sensitive features and is rehabilitated on completion of construction.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• The Contractors Site Camp and Temporary Laydown must be situated within the development area in the position identified in the approved Site Layout Plan • No temporary site camps will be allowed outside of the development footprint; • Any necessary plant rescue within the site camp and temporary laydown must be undertaken prior to the stripping of topsoil. • Topsoil from the site camp and temporary area must be stripped and stockpiled for re-use during rehabilitation. This must be done prior to levelling and placement of gravel; • The site camp must be suitably fenced off; • All construction material must be stored in the site camp, unless otherwise approved by the ECO. This may exclude PV panel mounting structures and panel components which will be stored at each installation point, as per the manufacturer plans; • No personnel may overnight in the site camp, except in the case of security personnel;	EPC Contractor	The EPC contractor to provide method statement for site camp and temporary laydown establishment. The ESA and ECO to monitor compliance with site camp and laydown requirements. ECO to sign off on final rehabilitation of the site camp and temporary laydown area.	Site camp to Be established prior to delivery of materials and plant (with the exception of plant and material required for the establishment of the perimeter fence)	ESA / ECO	Daily	Weekly environmental checklists. Monthly environmental control reports.

• Fires for cooking and/or heating are only allowed within the site camp after consultation with the Health and Safety Representative; • Fuel and other chemicals may only be stored in the camp site; • Storage of waste and waste management must take place within the site camp and must be removed on a regular basis. • Temporary waste pick up points in the field must be moved to the site camp on a daily basis; • The site camp must be provided with sufficient ablution facilities (chemical toilets and potable water) of which the content must be disposed of regularly and at the suitable facilities; • Any security lighting must be restricted to the Site Camp and Laydown area and no security lighting may be placed in the field; • Lighting during both the construction as well as operational phase of the development must be a low-pressure sodium type, preferably yellow; • All security lighting should be attached to motion sensers and be dark sky friendly; and • On completion of construction, the site camp and temporary laydown area must be rehabilitated as directed.						

5.5 MANAGEMENT OF TOPSOIL

Topsoil from all excavations and construction activities must be salvaged and reapplied during reclamation.

In terms of best practice and for rehabilitation purposes, it is essential that at least 300mm layer of topsoil from the building and road footprints (i.e., the on-site substation, auxiliary buildings, contractor's site camp and temporary laydown area) be stripped and stockpiled prior to the commencement of construction activities in each area. Topsoil should not be stripped from the development footprint below the solar arrays except where trenching for cabling is required (in which case topsoil should be placed on the opposite side of the trench from the subsoils and placed back in the same trench when cables are covered up).

Impact management outcome: To ensure that the handling of topsoil does not result in the pollution or loss of the resource.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• A minimum 300mm layer of topsoil must be stripped from the access, internal and perimeter roads, on-site substation, auxiliary buildings, contractors site camp and temporary laydown area; • The topsoil stockpile sites must be approved by the ECO and may not be within any sensitive areas as defined by the ECO; • The topsoil may not be stockpiled within any of the remaining natural areas (i.e., any open spaces between modules). An existing disturbed area within or adjacent to the laydown areas should rather be chosen for this purpose; • The topsoil stockpiles must be protected from erosion and dust as indicated by the ECO and this EMPr; • The topsoil stockpiles must be clearly demarcated to avoid contamination; • No topsoil may be mixed with subsoil; • No topsoil may be used as bedding material for cable trenches; • The topsoil stockpiles must not exceed 2m in height and stockpiles older than 6 months must be enriched before they are re-used.	EPC Contractor	The EPC contractor to provide method statement for topsoil management. The ESA and ECO to advise on the placement of topsoil stockpiles. The ESA and ECO to monitor compliance. ECO to sign off on final rehabilitation of the site camp and temporary laydown area.	Prior to construction activities in each specific area.	ESA / ECO	Daily	Weekly environmental checklists. Monthly environmental control reports.

• The topsoil must be replaced into disturbed areas (road verges, cable trenches and contractors site camp) on completion of construction;						

5.6 WATER SUPPLY

This section is specific to water supply during the construction phase. Water supply for the washing of panels is discussed under the operational phase requirements.

Impact management outcome: To ensure water used during construction is lawfully and sustainably utilised.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• The EPC contractor must ensure that all water sources utilised are lawful. • The EPC Contractor must ensure a supply of water is available on site for sanitation, drinking, dust suppression and all construction activities. • The EPC Contractor must ensure that water supplied for drinking water is of potable standards. • Water used for dust suppression on gravel roads must be of a quality compliant with the General Special Effluent Standards 31/03/2009): Temperature: max.25ºC, pH: between 5.5 & 7.5 and conductivity: not be increased more than 15% above the intake	EPC Contractor	The EPC contractor to provide method statement for Water Supply. The EPC Contractor must supply records of tests undertaken on drinking water to show that it is within potable standards (these tests should be done on a three monthly basis or anytime the water	Lawfulness and quality testing need to take place prior to construction. Remaining Actions applicable for the duration of The construction phase.	EPC Contractor to provide initial and 3 monthly quality test results to ESA. EPC Contractor to Supply weekly tests to ESA. Water usage records to be provided by EPC	3 Monthly for Potability tests. Weekly for internal testing	Weekly environmental checklists. Monthly environmental control reports.

water & not exceed 250 milli-Siemens per metre (determined at 25ºC). • No chemically treated or wastewater may be used for dust suppression. • Should any temporary water storage reservoirs need to be constructed for the purposes of construction, these must be positioned within the footprint of the development in a position agreed to with the ECO. Sufficient mechanisms to prevent fauna entrapment must be implemented to the satisfaction of the ECO. • Carry out Environmental Awareness Training with a discussion on water usage and conservation – This should form part of the Environm ental Induction of all construction staff. • The EPC contractor must maintain records of all water usage (via metering and / or water tuck logs) for the duration of the construction phase.		source changes) The EPC to measure (internally) PH, TDS and Conductivity of all water sources on a weekly basis.		contractor on a weekly basis. ESA / ECO to review results and provide recommenda tions.		

5.7 VEGETATION CLEARING

The objective of mitigation for any development is to firstly avoid and minimise impacts on vegetation where possible and where these cannot be completely avoided, to compensate for the negative impacts of the development on vegetation and animal habitats, and to maximise re-vegetation and rehabilitation of disturbed areas. This section deals with the management of impacts associated with the clearing of vegetation. Please refer to the section below for details regarding the rehabilitation and restoration of affected areas after completion of the construction activities.

Some loss of vegetation is an inevitable consequence of the construction of PV facilities, and vegetation clearing required for the laydown area, roads, buildings etc. could impact listed plant species, as well as high-biodiversity plant communities. Vegetation clearing will also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.

The clearing of vegetation must be restricted to areas for the development and service infrastructure and must be limited to the footprint. The environmental impact management actions detailed in this section as well as those in the previous section on demarcation of no-go areas will help achieve this end.

Impact management outcome: To ensure that vegetation is lawful, minimised and restricted to the development footprint.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Vegetation clearing can only commence once: - All necessary permits are in place, - Development footprint has been Demarcated • Vegetation clearing must be kept to a minimum and restricted to the following areas: - Internal Road Network, - Perimeter Road, - Inverter / Transformer Stations, - Laydown Area, - Site Camp and - Building Footprints • For the PV Array, the grass layer should be left intact (albeit trampled by construction activities) and only the larger woody plants cleared or trimmed. • All areas to be cleared should be clearly demarcated, prior to the commencement of clearing activities; • Vegetation cleared / removed as part of the site clearing activities must be stockpiled for use during the re-vegetation and rehabilitation stage for brushpacking. The location of the vegetation stockpile can be in	EPC Contractor	The EPC contractor to provide method statement for vegetation clearing activities.	Throughout the duration of construction.	ESA / ECO	Daily	Weekly environmental checklists. Monthly environmental control reports.

the same area as the topsoil stockpile, as designated in consultation with the ECO; • Any vegetation clearing that needs to take place as part of maintenance activities (during construction and operation phases) should be done in an environmentally friendly manner, using the most effective methodology suited to the target species (herbicides and/or manual clearing).						

5.8 TRENCHING AND CABLING

Electric cables required to connect the inverters to the on-site switching station (i.e., AC cables) within the boundaries of the development must be installed underground, within or parallel to the internal road network and/or paths between the panel rows, as far as possible. There will also be limited trenching associated with the DC cabling (although the majority of this will be aboveground – mounted to the panel arrays.)

Cable trench excavation, cable laying and backfill must be carried out in a systematic and continuous operation, minimising the length of trench open at any one time in order to reduce the risk of runoff or faunal entrapment. Cable trenches must be backfilled in such a manner as to prevent the trench from acting as a ditch or a conduit for water flow.

Impact management outcome: To ensure that trenching activities are spatially restricted and do not result in loss or contamination of topsoil resources.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Trenching shall be kept to a minimum through the use of single trenches for multiple service provision (including communication cabling and AC cabling in the same trenches);	EPC Contractor	The EPC contractor to provide method statement trenching activities.	Throughout The construction phase	ESA and ECO	Daily	Weekly environmental checklists. Monthly environmental

• Open trenches to be closed as quickly as possible to prevent faunal entrapment and erosion; • The planning and selection should be done in approximation to the SDP and cognisance shall be given to minimising the potential for soil erosion; • Trench routes with permitted working areas shall be clearly defined and marked with prior to excavation; • The stripping and separation of topsoil and subsoil shall occur on separate sides of the excavated trench and replaced in the same order (i.e., topsoil on top); • Trench lengths shall be kept as short as practically possible before backfilling and compacting; • The ECO may require the planting of additional indigenous vegetation along trench routes in order to speed up rehabilitation (particularly in areas that may be prone to erosion); • Open trenches must be inspected daily for faunal entrapment (small mammals and reptiles), which are to be removed before backfilling of the trenches; • Trenches shall be backfilled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion. Excess soil shall be stockpiled in an area designated by the ECO. • Topsoil may not be used for bedding or blanket material in trenches.						control reports.

5.9 DRILLING AND RAMMING OPERATIONS

It is envisioned that drilling and ramming will be the preferred method of installing the panel support structures / sub-structures. The following actions must be implemented in this regard.

Impact management outcome: To ensure that installation of the sub-structures do not cause pollution or undue mechanical damage to the environment.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• The plant required for the installation of the sub-structures (i.e., the trackers and module mounting structures) is the only plant that is allowed to leave the internal road network. The contractor shall submit a method statement detailing his proposals to prevent pollution (from hydraulic fluids, fuel or oil leaks) during ramming operations. This shall be approved by the engineer and the ECO prior to the onset of any ramming operations; • The contractor shall take all reasonable measures to limit dust generation as a result of drilling and ramming operations (also see section below addressing management of dust); • Noise and dust nuisances shall comply with the applicable standards according to the Occupational Health and Safety (Act No. 85 of 1993) as well as the dust control regulations; • Other than the known acceptable impact from trampling, any areas damaged by the ramming and associated activities shall be rehabilitated by the contractor to the satisfaction of the ECO.	EPC Contractor	The EPC contractor to provide method statement drilling and ramming operations.	Throughout The construction phase	ESA and ECO	Daily	Weekly environmental checklists. Monthly environmental control reports.

5.10 FENCING

During construction it will be necessary to fence in the Contractor's Site Camp (to avoid theft of construction equipment and materials) and the PV Laydown Area/s (to avoid theft of the solar panels and associated infrastructure). This temporary fencing will be restricted to these areas and be removed at the end of the construction phase. The total footprint of the facility will be fenced with a permanent perimeter electrified fence in order to protect the operational assets.

Impact management outcome: To ensure that fencing protects project assets and the environment while limiting impact on faunal passages.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• The establishment of the perimeter fence should be the first activity that takes place on site, as this serves to demarcate the total disturbance footprint. • Any sensitive features within the project footprint should be temporarily fenced prior to commencement of construction (refer to above section on the demarcation of no-go areas). This temporary fencing must be replaced with permanent fencing prior to the completion of the construction phase. • Temporary storage ponds and topsoil stockpile should be temporarily fenced. • The perimeter security fencing should be constructed in a manner which allows for the passage of small and medium sized mammals, at strategic places, such as areas of dense vegetation • Only the facility itself should be fenced-off. • Other than the fencing around the site camp / laydown area and operational buildings. No lighting may be placed on the perimeter security fencing. • The final fencing plan should be submitted to the ECO for comments and approval.	EPC Contractor	Implementation of the actions herein. EPC contractor to submit final fencing plan to the ECO for approval.	Throughout The construction phase	ESA and ECO	Daily	Weekly environmental checklists. Monthly environmental control reports.

5.11 CONSTRUCTION VEHICLES AND TRAFFIC MANAGEMENT PLAN

Construction vehicles carrying materials to the site, should avoid using roads through densely populated areas as to not disturb existing retail and commercial operations. Permit for all abnormal loads be obtained from provincial government.

Impact management outcome: To minimise the impact on the road network from dust and noise pollution as well as the transport of materials and staff to site.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Stagger component delivery to site • The use of mobile batch plants and quarries near the site would decrease the impact on the surrounding road network • Dust suppression must take place on main access road • Reduce the construction period as far as possible • Maintenance of gravel Roads • Apply for abnormal load permits prior to commencement of delivery via abnormal loads • Assess the preferred route (from port of entry to site) and undertake a 'dry run' to test • Staff and general trips should occur outside of peak traffic periods as far as possible. • Any low hanging overhead lines (lower than 5.1m) e.g., Eskom and Telkom lines, along the proposed routes will have to be	Holder of the EA and EPC Contractor	Implementation in compliance with the actions defined. Implementation of the measures. Implementation of the measured identified in the TIA's. Regular monitoring of road surface quality. Apply for prior to commencement of construction	Throughout the construction phase	ESA and ECO	At commencement of construction Daily	Weekly environmental checklists. Monthly environmental control reports.

moved to accommodate the abnormal load vehicles, if required						

This following section provides additional management actions specifically with regards to management of construction vehicles in respect of bio-physical impacts.

Signs must be placed along construction roads to identify speed limit, travel restriction and other standard traffic control information. Furthermore, in compliance, all construction vehicles should adhere to a low-speed limit to avoid collisions with susceptible faunal species. In order comply with these conditions, the following environmental management actions are required.

Impact management outcome: To ensure that construction traffic does not cause faunal fatalities, nor undue damage to vegetation or pollution of the environment.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• The designated access to the site must be established and clearly signposted prior to physical construction commencing on site. • Speed limits for main access road should be set at 50km per hour. • Speed limits for internal roads must be set at 25km per hour. • Speed control signage to be placed at intervals along the access road, at the entrance to the site and at intervals along the internal road network. • Temporary signage to be in place for the construction phase. This signage to be replaced with permanent signage for the operational phase. • Other than vehicles and plant required for the drilling and ramming operations, no vehicles or plant may leave the access, or	EPC Contractor	Implementation in compliance with the actions defined.	Throughout The construction phase	ESA and ECO	Daily	Weekly environmental checklists. Monthly environmental control reports.

internal road network (except when within the site camp and laydown area) • Dust control (as described below) must be implemented the full length of the access road and on all main internal haul roads. • Any faunal fatalities as a result of vehicles and plant must be reported to the ESA within 1 hour of the incident.						

5.12 CONSTRUCTION WASTE

An integrated waste management approach must be implemented that is based on waste minimisation and must incorporate reduction, recycling and re-use options where appropriate. Where solid waste is disposed of, such disposal shall only occur at a landfill licenced in terms of section 20(b) of the National Environmental Management Waste Act, 2008 (Act 59 of 2008).

It is proposed that the local municipality will provide services in terms of waste removal and sewage for the construction phase of the proposed project. However, should the municipality not have adequate capacity available for the handling of waste and sewage, then the EPC Contractor must make use of private contractors to ensure that the services are provided. The EPC Contractor must also ensure that adequate waste disposal measures are implemented by obtaining waste disposal dockets / slips of all waste and sewage that is removed from site.

Impact management outcome: To promote an integrated waste22 management approach and ensure the management of waste during the construction phase is both lawful and sustainable.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• A dedicated waste management area should be set up in the contractors site camp. This waste management area must as a minimum: - Be clearly demarcated and sign posted - Be wind and scavenger proof;	EPC Contractor	The EPC contractor to provide method statement for waste management.	Throughout the construction phase	ESA and ECO. EPC Contractor to provide	Daily	Weekly environmental checklists. Monthly

- Include separation of wate streams (Recyclable waste, General Waste, Construction Rubble and Hazardous Waste); - Be maintained in a neat and tidy state with waste regularly removed. • The EPC Contractor must provide the ESA with a Waste Management register / report on a weekly Basis. This register / report must include as a minimum: - Records of all waste volumes for waste stream, - Proof of all volumes of recycling, - Disposal slips for all waste transported to a landfill,Disposal slips for all hazardous waste, • All hazardous waste (including chemicals, bitumen, fuel, lubricants, oils, contaminated soil from hydrocarbon spills, paints etc.) shall be disposed of at an approved / registered hazardous-waste landfill site. The Contractor shall provide disposal certificates to the ECO. • All Hazardous waste must be temporary stored in sealed waterproof containers and may not be stored on site for longest than 30 days. • Used oil and grease must be removed from site to an approved used oil recycling company. • Under NO circumstances may any waste be spoiled on the site. • Where possible, the routine maintenance of construction plant should take place off-site. Where such maintenance must occur, it must be done in the site camp on an impermeable surface with a sump to collect any oil spills. • Temporary waste receptacles in the field must be removed to the dedicated waste				records of all waste volumes and disposal slips on a weekly basis.		environmental control reports.

management area before the end of each working day. • Ensure that no waste materials or sediments are left in the surrounding drainage lines (as a result of the construction). • Wastewater must be collected and disposed of at a suitable licenced disposal facility. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes						

5.13 FUEL AND CHEMICAL STORAGE

The above ground storage of fuel is subject to authorisation in terms of the National Environmental Management Act (NEMA EIA regulations) if more than 30m³ is stored on site at any one time. The environmental authorisation for this development does not include authorisation for the storage of more than 30 cubicmetres of fuel.

The temporary storage of hazardous or toxic materials / liquids (chemicals, fuels, lubricants and oils) must comply with legislation and the actions in the table below must be implemented.

Impact management outcome: To ensure lawful fuel storage that does not cause soil and water pollution.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Temporary fuel storage must take place within the contractors site camp and laydown area in an area approved by the ECO; • No storage of fuel may take place on any other portion of the site;	EPC Contractor	The EPC contractor to provide method statement for chemical and fuel storage.	Throughout the construction phase	ESA and ECO. EPC Contractor maintain a fuel and chemical register and	Daily	Weekly environmental checklists. Monthly environmental control reports.

• All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up immediately in the appropriate manner, as related to the nature of the spill. • Mobile fuel units used to refuel plant on site must make use of drip trays when refuelling; • Storage facilities may not be located within 60m of any freshwater resources where there is a potential for any spilled fuel to enter the resource; • Fuel storage facilities should be located on flat ground. No cut and fill should take place immediately on or adjacent to fuel storage areas; • All storage tanks should be double lined and be ISO 9001 certified; • All storage tanks must be enclosed by bund walls; • Bund walls must be constructed to contain at least 110% of the total capacity of the storage tanks; • Bund walls must be constructed of impermeable material or lined to ensure that petroleum products cannot escape; • A suitable material should be placed in the base of the bund walls to soak up any accidental spillages; • The tanks should be locked and secured when not in use; • Automatic shut-off nozzles are required on all dispensing units; • Storage tanks should be drained within one week of completion of activities (only unused fuel can be used by the contractor on other work sites or returned to the supplier). If the construction program extends over the				provide this to the ECO on a monthly basis.		

builder's shutdown, the contractor must ensure that storage tanks are emptied prior to this period; • All storage tanks, containers and related equipment should be regularly maintained to ensure safe storage and dispensing of material. The engineer is to sign off on the condition and integrity of the storage tanks; • Defective hoses, valves and containment structures should be promptly repaired; • Vehicle and equipment fuelling should be undertaken on a hard impermeable surface, over drip pans or bund walls to ensure spilled fuel or toxic liquids is captured and cleaned up; • The area must be totally rehabilitated on completion of the contract and all contaminated material must be carefully removed and disposed of at a licensed dumping site for that purpose; and • Spill kits must be made available on-site for the clean-up of spills. A minimum of 2 spill kits must be in the contractors site camp. Spill kits must also be available in the field within 500m of any drilling and ramming operations.						

5.14 NOISE MANAGEMENT

Although the proposed development is located outside of an urban area, the following noise management actions are applicable to the construction phase of the development due to its proximity to farm homesteads.

The Contractor shall furthermore be responsible for compliance with the relevant legislation with respect to noise inter alia Section 25 of ECA (73 of 1989) and standards applicable to noise nuisances in the Occupational Health and Safety Act (No. 85 of 1993).

Impact management outcome: To ensure nuisance from noise and vibration does not occur.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• It is recommended that noise generation be kept to a minimum and that construction activities be confined to normal working hours (07:00 - 17:00 on Monday to Saturday). Should the Contractor wish to deviate from these work hours, approval must be granted by the Holder of the EA, • The following noise reduction actions in respect of plant should be implemented: - Provide baffle and noise screens on noisy machines as necessary; - Provide absorptive linings to the interior of engine compartments; - Ensure machinery is properly maintained (fasten loose panels, replace defective silencers); - Switch off machinery immediately when not in use; and - Reduce impact noise by careful handling.	EPC Contractor	As per the stated actions	Throughout the construction phase	ESA and ECO.	Daily	Weekly environmental checklists. Monthly environmental control reports.

5.15 CONCRETE MANAGEMENT

Proper concrete management is of utmost importance. Concrete works are likely to be limited to the construction of the on-site sub-station and auxiliary buildings and are not likely to be extensive (the preferred alternative for the panel support structures will make use of a technology that does not require concrete footings, due to rammed piles/earth screws/rock anchors). However, in instances where rammed piles/earth screws or rock anchors will not be practically possible and for other concrete work associated with the substation and inverter stations, the following actions in terms of concrete management should take place.

Cement powder has a high alkaline pH that may contaminate and adversely affect both soil pH and water pH negatively. A rapid change in pH can have consequences on the functioning of soil and water organisms, as well as on the botanical component.

The use of ready-mix trucks delivering concrete directly to site is recommended and mass batching of concrete on site should be limited as far as possible.

Impact management outcome: To ensure that the handling of concrete does not result in pollution of soil or water resources.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Trucks should deliver pre-mixed concrete to the site and pour the concrete directly into the prepared excavations. • When concrete trucks have unloaded, there is a requirement to wash out the inside of the concrete drum. Water can be provided to the trucks for this purpose (at the discretion of the contractor). Concrete suppliers may NOT dispose of this wash water anywhere on site. Trucks should return to their depot for this purpose. • Any spillages of concrete outside of the excavations (including haulage routes) must be cleaned up immediately by the supplier. • Where small batching of concrete or plaster takes place on site, the following actions must be implemented: - Concrete batching may only take place in areas approved by the ECO (preferably in the Site Camp); - Concrete mixing must take place on batching plates unless it is on an area that is	EPC Contractor	The EPC contractor to provide method statement for all on site concrete batching.	Throughout the construction phase	ESA and ECO.	Daily	Weekly environmental checklists. Monthly environmental control reports.

to be hard surfaced as part of the development; - Equipment (wheelbarrows, shovels etc) must be washed into a lined settling pond; - Once the settling ponds dry out, the concrete must be removed and dispatched to a suitable disposal site. Ideally, all concrete batching should take place on an area that is to be hard surfaced as part of the development (building floor, road or paved area); • In order to avoid resource contamination, concrete batching should not be located within 60m of any stormwater management structure. • If an area outside of the site camp is identified for batching it must first be approved by the ECO and all topsoil must be stripped and stockpiled for re-use. • Batching at satellite sites must be done on a batching plate to prevent soil contamination. • Empty cement bags must be treated as hazardous waste and must be treated accordingly. • Cement wash water may not be discharged into the environment.						

5.16 FIRE MANAGEMENT AND PROTECTION

As required in the veld and fire management act, it is the landowner's responsibility to develop and maintain firebreaks as well as be sufficiently prepared to combat veld fires. This requirement will fall on the lawful user of the land in respect of the PV Development.

Impact management outcome: To reduce the risk of fire to infrastructure and environment.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Fires should only be allowed within fire-safe demarcated areas (and only within the site camp); • No fuelwood collection is allowed on-site; • The total removal of all invasive alien vegetation should take place in order to decrease the fire risk • Cigarette butts may not be thrown in the veld but must be disposed of correctly. The contractor, must designate smoking areas (in compliance with the Tobacco Products Control Amendment Act 63 of 2008) with suitable receptacles for disposal; • In case of an emergency, the contact details of the local fire and emergency services must be readily available; • Contractors must ensure that basic firefighting equipment and suitably qualified/experienced personnel are available on site at all times, as per the specifications defined by the health and safety representative / consultant; • The fire risk on site is a point of discussion that must take place as part of the preconstruction compliance workshop and the environmental induction training prior to commencement of construction; and • The contractor must also comply with the requirements of the Occupational Health and Safety Act with regards to fire protection.	EPC Contractor	In compliance with the actions defined as well as requirements detailed in the health and safety plan.	Throughout the construction phase	ESA and ECO.	Daily	Weekly environmental checklists. Monthly environmental control reports.

5.17 SANITATION

The holder of the EA must provide sanitation facilities within the construction area and along the road so that workers do not pollute the surrounding environment. These facilities must be removed from the site when the construction phase is completed. Associated waste must be disposed of at a registered waste disposal site.

Impact management outcome: To ensure safe and healthy sanitation for construction staff without increasing pollution risk.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
Portable chemical ablution facilities must be made available for the use by construction staff for the duration of the construction period. The following actions must be implemented in this regard: • Toilet and washing facilities must be available to the site personnel at all times (at the site camp and in the field); • These facilities must be situated away from freshwater resources; • One toilet for every 15 personnel is required; • The facilities must be serviced on a regular basis to prevent any overflow or spillage; • The servicing contractor must dispose of the waste in an approved manner (e.g., via the municipal wastewater treatment system); • The ECO must be provided with the service providers' details and the service schedule for the site; • The toilets should be secured to ensure that they do not blow over in windy conditions; • All toilet facilities must be removed from site on completion of the contract period, and;	EPC Contractor	As per the stated actions	Throughout the construction phase	ESA and ECO. The EPC Contractor to Supply chemical toilet service records to the ESA on a weekly basis.	Daily	Weekly environmental checklists. Monthly environmental control reports.

• Should the construction period be interrupted by a builder's break, the toilets should be emptied prior to the break.						

5.18 BLASTING ACTIVITIES

Due to the fact that the PV panel mountings will be drilled / rammed into the earth and will thus not require extensive excavation for foundations, it is therefore unlikely that blasting will be required. Should blasting be required for whatever reasons, the following actions must be implemented:

Impact management outcome: To ensure any blasting activities do not disturb sensitive environmental nor social features.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• No blasting may take place within 50m of a borehole without approval of a suitably qualified engineering geologist. Preventative mitigation actions could include installing PVC casing and screens in potentially affected boreholes before blasting, while damaged boreholes will have to be re-drilled; • A current and valid permit shall be obtained from the relevant authorities prior to any blasting activity; • A method statement shall be required for any blasting related activities; • All laws and regulations applicable to blasting activities shall be adhered to at all times; • A qualified and registered blaster shall supervise all blasting and rock splitting operations at all times;	EPC Contractor	The EPC contractor to provide method statement for blasting activities should they be needed.	Throughout the construction phase	ESA and ECO. The EPC Contractor to Supply chemical toilet service records to the ESA on a weekly basis.	Daily	Weekly environmental checklists. Monthly environmental control reports.

• The contractor shall ensure that appropriate pre-blast monitoring records are in place (i.e., photographic and inspection records of structures in close proximity to the blast area); • The contractor shall allow for good quality vibration monitoring equipment and record keeping on site at all times during blasting operations; • The contractor shall ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on site; • The contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused by blasting / drilling shall be repaired at the contractor's expense to the satisfaction of the ECO; • The contractor shall ensure that adequate warning is provided immediately prior to all blasting. All signals shall also be clearly given; • The contractor shall use blast mats for cover material during blasting. Topsoil may not be used as blast cover; • During demolition, the contractor shall ensure, where possible, that trees in the area are not damaged; • Appropriate blast shaping techniques shall be employed to aid in the landscaping of blast areas, and a method statement to be approved by the Engineer, shall be required in this regard; and • At least one week prior to blasting, the relevant occupants/owners of surrounding land shall be notified by the contractor and any concerns addressed. Buildings within						

the potential damaging zone of the blast shall be surveyed, preferably with the owner present and any cracks or latent defects pointed out and recorded either using photographs or video. Failing to do so shall render the contractor fully liable for any claim of whatsoever nature, which may arise. The contractor shall indemnify the employer in this regard.						

5.19 THEFT AND ENVIRONMENTAL CRIME

An increase in crime during the construction phase is often a concern. In the case of this development, the risk is likely to be low due to the remote nature of the site. Theft and other crime associated with construction sites is not only a concern for surrounding residents, but also the developer and the contractor. Considering this, contractors need to be proactive in order to curtail theft and crime on and resulting from the construction site.

It is recommended that the contractor develop a jobsite security plan prior to commencement of construction. This jobsite security plan should take into account protection of the construction site from both internal and external crime elements, as well as the protection of surrounding communities from internal crime elements. All incidents of theft or other crime should be reported to the South African Police Service, no matter how seemingly insignificant. A copy of the jobsite security plan should be included in the first environmental control report to be submitted to the competent authority.

It is likely that the Contractor's Site Camp and the PV Laydown area/s will be fenced with a temporary fence to avoid theft during construction. Additional security measures during construction may include CCTV camera surveillance and security guards.

Impact management outcome: To ensure that activities on site do not increase the criminal activity of the area.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• The following actions are relevant in this regard (refer to the section above for details of the facility permanent security fencing): • The EPC Contractor must develop a Job Site Security Plan for the project. • All portable construction equipment and material must be locked away within the Contractor's Site Camp overnight and during holiday periods; • Fuel storages tanks must be locked when not in use; • All unassembled / un-installed PV materials must be locked within the fenced Laydown areas overnight and during holiday periods. • The minimum amount of lighting should be used at night and this should be of the low-UV emitting kind that attracts less insects. • Hunting or harvesting of any plants or animals at the site is strictly forbidden, and thus any person found undertaking any of these actions will be considered guilty of committing a crime. Any incidents of such crimes on nature must be reported to the ECO immediately, who will report the incident to the SAPS.	EPC Contractor	Implementation of a Job site security plan to be compiled by the EPC.	Jobsite Security Plan to be prepared prior to site establishment Throughout the construction phase	ESA and ECO.	Daily	Weekly environmental checklists. Monthly environmental control reports.

5.20 REHABILITATION AND HABITAT RESTORATION

All areas not forming part of the development's hard surfaces must be rehabilitated and restored on completion of construction. These include:

- The temporary laydown area (a maximum laydown of less than 1ha may for operational requirements);
- The contract site camp;
- Temporary water storage ponds;

- Overburden spoil sites;
- Temporary haul roads;
- Batching areas; and
- All other areas within the PV array and adjacent to buildings that have been compacted or impacted by any of the construction activities.

One of the primary objectives of all the previously listed impact management outcomes are to avoid and reduce impact on the receiving environment, thus minimising the rehabilitation and restoration requirements on completion of construction. The EPC contractor must be mindful of this primary objective as part of all activities taking place on site.

Impact management outcome: To restore habitat disturbed during construction activities

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
Topsoil management • Effective topsoil management is a critical element of rehabilitation, particularly in arid and semi-arid areas where soil properties are a fundamental determinant of vegetation composition and abundance. Although some parts of the site consist of exposed bedrock, most parts of the site have at least some topsoil. Where any excavation or topsoil clearing is required, the topsoil should stockpiled and later used to cover cleared and disturbed areas once construction activity has ceased. • Excess inert material and other disturbed areas should be reshaped to blend in with the natural contours of the area; • The contractor must be mindful that should insufficient topsoil be available for rehabilitation purposes, additional topsoil will	EPC Contractor	Implementation of the actions detailed here. Provision of a sufficient budget to undertake rehabilitation activities	Throughout the construction phase. Physical rehabilitation activities to be completed prior to contractual operations date.	ESA and ECO and Rehabilitation Specialist	Daily	Weekly environmental checklists. Monthly environmental control reports.

need to be sourced from a commercial source at a cost to the contractor. • Topsoil is the top-most layer (0-30cm) of the soil in undisturbed areas. This soil layer is important as it contains nutrients, organic matter, seeds, micro-organisms fungi and soil fauna. All these elements are necessary for soil processes such as nutrient cycling and the growth of new plants. The biologically active upper layer of the soil is fundamental in the maintenance of the entire ecosystem. • Topsoil should be retained on site in order to be used for site rehabilitation. The correct handling of the topsoil (as detailed earlier in the report) is a key element to rehabilitation success. Firstly, it is important that the correct depth of topsoil is excavated. If the excavation is too deep, the topsoil will be mixed with sterile deeper soil, leading to reduction in nutrient levels and a decline in plant performance on the soil. • Wherever possible, stripped topsoil should be placed directly onto an area being rehabilitated. This avoids stockpiling and double handling of the soil. Topsoil placed directly onto rehabilitation areas contains viable seed, nutrients and microbes that allow it to revegetate more rapidly than topsoil that has been in stockpile for long periods. • If direct transfer is not possible, the topsoil should be stored separately from other soil heaps until construction in an area is complete. The soil should not be stored for a long time and should be used as soon as possible. The longer the topsoil is stored, the more seeds, micro-organisms and soil biota are killed.						

• Ideally stored topsoil should be used within a month and should not be stored for longer than three months. In addition, topsoil stores should not be too deep, a maximum depth of 1m is recommended to avoid compaction and the development of anaerobic conditions within the soil. **Ripping & Substrate preparation** • Before commencement with restoration activities detailed below, all identified rehabilitation areas that are compacted as a result of construction activities must be mechanically ripped. • Imported gravel layers (such as in the laydown area and site camp) must be removed prior to ripping and commencing with rehabilitation. **Mulching** • Mulching is the covering of the soil with a layer of organic matter of leaves, twigs bark or wood chips, usually chopped quite finely. The main purpose of mulching is to protect and cover the soil surface as well as serve as a source of seed for revegetation purposes. • During site clearing the standing woody vegetation should not be cleared and burned, removed or mixed with the soil, but should be cleared separately. The cleared vegetation should be stockpiled and used whole or shredded by hand or machine to protect the soil in disturbed areas and promote the return of indigenous species. Where there is a low shrub or grass layer, this material can be cleared and mixed as part of the topsoil (or applied as a top mulch) as this will aid revegetation and recovery when it is reapplied.						

• All mulch should be harvested from areas that are to be denuded of vegetation during construction activities, provided that they are free of seed-bearing alien invasive plants; • No harvesting of vegetation may be done outside the area to be disturbed by construction activities; • Brush-cut mulch should be stored for as short a period as possible, and seed released from stockpiles can also be collected for use in the rehabilitation process. **Seeding** • In some areas the natural regeneration of the vegetation may be poor and the application of seed to enhance vegetation recovery may be required as directed by the ECO. • Seed should be collected from plants present at the site and should be used immediately or stored appropriately and used at the start of the following wet season. Seed can be broadcast onto the soil but should preferably be applied in conjunction with measures to improve seedling survival such as scarification of the soil surface or simultaneous application of mulch. • Indigenous seeds may be harvested24 for purposes of re-vegetation in areas that are free of alien or invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites; • Seed may be harvested by hand and if necessary dried or treated appropriately; • No seed of alien or foreign species should be used or brought onto the site. **Transplants**						

• Where succulent plants are available or other species which may survive translocation are present, individual plants can be dug out from areas about to be cleared and planted into areas which require revegetation. This can be an effective means of establishing indigenous species quickly, this is however unlikely to be a viable option at the current site as there are few suitable species present, but if the conditions are wet then most species have some probability of surviving. • Plants for transplant should only be removed from areas that are going to be cleared. • Perennial grasses, shrubs, succulents and geophytes are all potentially suitable candidates for transplant. • Transplants should be placed within a similar environment from where they came in terms of aspect, slope and soil depth. • Transplants must remain within the site and may not be transported off the site. • Some species can also grow from cuttings and branches of many succulent species can be rooted in the field. **Use of soil savers** • On steep slopes (unlikely on the development site) and areas where seed and organic matter retention is low, it is recommended that soil savers are used to stabilise the soil surface. Soil savers are man-made materials, usually constructed of organic material such as hemp or jute and are usually applied in areas where traditional rehabilitation techniques are not likely to succeed. • In areas where soil saver is used, it should be pegged down to ensure that is captures						

soil and organic matter flowing over the surface. • Soil saver may be seeded directly once applied as the holes in the material catch seeds and provide suitable microsites for germination. Alternatively, fresh mulch containing seed can be applied to the soil saver. **General recommendations** Progressive rehabilitation is an important element of the rehabilitation strategy and should be implemented where feasible. • Once re-vegetated, areas should be protected to prevent trampling and erosion. • No construction equipment, vehicles or unauthorised personnel should be allowed onto areas that have been vegetated. • Where rehabilitation sites are located within actively grazed areas, they should be fenced. • Fencing should be removed once a sound vegetative cover has been achieved. • Any runnels, erosion channels or washaways developing after revegetation should be backfilled and consolidated and the areas restored to a proper stable condition.						

As highlighted in the introduction to this section, the most cost-effective way to reduce the cost and effort for rehabilitation is to reduce and minimise the disturbance footprint. The installation of the panel arrays without clearing the site, is the biggest benefit that can be applied in this regard.

The PV panels and roads within the development represent hard surfaces that will generate a lot of runoff. As a result, effective runoff management is essential as is an effective vegetation cover to prevent widespread erosion across the site.

5.21 FAUNAL MANAGEMENT

Impact management outcome: To reduce the direct impact on animals affected by the construction activities.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Any animals (including snakes, tortoises and lizards) directly threatened by the clearing or construction activities should be removed to a safe location outside of the construction area by the ECO or other suitably qualified/experienced person. • All trenches, open excavations and fence lines should be inspected on a daily basis (first thing in the morning) for any trapped fauna (particularly small mammals and reptiles). These should be removed to a safe location outside of the construction area by the ECO or other suitably qualified / experienced person. • Faunal ladders to be installed in all temporary water storage areas. • The development footprint may need to be flushed prior to completion of the perimeter fence to ensure that no large mammals become trapped within the development site. • All faunal mortalities are to be reported to the ESA, who must maintain a register of faunal mortalities. • The ESA must maintain a register of all faunal observations within the development site.	EPC Contractor	Implementation of the actions detailed here.	Throughout the construction phase.	ESA and ECO	Daily	Weekly environmental checklists. Monthly environmental control reports.

In addition to the above actions, the ecological specialist recommends the following actions in respect of avifauna.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
The noise and movement associated with the construction activities at the development footprint willbe a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (EMPr.)	A site-specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and should apply good environmental practice during construction. The EMPr must specifically include the following: • No off-road driving; • Maximum use of existing roads; • Measures to control noise and dust according to latest best practice; • Restricted access to the rest of the property;	• Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. • Ensure that construction personnel are made aware of the impacts relating to off-road driving. • Construction access roads must be demarcated clearly. Undertake site inspections to verify. • Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. • Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	On a daily basis	Contractor and ECO

5.22 HERITAGE FEATURES

Should any archaeological sites, artefacts, palaeontological fossils or graves be exposed during construction work, work in the immediate vicinity of the find must be stopped, the South African Heritage Resource Agency (SAHRA) must be informed, and the services of an accredited heritage professional obtained.

Impact management outcome: Impact to heritage resources is minimised.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Identify, demarcate and prevent impact to all known sensitive heritage features on site in accordance with the No-Go procedure detailed above; • Carry out general monitoring of excavations for potential fossils, artefacts and material of heritage importance; • All work in a specific area must cease immediately, if any human remains and/or other archaeological, palaeontological and historical material are uncovered. Such material, if exposed, must be reported to the nearest museum, archaeologist/ palaeontologist (or the South African Police Services), so that a systematic and professional investigation can be undertaken. Sufficient time must be allowed to remove/collect such material before development recommences in that area.	EPC Contractor	Implementation of the actions detailed here. Implementation of chance find procedure.	Throughout the construction phase.	ESA and ECO	Daily	Weekly environmental checklists. Monthly environmental control reports.

6. OPERATIONAL PHASE – IMPACT MANAGEMENT OUTCOMES AND ACTIONS

This section provides details on the operational phase impact management outcomes and actions that are commonly applicable to the operation of a PV Energy Facility and its associated infrastructure, as well as management actions outlined in the EMPR for the facility.

Each subsection includes an aspect identified for the development of a PV Energy Facility, and for each aspect a set of prescribed impact management outcomes and associated impact management actions have been identified.

The holder of the EA is ultimately responsible to ensure the implementation of these outcomes and actions.

Written notice of intent to commence operations must be submitted to the DFFE at least 14 days prior to the commencement of operations.

6.1 CLEANING OF PV MODULES

Any rainfall on the solar panels would be welcomed due to its cleaning effect, but as mentioned before, the annual predicted rainfall is very low. Water for cleaning panels should take place using water from lawful sources and can be supplemented from the rainwater collection / storage systems on site. To further reduce the use of water at the solar facility, the use of alternative panel cleaning methods could be investigated.

Impact management outcome: To ensure that cleaning of PV modules is lawful, resource efficient and does not cause erosion or pollution of the surrounding environment.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Water for the cleaning of PV modules must be lawful. • Only clean water or biodegradable cleaning materials may be used for washing purposes.	O&M Contractor	Implementation of the actions detailed in this section.	Throughout The Operational Phase	O&M Contractor Audit consultant.	Daily by O&M Contractor. Annually as part of operational	Operational Environmental Audit Report.

• Care should be taken that the wash-water does not cause any erosion (the use of labour intensive, or high pressure/low volume techniques is recommended in this regard). • Water used in the cleaning process is likely to encourage the growth of natural vegetation around the panel arrays and rows, which will require routine brushcutting / trimming to avoid vegetation shading the panels, interfering with tracking mechanisms or the risk of fires. Under no circumstances should vegetation beneath or around the panel arrays and rows be cleared / removed entirely, as this will result in significant erosion and associated sandblasting of infrastructure. Due to stunted nature of the xerophytic vegetation, it is unlikely that this will need to be done often. Biomass produced from these trimming activities could be chipped and used as mulch under the PV panels (to increase stormwater infiltration and reduce erosion). • The management of a vegetated cover on as much of the site as possible must take place. This will reduce fugitive dust emissions and thus cleaning frequencies. • Where practical, adopt "dry" cleaning methods, such as dusting and sweeping the site before washing down. • Low level and ongoing cleaning of PV panels over time to reduce demand on aquifers.					environmental audits	

6.2 OPERATIONAL WASTE

During the operational phase of the development, the amount of waste generated is likely to be very minimal and limited to normal domestic waste generated in the office, workshop waste from maintenance activities and damaged PV modules.

It is proposed that the local municipality will provide services in terms of waste removal and sewage for the operational phase (excluding Hazardous Waste and damaged PV Modules) of the proposed project. However, should the municipality not have adequate capacity available for the handling of waste and sewage; then the O&M Contractor must make use of private contractors to ensure that the services are provided. The O&M Contractor must also ensure that adequate waste disposal measures are implemented by obtaining waste disposal dockets / slips of all waste and sewage that is removed from site.

Impact management outcome: To promote an integrated waste26 management approach and ensure the management of waste during the construction phase is both lawful and sustainable

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Wind and scavenger proof bins must be installed at the maintenance / control buildings and on-site substation and must be emptied on a weekly basis • All hazardous waste (including bitumen, fuel, oils, paints etc.) used during the operation and maintenance of the solar facility shall be disposed of at an approved/registered hazardous-waste landfill site. The contractor responsible for the disposal shall provide disposal certificates to the site manager. • Used oil and grease must be removed from site to an approved used oil recycling company. • Under NO circumstances may any hazardous waste be spoiled on the site. • The servicing of operation/maintenance vehicles may not take place on site. • Damaged PV modules should be stored in a designated area within the O&M complex before being returned to supplier for recycling.	O&M Contractor	Implementation of the actions detailed in this section.	Throughout The Operational Phase	O&M Contractor Audit consultant.	Daily by O&M Contractor. Annually/three yearly as part of operational environmental audits	Operational Environmental Audit Report.

• Biomass from vegetation management activities must not be disposed of off-site but must be utilised as mulch as part of the ongoing rehabilitation. • Wastewater must be collected and disposed of at a suitable licenced disposal facility. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes						

6.3 OPERATIONAL GENERAL ECOLOGY CONSIDERATIONS

This section provides general management actions to ensure that operational activities do not degrade the ecological functioning of the site.

Impact management outcome: Ensure that operational activities do not degrade the ecological functioning of the site.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Dust control should be continued into operation. • Any trimming of protected species that may establish under the modules must be done in accordance with a permit. • Other than the maintenance of the vegetated layer under the PV modules, NO further clearing of vegetation should take place. • Speed limits within the facility must be maintained and enforced. • Specialist advice to be sought for the management of any fauna that establishes within the site during operations.	O&M Contractor	Implementation of the actions detailed in this section.	Throughout The Operational Phase	O&M Contractor to implement and maintain records. Audit consultant.	Daily by O&M Contractor. Annually/three yearly as part of operational environmental audits	Operational Environmental Audit Report.

• The O&M contractor must ensure that the Avifaunal Monitoring of this EMPr is implemented.						

6.4 GENERAL OPERATIONAL MAINTENANCE

The section in the table below details general operational maintenance environmental impact management actions that are not covered in the sections above.

Impact Management Actions	Responsible Person	Method of implementation	Timeframe for implementation	Responsible party for monitoring	Frequency of monitoring	Evidence of compliance
• Lubricants used to grease bearing of panel tracking systems should be conservatively used to avoid leakage or spills. Any leaks or spills that occur during maintenance operations must be cleaned up immediately and the contaminated soil / material disposed on at a registered disposal site for hazardous materials. • The tracks / pathways between the PV panel rows used for cleaning and maintenance of the panels, should be maintained as single tracks and regularly brush-cut and/or mowed to allow reasonable access. • Access roads and the internal road network must be maintained in a condition that allows for reasonable access and minimised erosion potential. All drainage, stormwater management and erosion control structures must be maintained to ensure their proper functioning. • Regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other	O&M Contractor	Implementation of the actions detailed in this section.	Throughout The Operational Phase	O&M Contractor to implement and maintain records. Audit consultant.	Daily by O&M Contractor. Annually/three yearly as part of operational environmental audits	Operational Environmental Audit Report.

infrastructure. All erosion problems observed should be rectified as soon as possible. • All maintenance vehicles to remain on the demarcated roads. • The conservancy tank, associated with the ablution facilities at the on-site substation / maintenance buildings, must be maintained in full working condition. • The perimeter security fence should be routinely patrolled to ensure that is still allows for the passage of small and medium sized mammals, at least at strategic places, and that the electrified strands are not causing animal electrocution. • No unauthorized persons should be allowed onto the site. • The maintenance of the transmission line infrastructure must retain the bird-friendly design features (bird-flappers and insulation). Any bird electrocution and collision events that occur should be recorded, including the species affected and the date. If repeated collisions occur within the same area, then further mitigation and avoidance measures may need to be implemented. • Staff present during the operational phase should receive environmental education so as to ensure that that no hunting, killing or harvesting of plants and animals occurs. • All alien plants present at the site should be controlled at least twice a year using the best practice methods for the species present. • Bare soil should be kept to a minimum, and at least some grass or low shrub cover should be encouraged under the panels. • No pets (cats and dogs) should be allowed within the solar facility.						

6.5 AVIFAUNAL MANAGEMENT

The following avifaunal impact management actions must be implemented during the operational phase. These actions are additional to the Avifaunal monitoring requirements detailed below.

Impact	**Mitigation/Management Objectives and Outcomes**	**Mitigation/Management Actions**	**Monitoring**		
			Methodology	**Frequency**	**Responsibility**
Avifauna: Displacement due to habitat transformation					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plant and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the Ecological specialist study.	Develop a Habitat Restoration Plan (HRP) and ensure that it is approved. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.	Appointment of rehabilitation specialist to develop Habitat Restoration Plan (HRP). Site inspections to monitor progress of HRP. Adaptive management to ensure HRP goals are met.	Once-off Once a year As and when required	Project developer Facility Environmental Manager Project developer and facility operational manager
Avifauna: Mortality due to electrocution					
Electrocution of priority avifauna in the onsite substation or inverter station.	Prevention of ongoing electrocution of avifauna through reactive mitigation if necessary, depending on the gravity of the problem.	Implementation of mitigation measures such as insulation of live parts to prevent further electrocutions.	Site investigation to determine causes of the mortality. Implementation of appropriate measures e.g., insulation of live parts with appropriate products.	As and when required	Facility Environmental Manager Facility operational manager

7. ALIEN INVASIVE VEGETATION MANAGEMENT PLAN

The following alien invasive vegetation management plan must be adopted an implemented by the EPC contractor.

Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing, but must be temporarily stored in a demarcated area.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
DESIGN PHASE					
Impacts due to establishment of alien invasive plants	Ensure the appropriate removal of alien invasive vegetation from the proposed project area and prevent the establishment and spread of alien invasive plants due to the project activities.	• Ensure compliance with relevant Environmental Specifications for the control and removal of alien invasive plant species. • Appoint a specialist or contact relevant authorities to seek guidance on the removal of the alien vegetation on site. • Compile and finalise an alien weed eradication programme.	• Appoint a suitable specialist/ Contractor or contact the relevant authorities to seek guidance on the removal of the planted alien invasive species. • Appoint a suitable specialist to compile an alien invasive vegetation eradication plan. • Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	Once-off during the design phase.	Holder of the EA / EPC contractor
CONSTRUCTION PHASE					
Impacts due to the establishment of and increased spread of alien invasive plants	Avoid establishment and reduce the spread of alien invasive plants due to the project activities.	• Appoint a specialist or contractor to undertake a sweep and survey of the final development footprint site, with an alien invasive eradication team to remove exotic vegetation	• Appoint a suitable vegetation contractor to inspect the site and remove any exotic weeds prior to the commencement of construction. ECO to	Prior to the commencement of construction Once-off	EPC Contractor /ESA and ECO

		prior to the commencement of construction. • Establish an ongoing monitoring programme for the construction phase to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) and National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEM: BA)).	ensure that this is taken into consideration and implemented. • Prepare monitoring programme which will monitor the presence of alien invasive species on the site. If any alien invasive species are detected, then the distribution of these should be mapped (GPS co-ordinates of concentrations of plants). The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area.		
		Ensure proper management of soil stockpiles. Do not import soil stockpiles from areas with alien plants to ensure proper management of stockpiles.	Monitor the presence of alien invasive plants during the construction phase via visual inspections and take action to remove and control these species.	On-going	ECO and EPC Contractor
		Keep clearance and disturbance of indigenous vegetation to a minimum.	Monitor and manage vegetation clearing by undertaking visual inspections to ensure minimal disturbance and to restrict activities to within demarcated areas.	On-going	ECO and EPC Contractor
		Ensure that the footprint required for the proposed project activities (such as temporary stockpiling, earthworks, storage areas, site establishment etc.) is kept at a minimum.	Verify that the proposed project area is determined and outlined prior to the commencement of the construction phase by undertaking visual inspections.	Once-off prior to construction and as required during the construction process.	ECO and EPC Contractor
		Ensure that alien invasive vegetation found on site, within the	Monitor the presence of alien invasive plants during the	On-going	ECO and EPC Contractor

		proposed project footprint, is immediately controlled and removed promptly, in a scheduled manner throughout the construction phase. The removal of alien vegetation on site during the construction phase should use registered control methods and take into consideration the Alien and Invasive Species Regulations published in terms of Section 97(1) of the NEM: BA, if applicable.	construction phase via visual inspections and take action to remove and control these species. If any alien invasive species are detected, then the distribution of these should be mapped (GPS coordinates of concentrations of plants). The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. Any alien invasive should be cleared from site.		
		The removed alien invasive vegetation should be immediately disposed at a suitable waste disposal facility and should not be kept on site for prolonged periods of time, as this will enhance the spread of these species.	Monitor the removal of the alien vegetation found on site via visual inspections.	As necessary during the construction phase.	ECO
		All construction machinery and plant equipment delivered to site for use during the construction phase should be cleaned in order to limit the introduction of alien species.	Clean machinery and equipment prior to the construction phase. ECO to conduct visual inspections to verify that machinery and equipment are cleaned and report any non-compliance.	Prior to the commencement of construction. As necessary during the construction phase.	ECO and EPC Contractor
OPERATIONAL PHASE					
Impacts due to establishment of alien invasive plants. Exotic weed invasion may result in the ousting of natural vegetation and alteration of ecological processes	Reduce the establishment and spread of alien invasive plants.	Continue with on-going monitoring programme to detect and quantify any alien species that may become established and identify the highly invasive species during the operation phase.	Annual audit of project area and immediate surroundings. If any alien invasive species are detected, then the distribution of these should be mapped (GPS co-ordinates of concentrations of plants). The results should be interpreted in terms of the risk	Annual	Operations and Maintenance Contractor

on site, with incremental impacts on the adjacent veld types.			posed to sensitive habitats within and surrounding the project area.		
		Immediately control any alien plants that become established using registered control methods. Use of herbicides and undertake manual removal of alien vegetation on site where this may arise. Regular address and redress of weeds identified on site by a suitable contractor. The clearance of exotic weed to be undertaken bi-annually at a minimum and on a need's basis at an intermittent level.	Monitor the use of herbicide sprays and manual removal of alien vegetation by undertaking visual inspections and reporting any non-compliance. Maintain register of weed spraying activities and ensure that herbicide use is recorded.	Bi-annually	Holder of the EA
DECOMMISSIONING PHASE					
Exotic weed invasion of the decommissioned site resulting in ecological change	To prevent the excessive growth and propagation of exotic weeds on disturbed lands that formed a portion of the PV facility.	All-natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally sourced seed of indigenous grass species that were recorded on site pre-construction.	Final external audit of area to confirm that area is rehabilitated to an acceptable level.	Once off	Main Contractor with advice from specialist
		Exotic weed control measures to be instituted through weed control programme. Regular redress of exotic weed through the use of herbicide and manual removal.	Compile weed eradication programme for a period of 12 months after the decommissioning exercise. Appoint contractor to undertake the weed eradication programme. Monitor newly disturbed areas where infrastructure has been removed to detect and quantify any aliens that may become established after decommissioning and rehabilitation. Final external audit of area to confirm that area is free of alien invasive plants after 5 years.	Weed eradication exercise to be undertaken every 6 months for a period of 12 months following decommissioning. Prior to the commencement of the decommissioning phase. Once-off	Holder of the EA with input from the specialist where necessary.

8. PLANT RESCUE AND PROTECTION PLAN / RE-VEGETATION AND HABITAT REHABILITATION PLAN

All disturbed soil must be reclaimed using only indigenous vegetation and rehabilitation activities should take place in compliance with this EMPr.

No exotic plants should be used for rehabilitation purposes.

Environmental Management Programme rehabilitation should take place as soon as possible after the completion of construction in a particular area. The ECO must ensure that the EPC commences with the actions detailed in the plan below as soon as possible to ensure compliance with the EIA Regulation.

Appropriate permits must be obtained from the DFFE (Forestry) and the provincial conservation authority for the removal of all plants listed in terms of the National Forest Act and provincial legislation. These permits must be in place prior to any vegetation clearing and copies of these permits must be kept on file in the EMPr file. In addition to the environmental impact management actions detailed in the table below, all conditions contained within these permits must be complied with by the EPC Contractor.

The following plant rescue and protection plan / re –vegetation and habitat rehabilitation plan must be adopted and implemented.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
CONSTRUCTION PHASE					
Excessive loss of natural vegetation in and outside the development footprint area and veld degradation	Minimise loss of natural vegetation. Prevent impacts on natural vegetation in sensitive habitats and SSC.	Sensitive habitats and areas outside of the project development area should be clearly demarcated as no go areas during the construction phase to avoid accidental impacts. No development or activities should take place in the high sensitivity ecosystems	Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. ECO must monitor activities and record and report non-compliance Strict control and proper education of staff to prevent misconduct. If ECO is absent, there should be a designated EO	Daily	ECO and Contractor

			present to deal with any urgent issues.		
		Ensure that the footprint required for the proposed project activities is kept at a minimum.	Verify that the proposed project area is determined and outlined prior to the commencement of the construction phase by undertaking visual inspections.	Once-off prior to construction and as required during the construction process.	ECO
		The proposed project footprint must be demarcated to reduce unnecessary disturbance beyond the proposed project area.	Carry out visual inspections to ensure strict control over the behaviour of staff in order to restrict activities to within demarcated areas.	Weekly	ECO
		The Contractors and construction personnel must be made aware that indigenous vegetation must not be removed or damaged	Carry out Environmental Awareness Training. Conduct audits of the signed attendance registers.	Once-off training and ensure that all new staff are inducted. Monthly	Contractor/ ECO
		Ensure that the temporary site camp is established at least 32 m away from any banks of the major drainage lines.	Monitor the placement of the site camp via visual inspections, and record and report any noncompliance.	Once-off prior to construction and as required during the construction phase.	ECO
		Unnecessary impacts on surrounding natural vegetation must be avoided during construction. All construction vehicles should remain on properly and clearly demarcated roads.	Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. Include periodical site inspection in environmental performance reporting that specifically records occurrence of off-road vehicle tracks in specific areas.	Daily	ECO and Contractor
		Undertake rehabilitation of disturbed areas as soon as possible after construction. Stockpile the	Undertake following the construction phase and report any non-compliance.	Daily	ECO and Contractor

		shallow topsoil layer separately from the subsoil layers. Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly recolonize the bare soil areas. Re-seed with locally sourced seed of indigenous grass species that were recorded on site during the pre-construction phase.			
		The collection, hunting or harvesting of any plants, fuel wood or animals at the site during construction should be strictly forbidden and the staff educated to prevent this from happening.	Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. Carry out Environmental Awareness Training. Conduct audits of the signed attendance registers.	Daily Once-off training and ensure that all new staff are inducted. Monthly	ECO and Contractor
		Fires should only be allowed within fire-safe demarcated areas. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on site for the duration of the construction phase.	Strict control over the behaviour of construction workers, restricting activities to within demarcated areas. Ensure fire safety requirements are well understood and respected by workers (by providing basic fire safety training).	Daily	ECO and Contractor
		Existing access roads/servitudes must be used and should be located along the boundaries of existing disturbed areas, if possible.	Compile plan pre-construction.	Prior to construction commencing	Holder of the EA
Impact on indigenous vegetation, and on SSC and their habitats	To reduce negative impacts on and loss of indigenous vegetation and protected trees. Minimise impacts on SSC and protected trees.	Appoint a specialist to undertake a second review and site visit of the final layout of the development footprint, possibly during the late summer period, in order to identify any plant species on site that may	Appoint an Ecologist to oversee the final development footprint area through a reconnaissance survey	Prior to the commencement of construction	Holder of the EA

		require "rescue" as well as any exotic weeds/vegetation that require removal.			
		Identification of roadways and areas where extensive vegetation loss will result is required. Upon consideration, the avoidance of unnecessary clearance of vegetation on site should be undertaken through minor deviations to the design. Ensure that the footprint required for the proposed project activities is kept at a minimum.	Review how larger vegetation will be dealt with by contractors. Vegetation should be subject to redress when given a height that aligns with the lower limit of the PV array or when adjudged to affect construction.	Ongoing	Holder of the EA
		A plant rescue operation must be initiated to confirm that no other species are located within the development site.	ECO must undertake a final walkthrough of the site prior to commencement of construction to ensure no SCC will be impacted on	Once-off	ECO and Contractor
		Clearing of vegetation should be kept to a minimum, keeping the width and length of the earthworks to a minimum.	Monitor activities and record and report noncompliance.	Daily	ECO and Contractor
		Avoid the removal of listed SSC or protected species as far as possible. Should any of the listed/protected species need to be removed, the requisite permits must be obtained prior to the removal of the species.	Monitor activities and record and report noncompliance.	Daily	ECO and Contractor
Disturbance of terrestrial fauna and flora on site due to construction workers and activities	To advise construction staff of the requirements in respect of management of flora and fauna on site during the construction phase.	Conduct an Environmental Awareness Training and induction for all construction staff and personnel.	Carry out Environmental Awareness Training with a discussion on the management of terrestrial fauna and flora on site. Conduct audits of the signed attendance registers.	Prior to construction and as required by the ECO. Ensure that all new staff are inducted. Monthly	ECO and Contractor ECO
Impact on fauna as a result of construction activities.	To identify any faunal mortalities and record the	Establish a recording method in order to monitor the construction activities, including species	Establish database of species, siting's etc.	Daily to monthly	ECO

	details (such as the reason, spatial extent etc.) in order to avoid repetition of fatality.	presence within site, mortalities and siting's.	Construction personnel should advise on the findings and presence of fauna on site.		
	To remove species that may be found present in the construction footprint and laydown area.	Appoint a specialist to conduct an inspection of the final project area and sweep or inspect the site for any fauna, once the fencing is complete (i.e., the established site should be flushed to ensure any large wildlife is not contained within the fenced area). Appoint a small team to flush game during the early evening. Game should be flushed by driving a team through the gated facility towards the exit.	Team to flush game as required. ECO to monitor flushing process and record any incidents or non-compliance.	Once off prior to commencement and thereafter if required.	ECO and Holder of the EA
		The Contractor or Contractors Environmental Officer should monitor trenches at the start and end of each working day to check if any small animals are trapped.	Monitor activities and record and report noncompliance.	As required during construction	ECO and Contractor
		No animals (including snakes) shall be killed on site. An expert or a suitable specialist should be appointed to remove and relocate any poisonous snakes during the construction phase.	Monitor activities and record and report noncompliance.	As required during construction	ECO and Contractor
Faunal and avifaunal road mortality as a result of increased vehicles travelling to and within the site.	Minimise loss of fauna as a result of road mortalities.	The construction personnel and staff should be made aware of the presence of fauna within the proposed project area. The construction personnel and staff must also be made aware of the general speed limits on site and must be alert at all times for potential crossings.	Carry out Environmental Awareness Training. Conduct audits of the signed attendance registers.	Once-off training and ensure that all new staff are inducted. Monthly	ECO and Contractor ECO
		To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with	Monitor the activities via visual inspections, and record and report any non-compliance.	Daily	ECO and Contractor

		suitable material, where appropriate, and the site camp must be kept clean on a daily basis.			
Impact and loss of fauna as a result of the fence line and exclusion of fauna from site resulting in ecological change within the site.	To reduce incidental mortality and injury of fauna within the construction area.	Ensure that the live electrical fence wire is not placed at ground level. Conduct inspections of the fence line to address any animals that may be affected by the fence.	Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence.	Daily to monthly record keeping. A register of all faunal siting's indicating date of siting; species affected; position of species (specific or indicative) and other observations should be established.	Holder of the EA
Increased ELP, leading to changes in nocturnal behavioural patterns amongst fauna	The avoidance of electrical light pollution through prudent positioning of external lighting.	Placement of lighting, particularly security lighting, to avoid excessive influence on surrounding areas. Placement of lighting to be judiciously considered at time of implementation.	Review lighting plans and identify important habitat zones to be avoided.	Prior to the installation of lighting.	Holder of the EA, Contractor and ECO
OPERATIONAL PHASE					
Vegetation management on site	Manage vegetation throughout the site to avoid conflict with operations of the proposed PV facility. Excessive growth of vegetation on site may affect operations of the PV facility, while excessive clearance of vegetation on site has concomitant impacts on the land in question. Management of vegetation at an optimum level of growth and height is required. Vegetation	Identify protocol for pruning of vegetation and clearance where required. Identify level of pruning and vegetation management required.	Identify means of pruning and clearance of vegetation. For example, brush cutter, grazing etc.	Ongoing and as required	Environmental Manager

	should be managed by brush cutters after the rainy season once the vegetation has flowered and disbursed seeds (June – August)				
Loss of SSC and their Habitats	Control loss of natural vegetation during the operational phase. Prevent impacts on natural vegetation in sensitive habitats and SSC.	Unnecessary impacts on surrounding natural vegetation must be avoided. All operational and maintenance vehicles to remain on the roads and no driving off road allowed. No unauthorized persons should be allowed onto the site.	Strict control over the behaviour of operation workers, restricting activities to within demarcated areas for operation. Strict control and proper education of staff to prevent misconduct.	Monthly	Environmental Manager
		The collection, hunting or harvesting of any plants, any protected trees, fuel wood or animals at the site should be strictly forbidden and the staff educated to prevent this from happening.	Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. Carry out Environmental Awareness Training. Conduct audits of the signed attendance registers.	Daily Once-off training and ensure all new staff are inducted. As required	Facility Manager and Environmental Manager
		All hazardous materials should be stored in the appropriate manner to prevent impacts on vegetation. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.	Monitor the activities via visual inspections, and record and report any non-compliance.	Daily	Environmental Manager
		Fires should only be allowed within fire-safe demarcated areas. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on site for the duration of the operational phase.	Strict control over the behaviour of construction workers, restricting activities to within demarcated areas. Ensure fire safety requirements are well understood and respected by workers (by	Daily	Facility Manager and Environmental Manager

			providing basic fire safety training).		
		storm-water management plan must be implemented during the operational phase. Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	Verify that the stormwater management plan is being implemented and signed off prior the commencement of operations. Undertake regular inspections of the stormwater infrastructure (i.e., by implementing walk through inspections).	Prior to commencement of operations. Weekly/Monthly	Environmental Manager Facility Manager
		Undertake maintenance of rehabilitated areas in accordance with the rehabilitation and landscaping plan.	Monitor topsoil removal and rehabilitation activities, and record and report non-compliance.	Weekly or Monthly	Facility Manager and Environmental Manager
		Continue with on-going monitoring programme to detect and quantify any alien species that may become established and identify the highly invasive species during the operation phase.	Monitor the presence of alien invasive species on the development site.	Reporting frequency depends on legal compliance framework	Facility Manager and Environmental Manager
Impact and loss of fauna as a result of operational activities.	To reduce the loss of and impact on fauna.	Prior to the commencement of the operational phase, the plant manager and the landowner need to reach a decision in terms of the allowance of faunal activities or redress of faunal activities within site. Identify points of excessive faunal activity and impact on operations. Undertake monitoring of faunal activities within the fenced area of the site and the immediate proximity of the site. Reduction in speed limits in and around site.	Establish reporting procedure. Monitor the presence of fauna during the operational phase via visual inspections and site visits. Carry out Environmental Awareness Training. Conduct audits of the signed attendance registers.	Daily Once-off training and ensure all newstaff are inducted. As required	Facility Manager and Environmental Manager Facility Manager

Impact and loss of fauna as a result of the fence line and exclusion of fauna from site resulting in ecological change within the site.	To reduce the impact and loss of fauna from site as a result of their exclusion from the area.	Avoidance of damage to infrastructure by faunal activity as well as impact on fauna as a result of the site infrastructure. Identify impact of burrowing and other faunal activities on the fence line and operations activities. Undertake the management of faunal intrusion through the fence, including possible mortalities. Provide critter paths through the fence line to allow species access to site. Ensure that the live electrical fence wire is not placed at ground level. Conduct inspections of the fence line to address any animals that may be affected by the fence. Promote and support faunal presence andactivities within the proposed PV facility	Identify where fauna may be affecting operations of site (burrows etc.) Consider redress if necessary. Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence. Monitor the activities via visual inspections, and record and report any non-compliance.	Daily to monthly record keeping. A register of all faunal siting's indicating date of siting; species affected; position of species (specific or indicative) and other observations should be established. Daily	Holder of the EA
Impact of ELP around the site.	The avoidance of electrical light pollution through prudent positioning of external lighting.	Placement of lighting, particularly security lighting to avoid excessive influence on surrounding areas.	Review lighting plans and identify important habitat zones to be avoided.	Prior to the installation of lighting.	Holder of the EA and Environmental Manager
Faunal and avifaunal road mortality as a result of increased vehicles travelling to and within the site.	Minimise loss of fauna as a result of road mortalities.	The operational personnel and staff should be made aware of the presence of fauna within the proposed project area. The operational personnel and staff must also be made aware of the general speed limits on site and must be alert at all times for potential crossings.	Carry out Environmental Awareness Training. Conduct audits of the signed attendance registers.	Once-off training and ensure that all new staff are inducted. Monthly	Facility Manager Environmental Manager

		To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the offices must be kept clean on a daily basis.	Monitor the activities via visual inspections, and record and report any non-compliance.	Daily	ECO and Contractor
DECOMMISSIONING PHASE					
Rehabilitation of flora on Site	Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to operation.	All damaged areas shall be rehabilitated upon completion of the contract. All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally sourced seed of indigenous grass species that were recorded on site preconstruction. Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas.	Conduct a final external audit to confirm that area is rehabilitated to an acceptable level.	Once off	Holder of the EA with feedback and input from an appropriate specialist. with advice from specialist

9. OPEN SPACE MANAGEMENT PLAN

The following open space management plan must be adopted and implemented.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
DESIGN PHASE					
Loss of vegetation and habitat fragmentation	Keeping the area cleared of vegetation to a minimum	Clearing of vegetation should be kept to a minimum	Ensure that solar panel/array design and layout is uniform and well-adapted to the surrounding environment and that no unnecessary areas are cleared of vegetation.	Once-off during design	Holder of the EA
Impacts due to establishment of alien invasive plants	Ensure the appropriate removal of alien invasive vegetation from the proposed project area and prevent the establishment and spread of alien invasive plants due to the project activities.	Ensure compliance with relevant Environmental Specifications for the control and removal of alien invasive plant species. Appoint a specialist or contact relevant authorities to seek guidance on the removal of the alien vegetation on site. Compile and finalise an alien weed eradication programme.	Appoint a suitable specialist/ Contractor or contact the relevant authorities to seek guidance on the removal of the planted alien invasive species. Appoint a suitable specialist to compile an alien invasive vegetation eradication plan. Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	Once-off during the design phase.	Holder of the EA
Permanent barriers to animal movement and habitat fragmentation	The reduction in the impact that barrier will have on animal movement within the area	Fencing should allow for the passage of small and medium sized mammals and all forms of mesh fencing should be avoided.	Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	Once-off during the planning and design phase	Holder of the EA
		All remaining areas that are not impacted upon by the proposed development footprint should remain	Ensure that this is taken into consideration during the planning and design phase by reviewing	Once-off during the planning and design	Holder of the EA

		unfenced to allow for movement corridors between the remainder of the farm.	signed minutes of meetings or signed reports.	phase	
		Bidirectional Forwarding Detection (BFDs) should be installed on the overhead cables where known flight paths of birds occur.	Identify appropriate points within infrastructure for the establishment of BFDs. Verify that this is undertaken by reviewing the signed approved designs.	Once-off	Holder of the EA and ECO
CONSTRUCTION PHASE					
Permanent barriers to animal movement and habitat fragmentation	The reduction in the impact that barrier will have on animal movement within the area	BFDs should be installed on the overhead cables where known flight paths of birds occur.	The flight paths and birds observed in the area should be monitored by the ECO during the construction phase to determine where these measures should be installed. Verify whether these have been installed by inspecting the site prior to commencement of the operational phase.	Daily Once-off	ECO and Contractor ECO
		Fencing should allow for the passage of small and medium sized mammals and all forms of mesh fencing should be avoided.	This should be monitored by the ECO to determine whether this is effective.	Daily	ECO and Contractor
Loss of vegetation and habitat fragmentation	Keeping the area cleared of vegetation to a minimum	Clearing of vegetation should be kept to a minimum, keeping the width and length of the earthworks to a minimum.	Monitor activities and record and report non-compliance.	Daily	ECO and Contractor
OPERATIONAL PHASE					
Increased risk of alien plant invasion	Ensure that the site is kept free from alien invasive species.	Continuously monitor the site and remove alien invasive species that are found.	Monitor the presence of alien invasive species on the development site.	Reporting frequency depends on legal compliance framework	Facility Manager and Environmental Manager
Increased animal road mortality	Minimise loss of fauna as a result of road mortalities.	Create awareness during staff induction programmes. Staff must be made aware of the general speed limits as well as the potential	Conduct staff awareness training programmes.	Once-off training and ensure all new staff are inducted.	Facility Manager and Environmental Manager

		animals that may cross and how to react in these situations			
Permanent barriers to animal movement and habitat fragmentation	Avoid or reduce bird collisions with or due to infrastructure related to the project	The impact on birds must be monitored by environmental staff member during the first six months of the operational phase.	Record any evidence of bird collisions, injury or other bird-related incidents (with GPS coordinates). Where necessary, a bird specialist should oversee the recording and reporting of incidents, help with species identification, assess the significance of any impacts, and if required, suggest mitigation.	Weekly for the first month, thereafter, monthly	Holder of the EA.
		Annual monitoring by an avifaunal specialist. This should be based on a minimum of 3-5 days observations.	Monitor the flight paths of birds occurring on site, noting which birds are seen.	Annually	Holder of the EA.
		Any avian mortality or injury at the facility should be duly recorded and reported.	Record any bird fatalities and undertake the necessary reporting to relevant authority.	When required	Holder of the EA.
DECOMMISSIONING PHASE					
No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area.	To manage impacts on the surrounding environment during the operational phase.	Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes	Final external audit of area to confirm that area is rehabilitated to an acceptable level	Once off	Holder of the EA.
		Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of native species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape.	Final external audit of area to confirm that area is rehabilitated to an acceptable level	Once off	Holder of the EA.
		Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape.	Final external audit of area to confirm that area is rehabilitated to an acceptable level	Once off	Holder of the EA.

10. HAZARDOUS SUBSTANCES LEAKAGE OR SPILLAGE MONITORING SYSTEM

The following hazardous substances leakage or spillage monitoring system must be adopted and implemented.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
CONSTRUCTION PHASE					
Contamination of soil and risk of damage to vegetation and/or fauna through spillage of concrete and cement.	To control concrete and cement batching activities in order to reduce spillages and resulting contamination of soil, groundwater and the vegetation and/or fauna.	If any concrete mixing takes placed on site, this must be carried out in a clearly marked, designated area at the site camp on an impermeable surface (such as on boards or plastic sheeting and/or within a bunded area with an impermeable surface).	Monitor the handling and storage of sand, stone and cement as instructed.	Daily	Holder of the EA, EPC contractor and ECO.
		Bagged cement must be stored in an appropriate facility and at least 10 m away from any water courses, gullies and drains.	Monitor the handling and storage of sand, stone and cement as instructed.	Daily	Holder of the EA, EPC contractor and ECO.
		A washout facility must be provided for washing of concrete associated equipment. Water used for washing must be restricted.	Monitor the handling and storage of sand, stone and cement as instructed.	Daily	Holder of the EA, EPC contractor and ECO.
		Hardened concrete from the washout facility or concrete mixer can either be reused or disposed of at an appropriate licenced disposal facility. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes.	Monitor the handling and storage of sand, stone and cement as instructed. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	Daily Monthly	Holder of the EA, EPC contractor and ECO.
		Empty cement bags must be secured with adequate binding	Monitor the handling and storage of sand, stone and cement as instructed.	Daily	Holder of the EA, EPC

		material if these will be temporarily stored on site. Empty cement bags must be collected from the construction area at the end of every day. Sand and aggregates containing cement must be kept damp to prevent the generation of dust.			contractor and ECO.
		Any excess sand, stone and cement must be removed fromsite at the completion of the construction period and disposed at a licenced waste disposal facility. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes.	Monitor the handling and storage of sand, stone and cement as instructed. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	Daily Monthly	Holder of the EA, EPC contractor and ECO.
Contamination of soil and risk of damage to vegetation and/or fauna through spillage of fuels and oils.	To control and eliminate fuel and oil spillages which may result in soil contamination and damage to vegetation and/or fauna.	Ensure that adequate containment structures are provided for the temporary storage of liquid dangerous goods and hazardous materials on site (such as chemicals, oil, fuel,hydraulic fluids, lubricating oils etc.). Appropriate bund areas must be provided for the storage of these materials at the site camp. Bund areas should contain an impervious surface in order to prevent spillages from entering the ground. Bund areas should have a capacity of 110 % of the volume of the largest tank in the bund (tanks include storage of fuel/diesel).	Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record noncompliance and incidents.	Weekly	EPC Contractor and ECO
		Monitor and inspect construction equipment and vehicles to ensure that no fuel spillage takes place. Ensure that drip trays are provided for construction equipment and vehicles as required.	Monitor the construction equipment and vehicles and monitor the occurrence of spills and the management process thereof. Record all spills and lessons learnt.	Daily During spill events	EPC Contractor and ECO

		Contractor to compile a Method Statement for refueling activities under normal and emergency situations. If on-site servicing and refuelling is required in emergency situations, a designated area must be created at the construction site camp for this purpose. Drip trays30 or similar impervious materials must be used during these procedures.	Verify if a Method Statement is compiled by reviewing approved and signed off reports. Monitor the refuelling/ servicing process and record the occurrence of any spillages.	Once-off prior to commencement of construction. During emergency refuelling and servicing activities.	ECO
		Spilled fuel, oil or grease must be retrieved, and contaminated soil removed, cleaned and replaced.	Monitor the handling and storage of fuels and oils via site audits and monitor if spillages have taken place and if so, are removed correctly. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	Daily (or during spills)	EPC Contractor and ECO
		Contaminated soil to be collected by the Contractor (under observation of the ECO) and disposed of at a registered waste facility designated for this purpose. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes.	Monitor the correct removal of contaminated soil. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	Daily (or during spills)	EPC Contractor and ECO
		A Spill Response Method Statement must be compiled by the Contractor for the construction phase in order to manage potential spill events.	Compile a Spill Response Method Statement. Audit signed and approved Spill Response Method Statement	Once-off (and thereafter updated as required during the construction phase). Once-off (and thereafter as required during the construction phase).	Holder of the EA, EPC contractor and ECO.
		The Contractor must ensure that adequate spill containment and	Monitor via site audits and	Daily/Weekly	ECO and EPC Contractor

		clean-up equipment are provided on site for use during spill events.	record incidents and non-compliance.		
		Portable bioremediation kit (to remedy chemical spills) is to be held on site and used as required.	Ensure that a well-maintained portable bioremediation kit is available on site and that construction personnel and contractors are aware of its location and instructions	Daily	EPC Contractor and ECO
		In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree and level of contamination, excavation and removal to a hazardous waste disposal facility could be necessary. If the spillage is widespread and the soil is considered to be significantly contaminated, a specialist will need to be immediately appointed to address the spillage. This will usually entail the collection of samples of the contaminated soil followed by analysis in terms of the 2014 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (i.e., GN 331). If the soil is determined to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant, including notifying the Minister of Environmental Affairs of the significant contamination.	Ensure that a suitably qualified specialist is appointed to collect and analyse the contaminated soil samples in terms of the 2014 Norms and Standards (i.e., GN 331) in order to determine if the soil is significantly contaminated or not. If the contaminated soil is considered to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant.	During spill events	Holder of the EA
		The Contractor must record and document all significant spill events.	Monitor documentation and records of significant spill events via audits and record non-compliance and incidents.	During spill events	ECO
OPERATIONAL PHASE					

Contamination of soil and risk of damage to vegetation and/or fauna through spillage of fuels and oils	To control and eliminate fuel and oil spillages which may result in soil contamination and damage to vegetation and/or fauna.	Monitor and inspect maintenance equipment and vehicles to ensure that no fuel spillage takes place.	Implement specifications for maintenance equipment use as specified by the maintenance Contractor.	Monthly	Holder of the EA
		Spilled fuel, oil or grease is retrieved during operations where possible and contaminated soil removed, cleaned and replaced.	Monitor the handling and storage of fuels and oils via site audits and monitor if spillages have taken place and if so, are removed correctly. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	During spills	Holder of the EA
		Contaminated soil to be collected by the Contractor and disposed of at a registered waste facility designated for this purpose. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes.	Monitor the correct removal of contaminated soil. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	During spills	Holder of the EA
		A Spill Response Plan must be compiled for the operational phase in order to manage potential spill events.	Compile a Spill Response Plan. Audit signed and approved Spill Response Method Statement	Once-off (and thereafter updated as required). Once-off (and thereafter as required).	Holder of the EA and Facility Manager
		Ensure that adequate spill containment and clean-up equipment are provided on site for use during spill events. Portable bioremediation kit (to remedy chemical spills) is to be held on site and used as required.	Ensure that a well-maintained portable bioremediation kit is available on site and that operational personnel are aware of its location and instructions.	Weekly	Facility Manager
		In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree and level of contamination, excavation and removal to a hazardous waste disposal facility could be necessary. If the spillage is	Ensure that a suitably qualified specialist is appointed to collect and analyse the contaminated soil samples in terms of the 2014 Norms and Standards (i.e., GN 331) in order to determine if the soil is	During spill events	Holder of the EA

		widespread and the soil is considered to be significantly contaminated, a specialist will need to be immediately appointed to address the spillage. This will usually entail the collection of samples of the contaminated soil followed by analysis in terms of the 2014 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (i.e., GN 331). If the soil is determined to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant, including notifying the Minister of Environmental Affairs of the significant contamination.	significantly contaminated or not. If the contaminated soil is considered to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant.		
		Ensure that adequate containment structures are provided for the temporary storage of liquid dangerous goods and hazardous materials on site (such as chemicals, oil, fuel, hydraulic fluids, lubricating oils etc.). Appropriate bund areas must be provided for the storage of these materials at the PV facility. Bund areas should contain an impervious surface in order to prevent spillages from entering the ground. Bund areas should have a capacity of 110 % of the volume of the largest tank in the bund (tanks include storage of fuel/diesel).	Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record noncompliance and incidents.	Weekly	Facility Manager
Impacts due to management solid and liquid wastes disposed of	Prevent environmental impacts as a result of the operational phase such as	All operation waste to be removed from the site by an appointed service provider.	Waste removal and disposal to be monitored throughout operation.	Monthly	Facility Manager

on the site during operational phase.	pollution.	All liquid waste or spills (used oil, paints, lubricating compounds and grease from vehicles passing through the entrance facility) to be packaged and disposed appropriately at a registered landfill site.	Monitor the correct removal of liquid waste or spills. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	During spills	Holder of the EA
		Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided in order to avoid spillages.	Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record noncompliance and incidents.	Weekly	Facility Manager
DECOMMISSIONING PHASE					
No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area.					

11. STORMWATER MANAGEMENT PLAN

The following Stormwater Management Plan must be adopted and implemented. No discharge of effluent or polluted water must be allowed to enter any rivers or wetland areas.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	**Frequency**	**Responsibility**
		DESIGN PHASE			
Impact of the project if a detailed storm water management plan is not correctly prepared.	To limit the effect of uncontrolled storm water runoff from developed areas onto natural areas	Prepare a detailed stormwater management plan outlining appropriate treatment measures to address runoff from disturbed portions of the site, such that they do not: - result in concentrated flows into natural watercourses i.e., provision should be made for temporary or permanent measures that allow for attenuation, control of velocities and capturing of sediment upstream of natural water courses; - result in any necessity for concrete or other lining of natural water courses to protect them from concentrated flows of the development;	Check compliance with specified conditions. Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	Once-off during design followed by regular control During the design phase	Contractor ECO

		- divert flows out of their natural flow pathways, thus depriving downstream watercourses of water.			
CONSTRUCTION PHASE					
Diversion and impedance surface water flows – Changes to the hydrological regime and increased potential for erosion.	Prevent interference with natural run-off patterns, diverting flows and increasing the velocity of surface water flows.	The appointed Contractor should compile a Method Statement for Stormwater Management during the construction phase.	Compile a Method Statement for Stormwater Management during the construction phase. Inspect and verify if a Method Statement for Stormwater Management has been compiled by the Contractor via audits prior to the commencement of the construction phase.	Prior to the construction phase. Once-off prior to the commencement of the construction phase.	Contractor ECO
Diversion and increased velocity of surface water flows –reduction in permeable surfaces		Stormwater and any run-off generated by the hard surfaces should be discharged into retention swales or areas with rock riprap (or similar). These could be used to enhance the sense of place, if they are planted with indigenous vegetation.	Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	Weekly or bi-weekly	ECO
		Erosion and sedimentation into water bodies must be minimised through the effective stabilisation (gabions and Reno mattresses or similar) and the re-vegetation of any disturbed riverbanks.	Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	Weekly or bi-weekly	ECO
		Place energy dissipation structures in a manner that allows the management of flows prior to being discharged into the natural environment, thus not only preventing erosion, but supporting the maintenance of natural base flows within these systems i.e., hydrological regime (water quantity and quality) is maintained.	Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	Weekly or bi-weekly	ECO

		Reinforce soil slopes to minimise erosion during rehabilitation (as needed, and once construction in a specific area has ceased).	Monitor activities and record and report non-compliance.	As needed during the construction phase	ECO
		Any irrigation of the development area for landscaping or dust control purposes should be controlled, such that it does not result in any measurable increase in moisture being passed into natural drainage lines.	Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	Weekly or bi-weekly	ECO
		Drainage along the sides of the roads should be designed so that it does not result in concentrated flows into watercourses.	Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	Weekly or bi-weekly	ECO
		Perform periodic inspections and maintenance ofsoil erosion measures and stormwater control structures.	Monitor activities and record and report non-compliance.	As needed during the construction phase	ECO
Pollution of the surrounding environment as a result of the contamination of stormwater. Contamination could result from the spillage of chemicals, oils, fuels, sewage, solid waste, litter etc.	To prevent contaminated stormwater from entering into and adversely impacting on freshwater ecosystems and reducing the water quality. To reduce sedimentation of nearby water systems. To apply best practice principles in managing risks to storm water pollution.	The appointed Contractor should compile a Method Statement for Stormwater Management during the construction phase.	Compile a Method Statement for Stormwater Management during the construction phase. Inspect and verify if a Method Statement for Stormwater Management has been compiled by the Contractor via audits prior to the commencement of the construction phase.	Prior to the construction phase. Once-off prior to the commencement of the construction phase.	Contractor ECO
		Provide secure storage for fuel, oil, chemicals and other waste materials to prevent contamination of stormwater runoff. Fuels and chemicals (i.e., any hazardous materials and dangerous goods) used during the construction phase must be stored safely on site and in bunded areas. Fuel and chemical	Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents. Monitor if spillages have taken place and if they are removed correctly.	Weekly	ECO

		storage containers must be inspected to ensure that any leaks are detected early.			
		All stockpiles must be protected from erosion and stored on flat areas where run-off will be minimised. Erosion and sedimentation into water bodies must be minimised through effective stabilisation. No stockpiling should take place within a watercourse. Stockpiles must be located away from river channels i.e., greater than 32 m.	Monitor the excavations and stockpiling process throughout the construction phase via visual site inspections. Record non-compliance and incidents.	Daily	ECO
		Littering and contamination of water resources during construction must be prevented by effective construction camp management.	Monitor via site audits and record noncompliance and incidents (i.e., by implementing walk through inspections).	Weekly	Contractor and ECO
		Emergency plans must be in place to deal with potential spillages (especially those leading to any watercourses).	Check compliance with specified conditions of the Stormwater Management Plan and Method Statement	Weekly or Bi-weekly	ECO
		Erosion and sedimentation into water bodies must be minimised through the effective stabilisation (gabions and Reno mattresses or similar) and the re-vegetation of any disturbed riverbanks.	Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	Weekly or Bi-weekly	ECO
		Ensure that the temporary site camp and ablution facilities are established at least 32 m away from the banks of the major drainage lines.	Monitor the placement of the site camp via visual inspections, and record and report any non-compliance	Once-off prior to construction and as required during the construction phase.	ECO
		Ensure that there is no ad-hoc crossing of channels by vehicles during the construction phase.	Check compliance with specified conditions of the Stormwater Management Plan and Method	Weekly or Bi-weekly	ECO

		Access routes across the site should be strictly demarcated and selected with a view to minimise impacts on drainage lines.	Statement.		
		Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	Monitor via site audits and record noncompliance and incidents (i.e., by implementing walk through inspections).	Weekly	Contractor and ECO
OPERATIONAL PHASE					
Stormwater discharge into the surrounding environment during operations	To minimise the contamination of stormwater by uncontrolled release of contaminated or grey water. To protect soil resources and prevent soil erosion.	An operational phase Stormwater Management Plan should be designed and implemented, with a view to prevent the passage of concentrated flows from hardened surfaces and onto natural areas.	Compile a Stormwater Management Plan for the operational phase. Inspect and verify if a Stormwater Management Plan has been compiled prior to the commencement of the operational phase.	Continuously during operational phase. Once-off prior to the commencement of the operational phase.	Holder of the EA /EPC contractor
		All release points into the natural environment must have appropriate energy dissipaters to minimise scouring/erosion.	Monitor activities and record and report non-compliance. Monitor the placement of energy dissipaters via visual inspections, and record and report any non-compliance	On-going	Holder of the EA /EPC contractor
		As far as reasonably possible, separate “clean” and “dirty” storm water. As far as reasonably possible, capture and contain “dirty” stormwater for appropriate disposal/discharge.	Monitor via site audits and record noncompliance and incidents (i.e., by implementing inspections).	Weekly or as required during operations.	Holder of the EA /EPC contractor
		Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	Undertake regular inspections of the stormwater infrastructure (i.e., by implementing walk through inspections).	Weekly/Monthly	Holder of the EA /EPC contractor
DECOMMISSIONING PHASE					
The proposed solar facility would be expected to run for a minimum period of 25 years, after which it would either be decommissioned, alternatively upgraded or an application submitted to obtain a new license. Should the plant be decommissioned, the solar field would be rehabilitated to its original (pre-development) state. In the (unlikely) event that none of the mitigation measures outlined for the construction and operational phases of the proposed project had been implemented, the period of time for recovery to take place would be extended. In the event that decommissioning occurs, and assuming implementation of mitigation measures, the hydrological regime should fully recover over time to present day conditions.					

12. EROSION MANAGEMENT PLAN

The following Erosion Management Plan must be adopted and implemented.

Anti-erosion measures such as silt fences must be installed in disturbed areas. The plan in the table below provides the actions required for compliance.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
CONSTRUCTION PHASE					
Increased wind erosion and resultant deposition of dust	Prevent wind erosion and resultant deposition of dust on surrounding indigenous vegetation.	Sand, stone and cement should be stored in demarcated areas, and covered or sealed to prevent wind erosion and resultant deposition of dust on the surrounding indigenous vegetation.	Undertake regular inspections of the via site audits to verify that sand, stone and cement are stored and handled as instructed.	Daily	ECO and Contractor
		During construction, efforts should be made to retain as much natural vegetation as possible on the site, to reduce disturbed areas and maintain plant cover, thus reducing erosion risks.	Monitor activities via site inspections and record and report non-compliance.	Daily	ECO and Contractor
		All stockpiles must be protected from erosion and stored on flat areas where run-off will be minimised. Erosion and sedimentation into water bodies must be minimised through effective stabilisation.	Monitor the stockpiling process throughout the construction phase via visual site inspections. Record noncompliance and incidents.	Daily	ECO
Excessive loss of natural vegetation within the development footprint area	Prevent loss of natural vegetation through erosion.	Vegetation clearing during construction must be restricted to the footprint of the proposed project components and planned infrastructure only. It should be	Monitor vegetation clearing throughout the construction phase via visual site inspections. Record non-compliance and incidents.	Daily	ECO and Contractor ECO

		phased to ensure that the minimum area of soil is exposed to potential erosion at any one time.	Undertake regular monitoring for erosion to ensure is reduced and rectified as soon as possible.		
		Stockpile the shallow topsoil layer separately fromthe subsoil layers (especially if the excavation exceeds 0.5 m). Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas.	Rehabilitate disturbed areas and monitor the presence of alien invasive species on site.	Daily (stockpiling) and once-off for the reinstatement of the topsoil layer	ECO and Contractor
		Re-seed with locally sourced seed of indigenous grass species that were recorded on site preconstruction.	Re-seed with seeds of indigenous grass species.	Once off	ECO with advice from specialist (if required)
		Topsoil stockpiles not used in three months after stripping must be seeded to prevent dust and erosion.	Regular monitoring for erosion to ensure that no erosion problems are occurring at the site. All erosion problems observed should be rectified as soon as possible.	Weekly initially and thereafter monthly	ECO and Contractor
Erosion of surface soils, riling and gulley's.	Measures to be implemented that address or avoid the loss of surface soils and exacerbates gulley formation	Identify cause of erosion and possible means of redress (i.e., implement erosion control measures, where applicable), such as the use of geofabric, stone gabions and re-vegetation or similar measures. Erosion control measures should seek to reduce surface flow velocity and allow for settlement on site of silt laden surface waters. Washaways, excessive loss of soils and galleys can be considered to be indicative of excessive erosion.	Monitor the erosion on site during construction, as well as the implementation and effectiveness of erosion control on site (such as the use of geofabric, stone gabions and revegetation or similar measures).	Ongoing and as required during erosion events.	ECO and Project Developer (Imvunulo-Kwaggafontein Solar)
OPERATIONAL PHASE					

Excessive loss of natural vegetation in the development footprint area and resulting impacts on SSC, faunal habitat and habitat fragmentation.	Prevent loss of natural vegetation and minimise habitat fragmentation and the loss of connectivity as a result of erosion.	To prevent erosion, indigenous grasses that seed themselves below the solar arrays should (where possible) be left to form a ground cover and kept short.	ECO to advise on seed to be used.	Prior to re-vegetation.	Holder of the EA / EPC contractor
		The use of silt fences, sandbags or other suitable methods must be implemented in areas that are susceptible to erosion. Other erosion control measures that can be implemented are as follows: 1) Brush packing with cleared vegetation, 2) Planting of vegetation, 3) Hydro seeding/hand sowing. All erosion control mechanisms need to be regularly maintained.	Monitor efficiency of erosion control measures.	Weekly or monthly	Holder of the EA /EPC contractor
		Conduct regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. Ensure that all erosion problems are rectified as soon as possible.	Undertake regular monitoring for erosion to ensure is reduced and rectified as soon as possible.	Monthly	Holder of the EA /EPC contractor
Increased wind erosion and resultant deposition of dust.	Prevent wind erosion and resultant deposition of dust on surrounding indigenous vegetation.	Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.	Include periodic site inspections in environmental performance reporting that inspects the effectiveness and integrity of the run-off control system and specifically records occurrence or non-occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	Monthly	Holder of the EA /EPC contractor
DECOMMISSIONING PHASE					
No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area. Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas. Monitoring: Final external audit of area to confirm that area is rehabilitated to an acceptable level (once off event to be conducted by ECO).					

13. FIRE MANAGEMENT PLAN

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
DESIGN PHASE					
Potential impacts resulting from the lack of overall compliance with the recommendations included in the EMPr	Ensure compliance with the recommendations included in the EMPr	Audit the implementation of the EMPr requirements.	Audit report on compliance with actions and monitoring requirements.	Weekly	ECO / ESA
		Establish clear and transparent reporting of the activities undertaken with regard to all recommendations included in the EMPr.	Audit report on compliance with actions and monitoring requirements.	Weekly	Holder of the EA /EPC contractor
CONSTRUCTION PHASE					
Potential risk of fire due to construction activities or behaviour of staff on site during the construction phase	Prevent fire on site resulting of workers smoking or starting fires (i.e., cooking, heating purposes).	Designate smoking areas, as well as areas for cooking, where the fire hazard could be regarded as insignificant.	Ad-hoc checks to ensure workers are smoking or cooking in designated areas only.	Daily	ECO and Contractor
		Educate workers on the dangers of open and/or unattended fires.	Ensure fire safety requirements are well understood and respected by construction personnel. Carry out Environmental Awareness Training. Conduct audits of the signed attendance registers.	Ongoing. Once-off training and ensure that all new staff are inducted. Monthly	ECO and Contractor Contractor/ ECO ECO
		Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on the site for the duration of the construction phase.	Ensure fire safety requirements are well understood and respected by construction personnel. Provide basic fire safety training.	On-going	ECO and Contractor
		Fire-fighting equipment must be made available at various appropriate locations on the construction site.	Ensure fire safety requirements are well understood and respected by workers. Assurance of functionality of fire	On-going Bi-annually	ECO and Contractor Contractor

			extinguishers via inspections and certification by an accredited fire service company.		
		No person other than a qualified specialist or personnel authorised by the Project Developer, will disturb animals on the site.	Check compliance with specified conditions using a report card and allocate fines when necessary.	On-going	ECO and Contractors
		Educate workers on site about suitable behaviour on site and initiate environmental awareness. Staff must be informed that no trapping, snaring or feeding of any animal will be allowed.	Carry out Environmental Awareness Training. Conduct audits of the signed attendance registers.	Once-off training and ensure that all new staff are inducted. Monthly	Contractor/ ECO ECO
		The Contractor should install and maintain Construction Site Information Boards in the position, quantity, design and dimensions specified by the Project Developer.	Monitor compliance and record noncompliance and incidents.	Before construction	ECO
		General building materials should be stored in appropriate designated areas on site such that there will be no runoff from these areas towards sensitive systems. The site camp must be removed after construction.	Monitor compliance and record noncompliance and incidents.	Before construction	ECO
		Make construction personnel aware of the importance of limiting water wastage, as well as reducing water use.	Conduct audits of the signed attendance registers.	Once-off training and ensure that all new staff are inducted. Monthly	Contractor/ ECO ECO
OPERATIONAL PHASE					
Potential risk of fire due to behaviour of staff on site during the operational phase	Ensure appropriate and efficient fire prevention during the operational phase.	Designate smoking areas as well as areas for cooking, where the fire hazard could be regarded as insignificant.	Random inspections during a month to ensure workers are smoking or starting fires in designated areas only.	Monthly	Facility Manager
		Educate workers on the dangers of open and/or unattended fires.	Ensure fire safety requirements are well understood and respected by operational personnel.	Ongoing Once-off training and ensure that all new staff are inducted. Monthly	Facility Manager

			Carry out Environmental Awareness Training. Conduct audits of the signed attendance registers.		
		Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on the site for the duration of the operational phase.	Ensure fire safety requirements are well understood and respected by operational personnel. Provide basic fire safety training.	On-going	Holder of the EA /EPC contractor
		Ensure that adequate fire-fighting equipment is available and easily accessible on site.	Ensure fire safety requirements are well understood and respected by workers. Assurance of functionality of fire extinguishers via inspections and certification by an accredited fire service company.	On-going Bi-annually	Holder of the EA /EPC contractor
DECOMMISSIONING PHASE					
Ensure that the construction mitigation and management measures are adhered to during the decommissioning phase.					

14. DECOMISSIONING PHASE – IMPACT MANAGEMENT OUTCOMES AND ACTIONS

Should the activity ever cease or become redundant, the holder of the authorisation must undertake the required actions as prescribed by legislation at the time and comply with all relevant legal requirements.

After the lifespan of the facility (25 years), there is a possibility that the entire facility will be decommissioned and closed (although other options for continuation may be investigated)

Appendix 5 of Regulation 326 of the 2017 EIA Regulations contains the required contents of a Closure Plan. The table below shows the minimum requirements for a closure plan. The operating entity for this facility must ensure that the closure plan complies with these requirements as well as any other legislative requirements that may come into effect during the lifecycle of the project.

Requirement
(1) A closure plan must include –
(a) Details of - (i) The EAP who prepared the closure plan; and (ii) The expertise of that EAP.
(b) Closure objectives.
(c) Proposed mechanisms for monitoring compliance with and performance assessment against the closure plan and reporting thereon.
(d) Measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity and associated closure to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development including a handover report, where applicable.
(e) Information on any proposed avoidance, management and mitigation measures that will be taken to address the environmental impacts resulting from the undertaking of the closure activity.
(f) A description of the manner in which it intends to – (i) Modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation during closure; (ii) Remedy the cause of pollution or degradation and migration of pollutants during closure. (iii) Comply with any prescribed environmental management standards or practises; or (iv) Comply with any applicable provisions of the Act regarding closure.
(g) Time periods within which the measure contemplated in the closure plan must be implemented.
(h) The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of closure.
(i) Details of all public participation processes conducted in terms of regulation 41 of the Regulation, including – (i) Copies of any representations and comments received from registered interested and affected parties;

(ii) A summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; (iii) The minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants; (iv) Where applicable, an indication of the amendments made to the plan as a result of public participation processes conduction in terms of regulation 41 of these Regulations.
(j) Where applicable, details of any financial provisions for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts.

Within a period of at least 12 months prior to the planned closure and decommissioning of the site, a Closure Plan must be prepared and submitted to the Local Planning Authority (Thembisile Hani Local Municipality), as well as the Provincial and National Environmental Authorities (the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) and the Department of Forestry, Fisheries and the Environment (DFFE)) for input and approval. This plan must provide detail pertaining to site restoration, soil replacement, landscaping, pro-active conservation, and a timeframe for implementation. Furthermore, the Closure Plan must comply with any additional legislation and guidelines that may be applicable at the time.

Two possible scenarios are considered for this decommissioning phase, as follows:

14.1 SCENARIO 1: TOTAL CLOSURE & DECOMMISSIONING OF SOLAR FACILITY

If the decision is taken at the end of the project lifespan (25 years) to totally decommission the solar facility i.e., make the land available for an alternative land use, a closure plan as detailed above should be developed and should include provision for the following:

- All concrete and solar infrastructure etc. must be removed from the solar site i.e., panels, support structures etc.;
- The holes where the panel support structures are removed must be levelled and covered with subsoil and topsoil;
- Tracks that are to be utilised for the future land use operations should be left in-situ. The remainder of the tracks to be removed (ripped), topsoil replaced and brush-packed to encourage re-vegetation and minimise erosion;
- All auxiliary buildings and access points should be demolished, and rubble removed, unless they can be used for/by the future land use. The competent authority may prescribe that the landscaping and underground infrastructure i.e., foundations be left in situ;
- The underground electric cables must be removed, if they cannot be used in the future land use;
- All material (cables, PV Panels etc.) must be re-used or recycled wherever possible. Functional panels that still produce sufficient output could be repurposed upon decommissioning;
- The disturbed portions of the site must be brush-packed, replanted and/or seeded with locally sourced indigenous vegetation (as prescribed by the competent authorities) to allow re-vegetation and rehabilitation of the site (see plant species list attached);
- Discontinuation of Lease and Easement Agreements for main land and assess roads;
- Consider whatever is economically or socially beneficial and risky for the project's Owners and other Stakeholders at this last stage

- This could include selling equipment on secondary market, recycling of metals and modules as scrap, using some or all of the proceeds to pay the local labour for uninstallation work, etc?
- PV leaves no pollution and the equipment other than the modules which should be reused or recycled (There is an existing market for this).

14.2 SCENARIO 2: PARTIAL DECOMMISSIONING / UPGRADE OF SOLAR FACILITY

Due to low variable costs, any owner of the facility may be interested in prolonging technical, functional, legal and economic lives of the plants for as long as possible, even beyond Power Purchase Agreement.

- This will require disposal of assets with shorter technical lives are critical (inverters, etc). PV modules, substructures, cables have a lifespan that should be longer than 25 years;
- Under this option, the O&M contractor will have to ensure that the validity period of all licences/ permits and agreements is extended where necessary and that any legislation that has subsequently been promulgated is considered.

Should more advanced technology become available it may be decided to continue to use the site as a renewable energy / photovoltaic / solar facility. Should this be the case, it is likely that much of the existing infrastructure will be re-used in the upgraded facility.

All infrastructure that will no longer be required for the upgraded facility must be removed as described in Scenario 1 above. The remainder of the infrastructure should remain in place or upgraded depending on the requirements of the new facility. As described for Scenario 1 above, the function PV panels that are still capable of producing sufficient output, could be donated to local schools and clinics. Any upgrades to the facility at this stage must comply with relevant legislation and guidelines of the time.

15. MONITORING AND AUDITING

This section provided additional information of the monitoring and auditing requirements for the facility. It should be read in conjunction with the monitoring requirements outlined in the environmental impact management action tables as well the section on document control and reporting (which mainly deals with the internal monitoring requirements).

Environmental monitoring and audits are fundamental in ensuring the implementation of the management actions contained within this EMP are environmentally sustainable during development and operation of this PV Facility.

15.1 ENVIRONMENTAL MONITORING

15.1.1 Construction ECO and ESA Monitoring

The ECO, assisted by the ESA, is responsible for environmental monitoring during of the construction phase impact management actions as outlined in of this EMPr. The monthly environmental control reports compiled by the ECO (which include the weekly environmental checklists compiled by the ESA), as well as the photographic record of works, must be submitted to the Holder of the EA, the EPC contractor, the local authority, the provincial environmental authority, the national environmental authority and Eskom.

The following overarching recording and reporting requirements are required:

- The holder of the authorisation must keep all records relating to monitoring and auditing on site and make it available for inspection to any relevant and competent authority in respect of this development.
- These compliance records must be submitted to the Director: Compliance monitoring at the DFFE.

15.1.2 Operational Avifaunal Monitoring

The operational monitoring at the Solar Energy Facility will be conducted in accordance with the latest version of the Solar Best Practice Guidelines, hereafter referred to as the Best Practice Guidelines.

<u>15.1.2.1 Aim of operational monitoring</u>

Operational monitoring should assess if there are any changes in the following:

- Habitat available to birds in and around the Solar Energy facility
- Abundance and species composition of birds
- Movements of priority species
- Breeding success of priority species
- To record any avifaunal mortality linked to the Solar Energy Facility
- Assess the significance of recorded mortality of the Solar Energy Facility

Most importantly, operational monitoring should highlight if additional mitigation is required to reduce impacts to acceptable levels.

Operational monitoring can be divided into two categories:

- Habitat classification
- Quantifying bird numbers and movements (replicating baseline data collection)

The objectives of operational monitoring are to:

- determine the actual impacts of the Solar Energy Facility (SEF)
- assess the significance of measured impacts at the SEF
- determine if additional mitigation is required at the SEF

<u>15.1.2.2 Timing</u>

Operational monitoring should commence within three months of Commercial Operation Date (COD) to ensure that the immediate effects of the facility on resident and passing birds are recorded, before they have time to adjust or habituate to the development. However, it should be borne in mind that it is also important to obtain an understanding of the impacts of the facility as they would be over the lifespan of the facility. Over time the habitat within the SEF may change, birds may become habituated to, or learn to avoid the facility. It is therefore necessary to monitor over a longer period than just an initial one year. Two surveys must be conducted every year in the high season (February to March), preferably after the site has experienced substantial rainfall, and in the dry season (May to October).

15.1.2.3 Duration

The monitoring should run over a period of at least two years. After the first two years of monitoring, the programme must be reviewed to incorporate significant findings that have emerged. If significant displacement impacts (or other impacts e.g., collision mortalities) are observed and mitigation is required, the avifaunal specialist must engage with the owner to discuss potential mitigation measures and the extension of the monitoring beyond the two-year mark. The monitoring should also be extended if the first two years experienced below average rainfall. Should it be necessary to extend the monitoring for the reasons mentioned, it should be conducted for at least another three years to account for climatic variation.

15.1.2.4 Habitat classification

Any observed changes in bird numbers and movements at a SEF may be linked to changes in the available habitat. The avian habitats will be assessed twice a year (i.e., when the surveys are conducted), to record any changes in the baseline conditions.

16.1.2.5 Avifaunal live-bird monitoring and carcass searches

In order to determine if there are any impacts relating to displacement and/or disturbance, all methods used to estimate bird numbers and movements during the original pre-construction baseline monitoring in the BAR phase must be applied as far as is practically possible in the same way to operational work in order to ensure maximum comparability of these two data sets. In the present instance, the following data collection protocol must be implemented:

- On-site surveys must be conducted in the following manner:
    - Four (4) walk transects must be identified by the avifaunal specialist, using the final lay-out plan, totalling 1km each, three (3) within the PV footprint, and one (1) control transect outside the footprint.
    - A suitable monitor must be identified to conduct the monitoring. This can either be the ecological specialist his/herself, or it can be a person trained by the avifaunal specialist in the monitoring protocol.
    - The monitor must record all species on both sides of the walk transect. The monitor must stop at regular intervals to scan the environment with binoculars.
    - Each transect must be counted twice during each survey over a period of four days.
    - Transects must be counted early in the morning, and late in the afternoon.
    - The following variables must recorded:
        - Species;
        - Number of birds;
        - Date;

        - Start time and end time;
        - Estimated distance from transect (m);
        - Wind direction;
        - Wind strength (estimated Beaufort scale 1 - 7);
        - Weather (sunny; cloudy; partly cloudy; rain; mist);
        - Temperature (cold; mild; warm; hot);
        - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flyingforaging; flying-commute; foraging on the ground.
- All incidental sightings of priority species in and around the proposed PV development area must recorded.
- A sample of solar panel rows, perimeter fence must be systematically searched for bird carcasses on a weekly basis. The searcher could be a SEF staff member that is permanently based at the facility and reports to the SEF management. If a carcass is discovered, the following must be done:
    - The carcass must be photographed (both front and back) and given a unique ID number, and the following details must be recorded in a register of mortalities:
        - Date found
        - Time found
        - Coordinates
        - Habitat
        - Estimated time since death
        - Carcass condition
        - Probable cause of death
    - The carcass must then be stored in a plastic bag with its unique ID number on site in a freezer for subsequent confirmation of species identity by the avifaunal specialist.
    - The Operations Manager must ensure that the mortality register is kept up to date.
- If there are sections where the 22kV cables cannot buried due to technical constraints, a bird-friendly design must be employed after an appropriately qualified and experienced avifaunal specialist have signed-off on the final design.

<u>15.1.2.6 Deliverables</u>

<u>Annual report</u>

An operational monitoring report will be completed at the end of each year of operational monitoring.

As a minimum, the report will attempt to answer the following questions:

- How has the habitat available to birds in and around the Solar Energy Facility changed?
- How has the number birds and species composition changed?
- How have the movements of priority species changed?
- How has the Solar Energy Facility affected priority species' breeding success?
- What are the likely drivers of any changes observed?
- What is the significance of any impacts observed, both locally and regionally?
- What mitigation measures are required to reduce the impacts?

<u>Progress reports</u>

One progress report must be provided with basic statistics and any issues that need to be red flagged. The progress report must provide a summary of the transect data and any mortality that have been collected to date and must highlight and discuss any concerns that have emerged during the monitoring so far. If need be, suggestions for mitigation should also be included.

15.1.3 Construction Phase Alien Vegetation Monitoring

This section must be read in conjunction with the Alien Invasive Vegetation Management Plan above.

The following monitoring actions should be implemented during the construction phase of the development.

Table 5: Alien vegetation monitoring requirements during the construction phase.

Monitoring Action	Indictor	Timeframe
Document alien species present at the site	List of alien species	Preconstruction
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannually

15.1.4 Operational Phase Alien Vegetation Monitoring

This section must be read in conjunction with the Alien Invasive Vegetation Management Plan above.

The following monitoring actions should be implemented during the operational phase of the development.

Table 6: Alien vegetation monitoring requirements during the operational phase

Monitoring Action	Indictor	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Biannually
Document rehabilitation measures implemented, and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

15.1.5 Rehabilitation and Habitat Restoration Monitoring requirements

As rehabilitation success, particularly in arid areas is unpredictable, monitoring and follow-up actions are important to achieve the desired cover and soil protection.

- Re-vegetated areas should be monitored every 4 months for the first 12 months following construction.
- Re-vegetated areas showing inadequate surface coverage (less than 20% within 12 months after re-vegetation) should be prepared and re-vegetated;
- Any areas showing erosion, should be re-contoured and seeded with indigenous grasses or other locally occurring species which grow quickly.

15.1.6 Plant Rescue Monitoring Requirements

It is important to monitor the success of the plant rescue operations, in order to the licencing authority on such conditional rescue.

Post construction monitoring of plants translocated during search and rescue must be undertaken to evaluate the success of the intervention. Biannual monitoring for 2 years post-transplant should be sufficient to gauge success.

The condition and numbers of all the rescued plants should be recorded and provided to the Audit consultant for inclusion in the environmental audit report.

15.2 ENVIRONMENTAL AUDITING

The holder of the environmental authorisation must, for the period during which the environmental authorisation is valid, ensure that project compliance with the EMPr are audited, and that the audit reports are submitted to the Director: Compliance Monitoring at DFFE.

The frequency of auditing and submission of the environmental audit reports must be as per the frequency indicated in the EMPr taking into account the processes for such auditing prescribed in Regulation 34 of GN R. 326. In this regard, this EMPr recommends that audits be submitted to the following auditing schedule:

- Within 1 year commencement of construction activities;
- Within 1 year of commencement of operational activities;
- Every 3 years after the initial operational audit.

The holder of the authorisation must in addition to the schedule above, submit environmental audit reports to the Department within 30 days of completion of the construction phase and within 30 days of completion of rehabilitation activities. The Rehabilitation requirements detailed in this EMPr however require that rehabilitation be concluded simultaneously with the construction phase. I this regard, a single environmental audit report can be compiled.

To promote transparency and cooperative governance, the results of relevant audits should be submitted to:

- The operators of the facility;
- The local authority (Thembisile Hani Local Municipality);
- The provincial environmental authority: Department of Agriculture, Rural Development, Land and Environmental Affairs;
- The national environmental authority: (DFFE); and
- Eskom.

The results of the audit must be recorded in an environmental audit report and any non-compliance must be formally recorded, along with the response-action required or undertaken. Each non-compliance incident report must be issued to the relevant person(s), so that the appropriate corrective and preventative action is taken within an agreed upon timeframe.

The audits be compiled in accordance with Appendix 7 of the EIA regulations, 2017. Appendix 7 of Regulation 326 of the 2014 EIA Regulations contains the required contents of an Environmental Audit Report. The table below shows the legislated requirements of an audit reports, and all relevant environmental audits undertaken as part of this development (during construction and operation) should comply with these requirements.

Table 7: Contents of an audit report

(1) An Environmental audit report prepared in terms of these Regulations must contain:
(a) Details of – (i) The independent person who prepared the environmental audit report; and (ii) The expertise of independent person that compiled the environmental audit report.
(b)Details of – (i) The independent person who prepared the environmental audit report; and (ii) The expertise of independent person that compiled the environmental audit report.
(c) A declaration that the independent auditor is independent in a form as may be specified by the competent authority.
(d) An indication of the scope of, and the purpose for which, the environmental audit report was prepared.
(e) A description of the methodology adopted in preparing the environmental audit report.
(f) An indication of the ability of the EMPr, and where applicable the closure plan to – (i) Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an on-going basis; (ii) Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the closure of the facility; and (iii) Ensure compliance with the provisions of environmental authorisation, EMPr, and where applicable, the closure plan.
(g) A description of any assumptions made, and any uncertainties or gaps in knowledge.
(h) A description of a consultation process that was undertaken during the course of carrying out the environmental audit report.
(i) A summary and copies of any comments that were received during any consultation process
(j) Any other information requested by the competent authority.

16. METHOD STATEMENTS

Method statements are written submissions by the Contractor to the Engineer and ECO in response to the requirements of this EMPr or in response to a request by the Engineer or ECO. The Contractor shall be required to prepare method statements for several specific construction activities and/or environmental management aspects.

The Contractor shall not commence the activity for which a method statement is required until the Engineer and ECO have approved the relevant method statement.

Method statements must be submitted at least five (5) working days prior to the proposed date of commencement of the specific activity. Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved.

An approved method statement shall not absolve the Contractor from any of his obligations or responsibilities in terms of the contract. However, any damage caused to the environment through activities undertaken without an approved method statement shall be rehabilitated at the contractor’s cost.

Additional method statements can be requested at the ECO’s discretion at any time during the construction phase.

The method statements should include relevant details, such as:

- Construction procedures and location on the construction site;
- Start date and duration of the specific construction procedure;
- Materials, equipment and labour to be used;
- How materials, equipment and labour would be moved to and from the development site, as well as on site during construction;
- Storage, removal and subsequent handling of all materials, excess materials and waste materials;
- Emergency procedures in case of any potential accident / incident which could occur during the procedure;
- Compliance / non-compliance with an EMPr specification and motivation for proposed noncompliance.

16.1 METHOD STATEMENTS REQUIRED

Based on the specifications in this EMPr, the following method statements are likely to be required as a minimum (more method statements may be requested at any time as required under the direction of the ECO):

- Vegetation clearing & topsoil stripping, and associated stockpiling;
- Hazardous substances declaration of use, handling and storage – e.g., for fuels, chemicals, oils and any other harmful / toxic / hazardous materials;
- Cement and concrete batching;
- Traffic, transport & delivery accommodation e.g., need for traffic diversion/turning circles etc.;
- Solid waste management / control procedures;
- Stormwater and wastewater management / control systems;
- Erosion remediation and stabilisation;

- Fire control and emergency procedures;
- Job site security plan;
- Blasting activities (if necessary);
- Drilling and Ramming activities;
- Re-vegetation, rehabilitation and re-seeding.

17. HEALTH & SAFETY

The holder of the Authorisation must train safety representatives, managers and workers in workplace safety. The construction process must be compliant with all safety and health measures by the relevant act.

This section aims to provide a high-level overview to occupational Health and Safety Act but does not in any manner replace the project specific Health and Safety plan which would need to be compiled and approved in terms of this act and associated regulations.

The Occupational Health and Safety Act (No. 85 of 1993) aims to provide for / ensure the health and safety of persons at work or in connection with the activities of persons at work and to establish an advisory council for occupational health and safety.

The main Contractor must ensure compliance with the Occupational Health and Safety Act, as well as that all subcontractors comply with the Occupational Health and Safety Act.

The following is of key importance (Section 8 of the aforesaid Act):

General duties of employers to their employees

(1) Every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees.

(2) Without derogating from the generality of an employer's duties under subsection (1), the matters to which those duties refer include in particular-

a) the provision and maintenance of systems of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health;
b) taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment;
c) making arrangements for ensuring, as far as is reasonably practicable, the safety and absence of risks to health in connection with the production, processing, use, handling, storage or transport of articles or substances;
d) establishing, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business, and he shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons, and he shall provide the necessary means to apply such precautionary measures;
e) providing such information, instructions, training and supervision as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of his employees;

f) as far as is reasonably practicable, not permitting any employee to do any work or to produce, process, use, handle, store or transport any article or substance or to operate any plant or machinery, unless the precautionary measures contemplated in paragraphs (b) and (d), or any other precautionary measures which may be prescribed, have been taken;
g) taking all necessary measures to ensure that tire requirements of this Act are complied with by every person in his employment or on premises under his control where plant or machinery is used;
h) enforcing such measures as may be necessary in the interest of health and safety;
i) ensuring that work is performed, and that plant or machinery is used under the general supervision of a person trained to understand the hazards associated with it and who have the authority to ensure that precautionary measures taken by the employer are implemented; and
j) causing all employees to be informed regarding the scope of their authority as contemplated in section 37 (1) (b).

18. CONTRACTORS CODE OF CONDUCT

The Contractor's Code of Conduct is a document to be drawn up by the holder of the EA and provided to all contractors or subcontractors that undertake any service on site. This code of conduct should include generic conduct rules for construction and operation activities on this Solar Energy Facility and must be signed by all contractors. *This code of conduct does not exonerate contractors from complying with this EMPr and must not be viewed as a stand-alone document*.

The following general template is suggested for this Code of Conduct document and must be adapted and updated to include the provisions of this EMPr, recommendations of participating specialists, conditions of approval of the Environmental Authorisation, conditions imposed by the Local Authority (as part of the rezoning and consent use), as well as all service agreements.

18.1 OBJECTIVES

To ensure compliance with the Conditions of the Environmental Authorisation, the Environmental Management Programme (EMPr), recommendations of participating specialists, conditions imposed by the Local Authority as part of the rezoning and subdivision, as well as the service agreements.

- To ensure the least possible damage to:
    - Existing infrastructure on and adjacent to the site;
    - Indigenous flora and fauna (biophysical environment); and
    - Water quality of surface and groundwater on and surrounding the site;
- Construction and development are undertaken with due consideration to all environmental factors;
- Where such damage occurs, provision is made for re-instatement and rehabilitation;

18.2 ACCEPTANCE OF REQUIREMENTS

In order to achieve these objectives, the Developer and EPC Contractor bind themselves jointly and severally to fulfil and comply with all the obligations contained herein, as well as prescriptions and obligations contained in other documents controlling the development of this Solar Energy Facility.

18.3 CONTRACTOR'S PRE-CONSTRUCTION OBLIGATIONS

Contractors may not commence any construction of this Solar Energy Facility until:

- The Contractor and the ECO have carried out a joint site inspection (this is to be done as part of the pre-construction compliance workshop as detailed in the EMPr above);
- A qualified ecologist has undertaken an inspection of the final development footprint and determined the number, species and extent of protected / listed plant species within this area;
- Search and rescue of sensitive plants, within the development footprint has been carried out in compliance with the plant rescue and protection plan and signed off by the ECO (where this is necessary);
- The construction and no-go areas are suitably demarcated to the satisfaction of the ECO;
- Where necessary, approval of Building / Construction Plans has been obtained from the local authority (Thembisile Hani Local Municipality); and
- All contract staff have attended the required environmental induction training and on-going environmental education sessions, as necessary.

18.4 CONTRACTOR'S OBLIGATIONS DURING CONSTRUCTION

- The Contractor is required to comply with the necessary Health and Safety requirements as required by the Occupational Health and Safety Act of 1993;
- The Contractor must comply with the construction requirements as detailed in the EMPr;
- The contractor must comply with all the requirements detailed in the Environmental Authorisation;
- All conditions, processes and fees as prescribed by the Local Authority must be complied with.

20. SITE DEVELOPMENT PLAN

The Site Layout Plan (SLP) is attached in Appendix A of this EMPr. Approval of this EMPr infers approval of the SLP. The holder of the EA and the contractor must ensure that all works are undertaken in approximation to the SLP. Should there be any dispute on any aspect of the works in relation to the SDP, the ECO must make ruling, which should be referred to the CA if necessary.

The table below shows the key components as defined in the SDP and the EMPr applicability of each of these components.

Table 8: EMPr Sections applicable to SLP Components

SDP Component	EMPr Applicability
Construction Road	Sections 4, 5, 6,7 & 8

Perimeter Road	Sections 4, 5, 6,7 & 8
Internal Roads	Sections 4, 5, 6,7 & 8
Access Road	Sections 4, 5, 6,7 & 8
Perimeter Fencing	Sections 5
PV Arrays including sub-structures	Sections 4, 5, 6,7 & 8
Inverter Stations	Sections 4, 5, 6,7 & 8
AC Cabling	Sections 4 & 5,
Sub-Station	Appendix A
Auxilliary Building	Sections 4 & 5
Laydown Area	Section 5

20. PENALTIES

Should any person commit an action of non-compliance he/she may be convicted of an offence, in terms of Sub-regulation (1) of the National Environmental Management Act, to imprisonment for a period not exceeding ten years or to a fine not exceeding R10 Million as prescribed in terms of the Adjustment of Fines Act, 1991 (Act No. 101 of 1991).

Apart from a fine resulting from any legal mechanism, the ECO may advise the Engineer to impose a penalty for non-compliance in terms of this Environmental Management Programme (EMPr). The procedure detailed below is for a spot fine in terms of this EMPr and does not detail the procedure for fining in terms of any other legal mechanism.

20.1 PROCEDURES

The contractor shall comply with the environmental specifications and requirements of this EMPr, the EA and Section 28 of NEMA, on an on-going basis and any failure on his part to do so will entitle the ER to impose a penalty.

In the event of non-compliance, the following recommended process shall be followed:

- The ECO shall issue a notice of non-compliance to the Engineer, stating the nature and magnitude of the contravention. A copy shall be provided to the Project Developer / Proponent.
- The Engineer will issue this notice to the Contractor.
- The Contractor shall act to correct the transgression within the period specified by the Engineer.
- The Contractor shall provide the Engineer with a written statement describing the actions to be taken to discontinue the non-compliance, the actions taken to mitigate its effects and the expected results of the actions. A copy shall be provided to the Project Developer / Proponent.
- In the case of the Contractor failing to remedy the situation within the predetermined time frame, the Engineer shall impose a monetary penalty (spot fine) based on the conditions of contract.
- Should the transgression be a blatant disregard of conditions of the EMPr or EA, the Engineer (on advice from the ECO) can at their discretion immediately issue a fine and require the remediation (without first giving the contractor a chance to remediate).

- In the case of non-compliance giving rise to physical environmental damage or destruction, the Engineer shall be entitled to undertake or to cause to be undertaken such remedial works as may be required to make good such damage and to recover from the Contractor the full costs incurred in doing so.
- In the event of a dispute, difference of opinion, etc. between any parties in regard to or arising out of interpretation of the conditions of the EMPr, disagreement regarding the implementation or method of implementation of conditions of the EMPr or EA etc. any party shall be entitled to require that the issue be referred to specialists for determination.
- The Engineer on advice from the ECO shall at all times have the right to stop work and/or certain activities on site in the case of non-compliance or failure to implement remediation measures.

20.2 OFFENCES AND PENALTIES

Any avoidable non-compliance with the conditions of the EMPR shall be considered sufficient ground for the imposition of a monetary penalty by the Engineer

Possible offences, which should result in the issuing of a contractual penalty, include, but are not limited to:

- Unauthorised entrance into no-go areas;
- Catching and killing of wild animals, and removal or damage to conservation-worthy plant species;
- Open fires outside of the contractor camp site and insufficient fire control;
- Unauthorised damage to natural vegetation;
- Unauthorised camp establishment (including stockpiling, storage, etc.);
- Hydrocarbons / hazardous material: negligent spills / leaks and insufficient storage;
- Ablution facilities: non-use, insufficient facilities, insufficient maintenance;
- Insufficient solid waste management (including clean-up of litter, unauthorised dumping etc.;
- Erosion due to negligence / non-performance;
- Excessive cement / concrete spillage / contamination;
- Non-induction of staff.

21. ABBREVIATIONS

CBA Critical Biodiversity Area

EAP Environmental Assessment Practitioner

EHS Environmental, Health & Safety

EIA Environmental Impact Assessment

EMPr Environmental Management Programme

ESA Ecological Support Area

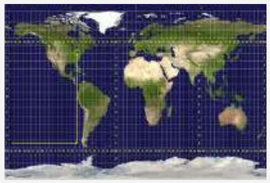
GPS Global Positioning System

I&Aps Interested and Affected Parties

IDP	Integrated Development Plan
IPP	Independent Power Producer
kV	Kilo Volt
MW	Mega Watt
NWA	National Water Act
SAHRA	South African National Heritage Resources Agency
SANBI	South Africa National Biodiversity Institute
SANS	South Africa National Standards
SDF	Spatial Development Framework

APPENDIX G: EAP CV

Mulaudzi Sedzani Rosslyn



76 Bushwillow, Impala street,
Witbank,
1035
cell: 076 560 8193
sedzanirosslyn@gmail.com

PERSONAL

Date of Birth:	:1988/12/24
ID Number	: 8812241089085
Gender	: Female
Nationality	: South African
Marital status	: Single
Criminal record	: None
Home language	: Tshivenda
Other Languages	: English, Xitsonga, Sesotho, isiZulu
State of health	: Excellent
Driver's License	: Code 10

EMPLOYMENT

Company:	**Mukhadakhomu Environmental Services**
Position :	**Environmental Assessment Practitioner**
Duration :	**1st August 2016 – Present**

Company:	**Maphaha Projects and Investments**
Position :	**Environmental Assessment Practitioner**
Duration :	**1st March 2021 - Present**

Position description:

- Prospecting Right Applications (MPRDA)
- □ Including Prospecting Work Program, Regulation 2(2) Plan, PP Process and Environmental Management Plan
- Mining Right Applications (MPRDA)
- □ Including Mining Work Program, Regulation 2(2) Plan.
- Mining Permit Applications (MPRDA)
- Development of Scoping Reports (NEMA)
- Development of Basic Assessment Reports (NEMA)
- Development of Environmental Impact Assessments (NEMA)
- Development of Environmental Management Programs (NEMA)
- Environmental Audits / Inspections (Including Reports)
- Water Quality Reports
- Environmental Performance Assessment Reports
- Water Use Licence Audit Reports
- Public Participation
- Water Monitoring
- □ Monthly Surface Water monitoring, Quarterly Ground Water monitoring and Chemical Analysis
- Water Monitoring Reports
- Fallout dust monitoring
- □ Monthly dust monitoring, monthly dust monitoring reports

- Environmental Management of Mines

Project involvement and experience:

COMPANY	PROJECT
Sarmco group (Pty) Ltd (14163PR)	BAR process for the proposed prospecting right application including consultation process.(completed): in Witbank, Mpumalanga Province
Nsovo Environmental Consulting CC (14623PR)	BAR process for the proposed prospecting right application including consultation process.(completed): in Delmas, Mpumalanga Province
Nsovo Environmental Consulting CC (14631PR)	BAR process for the proposed prospecting right application including consultation process.(completed): in Delmas, Mpumalanga Province
Welthage House of Capital (Pty) Ltd(11028MP)	BAR process for the proposed mining permit application including consultation process.(completed): in Belfast, Mpumalanga Province
National Treasure Mineral (Pty) Ltd(11204MP)	BAR process for the proposed mining permit application including consultation process.(completed): Witbank, Mpumalanga Province
Welthage House of Capital (Pty) Ltd (11604MP)	BAR process for the proposed mining permit application including consultation process.(completed): in Witbank, Mpumalanga Province
Xakwa Coal (Pty) Ltd(11169MP) (Mguzalala Colliery)	-BAR process for the proposed mining permit application including consultation process.(completed): in Witbank, Mpumalanga Province -Environmental compliance auditing in fulfilment of the Environmental Authorisation and EMPr conditions.
National Treasure Minerals (Pty) Ltd(11375MP) (Risenga Colliery)	-BAR process for the proposed mining permit application including consultation process.(completed): in Carolina, Mpumalanga Province -Environmental compliance auditing in fulfilment of the Environmental Authorisation and EMPr conditions.
Dariophase (Pty) Ltd (11525MP)	BAR process for the proposed mining permit application including consultation process.(completed): in Middelburg, Mpumalanga Province
Wealthage House of Capital (Pty) Ltd (10620PR)	BAR process for the proposed prospecting right application including consultation

	process.(completed): in Cullinan, Gauteng Province
Dikwena Minerals (Pty) Ltd (12573PR)	BAR process for the proposed prospecting right application including consultation process.(completed): in Brits, North West Province
Universal Pulse 132 Tradings (Pty) Ltd (493MR)	EIA for the proposed mining right extension (Section 102): in Middelburg, Mpumalanga province. (completed)
Universal Coal Development III (Pty)Ltd (Ubuntu Colliery) (10027MR)	Environmental compliance auditing (for year 2020) in fulfilment of the Environmental Authorisation and EMPr conditions for mining right in Delmas, Mpumalanga Province.
Ritluka Resources (Pty) Ltd (12926MP)	-BAR process for the proposed mining permit application including consultation process.(in progress): in Carolina, Mpumalanga Province
Vegan Basket (Pty) Ltd (13082MP)	-BAR process for the proposed mining permit application including consultation process.(in progress): in Carolina, Mpumalanga Province

Company: **Tshikovha Environmental and Communication Consulting**
Position : **Environmental Assessment Practitioner**
Duration : **15th October 2015 – 29th July 2016**

Position description:

- Compiling Environmental Impact Assessment (EIA) applications
- Scoping reports, Exemption and Basic Assessment reports using Government Notice No.983, No.984 and No.985 of NEMA Regulation
- Compiling EMPr (Environmental Management Programme) for development projects
- Section 24G Applications
- Conducting public participation processes
- Conducting site inspection

Project involvement and experience:

- Environmental Management Programme for rectification of unlawful commencement of Santhobisa Lodge on portion 77 of the farm Kromdraai 292 JS within Emalahleni Local Municipality, Nkangala District, Mpumalanga Province.
- Environmental Impact Assessment for the proposed Londindha game lodge development with associated infrastructures at farm Ronaldsey 283 KU within the Bushbuckridge local municipality, Ehlanzeni district, Mpumalanga Province
- Environmental Impact Assessment for the proposed ConsMurch mining right with associated infrastructures in Phalaborwa local municipality, Limpopo Province.
- Environmental Impact Assessment for the proposed Taung prospecting right with associated infrastructures in Taung, North West Province.
- Environmental Impact Assessment for the proposed Lichtenburg borrow pit with

associated infrastructures in Lichtenburg, North West Province.

- Environmental Impact Assessment for the proposed Ladomode prospecting right with associated infrastructures in Secunda, Mpumalanga Province.

- Environmental Impact Assessment for the proposed Keewave filling station with associated infrastructures in Witbank, Mpumalanga Province.

- Environmental Impact Assessment for the proposed construction of Mangwazi nature reserve and associated infrastructures on the farm madras 292 KU and the farm Calcutta 94 KU, Sabie within Bushbuckridge Local Municipality, Ehlanzeni District, Mpumalanga province.

- Environmental Impact Assessment for the propose expansion of Acornhoek filling station with associated infrastructure on portion 08 of the farm Acornhoek 212 KU within the jurisdiction of Bushbuckridge Local Municipality under Ehlanzeni district, Mpumalanga Province.

Company: **Department Of Mineral Resources**
Position : **Intern: Minerals Information Management and Mine Environmental Management.**
Duration : **06 August 2014 to 05 August 2015**

DUTIES :
KRA's:

- Ensure that application for prospecting and mining rights are geographically recorded at the regions through the use of GIS Application (NMPS and SAMRAD)
- Ensure that applications received for prospecting and mining rights comply with the performance obligation of the rights;
- Produces and update thematic Maps for prospecting and mining rights issued within the region;
- Assist in the processing of Prospecting, mining right and mining Permit applications ;
- Run spatial analysis and model builder to compile spatial conflict report of the land in which the right is applied;
- Compile statistical information for various components in the Mineral Regulation Branch;
- Administer the Mineral and petroleum development Act during processing of applications;
- Investigate and resolve all issues pertaining to non registerable rights;
- Geographical Field Verification audit of all registered and non-registered operations ;
- Create and manage Geodatabase of all application rights within the region (ArcGIS);
- Attend client Request (assist lodging application, and enquiry relating to status and progress of their application);
- Implement Environmental management tools such as EIA's and management system to ensure compliance with Provincial and National Legislations and Policies.
- Implement all other applicable relevant legislations.
- Monitor, inspect, audit and assess environmental performance of mines.
- Investigate and resolve mine environmental related issues, queries and complaints

between mining industry and public.
- Consult with relevant State Departments and assist clients through promotion of administrative justice.

SKILLS/KNOWLEDGE

- Full knowledge and understanding of Environmental Legislations and Regulations.
- Full knowledge and understanding of Environmental Compliance and Enforcement management system.
- Sound knowledge of EIA process, procedures and Environmental Management.
- Full knowledge and understanding of MPRDA, Act No. 28 of 2002.
- Clear understanding of Mining and Prospecting methodology and rehabilitation measures.
- Knowledge of the National Environmental Management Act (NEMA) as amended;
- Leadership skills, conflict management and resolution
- Communication skills
- Administration skills
- Computer skills
- Report writing skills

Education

Institution	: University of Limpopo
Course	: BSC Environmental and Resource Studies
Qualification	: Degree
Major Courses	: Applied Geomorphology
	: Environmental Resource Management Plan
	: Remote Sensing
	: GIS Application
	: Tourism Studies
	: Natural Resource Ecology
	: Quantitative Technique
	: Waste Management
	: Settlement Geography
	: Applied Climatology
	: Impact Studies
Duration	: 2007- 2009
High school attended	: Tshiitwa Secondary School
Highest grade passed	: Grade 12 (National Senior Certificate)
Year passed	: 2006

Career Achievement (certificates)

- Office Computing Certificate
- Internship Programme Certificate
- Getting started with GIS 10.0 certificate
- GIS for Humanitarian Mine Action: Remotely Sensed Data Certificate
- GIS for Humanitarian Mine Action: Coordinate Systems and Map Projections Certificate
- Migrating to the ArcGIS for Local Government Information Model Certificate

References	Contacts person : Moudy Mudzielwana Occupation : Director (Tshikovha Environmental and Communication Consulting) Cell number : 076 431 1016 E-mail : moudy.mudzielwana@tshikovha.co.za Contacts person : Mpho Mutavhatsindi Occupation : Assistant Director (Mineral Information Management) Cell number : 074 305 5613 Office number : 013 653 0500 E-mail : mpho.mutavhatsindi@dmr.gov.za
Portfolio of evidence	I am a self-motivated individual who adapts to different situations, assertive, approachable, helpful, client focused and ethical, tactical, analytical, ability to conduct research and very open to new ideas. I am a team player who is responsible, able to rise under pressure and able to work on own initiative and deal with administrative duties competently. Moreover, I am fast at adapting to different environments. I am also fast at learning new things.