VREDE SOLAR PV FACILITY, NORTHERN CAPE PROVINCE

ENVIRONMENTAL MANAGEMENT PROGRAMME

May 2023

Prepared for
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PROJECT DETAILS

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DEFINITIONS AND TERMINOLOGY

The following definitions and terminology may be applicable to this project and may occur in the report below:

Alien species: A species that is not indigenous to the area or out of its natural distribution range.

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

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Assessment: The process of collecting, organising, analysing, interpreting and communicating information which is relevant.

Biological diversity: The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.

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

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

Cumulative impacts: in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities considering the impacts of a Project with surrounding land use). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

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

Development area: The Development Area is that identified area (located within the Project Site) of ~637ha demarcated within the Affected properties for consideration in the EIA process where the Vrede Solar PV Facility is planned to be located

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

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

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

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

Ecosystem: A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

Endangered species: means any indigenous species listed as an endangered species in terms of section 56 of the National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)

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

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

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

Environmental Authorisation (EA): means the authorisation issued by a competent authority of a listed activity or specified activity in terms of the National Environmental Management Act (No 107 of 1998) and the EIA Regulations promulgated under the Act.

Environmental assessment practitioner (EAP): An individual responsible for the planning, management and coordinating of an environmental management programme or any other appropriate environmental instruments introduced by legislation.

Environmental Control Officer (ECO): An individual appointed by the Owner prior to the commencement of any authorised activities, responsible for monitoring, reviewing and verifying compliance by the EPC Contractor with the environmental specifications of the EMPr and the conditions of the Environmental Authorisation.

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

Environmental impact assessment: As defined in the NEMA 2014 EIA Regulations and in relation to an application to which scoping must be applied, means a systematic process of identifying, assessing and reporting environmental impacts associated with an activity.

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

Environmental Management Programme (EMPr): An operational plan, approved by the competent authority in an application for an EA, that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Environmental Officer (EO): The Environmental Officer (EO), employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. The EO must act as liaison and advisor on all environmental and related issues and ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor.

Habitat: The place in which a species or ecological community occurs naturally.

Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

Indigenous: A biological organism that occurs or has historically occurred, naturally in a free state in nature within the borders of South Africa but excludes a species that has been introduced in the South Africa due to human activity.

Incident: An unplanned occurrence that has caused, or has the potential to cause, environmental damage.

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

Interested and affected party (I&AP): for the purposes of an application for an EA and in relation to the assessment of the environmental impact of a listed activity or related activity, means an interested and affected party contemplated in section 24 (4)((a) (v) of NEMA, and which includes:- (a) any person, group of persons or organisation interested in or affected by such operation or activity; and (b) any organ of state that may have jurisdiction over any aspect of the operation or activity.

Method Statement: a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's

proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.

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

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

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.

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

Project: Project includes the PV Facility and all the associated infrastructures such as access roads.

Project Site/Area: The Project Site/Area is the area with an extent of approx. 1703ha, within which the Vrede Solar PV Facility development footprint will be located.

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

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

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

Vulnerable species: A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

Waste: Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to the Waste Amendment Act (as amended on June 2014); or

any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the *Gazette*.

ABBREVIATIONS

The following abbreviations may be applicable to this project and may occur in the report below:

BGIS	Biodiversity Geographic Information System
CDSM	Chief Directorate Surveys and Mapping
CEMP	Construction Environmental Management Plan
DFFE	Department of Forestry, Fisheries and Environment
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
GPS	Global Positioning System
GWh	Giga Watt hour
I&APs	Interested and Affected Parties
IPP	Independent Power Producer
kV	Kilo Volt
MW	Mega Watt
NWA	National Water Act
PM	Post Meridiem; "Afternoon"
SACAA	South African Civil Aviation Authority
SANS	South Africa National Standards

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CHAPTER 1: INTRODUCTION

Vrede Solar Energy (Pty) Ltd (a consortium consisting of Akuo Energy Afrique, Africoast Investments and Golden Sunshine Trading) proposed to develop the Vrede Solar PV Facility and its associated electrical infrastructure on Portion 5 of the Farm Bas Berg 88 in the Renosterberg Local Municipality in the greater Pixley ka Seme District Municipality in the Northern Cape Province. The project site is located approximately 20km north of Philipstown and 30km west of Petrusville (refer to **Figure 1.1**). The facility will have a contracted capacity of up to 150MW.

From a regional perspective, the Northern Cape Province, and particularly the area under investigation, is considered favourable for the development of a commercial solar facility by virtue of prevailing climatic conditions (i.e. solar irradiation), relief, the extent of the affected properties, the availability of a direct grid connection (i.e., a point of connection of the national grid) and the availability of land on which the development can take place.

This EMPr has been developed based on the findings of the Environmental Impact Assessment (EIA), and must be implemented to protect sensitive on-site and off-site features through controlling construction, operation and decommissioning activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts. This EMPr is applicable to all employees and contractors working on the pre-construction, construction, and operation and maintenance phases of the project. In terms of the Duty of Care provision in S28(1) of NEMA, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, halted or minimised. The document must therefore be adhered to and updated as relevant throughout the project life cycle. This document fulfils the requirement of the EIA Regulations, 2014 (as amended) and forms part of the EIA Report for the project.

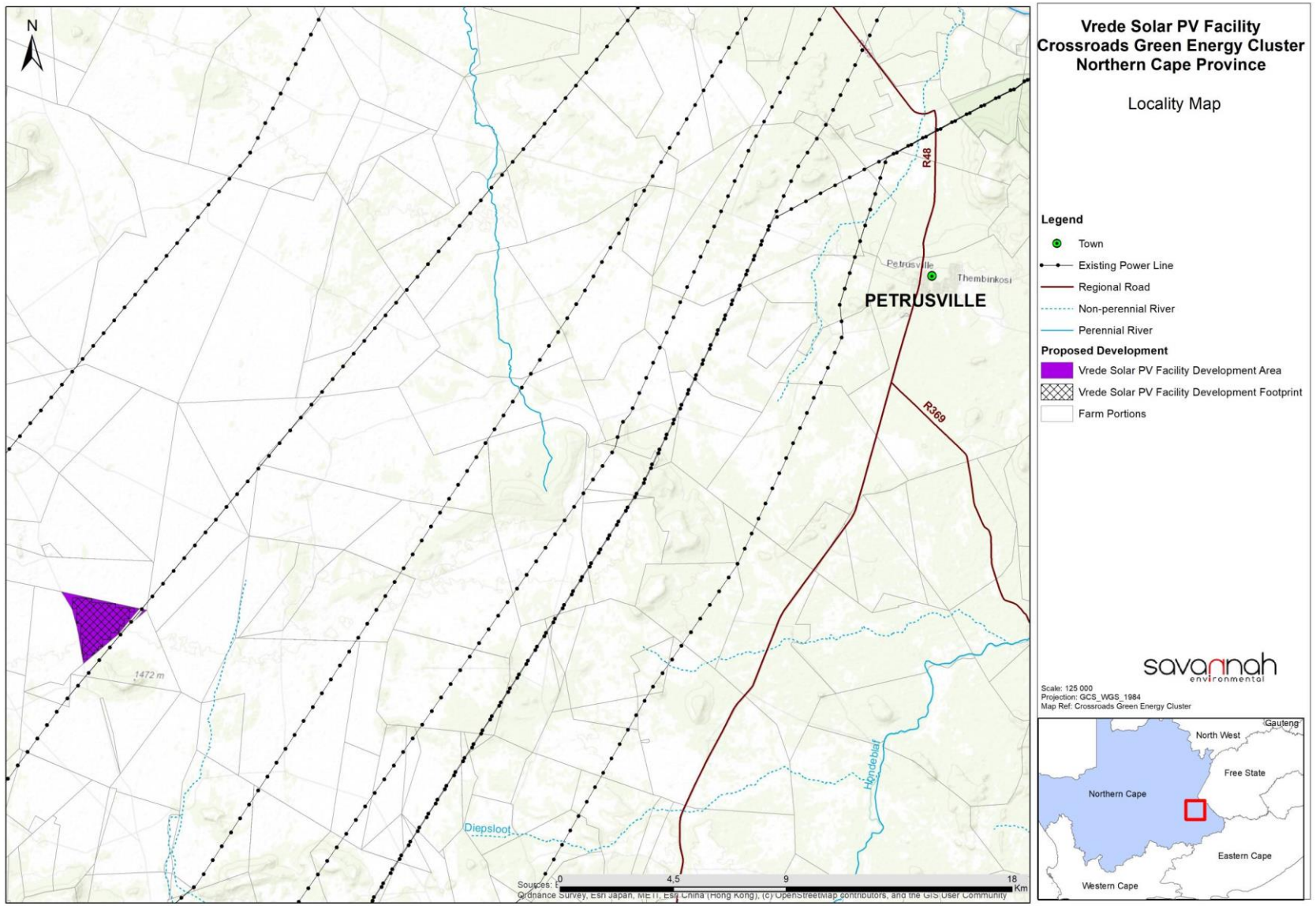

Figure 1.1 : Locality map for the Vrede Solar PV Facility

CHAPTER 2: PROJECT DETAILS

2.1 Project Site

Table 2.1 provides information regarding the proposed project site identified for the Project

Table 2.1 A description of the project site identified for the Project

Province	**Northern Cape Province**		
District Municipality	Pixley Ka Seme District Municipality		
Local Municipality	Renosterberg Local Municipality		
Ward Number (s)	Ward 4		
Nearest town(s)	Philipstown (20km north) and Petrusville (30km west)		
Farm name(s) and number(s) of properties affected by the Solar PV Facility	Portion 5 of the Farm Bas Berg 88		
SG 21 Digit Code (s) for all properties	N075C05700000000088000050		
Current zoning	Livestock Farming (mainly sheep farming)		
Current land use	Agriculture		
Site Extent (Study Area)	~1101ha		
PV Development Area	~400ha		
Site Coordinates (project site)		**Latitude:**	**Longitude:**
	Northern point	30°12'16.39"S	24°17'59.94"E
	Eastern point	30°12'42.04"S	24°20'46.71"E
	Western point	30°13'37.43"S	24°17'54.87"E
	Southern point	30°14'22.32"S	24°18'49.04"E
	Centre point	30°13'19.45"S	24°18'49.49"E

A layout map illustrating the location of the Project is provided in **Figure 2.1**.

2.2 Project Description

The facility will have a contracted capacity of up to 240MW and will include the following infrastructure:

- Solar PV array comprising PV modules and mounting structures (monofacial or bifacial and of fixed-tilt, single-axis tracking, and/or double-axis tracking PV technology)
- Inverters and transformers
- Cabling between the project components
- Battery Energy Storage System (BESS)
- On-site facility substation
- Site offices, Security office, operations and control, and maintenance and storage laydown areas
- Access roads, internal distribution roads

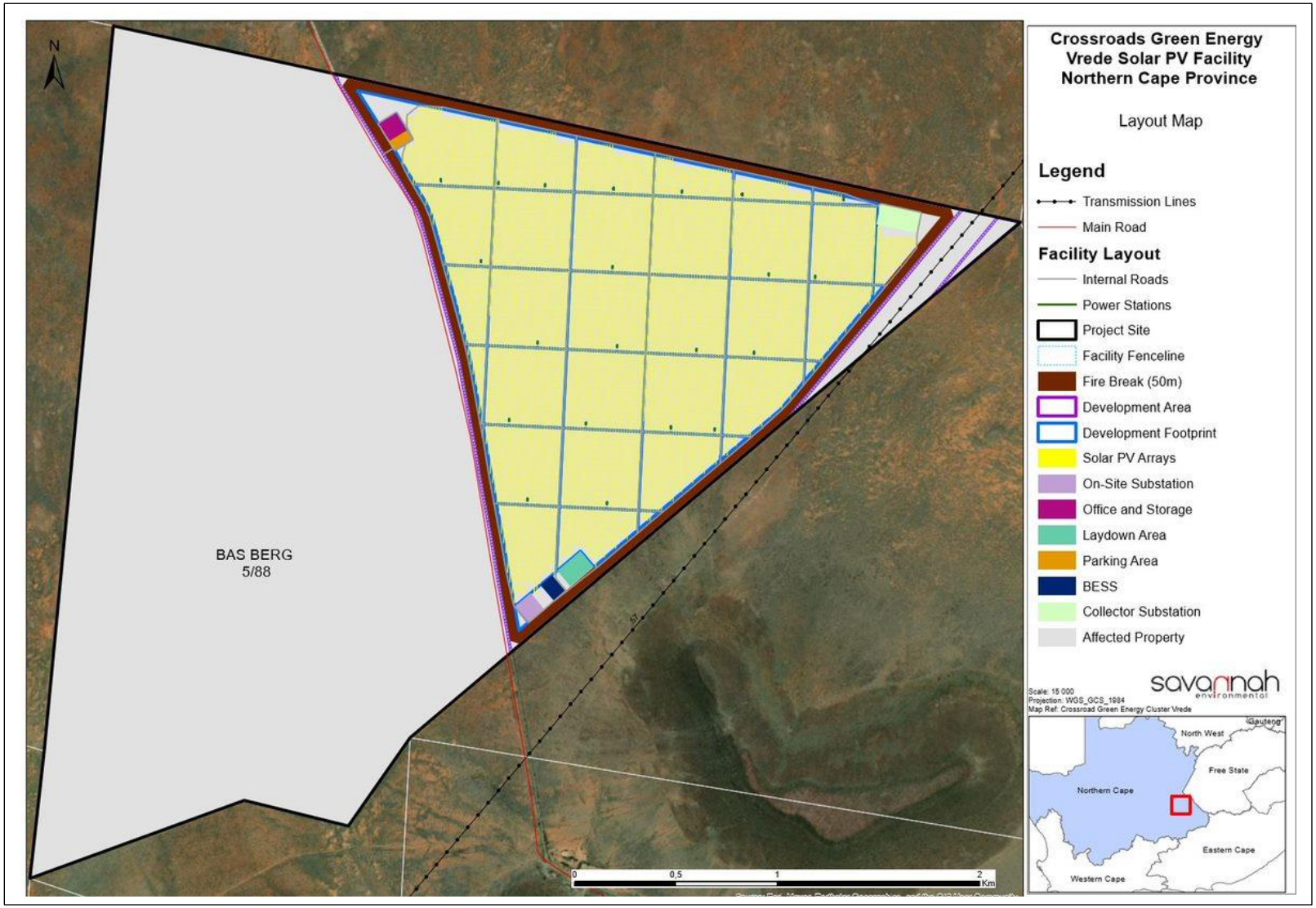

Figure 2.1: Layout map illustrating the location of the Project development area

A summary of the planned infrastructure proposed as part of the Project is provided in **Table 2.3** and described in more detail under the sub-headings below.

Table 2.3: Planned infrastructure proposed as part of the Project

Infrastructure	Footprint and dimensions
Contracted Capacity	Up to 150MW
Number of Panels	~ 510, 000 units of 540Wp panels or higher capacity panels if available
Panel Height	Up to 5m from ground level
Technology	Use of fixed-tilt, single-axis tracking, and/or double-axis tracking PV technology. Monofacial or bifacial panels are both considered
Battery Energy Storage System (BESS)	» Standard 20ft HC ISO container with a capacity ranging from 200kWh to 2MWh » The total size of the Battery Energy Storage System will be determined at a later stage but could be up to 1 MWh per MW of solar PV, taking the assumption that 15% of daily consumption is stored resulting in a 240MWh BESS capacity. » The use of containerized battery storage solutions, which capacity ranges from 200kWh to 2MWh, and which size is 6.06 x 2.44 x 2.90m. Considering circa. 30m2 footprint for a container, the total BESS footprint would be 1.15ha
Other infrastructures	» Operations building – ~ 500m^2 » Workshop – ~ 500m^2 » Stores - ~ 500m^2
Area occupied by laydown area	» Temporary laydown areas to be used in construction: 1ha/100MW » Permanent laydowns that will be used in operation: 0.25ha from temporary laydown area
Area occupied by the PV facility	» PV facility and associated infrastructure: ~400 ha » Laydown Area 2.5ha » Buildings, workshops and store rooms: 1ha
Area occupied by the substations	Facility substation: Not exceeding 2ha.
Access and internal roads	» A minimum required road width of 4 m (up to 8m wide) needs to be maintained and all turning radii must conform with the specifications needed for the abnormal load vehicles and haulage vehicles. It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed. The gravel roads will require grading with a grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage. » Main access road to the project site will be via the existing R48 gravel road. » Internal access roads (gravel) of up to 8m in width within a temporary 20 m construction corridor will be required to access the PV facility.
Grid connection	» The on-site substation will increase the voltage level from 33kV to 132kV or possibly up to 275kV for transmitting the generated electric power to the proposed central collector substation (or switching station), where several projects totalling a capacity up to 500MVA will connect. » A new line will run from the central collector substation and tie into the proposed Hydra B MTS via a double circuit, whether it will be an underground or overhead power line is dependent on the environmental sensitivities.

Infrastructure	Footprint and dimensions
	» The collector substation and the transmission line servitudes will be assessed as part of a separate Environmental Impact Assessment process in support of an application for Environmental Authorisation. This infrastructure is not included as part of this application.
Temporary infrastructure	» Temporary infrastructure, including laydown areas, hardstand areas and a concrete batching plant, will be required during the construction phase. » All areas affected by temporary infrastructure will be rehabilitated following the completion of the construction phase, where it is not required for the operation phase.

2.3. Life-cycle Phases of the Project

A series of activities are proposed as part of the design, pre-construction, construction, operation, and decommissioning phases associated with the development of the Project. These are discussed in more detail under the respective sub-headings below.

2.3.1. Design and Pre-Construction Phase

Planning

Several post-authorisation factors are expected to influence the final design of the solar energy facility and could result in small-scale modifications of the PV array and/or associated infrastructure. An objective of the Engineering, Procurement and Construction (EPC) Contractor, who will be responsible for the overall construction of the project, will be to comply with the approved facility design as far as possible. It should be understood however, that the construction process is dynamic and that unforeseen changes to the project specifications may take place. This EIA Report therefore describes the project in terms of the best available knowledge at the time. Should there be any substantive changes or deviations from the original facility layout of the project, the DFFE will be notified and, where relevant, the final facility design approved by the DFFE.

Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to, confirmation of the micro-siting footprint (i.e. the precise location of the PV panels, on-site facility substation and the associated infrastructure) and a geotechnical survey. Geotechnical surveys acquire information regarding the physical characteristics of soil and rocks underlying a proposed project site and inform the design of earthworks and foundations for structures.

2.3.2. Construction Phase

The construction phase will take approximately 15 - 18 months to complete, and will entail a series of activities including:

Procurement and employment

At the peak of construction, the project is likely to create a maximum of up to 300 employment opportunities. These employment opportunities will be temporary and will last for a period of approximately 15 – 18 months (i.e. the length of construction). Employment opportunities generated during the construction phase will include low skilled, semi-skilled, and skilled opportunities. Solar PV projects make use of high levels of unskilled and semi-skilled labour, so there will be good opportunity to use local labour, where available. Employment opportunities will peak during the construction phase and significantly decline during the operation phase.

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

Establishment of an Access Road

Main access to and Internal access roads within the site will be established at the commencement of construction. Existing access roads will be utilised, where possible, to minimise impact. It is unlikely that access roads will need to be upgraded as part of the proposed development. Main access road will be approximately 8m wide and will be located within a 4m servitude to accommodate side drainage, etc. Internal service road alignment will be approximately 8m wide. Location is to be determined by the final micro-siting or positioning of the PV panels.

Undertake Site Preparation

Including the clearance of vegetation at the footprint of PV panel supports, establishment of the laydown areas, the establishment of internal access roads and excavations for foundations. Stripping of topsoil to be stockpiled, for use during rehabilitation. Vegetation clearance to be undertaken in a systematic manner to reduce the risk of exposed ground being subject to erosion. Include search and rescue of floral species of concern (where required) and the identification and excavation of any sites of cultural/heritage value (where required).

Transport of Components and Equipment to Site

- The components for the solar PV facility and onsite substation will be transported to site by road. Transportation will take place via appropriate National and Provincial roads, and the dedicated access/haul road to the site.
- Some of the components (i.e. substation transformer) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989) by virtue of the dimensional limitations.
- Typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the mounting of the PV support structures, construction of the substation and site preparation.

Establishment of Laydown Areas on Site

- A laydown area for the storage of PV panels components and civil engineering construction equipment.
- The laydown will also accommodate building materials and equipment associated with the construction of buildings.
- No borrow pits will be required. Infilling or depositing materials will be sourced from licenced borrow pits within the surrounding areas.
- A temporary concrete batching plant of 50m x 50m in extent to facilitate the concrete requirements for foundations, if required.

Erect PV Panels and Associated Infrastructure

- The construction phase involves installation of the solar PV panels and the structural and electrical infrastructure to make the plant operational. In addition, preparation of the soil and improvement of the access roads would continue for most of the construction phase.
- For array installation, typically vertical support posts are driven into the ground. Depending on the results of the geotechnical study a different foundation method, such as screw pile, helical pile, micro-pile or drilled post/pile could be used. The posts will hold the support structures (tables) on which PV arrays would be mounted. Brackets attach the PV modules to the tables.

- Trenches are dug for the underground AC and DC cabling and the foundations of the inverter enclosures and transformers are prepared. While cables are being laid and combiner boxes are being installed, the PV tables are erected.
- Wire harnesses connect the PV modules to the electrical collection systems.
- Underground cables and overhead circuits connect the Power Conversion Stations (PCS) to the on-site AC electrical infrastructure and ultimately the project's on-site substation. This process also involves the installation of the BESS facility.

Undertake Site Rehabilitation

- Commence with rehabilitation efforts once construction completed in an area, and all construction equipment is removed.
- On commissioning, access points to the site not required during the operation phase will be closed and prepared for rehabilitation.

2.3.3. Operation Phase

- Duration will be ~30 years.
- Requirements for security and maintenance of the project.
- Employment opportunities relating mainly to operation activities and maintenance
- Approximately 15 or up to 30 employees will be required during the operational phase of the larger
- Crossroads Green Energy Cluster. There will also be contractors and temporary workers.
- Full time security, maintenance, and control room staff.
- All PV panels will be operational except under circumstances of mechanical breakdown, inclement weather conditions, or maintenance activities.
- Solar PV to be subject to periodic maintenance and inspection.
- It is anticipated that the PV panels will be washed two times a year during operation using clean water with no cleaning products or using non-hazardous biodegradable cleaning products.
- Disposal of waste products (e.g., oil) in accordance with relevant waste management legislation.
- Areas which were disturbed during the construction phase to be utilised, should a laydown area be required during operation.

2.3.4. Decommissioning Phase

- Expected lifespan of approximately 30 years (with maintenance) before decommissioning is required.
- Decommissioning of the Vrede Solar PV Facility infrastructure at the end of its economic life.
- Potential for repowering of the facility, depending on the condition of the facility at the time.
- Expected lifespan of approximately 30 years (with maintenance) before decommissioning is required.
- Decommissioning activities to comply with the legislation relevant at the time.

Site Preparation

- Confirming the integrity of site access to the site to accommodate the required decommissioning equipment.
- Preparation of the site (e.g., laydown areas and construction platform).
- Mobilisation of construction equipment.

Disassembly and removal of existing components

- Components to be reused, recycled, or disposed of in accordance with regulatory requirements.
- Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials and would be recycled to the extent feasible.
- Concrete will be removed to a depth as defined by an agricultural specialist and the area rehabilitated. Cables will be excavated and removed, as may be required.

Future plans for the site and infrastructure after decommissioning

Following decommissioning of the facility, the project site will be returned to the current land use (i.e. agriculture: livestock farming, specifically sheep farming).

2.4 Findings of the Environmental Impact Assessment (EIA)

No environmental fatal flaws were identified for the Project in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of highly sensitive features within the project site by the development footprint and the undertaking of monitoring, as specified by the specialists.

The potential environmental impacts associated with the Project identified and assessed through the EIA process include:

- Impacts on ecology, flora and fauna.
- Impacts on freshwater resources.
- Impacts on avifauna.
- Impacts to soils and agricultural potential.
- Visual Impacts.
- Traffic Impacts
- Heritage Impacts
- Social impacts.

2.4.1 Impacts on Ecology

The project area is situated in the Northern Upper Karoo vegetation type according to SANBI (2018). The project area is homogenous in terms of vegetation with a low karroid scrub grassland occurring throughout. One vegetation community type can be found in the project area: Karoo Grassland, which approximates Northern Upper Karoo. The project area includes ESA. Development of this nature (i.e.: Solar PV facilities and associated infrastructure) may occur in an ESA area provided all mitigation measures are adhered to. No Species of Conservation Concern (SCC) were recorded from the project area.

The main impact to the vegetation and habitat types within and surrounding the project area is grazing. Much of the project area comprises large areas of intact indigenous vegetation with little to no existing degradation, making these areas suitable for a wide variety of plant species (not all of which could be identified as a result of the seasonality of the site visit) as well as suitable habitat for a suite of faunal species, most notably various mammals. Based on the ecological assessment, all habitats within the project area of the proposed development were allocated a sensitivity category or Site Ecological Importance (SEI), which is considered a combined SEI for Terrestrial Biodiversity, Animal Species and Plant Species Themes.

The main expected impacts of the proposed infrastructure will include the following:

- Habitat loss and fragmentation as well as degradation of surrounding habitat;
- Disturbance and displacement caused during the construction and maintenance phases; and
- Direct mortality during the construction phase.

The primary expected impacts of the proposed project will be the loss of habitat and emigration of fauna. Based on the outcomes of the SEI determination, the study area is considered to have a Medium SEI which indicates that minimisation mitigation must be applied to the site.

It must be noted, when taken into consideration in conjunction with the other Solar PV facilities planned for all three phases of the overall proposed development, that the cumulative fragmentation of the ESA is very high. The associated cumulative fragmentation impacts are expected to be high for the overall development. This project should ideally not be considered in insolation but rather as a part of the full proposed development when considering impacts to the ESA.

Considering that this area has been identified as being of significance for biodiversity maintenance and ecological processes (ESA), development may proceed but with caution and only with the implementation of mitigation measures. Considering the above-mentioned information, no fatal flaws are evident for the proposed project. It is the opinion of the specialists that the project may be favourably considered, on condition that all prescribed mitigation measures and supporting recommendations are implemented.

2.4.2 Impacts on Freshwater Ecology

One (1) form of a watercourse was identified and delineated within the regulated area (Refer to **Figure 6.6** within the EIA report). This includes an ephemeral river (watercourse). No natural wetland systems, or even cryptic wetlands were identified for the area. The proposed development area is more than 650 m south of the watercourse. A borrow bit with no drainage was identified within the project area, but this is not considered to be a natural water resource. The results of the habitat assessment indicates natural (class A) and largely natural (class B) instream and riparian conditions for the watercourse catchment respectively. The recommended buffer was calculated to be 20 m for the river.

A site sensitivity verification forms part of reporting requirements. In this regard, the allocated sensitivities of low for the general area and medium sensitivity for the drainage features agrees with the Environmental Screening Tool. The project must take cognisance of this and avoid any unnecessary disturbance of the drainage features and adjacent habitat. Therefore, the aforementioned post-mitigation buffer should be implemented and treated as 'no go areas'.

The development footprint is not located within 100 m of the delineated water resource [as per the National Water Act, 1998 (Act No. 36 of 1998) in accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21(c) and 21(i)]. However, the closest water resource (ephemeral river) is rated as Very High sensitivity, and no development activities should take place within the delineated buffer zone. Since the development footprint is outside of the regulation zone and buffer zone, no risks to the freshwater systems are foreseen for the proposed project. Therefore, no impacts or risks were anticipated to the freshwater systems and therefore not assessed in this report. A Compliance Statement was prepared by the specialist in accordance with the specialist protocols.

As a result of the absence of impacts or risks to freshwater systems, the contribution of the project to cumulative impacts in the region are expected to be low.

No fatal flaws were identified for the project, and the development may be favourably considered and all prescribed mitigation measures must be considered by the issuing authority. No monitoring measures are deemed necessary for the development.

2.4.3 Impacts on Avifauna

The SABAP2 Data lists 234 avifauna species that could be expected to occur within the area. Eleven (11) of these expected species are regarded as SCC. One hundred and twenty-four (124) bird species were recorded across all properties within the Crossroads Green Energy Cluster in the first survey undertaken during 25 April- 6 May 2022, with Pied Crow, Red-billed Quelea, Spiked-heel Lark and Pink-billed Lark being the most abundant species. A number of species were found during the survey that would be regarded as 'high risk' species.

One hundred and two (102) bird species were recorded during the second survey across all properties within the Crossroads Green Energy Cluster in the second survey which was conducted from 1-10 July 2022. Nine of the species recorded were SCC on a national or international scale. They were found in varying degrees of frequency. During the second survey similar SCCs were recorded with the exception of the Karoo Korhaan and Lanner Falcon.

The assessment area overlaps is located within the Platberg–Karoo Conservancy IBA and includes with three habitat types namely, Grassland Karoo, Shrubland Karoo and Water Resources (Dams, drainage lines and river). These habitats were based on the species compositions in the various areas.

Three active Verreaux's Eagle nests were observed and an additional two inactive nests were also noted. Two active Secretarybird nests were also recorded (refer to Figure 6.9). As per the Species Environmental Assessment Guidelines (2020) a core area of 1km (core buffer) surrounding the nests must be treated as a no-go area, an additional area of 5.2km (seasonal buffer) was also placed around the nest as per the Birdlife Verreaux's Eagle and Wind Farms Guidelines (2021). This 5.2km area is based on the average home range of the Verreaux's Eagle during the breeding season, and as such this area must be avoided during the breeding season of the species which stretches from April to July to avoid disturbing the species. As per the guidelines, buffers were also placed around the inactive nests. For the Secretarybird nests a 4 km buffer was placed around the nests, of which 2km must be treated as no go (core buffer), while the other 2 km must be low impact development (low impact buffer) (pers comms Birdlife, 2022). Secretarybirds breeds year around therefore low impact development is required and a breeding season limitation will not suffice.

Sensitivities were compiled by the specialist for the avifauna study based on the field results and desktop information. The Water resources and Nest buffers were given a very high sensitivity based on the low receptor resilience these areas and species will have to change. The Karoo scrubland and Karoo Grasslands all support a large number of SCCs (9 species), the biodiversity importance of these areas are thus high.

Apart from the disruption of the nests, habitat loss, collisions and electrocutions are regarded as the main impacts. Should the mitigations, monitoring and avoidance guidelines be followed the impacts can be reduced to a Moderate-Low level.

The following is concluded by the specialist:

- The development within the area of the nest core buffers is regarded as a fatal flaw and no development is to be allowed in these areas.
- Construction is permitted In the seasonal/low impact buffer areas, however must be considered with caution based on the high number of species of conservation concern and 'risk' species present. It is recommended that should development take place in the seasonal/ low impact buffers that the rest of the property remain undeveloped.

The Vrede PV facility development footprint falls outside of the identified core buffers and a small portion of the PV facility falls within the seasonal/low impact buffer areas. With the implementation of the recommended mitigation measures, the project is considered to be acceptable as proposed.

2.4.4 Impacts on Soils and Agricultural Potential

The developable area is located in the Ae138 land type. The Ae land types are characterized with Hutton, Oakleaf and Mispah soil forms according to the Soil Classification Working Group, (1991) with the possibility of other soils and bare rocky areas. The Ae land type consists of red to yellow apedal soils which are freely drained. The soils tend to have a high base status and are deeper than 300 mm.

Fifteen land capabilities have been digitised by (DAFF, 2017) across South Africa, of which two are located within the proposed development area, including:

- Land Capability 1 to 5 (Very Low to Low Sensitivity); and
- Land Capability 6 to 8 (Low/Moderate to Moderate Sensitivity).

It is the specialist's opinion that the baseline findings concur with the land capabilities identified by means of the DAFF (2017) desktop findings regarding land capability sensitivities. No "High" land capability sensitivities were identified within the developable area. Considering the relatively medium to low sensitivities, it is the specialist's opinion that the proposed activities will have an acceptable level of impact on agricultural productivity for the area. Furthermore, no measures regarding moving components in their micro-setting are required to avoid or minimise fragmentation and disturbances of agricultural activities.

No fatal flaws were identified for the project. It is the specialist's opinion that the proposed activities may proceed as have been planned without the concern of loss of high sensitivity land capabilities or agricultural productivity for the developable area.

2.4.5 Visual Impacts

Despite the significant industrial type infrastructure which is present in the area, the greater landscape of the study area is characterised by wide-open spaces and otherwise very limited development. The study area is sparsely populated outside of the Philipstown (i.e. less than two people per km2 within the district municipality). A number of isolated homesteads occur throughout the study area. The study area is characterised by wide-open spaces and otherwise very limited development. It should however be noted that there are a number of authorised (and current) renewable energy applications within the study area and the greater region, that may change the landscape to some degree in the future. There are no formally protected or conservation areas within the study area. Sensitive visual receptors include residents or visitors to the area and users of local roads. Potential impacts include:

- The proposed development could change the character and sense of place of the landscape setting;
- The proposed development could change the character of the landscape as seen from the local roads;
- The proposed development could change the character of the landscape as seen from local agricultural homesteads;
- The proposed development could change the character of the landscape as seen from private nature reserves;
- Solar glare and glare impacts; and
- Lighting impacts.

The findings of the Visual Impact Assessment undertaken for the proposed Vrede Solar PV Facility is that the visual environment surrounding the site, especially within a 1km radius (and potentially up to a radius of 3km) of the proposed facility, may be visually impacted during the anticipated operational lifespan of the facility (i.e. a minimum of 20 years).

The following is a summary of impacts remaining:

- Construction activities may potentially result in a high temporary visual impact, that may be mitigated to moderate
- The operation of the proposed PV facility is expected to have a high visual impact pre-mitigation and a moderate visual impact post mitigation on the residents of Jakobsrus and observers/visitors travelling along the secondary roads within a 1km radius of the PV facility.
- The operational facility could have a high visual impact which may be mitigated to moderate on residents/visitors to the homestead of Middelplaas and observers travelling along the various secondary roads within 1 – 3km radius of the facility.
- The operational facility could have a moderate visual impact which may be mitigated to low on residents/visitors to the homestead of Wolwekuil and an unknown residence as well as observers travelling along the various secondary roads within 3 – 6km radius of the facility.
- The operational facility could have a low visual impact both pre and post mitigation on residents/visitors to various homesteads as well as observers travelling along the various secondary roads beyond the 6km radius of the facility.
- This anticipated lighting impact is likely to be of high significance and may be mitigated to moderate especially within 0-3 km radius of the PV facility.
- The potential visual impact related to solar glint and glare as a road travel hazard is therefore expected to be of low significance. No mitigation of this impact is required since the solar reflection is predicted towards a local/secondary road.
- There is a single affected residence, Jakobsrus, within a 1km radius of the proposed PV facility. The potential visual impact related to solar glint and glare on static ground-based receptors (residents of homesteads) is therefore expected to be of moderate significance before mitigation and low post mitigation.
- The anticipated visual impact resulting from ancillary infrastructure is likely to be of low significance both before and after mitigation.
- Decommissioning activities may potentially result in a high, temporary visual impact that may be mitigated to moderate.
- The anticipated significance of the visual impacts on the sense of place within the region (i.e. beyond a 6 km radius of the development and within the greater region) is expected to be of Moderate significance.
- The anticipated cumulative visual impact of the proposed facility is expected to be of high significance.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from prominently moderate to low significance. One visual impact of high is anticipated in terms of the cumulative visual impact of the proposed Phase 1 of the Crossroads Green Energy Cluster. Anticipated visual impacts on sensitive visual receptors (if and where present) in close proximity to the proposed Vrede Solar PV Facility are not considered to be fatal flaws for the proposed PV facility.

A number of mitigation measures have been proposed. Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility.

If mitigation is undertaken as recommended, it is concluded that the significance of most of the anticipated visual impacts will remain at or be managed to acceptable levels. As such, the Vrede Solar PV facility would be considered to be acceptable from a visual impact perspective and can therefore be authorised.

2.4.6 Traffic Impacts

The Traffic Impact Assessment concluded the following regarding key issues and alternatives to be considered for the proposed Vrede Solar PV Facility:

- The preferred Port of Entry for imported components is the Port of Ngqura.
- The proposed access road located off the R48 is deemed a suitable access road as it is an existing gravel road i.e., less expensive to upgrade.
- It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed. The gravel roads will require grading with a grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage.
- The construction phase traffic, although significant, will be temporary and can be mitigated to an acceptable level.
- During operation, it is expected that staff and security will periodically visit the facility. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.
- The construction and decommissioning phases of a development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e., the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network.

Impacts are expected to occur with the development of the project during the construction and operation phases.

Impacts during construction include:
- Construction related traffic
- The construction traffic would also lead to noise and dust pollution.
- This phase also includes the construction of roads, excavations, trenching for electrical cables and other ancillary construction works that will temporarily generate the most traffic.

Impacts during the operation phase include:

» During operation, it is expected that staff and security will visit the facility.
» Maintenance vehicles are expected on site at times.
» Should municipal water not be available, water will have to be transported to the site.

Cumulative Impacts
» Traffic congestion/delays on the surrounding road network.
» Noise and dust pollution

The construction and decommissioning phases of a development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e., the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network.

The development is supported from a transport perspective provided that the recommendations and mitigations contained in this report are adhered to.

The impacts associated with the facility are acceptable with the implementation of the recommended mitigation measures and can therefore be authorised.

2.4.7 Heritage Impacts

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific areas proposed for development have an overall low sensitivity for impacts to significant archaeological heritage.

The results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and are therefore not archaeologically significant. Specific mitigation measures are proposed for the few sensitive sites identified. Often, rock engravings and some archaeological sites from this area are associated with dolerite outcrops as these outcrops provide the raw material resource for rock engravings. The dolerite outcrops that are present within the areas proposed for development therefore have high levels of archaeological sensitivity and impacts to these outcrops must be avoided. No archaeological resources of significance were identified within the area proposed for the Vrede Solar PV Facility.

Based on previous surveys in the area, the land use (for grazing by sheep), the presence of superficial deposits (probable Pleistocene to Recent age) covering the fossiliferous sediments (probably Ecca and Beaufort Groups), as well as the extensive network of intrusive dolerite dykes and sills that bake (thermally metamorphose) adjacent mudrocks, it is anticipated that the impact of the development will mainly be low to moderate. However, any excavations > 1m could disrupt Ecca and Beaufort Group sediments which are highly fossiliferous and would increase the impact of the development to moderate to high. There are no objections on palaeontological heritage grounds, granted the excavations do not exceed 1m in depth. Any fossil finds, most likely in the superficial Quaternary sediments, are to be reported by the developer. Should important fossil material be found during excavations, a Fossil Finds Procedure must be implemented.

In terms of cultural landscape, the following recommendations are adapted from Winter and Wilson (2021) in terms of Solar PV placement ("where" and "how"). The following general principles apply to the PV layout:

» Avoid steep slopes.
» Avoid proximity to historic corridors.
» Avoid placement within viewshed of farmsteads.

The layout provided comply with the above general principles. The impact tables for this impact are fully addressed in the VIA.

There is no objection to the proposed development in terms of impacts to heritage resources on condition that:

» There are no objections on palaeontological heritage grounds, granted the excavations do not exceed 1m in depth. Any fossil finds, most likely in the superficial Quaternary sediments, are to be reported by the developer. Should important fossil material be found during excavations, an appropriate Fossil Finds Procedure must be implemented.
» A 100m Buffer is implemented around site TK001 (which is located outside of the development footprint)
» Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.

2.4.8 Social Impacts

The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The PKSDM SDF and IDP also support the development of renewable energy. The development of the proposed PV facility is therefore supported by key policy and planning documents.

The findings of the SIA indicate that the proposed Vrede PV SEF will result in several social and socio-economic benefits, including creation of employment and business opportunities during both the construction and operational phases. The project will also create economic development opportunities for the local community. The enhancement measures listed in the report should be implemented in order to maximise the potential benefits. The significance of this impact is rated as High Positive. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal-based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives.

The findings also indicate that the potential negative impacts associated with both the construction and operational phase are likely to be Low Negative with mitigation. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented.

On the basis of the above conclusion, the establishment of the proposed Vrede PV SEF and associated infrastructure is supported.

2.4.9 Risks Associated with the BESS

All types of batteries can be hazardous and can pose a safety risk. The risks associated with battery technologies are generally well understood and researched. The primary risks for all BESS technologies relate to fire hazards and the potential for a condition known as 'thermal runaway'. Thermal runaway occurs in situations where an increase in temperature changes the conditions in a way that causes a further increase in temperature, often leading to fires and/or explosions. Lithium-ion batteries and flow batteries in fire scenarios may generate toxic gas from the combustion of hydrocarbons, plastics, or acidic electrolytes. Physical damage to the battery can also lead to problems as this can allow the electrolyte inside to leak potentially resulting in toxic chemical exposure or pollution.

Flow batteries are generally considered the safer technology because they do not contain flammable materials, and the materials that they do contain, such as vanadium, are often environmentally friendly. However, lithium-ion batteries are easier to install (i.e. usually housed within containers as opposed to formal building structures) and require fewer staff to operate.

Liquid metal batteries are a good alternative battery solution to Lithium Ion and Redox. Liquid metal batteries are safe to transport, being in a solid state when not in use. This new technology utilises environmentally friendly materials which are recyclable after decommissioning and do no emit any toxic gases when operating. Because of the abundance of materials used in liquid metal batteries, the costs are also generally lower than lithium-ion and are much better equipped for stressed environments especially considering that liquid metal batteries can be exposed to harsh overcharging and discharging cycles without impacting on their capacities[1].

All of the listed battery technologies will require strict adherence to supplier Standard Operating Procedures to minimise risks to workers.

The Vrede Solar PV Facility development site is not located in close proximity to residences or water resources. The development of the BESS (regardless of technology selected) is therefore not expected to raise any unacceptably high-risk issues, i.e. the BESS facility of either technology type is not a No-Go option and **all technologies are considered acceptable**.

2.4.10 Cumulative Impacts

Cumulative impacts are expected to occur with the development of the project throughout all phases of the project life cycle and within all areas of study considered as part of this EIA report. The main aim for the assessment of cumulative impacts considering the Project is to test and determine whether the development will be acceptable within the landscape proposed for the development, and whether the loss, from an environmental and social perspective, will be acceptable without whole-scale change.

The following conclusions can be drawn regarding the cumulative impacts associated with the project when considered together with impacts of similar industrial-type projects in the area:

[1] https://www.energy-storage.news/ambri-gets-ul-1973-safety-certification-for-liquid-metal-battery-storage-tech/

- There will be no unacceptable loss or impact on ecological aspects (vegetation types, species and ecological processes), provided the recommended mitigation measures are implemented. This is due to the moderate sensitivity of the site and the acceptability of solar development within an ESA.
- There will be no significant loss of sensitive and significant aquatic features as the project is located outside of any freshwater resources.
- There will be no unacceptable loss or impact to avifauna or avifaunal habitats, provided the recommended mitigation measures are implemented. This is due to the location of the project infrastructure outside of identified no-go areas and the fact that solar development is considered to be low impact in terms of the BirdLife species specific guidelines.
- The project will not impact on any high potential agricultural land and will therefore not contribute to impacts on this resource or food security.
- Change to the sense of place and character of the area is expected with the development of the proposed Vrede Solar Energy Facility and other renewable energy facilities within a 30km radius of the site. Other industrial type infrastructure in the region include numerous power lines and substations. Whilst the proposed project will create a new large scale industrial operation and change the character of an area of rural landscape, this is not entirely out of character with the region. The cumulative impact is therefore considered to be acceptable.
- There will be no loss of heritage resources of significance due to the absence of any areas of sensitivity from the development footprint.
- No unacceptable social impacts are expected to occur.

Based on the specialist cumulative assessment and findings, the development of the Vrede Solar PV Facility and its contribution to the overall impact of all renewable energy projects to be developed within a 30km radius, it can be concluded that the cumulative impacts associated with the project will be of a low to high significance depending on the impact being considered. Based on all areas of study considered as part of this EIA report, the development of Vrede Solar PV Facility will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment.

Table 2.4: Summary of the cumulative impact significance for the Project.

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Terrestrial Ecology	Low	High
Freshwater Ecology	None	Low
Avifauna	Medium	Medium
Soils and Agricultural Potential	Low	Low
Heritage	None	Medium
Visual	Moderate	High
Social	Low to Medium (positive and negative)	Medium to High (positive and negative)
Traffic	Low	Medium

2.4.11. Assessment of the Facility Layout

The facility layout/development footprint assessed within this EIA Report (**Figure 2.2**) was designed by the project developer in order to respond to and avoid the sensitive environmental and social features located within the project site, which were identified by the specialists during the Scoping Phase of the EIA process.

This approach ensured the application of the mitigation hierarchy (i.e., avoid, minimise, mitigate, and offset) to the proposed project, which ultimately ensures that the development is appropriate from an environmental perspective and is suitable for development within the project site.

Based on the findings as documented in this EIA report, it was concluded that this layout avoids areas of sensitivity and recommended no-go areas, and therefore no further optimisation was recommended. As such, the impact of this proposed Facility Layout is considered to be acceptable and the layout is recommended for approval. Final micro-siting must however be undertaken prior to construction considering all mitigation measures recommended within this EIA Report and associated specialist studies.

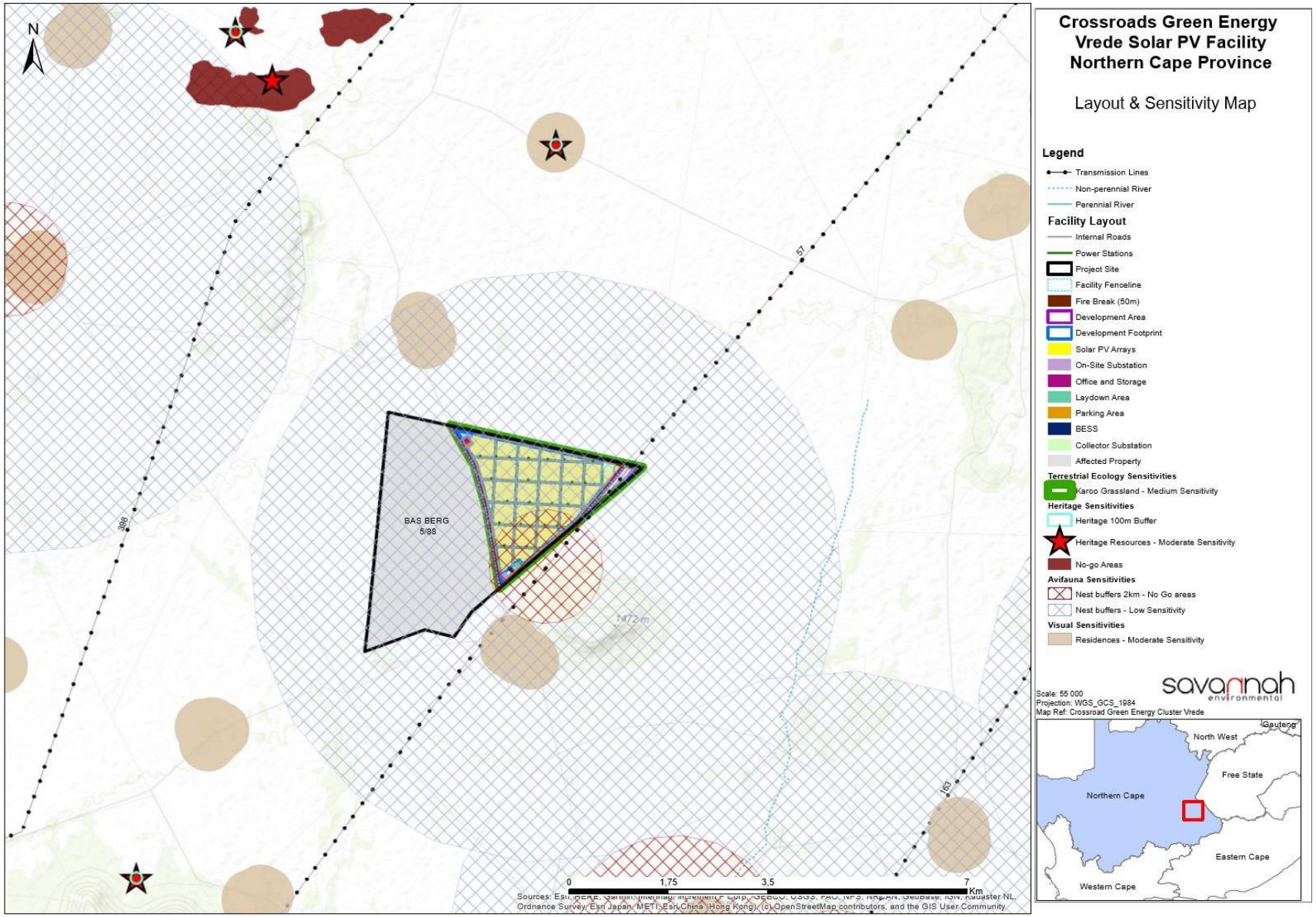

Figure 2.2: Sensitivity map for the Vrede Solar PV Facility

2.4.12. Overall Conclusion (Impact Statement)

The preferred activity was determined by the developer to be the development of a renewable energy facility on site using solar as the preferred technology, due to the availability of a strong solar resource, land availability, available grid capacity, benign topography, and good access. A technically viable development footprint was proposed by the developer considering environmental sensitivities identified in the scoping study and assessed as part of the EIA process. The assessment of the development footprint within the project site was undertaken by independent specialists and their findings have informed the results of this EIA Report.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen from a policy perspective at a local, provincial and National level.

The specialist findings from the EIA studies undertaken have indicated that there are no identified fatal flaws associated with the implementation of the development footprint within the project site subject to implementation of the recommended mitigation measures. The developer has designed a project development footprint in response to the identified sensitive environmental features and areas present within the project site. This approach is in line with the application of the mitigation hierarchy, where all the sensitive areas which could be impacted by the development have been avoided (i.e., tier 1 of the mitigation hierarchy). The impacts that are expected to remain after the avoidance of the sensitive areas by the facility layout have been reduced to acceptable levels through the recommendation of specific mitigation measures by the specialists. The minimisation of the significance of the impacts is in line with tier 2 of the mitigation hierarchy. Therefore, impacts can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures. The layout for the PV facility assessed within this EIA Report is located outside of the very high sensitivity areas and features regarded to be no-go for development and is therefore considered to be acceptable for implementation.

As detailed in the cost-benefit analysis, the benefits of the Vrede Solar PV Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level can be appropriately managed and minimised, the benefits of the project are expected to partially offset the localised environmental costs of the solar facility. From a social perspective, both positive and negative impacts are expected. The implementation of the 'do-nothing' alternative will result in a number of lost opportunities. The 'do nothing' alternative is therefore not preferred and not proposed to be implemented for the development of The Project.

Through the assessment of the development footprint within the project site, it can be concluded that the development of the Vrede Solar PV Facility will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures).

2.4.13 Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the Project Developer, the avoidance of the sensitive environmental features within the development footprint and the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the Project is acceptable within the landscape and can reasonably be authorised, subject to avoidance of the sensitive areas identified through the EIA process and the implementation of recommended mitigation measures. The following project details should be included within the EA for the Project:

» The Vrede Solar PV Facility with a contracted capacity of up to 150MW, to be located on Portion 5 of the Farm Bas Berg 88 in the Renosterberg Local Municipality in the greater Pixley ka Seme District Municipality in the Northern Cape Province. The project site is located approximately 20km north of Philipstown and 30km west of Petrusville and within the Central Transmission Corridor.
»

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

» Solar PV array comprising PV modules and mounting structures (monofacial or bifacial and of fixed-tilt, single-axis tracking, and/or double-axis tracking PV technology)
» Inverters and transformers
» Cabling between the project components
» Battery Energy Storage System (BESS)
» On-site facility substation
» Site offices, Security office, operations and control, and maintenance and storage laydown areas
» Access roads, internal distribution roads

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

» All mitigation measures detailed within this EIA Report, as well as the specialist reports contained within **Appendices D to K** are to be implemented.
» The EMPrs (for the facility and onsite substation) as contained within **Appendix M and N** of this EIA Report should form part of the contract with the Contractors appointed to construct and maintain the solar facility in order to ensure compliance with environmental specifications and management measures. The implementation of these EMPrs for all life cycle phases of the Project is considered key in achieving the appropriate environmental management standards as detailed for this project.
» Micro-siting must be undertaken for the final facility layout and must take all recommended mitigation measures into consideration. No development is permitted within the identified no-go areas as detailed in **Figure 2.2**.
» An Environmental Site Officer (ESO) must form part of the on-site team to ensure that the EMPrs are implemented and enforced and an Environmental Control Officer (ECO) must be appointed to monitor compliance for the duration of the construction phase.
» Preconstruction walk-through of the final development footprint must be undertaken for protected species that would be affected and that can be translocated must be undertaken. The survey must also cover sensitive habitats and species that are required to be avoided. Permits from the relevant provincial authorities, will be required to relocate and/or disturb listed plant species.
» All other relevant environmental permits must be obtained prior to the construction of the facility.

A period of 10 years for the commencement of the listed activities included in the EA is requested, should the project obtain approval from the DFFE.

CHAPTER 3: PURPOSE AND OBJECTIVES OF THE EMPR

An Environmental Management Programme (EMPr) is defined as "*an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced*". The objective of this EMPr is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. Its purpose is to help ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMPr is concerned with both the immediate outcome, as well as the long-term impacts of the project.

The EMPr provides specific environmental guidance for the construction and operation phases of a project and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (site clearing and site establishment) through to those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site rehabilitation (soil stabilisation, re-vegetation) and operation. The EMPr also defines monitoring requirements in order to ensure that the specified objectives are met.

This EMPr is applicable to all employees and contractors working on the pre-construction, construction, and operation and maintenance phases of the Project. The document must be adhered to and updated as relevant throughout the project life cycle.

This EMPr has been compiled in accordance with Appendix 4 of the 2014 EIA Regulations (refer to Table 4.1). This is a dynamic document and will be further developed in terms of specific requirements listed in any authorisations issued for the Project and/or as the project develops. This will ensure that the construction and operation activities are planned and implemented taking sensitive environmental features into account. The EMPr has been developed as a set of environmental specifications (i.e. principles of environmental management), which are appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation is provided through the inclusion of various monitoring and implementation tools). These, together with any additional mitigation and management measures included within the EIA for the project, must be implemented throughout the project lifecycle.

The EMPr has the following objectives:

- Outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation and operation phases of the project, to minimise the extent of environmental impacts, and to manage environmental impacts associated with the Project.
- Ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- Identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- Propose mechanisms and frequency for monitoring compliance and prevent long-term or permanent environmental degradation.

» Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that were not considered in the EIA process.

The mitigation measures identified within the EIA process are systematically addressed in the EMPr, ensuring the minimisation of adverse environmental impacts to an acceptable level.

The Developer must ensure that the implementation of the project complies with the requirements of all environmental authorisations, permits, and obligations emanating from relevant environmental legislation. This obligation is partly met through the development and the implementation of this EMPr, and through its integration into the relevant contract documentation provided to parties responsible for construction and/or operation activities on the site. Since this EMPr is part of the EIA process for the Project, it is important that this document be read in conjunction with the EIA Report compiled for this project. This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. Should there be a conflict of interpretation between this EMPr and the EA, the stipulations in the EA shall prevail over that of the EMPr, unless otherwise agreed by the authorities in writing. Similarly, any provisions in legislation overrule any provisions or interpretations within this EMPr.

This EMPr shall be binding on all the parties involved in the planning, construction and operational phases of the project, and shall be enforceable at all levels of contract and operational management within the project. The document must be adhered to and updated as relevant throughout the project life-cycle.

CHAPTER 4: STRUCTURE OF THIS EMPR

The preceding chapters provide background to the EMPr and the project, while the chapters which follow consider the following:

» Planning and design activities;
» Construction activities;
» Operation activities; and
» Decommissioning activities.

These chapters set out the procedures necessary for the project owner to minimise environmental impacts and achieve environmental compliance. For each of the phases of implementation for the project, an overarching environmental **goal** is stated. To meet this goal, several **objectives** are listed. The management programme has been structured in table format, to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions, monitoring requirements and performance indicators. A specific EMPr table has been established for each environmental objective. The information provided within the EMPr table for each objective is illustrated below:

OBJECTIVE: Description of the objective, which is necessary to meet the overall goals; which take into account the findings of the EIA specialist studies

Project Component/s	List of project components affecting the objective, i.e.: » PV array and BESS » Access roads; and » Associated infrastructure.
Potential Impact	Brief description of potential environmental impact if objective is not met.
Activity/Risk Source	Description of activities which could affect achieving the objective.
Mitigation: Target/Objective	Description of the target and/or desired outcomes of mitigation.

Mitigation: Action/Control	**Responsibility**	**Timeframe**
List specific action(s) required to meet the mitigation target/objective described above.	Who is responsible for the measures	Time periods for implementation of measures

Performance Indicator	Description of key indicator(s) that track progress/indicate the effectiveness of the management programme.
Monitoring	Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods, and reporting.

The objectives and EMPr tables are required to be reviewed and possibly modified whenever changes, such as the following, occur:

» Planned activities change (i.e. in terms of the components and/or layout of the PV Facility);

- Modification to or addition to environmental objectives and targets;
- Additional or unforeseen environmental impacts are identified and additional measures are required to be included in the EMPr to prevent deterioration or further deterioration of the environment.
- Relevant legal or other requirements are changed or introduced; and
- Significant progress has been made on achieving an objective or target such that it should be re-examined to determine if it is still relevant, should be modified, etc.

4.1 Contents of this Environmental Management Programme (EMPr)

This EMPr has been prepared as part of the EIA process being conducted in support of the application for (EA) for the Vrede Solar PV Facility. This EMPr has been prepared in accordance with the requirements as contained in Appendix 4 of the 2014 EIA Regulations. It provides recommended management and mitigation measures with which to minimise impacts and enhance benefits associated with the project.

An overview of the contents of this EMPr, as prescribed by Appendix 4 of the 2014 EIA Regulations, and where the corresponding information can be found within this EMPr is provided in Table 4.1.

Table 4.1: Summary of where the requirements of Appendix 4 of the 2014 NEMA EIA Regulations (GNR 326) are provided in this EMPr.

Requirement	Location in this EMPr
(1) An EMPr must comply with section 24N of the Act and include – (a) Details of – (i) The EAP who prepared the EMPr. (ii) The expertise of that EAP to prepare an EMPr, including a curriculum vitae.	Chapter 4 Appendix M10
(b) A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	Chapter 2
(c) 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.	Chapter 2 Figure 2.1 and Figure 2.2 Appendix M1
(d) A description of the impact management outcomes, 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 phases of the development including –	
(i) Planning and design.	Chapter 6
(ii) Pre-construction activities.	Chapter 6
(iii) Construction activities.	Chapter 7
(iv) Rehabilitation of the environment after construction and where applicable post closure.	Chapter 8
(v) Where relevant, operation activities.	Chapter 9
(f) A description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) 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 practices. (iii) Comply with any applicable provisions of the Act regarding closure, where applicable.	Chapters 6 - 9

Requirement	Location in this EMPr
(iv) Comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable.	
(g) The method of monitoring the implementation of the impact management actions contemplated in paragraph (f).	Chapters 6 - 9
(h) The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f).	Chapters 6 - 9
(i) An indication of the persons who will be responsible for the implementation of the impact management actions.	Chapters 6 - 9
(j) The time periods within which the impact management actions contemplated in paragraph (f) must be implemented.	Chapters 6 - 9
(k) The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f).	Chapters 6 - 9
(l) A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations.	Chapter 7
(m) An environmental awareness plan describing the manner in which – (i) The applicant intends to inform his or her employees of any environmental risk which may result from their work. (ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment.	Chapter 7
(n) Any specific information that may be required by the competent authority.	Table 4.2
(2) Where a government notice gazetted by the Minister provides for a generic EMPr, such generic EMPr as indicated in such notice will apply.	N/A

4.2 Project Team

In accordance with Regulation 12 of the 2014 EIA Regulations the applicant appointed Savannah Environmental (Pty) Ltd as the independent environmental consultants responsible for managing the application for EA and the supporting EIA process. The application for EA and the EIA process, is being managed in accordance with the requirements of NEMA, the 2014 EIA Regulations, and all other relevant applicable legislation.

4.2.1 Details and Expertise of the Environmental Assessment Practitioner (EAP)

In accordance with Regulation 12 of the 2014 EIA Regulations, Akuo Energy Afrique has appointed Savannah Environmental (Pty) Ltd as the independent Environmental Consultant responsible for managing the Application for EA and supporting Scoping and Environmental Impact Assessment (S&EIA) process; inclusive of comprehensive, independent specialist studies. The application for EA and S&EIA process will be managed in accordance with the requirements of NEMA, the 2014 EIA Regulations and other relevant applicable legislation.

Savannah Environmental, the EAPs employed by the company or any of the specialists responsible for undertaking studies for this project are not subsidiaries or affiliated to the applicant. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the PV Facility.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment, and planning to ensure compliance and

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

The Savannah Environmental team have considerable experience in environmental impact assessment processes and environmental management and have been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa, including those associated with electricity generation from renewable energy sources (Detailed CVs of the project members can be found in **Appendix M10**).

» **Carina de Ornelas**, Environmental Consultant and author of this report has recently started her environmental career at Savannah Environmental. She holds a Bachelor of Arts in Environmental Management and intends to further her studies in the near future. She previously worked in retail as a supervisor for over 4 years and has over 9 months of experience as an Environmental Consultant whereby she has helped in drafting of scoping reports, basic assessment reports, EIAs, GIS mapping for reports, public participation administration and environmental management programmes.

Jo-Anne Thomas, the principal EAP on this project, is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA - 2019/726) and a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP). She provides technical input for projects in the environmental management field, specialising in Strategic Environmental Advice, Environmental Impact Assessment studies, environmental auditing and monitoring, environmental permitting, public participation, Environmental Management Plans and Programmes, environmental policy, strategy and guideline formulation, and integrated environmental management. Her key focus is on integration of the specialist environmental studies and findings into larger engineering-based projects, strategic assessment, and providing practical and achievable environmental management solutions and mitigation measures. Responsibilities for environmental studies include project management (including client and authority liaison and management of specialist teams); review and manipulation of data; identification and assessment of potential negative environmental impacts and benefits; review of specialist studies; and the identification of mitigation measures.

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

4.2.2 Details of the Specialist Consultants

A number of independent specialist consultants have been appointed as part of the EIA project team er to adequately identify and assess potential impacts associated with the project (refer to **Table 4.1**). The specialist consultants have provided input into the EIA Report as well as this EMPr.

Table 4.2: Specialist Consultants which form part of the EIA project team.

Company	Specialist Area of Expertise	Specialist Name
The Biodiversity Company	Terrestrial ecology (flora & fauna), avifauna	Andrew Husted Lindi Steyn
The Biodiversity Company	Freshwater	Dale Kindler and Andrew Husted
The Biodiversity Company	Soils and Agricultural Potential	Matthew Mamera and Andrew Husted
JG Africa	Traffic	Adrian Johnson
LOGIS	Visual	Lourens du Plessis Bryony van Niekerk Tosca de Villiers
CTS Heritage	Heritage and Palaeontology	Jenna Lavin Nicholas Wiltshire
Tony Barbour	Social	Tony Barbour

CHAPTER 5: ROLES AND RESPONSIBILITIES

OBJECTIVE 1: Establish clear reporting, communication, and responsibilities in relation to the overall implementation of the EMPr during construction

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Technical Director/Manager, Site Manager, Internal Environmental Officer, Safety and Health Representative, Independent Environmental Control Officer (ECO) and Contractor for the construction phase of this project are as detailed below. Formal responsibilities are necessary to ensure that key procedures are executed.

i) The Developer

As the Proponent, Akuo Energy Afrique must ensure that the project's implementation complies with the requirements of all EAs and all other permits, and obligations emanating from relevant environmental legislation.

ii) Construction Manager

The Construction Manager will:

» Ensure all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s), so that they are aware of these.
» Ensure that Akuo Energy Afrique and its Contractor(s) are made aware of all stipulations within the EMPr.
» Ensure that the EMPr is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes through input from the independent ECO.
» Be fully conversant with the EIA for the project, the EMPr, the conditions of the EA, and all relevant environmental legislation.
» Be fully knowledgeable with the contents of all relevant licences and permits.

iii) Site Manager

The Project Manager/Site Manager is responsible for overall management of project and EMPr implementation. The following tasks will fall within his/her responsibilities:

» Be fully conversant with the EIA for the project, the EMPr, the EA conditions (once issued), and all relevant environmental legislation.
» Be fully knowledgeable with the contents of all relevant licences and permits.
» Be familiar with the recommendations and mitigation measures of this EMPr; and implement these measures.
» Ensure all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these.
» Monitor site activities daily for compliance.
» Ensure that the EMPr is correctly implemented throughout the project through site inspections and meetings. This must be documented as part of the site meeting minutes.

- Conduct internal audits of the construction site against the EMPr.
- Confine the construction site to the demarcated area.
- Rectify transgressions through the implementation of corrective action.

iv) Environmental Control Officer

A suitably qualified ECO[2] must be appointed by Akuo Energy Afrique prior to the commencement of any authorised activities and will be responsible for monitoring, reviewing and verifying compliance by the Contractor with the environmental specifications of the EMPr and the conditions of the EA. Accordingly, the ECO will:

- Be fully knowledgeable of:
  - The contents of the EIA Report.
  - The contents of the conditions of the EA (once issued).
  - The contents of the EMPr.
  - All the licences and permits issued for the project.
  - The contents of all relevant environmental legislation.
- Ensure that:
  - The contents of the EMPr are communicated to the Contractors' site staff and that the Site Manager and Contractors are constantly made aware of the contents through ongoing discussion.
  - Compliance with the EMPr, EA and the legislation is monitored through regular and comprehensive inspection of the site and surrounding areas.
  - The Site Manager has input into the review and acceptance of construction methods and method statements or site-specific plans.
  - If the EMPr, EA and/or the legislation conditions, regulations or specifications are not followed, then appropriate measures are undertaken to address any non-compliances (for example an ECO may cease construction or an activity to prevent a non-compliance from continuing).
  - Any non-compliance or remedial measures that need to be applied are reported.
- Keep records of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.
- Independently report to the DFFE in terms of compliance with the specifications of the EMPr and EA conditions (once issued).
- Keep records of all reports submitted to DFFE.

The ECO must be present full-time on site for the site preparation and initial clearing activities, to: ensure the correct demarcation of no-go areas; facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing (i.e. during site establishment, and excavation of foundations). Thereafter, monthly compliance audits can be undertaken, provided that adequate compliance with the EA, environmental permits and the EMPr is achieved. The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site handed over for operation.

For the project, Akuo Energy Afrique must also appoint a designated Environmental Officer (EO) to deal with any environmental issues at the project area as they arise.

[2] The ECO should have a relevant degree or technical diploma in environmental management and at least 2 years of experience in the field

v) Contractors

The Lead Contractor is responsible for the following:

- Ensure compliance with the EA, environmental permits and the EMPr at all times during construction.
- The EMPr and its implementation.
- Ensure that all appointed contractors and sub-contractors are aware of the EMPr and their respective responsibilities.
- Provide all necessary supervision during the project's execution.
- Comply with any special conditions, as stipulated by the landowner.
- Inform and educate all employees about the environmental risks associated with the various activities to be undertaken; and highlight those activities which must be avoided during the construction process, to minimise significant impacts to the environment.
- Maintain an environmental register, which keeps a record of all incidents which occur on the site during construction, including:
  - Public involvement / complaints.
  - Health and safety incidents.
  - Hazardous materials stored on the project area.
  - Non-compliance incidents.
  - Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the project area.
- Conduct audits, to ensure compliance to the EMPr.
- Ensure there is communication with the Project Manager, the ECO, and relevant discipline engineers on environmental matters.
- Should the Contractor require clarity on any aspect of the EMPr, the Contractor must contact the Environmental Consultant/Officer for advice.

Contractors and Service Providers must be aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications; and ensuring that employees are adequately experienced and properly trained to execute the works in a manner that will minimise environmental impacts. The contractor's obligations in this regard include the following:

- Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- A copy of the EMPr must be easily accessible to all on-site staff members.
- Employees must be familiar with the requirements of this EMPr and the environmental specifications as they apply to the construction of the solar facility.
- Prior to commencing any site works, all employees and sub-contractors must have attended an environmental awareness training course, which must provide staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- Staff will be informed of environmental issues as deemed necessary by the ECO.

All contractors (including sub-contractors and staff) and service providers are ultimately responsible for ensuring that:

- There is adherence to the environmental management specifications.

- Method Statements are submitted to the Site Manager (and ECO) for approval before any work is undertaken.
- Any instructions issued by the Site Manager on the advice of the ECO are adhered to.
- A report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting.
- A register is kept in the site office, which lists all transgressions issued by the ECO.
- A register of all public complaints is maintained.
- All employees, including those of sub-contractors, receive training before construction commences, so that they can constructively contribute towards the successful implementation of the EMPr (i.e. ensure their staff are appropriately trained as to the environmental obligations).

Any lack of adherence to the above will be considered as non-compliance to the EMPr's specifications.

vi) Contractor's Safety, Health and Environment Representative/Environmental Officer

The Contractor's Safety, Health and Environment (SHE) Representative/ (EO), employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the SHE/EO must act as liaison and advisor on all environmental and related issues and ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor.

The Contractor's SHE/EO should:

- Be well versed in environmental matters.
- Understand the relevant environmental legislation and processes.
- Understand the hierarchy of Environmental Compliance Reporting, and the implications of Non-Compliance.
- Know the background of the project and understand the implementation programme.
- Be able to resolve conflicts and make recommendations on site in terms of the requirements of this Specification.
- Keep accurate and detailed records of all EMPr-related activities on site.

OBJECTIVE 2: Establish clear reporting, communication, and responsibilities during operation in relation to overall implementation of the EMPr during operation

Formal responsibilities are necessary to ensure that key procedures are executed during operation. Several professionals will form part of the operation team. For the purposes of the EMPr, the generic roles that need to be defined are those of the:

- Operations Manager.
- Environmental Manager.

It is acknowledged that the specific titles for these functions may vary once the project is implemented. The purpose of this section of the EMPr is to give a generic outline of what these roles typically entail. It is expected that this will be further defined during project implementation.

i) Operations Manager

The Plant Manager will:

- Ensure that adequate resources (human, financial, technology) are made available and appropriately managed for the successful implementation of the operational EMPr.
- Conduct annual basis reviews of the EMPr to evaluate its effectiveness.
- Take appropriate action as a result of findings and recommendations in management reviews and audits.
- Provide forums to communicate matters regarding environmental management.

ii) Environmental Manager

The Environmental Manager will:

- Develop and Implement an Environmental Management System (EMS) for the project.
- Manage and report on the PV Facility's environmental performance.
- Maintain a register of all known environmental impacts and manage the monitoring thereof.
- Conduct internal environmental audits and co-ordinate external environmental audits.
- Liaise with statutory bodies (such as DFFE and conservation authorities) on environmental performance and other issues.
- Conduct environmental training and awareness for the employees who operate and maintain the PV Facility.
- Compile environmental policies and procedures.
- Liaise with interested and affected parties (I&APs) on environmental issues of common concern.
- Track and control the lodging of any complaints regarding environmental matters.

The Environmental Manager must provide fourteen (14) days written notification to the DFFE that the project's operation phase will commence.

CHAPTER 6: PLANNING AND DESIGN MANAGEMENT PROGRAMME

Overall Goal: undertake the pre-construction activities (planning and design phase) in a way that:

- Ensures that the preferred design and layout of the PV Facility and associated infrastructure responds to the identified environmental constraints and opportunities.
- Ensures that pre-construction activities are undertaken in accordance with all relevant legislative requirements.
- Ensures that adequate regard has been taken of any landowner and community concerns and that these are appropriately addressed through design and planning (where appropriate).
- Ensures that the best environmental options are selected for the linear components, including the access roads.
- Enables the construction activities to be undertaken without significant disruption to other land uses and activities in the area.

To meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

6.1 Objectives

OBJECTIVE 1: Ensure the facility design responds to identified environmental constraints and opportunities

Subject to final facility micro-siting and subsequent acceptance from DFFE, the development footprint detailed in **Figure 2.1** must be implemented. Cognisance of sensitive areas defined in **Figure 2.2** and within the EIA Report should be considered when undertaking the final design of the facility.

Project Component/s	» PV array » Access roads » BESS » Underground cabling » Associated buildings » Onsite substation
Potential Impact	» Impact on identified sensitive areas. » Design fails to respond optimally to the environmental considerations.
Activities/Risk Sources	» Positioning of all project components. » Pre-construction activities, e.g. geotechnical investigations, site surveys and environmental walk-through surveys. » Positioning of temporary sites.
Mitigation: Target/Objective	» The design of the Project responds to the identified environmental constraints and opportunities. » Optimal planning of infrastructure to minimise visual impact. » Site sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts.

Mitigation: Action/Control	Responsibility	Timeframe
Plan and conduct pre-construction activities in an environmentally acceptable manner.	Developer Contractor	Pre-construction
Nest buffers core areas must be treated as no go areas.	Project Manager, Environmental Officer	Construction and Operational Phase
Consider all design related mitigation measures recommended within the EIA process when compiling the final design. Ensure micro-siting avoids all identified areas of sensitivity.	Developer Contractor	Pre-construction
Heritage buffers core areas must be treated as no go areas.	Project Manager, Environmental Officer	Construction and Operational Phase
Undertake a detailed geotechnical pre-construction survey.	Developer Geotechnical specialist	Pre-construction
Pre-construction walk-through of the final facility layout, to locate SCC that can be translocated and comply with the DFFE permit conditions.	Developer Specialist	Pre-construction
Undertake search and rescue for identified SCC before construction.	Developer Specialist	Pre-construction
The EMPr should form part of the contract with the Contractors appointed to construct the Project and must be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life-cycle phases of the project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.	Developer Contractor	Tender Design and Design Review Stage
Plan the placement of laydown areas and assembly plant in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible and to avoid habitat loss and disturbance to adjoining areas.	Developer	Pre-construction
The construction equipment camps must be planned as close to the site as possible, to minimise impacts on the environment.	Developer	Pre-construction
Ensure that laydown areas and other temporary use areas are in areas of low sensitivity and are properly fenced or demarcated as appropriate and practically possible.	Developer	Project planning
Plan development levels to minimise earthworks, to ensure that levels are not elevated.	Developer	Project planning
All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution.	Developer Contractor	Planning & Design
The construction site must be fenced off. The fence around the PV Facility should be designed to be animal and bird friendly, to prevent entrapment and electrocutions of ground-dwelling birds and animals. In practical terms this means that the perimeter fence of the Facility should only include the developed areas and as little undeveloped ground or natural veld as possible. No electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands	Developer	Project planning

Mitigation: Action/Control	Responsibility	Timeframe
should be placed on the inside of the fence and not the outside as is the case on the majority of already constructed PV plants.		
Clear rules and regulations for access to the proposed site must be developed.	Developer Contractor	Pre-Construction
Access roads and entrances to the site should be carefully planned, to limit any intrusion on the neighbouring property owners and road users.	Developer	Planning and design
Plan and placement of light fixtures for the plant and the ancillary infrastructure in such a manner so as to minimise glare and impacts on the surrounding area.	Developer Contractor	Planning
Plan to maintain the height of structures as low as possible.	Developer Design engineer	Design and planning
Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development	Developer Design engineer	Design and planning
Reduce the construction period as far as possible, through careful planning and productive implementation of resources.	Developer Contractor	Pre-construction
Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further than that proposed for the project. Clearing of vegetation should be minimized and avoided where possible.	Developer Contractor	Pre-construction
Where possible, existing access routes and walking paths must be made use of.	Developer Contractor	Pre-construction

Performance Indicator	» The design meets the objectives and does not degrade the environment. » Demarcated sensitive areas are avoided at all times. » Design and layouts respond to the mitigation measures and recommendations in the EIA Report.
Monitoring	» Review of the design by the Project Manager and the ECO prior to the commencement of construction. » Monitor ongoing compliance with the EMPr and method statements.

OBJECTIVE 2: Ensure that relevant permits and plans are in place to manage impacts on the environment

Project Component/s	» PV Array and BESS » Access roads » Underground cabling » Associated buildings and services » Onsite substation
Potential Impact	» Impact on identified sensitive areas and protected species. » Design fails to respond optimally to the environmental considerations.
Activities/Risk Sources	» Positioning of all project components » Pre-construction activities, e.g. geotechnical investigations, site surveys and internal access roads and environmental walk-through surveys.

	» Positioning of temporary sites.
Mitigation: Target/Objective	» To ensure that the design of the Project responds to the identified environmental constraints and opportunities. » To ensure that pre-construction activities are undertaken in an environmentally friendly manner. » To ensure that the design of the Project responds to the identified constraints identified through pre-construction surveys.

Mitigation: Action/Control	Responsibility	Timeframe
Obtain abnormal load permits for transportation of project components to site (if required).	Contractor(s)	Pre-construction
Obtain permits from the relevant provincial authorities to relocate and/or disturb listed plant and animal species.	Developer	Pre-construction
The chance find procedure included in Appendix xx must be implemented in the event that archaeological or palaeontological resources are found.	Developer Contractor	Pre-construction
Prepare a detailed Fire Management Plan (FMP) in collaboration with surrounding landowners.	Developer	Pre-construction
Communicate the FMP to surrounding landowners and maintain records thereof.	Developer	Pre-construction Construction
A Stormwater Management Plan (SWMP) should be developed and should provide for a drainage system sufficiently designed to prevent water run-off from the solar panels to cause soil erosion.	Developer Design engineer	Pre-construction
Compile a procedure for the safe handling of battery cells during transportation and installation	Developer Design engineer	Pre-construction
Develop and implement an alien, invasives and weeds eradication/control plan	Developer Specialist	Pre-construction
Compile a Waste Management Plan for the full project life-cycle, including consideration of general and hazardous waste. Ensure provision is made for recycling where feasible. The Waste Management Plan must clearly outline how solar panels, battery storage equipment etc. will be disposed of after reaching their end of life.	Developer	Pre-construction Construction Operation Decommissioning

Performance Indicator	» Permits are obtained and relevant conditions complied with. » Impact on protected plant species reduced to some degree through Search and Rescue. » Relevant management plans and Method Statements prepared and implemented.
Monitoring	» Review of the design by the Project Manager and the ECO prior to the commencement of construction. » Monitor ongoing compliance with the EMP and method statements.

OBJECTIVE 3: Ensure appropriate planning is undertaken by contractors

Project Component/s	» PV array » Access roads » BESS » Underground cabling » Associated buildings and services » Onsite substation
Potential Impact	» Impact on identified sensitive areas. » Design and planning fail to respond optimally to the environmental considerations.
Activities/Risk Sources	» Positioning of all project components » Pre-construction activities. » Positioning of temporary sites. » Employment and procurement procedures.
Mitigation: Target/Objective	» To ensure that the design of the PV Facility responds to the identified environmental constraints and opportunities. » To ensure that pre-construction activities are undertaken in an environmentally friendly manner.

Mitigation: Action/Control	Responsibility	Timeframe
The terms of this EMPr and the EA must be included in Contractors contracts.	Developer Contractor	Pre-construction
Create awareness of skills through posters and media announcements and set-up a skills desk at a central and accessible location. The skills desk should serve to record local job seeker skills.	Developer Contractor	Pre-construction
The developer should engage with local and business organisations to investigate the possibility of procuring construction materials, goods and/or products from local suppliers were feasible.	Developer Contractor	Pre-construction

Performance Indicator	» Conditions of the EMPr form part of all contracts. » Local employment and procurement is encouraged.
Monitoring	» Monitor ongoing compliance with the EMP and method statements.

OBJECTIVE 4: Ensure effective communication mechanisms

On-going communication with affected and surrounding landowners is important to maintain during the construction and operation phases of the Project. Any issues and concerns raised should be addressed as far as possible in as short a timeframe as possible.

Project component/s	» PV facility » Access road

	» Associated infrastructure » Onsite substation
Potential Impact	» Impacts on affected and surrounding landowners and land uses
Activity/risk source	» Activities associated with construction » Activities associated with operation
Mitigation: Target/Objective	» Effective communication with affected and surrounding landowners, and communities. » Addressing of any issues and concerns raised as far as possible in as short a timeframe as possible.

Mitigation: Action/control	Responsibility	Timeframe
Compile and implement a grievance mechanism procedure for the public, to be implemented during both the construction and operation phases of the PV Facility. This procedure should include details of the contact person who will be receiving issues raised by I&APs and the process that will be followed to address issues.	Developer Contractor O&M Contractor	Pre-construction (construction procedure) Pre-operation (operation procedure)
Develop and implement a grievance mechanism for the construction, operation and closure phases of the project for all employees, contractors, subcontractors and site personnel. This procedure should be in line with the South African Labour Law.	Developer Contractor O&M Contractor	Pre-construction (construction procedure) Pre-operation (operation procedure)
Liaising with landowners must be undertaken prior to the commencement of construction in order to provide sufficient time for them to plan agricultural activities.	Developer Contractor	Pre-construction
Before construction commences, representatives from the local municipality, community leaders, community-based organisations and the surrounding property owners (of the larger area), must be informed of the construction schedules.	Developer Contractor	Pre-construction and construction
Clearly inform the local municipality of the potential impact of the proposed project in order for the necessary preparations to take place	Developer	Pre-construction

Performance Indicator	» Effective communication procedures in place.
Monitoring	» A Public Complaints register must be maintained, by the Contractor to record all complaints and queries relating to the project and the action taken to resolve the issue. » All correspondence should be in writing. » Developer and contractor must keep a record of local recruitments and information on local labour; to be shared with the ECO for reporting purposes during construction.

CHAPTER 7: MANAGEMENT PROGRAMME: CONSTRUCTION

Overall Goal: Undertake the construction phase in a way that:

- Ensures that construction activities are appropriately managed in respect of environmental aspects and impacts.
- Enables construction activities to be undertaken without significant disruption to other land uses and activities in the area, in particular concerning noise impacts, farming practices, traffic and road use, and effects on local residents.
- Minimises the impact on the indigenous natural vegetation, and habitats of ecological value.
- Minimises impacts on fauna (including birds) in the study area.
- Minimises the impact on heritage sites, should they be uncovered.
- Establish an environmental baseline during construction activities on the site, where possible.
- Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed.

7.1 Objectives

To meet the overall goal for construction, the following objectives, actions, and monitoring requirements have been identified.

OBJECTIVE 1: Minimise impacts related to inappropriate site establishment

Project Component/s	» PV arrays » Access roads » BESS » Underground cabling » Associated buildings and services » Onsite substation
Potential Impact	» Hazards to landowners and the public. » Damage to indigenous natural vegetation. » Loss of threatened plant species. » Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.
Activities/Risk Sources	» Any unintended or intended open excavations (foundations and cable trenches). » Movement of construction vehicles in the area and on-site. » Transport to and from the temporary construction area/s.
Mitigation: Target/Objective	» To secure the site against unauthorised entry. » To protect members of the public/landowners/residents. » No loss of or damage to sensitive vegetation in areas outside the immediate development footprint. » Minimal visual intrusion by construction activities and intact vegetation cover outside of the immediate construction work areas.

Mitigation: Action/Control	Responsibility	Timeframe
The use of herbicides and pesticides and other related horticultural chemicals should be carefully controlled and only applied by personnel adequately certified to apply pesticides and herbicides. It must be ensured that WHO Recommended Classification of Pesticides by Hazard Class 1a (extremely hazardous) or 1b (highly hazardous) are not purchased, stored or used on site, along with any other nationally or internationally similarly restricted/banned products.	Contractor	Construction
Secure site, working areas and excavations in an appropriate manner.	Contractor	Construction
Ensure that no activities infringe on identified no-go and high sensitivity areas, as defined in the EIA Report (refer to **Figure 2.2**).	Contractor	Duration of construction
The siting of the construction equipment camp/s must take cognisance of any sensitive areas identified in the EIA Report.	Contractor	Duration of construction
Ensure that vegetation is not unnecessarily cleared or removed during the construction phase.	Contractor	Construction
All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.	Developer Contractor	Pre-construction Construction
Contractor's EO must provide supervision and oversight of vegetation clearing activities within sensitive areas.	Contractor EO	Construction
Any individuals of protected species affected by and observed within the development footprint during construction should be translocated under the supervision of the Contractor's SHE or EO.	SHE/EO Specialist	Construction
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Contractor	Construction
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Contractor	Construction
The construction site must be fenced and security provided.	Contractor	Construction
Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access routes.	Contractor	Construction
All unattended open excavations must be adequately demarcated and/or fenced.	Contractor	Construction
Establish appropriately bunded areas for storage of hazardous materials (e.g. fuel to be required during construction).	Contractor	Construction
Visual impacts must be reduced during construction, through minimising areas of surface disturbance, controlling erosion, using dust suppression techniques, and restoring exposed soil as closely as possible to their original contour and vegetation.	Contractor	Construction
Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but must be temporarily stored in a demarcated area.	Contractor	Construction
Establish the necessary ablution facilities with chemical toilets and provide adequate sanitation facilities and ablutions for Construction workers so that the surrounding environment is not	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
polluted (at least one sanitary facility for each sex and for every 30 workers as per the 2014 Construction Regulations; Section 30(1)(b)) at appropriate locations on site). The facilities must be placed within the construction area and along the road.		
Ablution or sanitation facilities must not be located within 100m from a watercourse or within the 1:100 year flood.	Contractor	Construction
Supply adequate weather and vermin proof waste collection bins and skips (covered at minimum with secured netting or shade cloth) at the site where construction is being undertaken. Separate bins should be provided for general and hazardous waste. Provision should be made for separation of waste for recycling.	Contractor	Construction
Construct stormwater drains or bunds to divert clean runoff around dirty areas. The diversion should be sized for 1 in 5-year event. Typical design will be an excavated earth channel or berms.	Contractor	Construction
Foundations and trenches must be backfilled to originally excavated materials as much as possible. Excess excavation materials must be disposed of only in approved areas, or, if suitable, stockpiled for use in reclamation activities.	Contractor	Construction

Performance Indicator	» Site is secure and there is no unauthorised entry. » No members of the public/ landowners injured. » Appropriate and adequate waste management and sanitation facilities provided at construction site. » Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment), with no evidence of degradation or erosion.
Monitoring	» An incident reporting system is used to record non-conformances to the EMPr. » EO and ECO to monitor all construction areas on a continuous basis until all construction is completed. Non-conformances will be immediately reported to the site manager. » Monitoring of vegetation clearing during construction (by contractor as part of construction contract). » Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).

OBJECTIVE 2: Appropriate management of the construction site and construction workers

Project Component/s	» PV array » Access roads » BESS » Underground cabling » Associated buildings and services » Onsite substation
Potential Impact	» Damage to indigenous natural vegetation and sensitive areas. » Damage to and/or loss of topsoil (i.e. pollution, compaction etc.).

	» Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities. » Pollution/contamination of the environment.
Activities/Risk Sources	» Vegetation clearing and levelling of equipment storage area/s. » Access to and from the equipment storage area/s. » Ablution facilities. » Contractors not aware of the requirements of the EMPr, leading to unnecessary impacts on the surrounding environment.
Mitigation: Target/Objective	» Limit equipment storage within demarcated designated areas. » Ensure adequate sanitation facilities and waste management practices. » Ensure appropriate management of actions by on-site personnel, to minimise impacts to the surrounding environment.

Mitigation: Action/Control	Responsibility	Timeframe
Restrict public access to works area including construction areas, laydown and storage sites via appropriate security. Only allow site access after appropriate induction and use of appropriate personal protective equipment	Contractors	Construction
Contractors and construction workers must be clearly informed of the no-go, very high and high sensitivity areas as defined in the EIA Report (refer to **Figure 2.2**).	Developer Contractor	Prior to the commencement of construction
In order to minimise impacts on the surrounding environment, contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the EA, the EIA Report, and this EMPr, as well as the requirements of all relevant environmental legislation.	Contractors	Construction
Contractors must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct.	Contractor and sub-contractor/s	Pre-construction
Introduce an incident reporting system to be tabled at weekly/monthly project meetings.	Contractor and sub-contractor/s	Pre-construction
All construction vehicles must adhere to clearly defined and demarcated roads. No driving outside of the development boundary must be permitted.	Contractor	Construction
Ensure all construction equipment and vehicles are properly maintained at all times.	Contractor	Construction
Avoid parking of vehicles and equipment outside of designated parking areas.	Contractor	Site establishment, and during construction
Restrict work activities that require power tools and plant that generates noise to normal working hours and limit such activities over weekends.	Contractor	Construction
Ensure that construction workers are clearly identifiable. All workers should carry identification cards and wear identifiable clothing.	Contractor	Construction
Appoint a community liaison officer to deal with complaints and grievances from the public.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
As far as possible, minimise vegetation clearing and levelling for equipment storage areas.	Contractor	Site establishment, and during construction
Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they may pose to the community and/or environment.	Contractor	Construction
Contact details of emergency services should be prominently displayed on site.	Contractor	Construction
Open fires on the site for heating, smoking or cooking are not allowed, except in designated areas.	Contractor	Construction
Contractor must provide adequate firefighting equipment on site and firefighting training to selected construction staff.	Contractor	Construction
Personnel trained in first aid should be on site to deal with smaller incidents that require medical attention.	Contractor	Construction
Road borders must be regularly maintained to ensure that vegetation remains short to serve as an effective firebreak. An emergency fire plan must be developed with emergency procedures in the event of a fire.	Contractor	Site establishment, and during construction
Encourage contractors and local people to report any suspicious activity associated with crime to the appropriate authorities.	Contractor	Construction
Ensure that the local municipalities, police, security companies, and policing forums are alerted to the increased construction activities in the region and the risk it poses in respect of crime.	Contractor	Duration of Contract
Ensure waste storage facilities are maintained and emptied on a regular basis.	Contractor	Site establishment, and duration of construction
No liquid waste, including grey water, may be discharged into any water body or drainage line. All sewage disposal to take place at a registered and operational wastewater treatment works. Proof of disposal to be retained as proof of responsible disposal.	Contractor	Maintenance: duration of contract within a particular area
Ensure that all personnel have the appropriate level of environmental awareness and competence for continued environmental due diligence and on-going minimisation of environmental harm. This can be achieved through the provision of appropriate environmental awareness training to all personnel. Records of all training undertaken must be kept.	Contractor	Duration of construction
Ensure compliance with all national, regional and local legislation with regard to the storage, handling and disposal of hydrocarbons, chemicals, solvents and any other harmful and hazardous substances and materials.	Contractor	During construction.
Ensure ablution facilities are appropriately maintained. Ablutions must be cleaned regularly and associated waste disposed of at a registered/permitted waste disposal site. Ablutions must be removed from site when construction is completed.	Contractor and sub-contractor/s	Duration of contract
Cooking and eating of meals must take place in a designated area. No fires are allowed on site. No firewood or kindling may be gathered from the site or surrounds.	Contractor and sub-contractor/s	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area. Particular attention needs to be paid to food waste.	Contractor and sub-contractor/s	Duration of contract
Keep a record of all hazardous substances stored on site. Clearly label all the containers storing hazardous waste.	Contractor	Duration of contract
A Method Statement should be compiled for the management of pests and vermin within the site, specifically relating to the canteen area if applicable.	Contractor	Construction
No disturbance of flora or fauna must be undertaken outside of the demarcated construction area/s.	Contractor and sub-contractor/s	Duration of contract
Fire-fighting equipment and training must be provided before the construction phase commences.	Contractor and sub-contractor/s	Duration of contract
Workers must be aware of the importance of watercourses and drainage systems (especially those located within and surrounding the project site) and the significance of not undertaking activities that could result in such pollution.	Contractor and EO	Pre-construction Construction
On completion of the construction phase, all construction workers must leave the site within one week of their contract ending.	Contractor and sub-contractor/s	Construction
When possible, no activity should be undertaken at the site between sunset and sunrise, except for security personnel guarding the development.	Contractor and sub-contractor/s	Construction
Keep record of all accidents or transgressions of safety in accordance with OHS Act and implement corrective action.	Contractor	Construction
Implement an HIV/AIDS Awareness and Training Programme for the Contractor's workforce and if feasible the local community within two weeks of commencement of construction. Ensure that the HIV/AIDS Awareness and Training Programme is consistent with national guidelines and/or IFC's Good Practice.	Contractor	Construction
Provide voluntary and free counselling, free testing and condom distribution services.	Contractor	Construction

Performance Indicator	» The construction camps and laydown areas have avoided sensitive areas. » Ablution and waste removal facilities are in a good working order and do not pollute the environment due to mismanagement. » All areas are rehabilitated promptly after construction in an area is complete. » Excess vegetation clearing and levelling is not undertaken. » No complaints regarding contractor behaviour or habits. » Appropriate training of all staff is undertaken prior to them commencing work on the construction site. » Code of Conduct drafted before commencement of the construction phase. » Compliance with OHS Act.
Monitoring	» Regular audits of the construction camps and areas of construction on site by the EO. » Proof of disposal of sewage at an appropriate licensed wastewater treatment works. » Proof of disposal of waste at an appropriate licensed waste disposal facility. » An incident reporting system should be used to record non-conformances to the EMPr. » Observation and supervision of Contractor practices throughout the construction phase by the EO. » Complaints are investigated and, if appropriate, acted upon.

	» Comprehensive record of accidents and incidence and related investigations, findings and corrective action in accordance with the OHS Act.

OBJECTIVE 3: Maximise benefits to the social environment associated with the construction phase

Employment opportunities will be created during the construction phase, specifically for semi-skilled and unskilled workers. Employment of locals and the involvement of local SMMEs would enhance the social benefits associated with the project, even if the opportunities are only temporary. The procurement of local goods could furthermore result in positive economic spin-offs.

Project Component/s	» Construction activities associated with the establishment of the PV facility. » Availability of required skills in the local communities for the undertaking of the construction activities.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activities/Risk Sources	» Contractors who make use of their own labour for unskilled tasks, thereby reducing the employment and business opportunities for locals. » Sourcing of individuals with skills similar to the local labour pool outside the municipal area. » Unavailability of locals with the required skills resulting in locals not being employed and labour being sourced from outside the municipal area. » Higher skilled positions might be sourced internationally, where required.
Enhancement: Target/Objective	» The contractor should aim to employ as many low-skilled and semi-skilled workers from the local area as possible. This should also be made a requirement for all contractors. » Employment of a maximum number of the low-skilled and/or semi-skilled workers from the local area where possible. » Appropriate skills training and capacity building.

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Where feasible, effort must be made to employ locally in order to create maximum benefit for the communities. Ensure that the majority of the low-skilled workforce is recruited locally, where feasible	Contractor	Construction
Undertake a skills audit to determine level of skills and establish the development and training requirements.	Contractor	Construction
Commence with skill development programmes within the first month of construction	Contractor	Construction
Identify employment opportunities for women and ensure that women are employed on the construction site and are trained.	Contractor	Construction
Facilitate the transfer of knowledge between experienced employees and the staff.	Contractor	Construction
Identify opportunities for local businesses and ensure that the services from local businesses are prioritised where possible	Contractor	Construction

Performance Indicator	» Composition of labour force and value of procurement from local businesses. » Level of skills imparted to local workforce.
Monitoring	» Human Resources and Finance function to monitor and report on through audits.

OBJECTIVE 4: Protection of sensitive areas, flora, fauna, avifauna and soils

Project Component/s	» PV array » Access roads » BESS » Underground cabling » Associated buildings and services » Onsite substation
Potential Impact	» Impacts on natural vegetation, habitats and fauna (including avifauna). » Loss of indigenous natural vegetation due to construction activities. » Fragmentation and degradation of habitats and ecosystems » Impacts on soil. » Loss of topsoil. » Erosion.
Activity/Risk Source	» Vegetation clearing. » Site preparation and earthworks. » Excavation of foundations. » Construction of infrastructure. » Site preparation (e.g. compaction). » Excavation of foundations. » Stockpiling of topsoil, subsoil and spoil material.
Mitigation: Target/Objective	» To minimise the development area as far as possible. » To minimise impacts on surrounding sensitive areas. » To minimise impacts on soils. » Minimise spoil material. » Minimise erosion potential.

Mitigation: Action/Control	Responsibility	Timeframe
To minimise impacts on flora, fauna, and ecological processes, the development footprint should be limited to the minimum necessary to accommodate the required infrastructure.	Contractor	Duration of contract
Nest buffers core areas must be treated as no go areas.	Project Manager, Environmental Officer	Construction and Operational Phase
Any individuals of protected species affected by and observed within the development footprint during construction should be translocated under the supervision of the Contractor's (EO).	Contractor EO	Construction
Land clearance must only be undertaken immediately prior to construction activities.	Contractor	Construction
Ensure that laydown areas, construction camps and other temporary use areas are in areas of low and medium sensitivity and are properly fenced or demarcated as appropriate and practically possible.	Contractor	Construction
All laydown, chemical toilets etc. should be restricted to very low/ low sensitivity areas. Any materials may not be stored for extended periods of time and must be removed from the project	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
area once the construction/closure phase has been concluded. No storage of vehicles or equipment will be allowed outside of the designated project areas.		
Retain and augment natural vegetation on all sides of the project site.	Contractor	Construction
During vegetation clearance, methods should be employed to minimise potential harm to fauna species.	Contractor	Construction
Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery.	Contractor	Construction
Areas to be cleared must be clearly marked on-site, to eliminate the potential for unnecessary clearing. No vegetation removal must be allowed outside the designated project development footprint. Restrict construction activity to demarcated areas.	Contractor	Duration of Construction
Practical phased development and vegetation clearing must be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time. Where possible work should be restricted to one area at a time.	Contractor	Construction
Access to adjacent areas to be strictly controlled.	Developer Contractor	Pre-construction Construction
No harvesting of plants for firewood, medicinal or any other purposes are to be permitted	Contractor	Construction
No killing and poaching of any wild animal to be allowed. This should be clearly communicated to all employees, including subcontractors.	Contractor	Construction
Enforce ban on hunting, collecting of any plants and animals or their products.	Contractor EO	Construction
Areas beyond the development footprint should be expressly off limits to construction personnel and construction vehicles and this should be communicated to them.	Contractor	Construction
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. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.	Contractor	Construction
Any fauna threatened or injured during construction should be removed to safety by a suitably qualified person, or allowed to passively vacate the area.	Suitably qualified person	Construction
Construction activity to only be within the project footprint and the area is to be well demarcated.	Contractor	Construction
Areas where vegetation has been cleared must be re-vegetated within local indigenous plant species.	Contractor	Construction
The use of laydown areas within the development footprint must be used, to avoid habitat loss and disturbance to adjoining areas.	Contractor	Construction
All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area.	Developer	Pre-Construction

Mitigation: Action/Control	Responsibility	Timeframe
Should any SCCs not move out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.	Contractor	Construction
Education of employees on the conservation importance of natural areas and fauna must be provided.	Contractor	Construction
Access to high sensitivity and no-go areas to be restricted and controlled. This should be clearly communicated to all employees.	Contractor	Construction
All construction vehicles should adhere to clearly defined and demarcated roads	Contractor	Construction
All construction vehicles should adhere to a low speed limit (30km/h for heavy vehicles and 40km/h for light vehicles) to avoid collisions with susceptible species such as snakes and tortoises.	Contractor	Construction
If the PV Facility is to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside.	Contractor	Construction
No collecting of flora species to be permitted.	Contractor	Construction
Topsoil must be removed and stored separately from subsoil and reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.	Contractor	Construction
Soil stockpiles must not exceed 2 m in height.	Contractor	Construction
Soil stockpiles must be dampened with dust suppressant or equivalent to prevent erosion by wind.	Contractor	Construction
Soil stockpiles must be located away from any waterway or preferential water flow path in the landscape, to minimise soil erosion from these	Contractor	Construction
All graded or disturbed areas which will not be covered by permanent infrastructure such as paving, buildings or roads must be stabilised using appropriate erosion control measures.	Contractor	Construction
A method statement must be developed and submitted to the engineer to deal with erosion issues prior to bulk earthworks operations commencing.	Contractor	Before and during construction
Stockpiles are not to be used as stormwater control features.	Contractor	Construction
Any stockpiling of materials may not exceed two metres in height to reduce materials being blown away during high wind velocity events.	Contractor	Construction
Any erosion problems within the development area as a result of the construction activities observed must be rectified immediately and monitored thereafter to ensure that they do not re-occur.	Contractor	Construction
Any signs of soil erosion on site should be documented (including photographic evidence and coordinates of the problem areas) and submitted to the management team for further action.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
During construction, the contractor shall protect areas susceptible to erosion by installing appropriate temporary and permanent drainage works as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring the slopes, banks or other areas.	Contractor	construction
Create energy dissipation at discharge areas to prevent scouring.	Contractor	construction
Activity at the site must be reduced after large rainfall events when the soils are wet. No driving of hardened roads should occur at any time and particularly immediately following large rainfall events.	Contractor	Construction
Silt traps or cut-off berms downslope of working areas should be used where there is a danger of topsoil or material stockpiles eroding and entering watercourses and other sensitive areas.	Contractor	Construction
Erosion control measures to be regularly maintained.	Contractor	Construction
If any erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place.	Contractor	Construction
If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion.	Contractor	Construction
Only the designated access routes are to be used to reduce any unnecessary compaction.	Contractor	Construction
Compacted areas are to be ripped to loosen the soil structure.	Contractor	Construction
The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks.	Contractor	Construction
Topsoil is to be stripped when the soil is dry, as to reduce compaction.	Contractor	Construction
The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate significantly	Contractor	Construction
Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles.	Contractor	Construction
The stockpiles must be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil.	Contractor	Construction
Only the designated access routes are to be used to reduce any unnecessary compaction.	Contractor	Construction
Compacted areas are to be ripped to loosen the soil structure.	Contractor	Construction
Place the above cleared vegetation where the topsoil stockpiles are to be placed.	Contractor	Construction
All construction vehicles must adhere to a low speed limit (40km/h) to avoid collisions with susceptible species such as snakes and tortoises.	Contractor	Construction Operation
Outside lighting should be designed to minimise impacts on fauna.	Contractor	Before construction
All night-lighting should use low-UV type lights (such as most LEDs), which do not attract insects. The lights should also be of types	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
which are directed downward and do not result in large amounts of light pollution.		
Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.	Contractor	Construction

Performance Indicator	» No disturbance outside of designated work areas. » Minimised clearing of existing vegetation. » Vegetation and habitat loss restricted to infrastructure footprint. » No poaching etc of fauna by construction personnel during construction. » Removal to safety of fauna encountered during construction » Low mortality of fauna due to construction machinery and activities » Topsoil appropriately stored, managed and rehabilitated. » Limited soil erosion around site. » No activity in restricted areas. » Minimal level of soil degradation. » Assess the state of rehabilitation and encroachment of alien vegetation.
Monitoring	» Contractor's EO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near the pan. » Supervision of all clearing and earthworks. » Ongoing monitoring of erosion management measures within the site. » Monthly inspections of sediment control devices by the EO. » An incident reporting system will be used to record non-conformances to the EMPr. »

OBJECTIVE 5: Minimise the establishment and spread of alien invasive plants

Major factors contributing to invasion by alien invader plants include high disturbance activities. Consequences of this may include:

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

Project Component/s	» PV array » Access roads » BESS » Underground cabling » Associated buildings

	» Onsite substation
Potential Impact	» Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species. » Impacts on soil. » Impact on faunal habitats. » Degradation and loss of agricultural potential.
Activities/Risk Sources	» Transport of construction materials to site. » Movement of construction machinery and personnel. » Site preparation and earthworks causing disturbance to indigenous vegetation. » Construction of site access roads. » Stockpiling of topsoil, subsoil and spoil material. » Routine maintenance work – especially vehicle movement.
Mitigation: Target/Objective	» To significantly reduce the presence of weeds and eradicate Alien Invasive Species (AIP). » To avoid the introduction of additional (AIP) to the site. » To avoid distribution and thickening of existing alien plants in the site. » To complement existing alien plant eradication programs in gradually causing a significant reduction of alien plant species throughout the site.

Mitigation: Action/Control	Responsibility	Timeframe
The affected area must be monitored for invasive plant encroachment and erosion and must be controlled.	Contractor	Construction
Develop and implement an IAP Control and Eradication Programme.	Contractor	Construction
Avoid creating conditions in which alien plants may become established: » Keep disturbance of indigenous vegetation to a minimum. » Rehabilitate disturbed areas as quickly as possible. » Do not import soil from areas with alien plants.	Contractor	Construction
When alien plants are detected, these must be controlled and cleared, using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur.	Contractor	Construction
All alien plant re-growth must be monitored and should it occur these plants should be eradicated	Contractor	Construction
Any alien and invasive vegetation removed should be taken to a registered landfill site to prevent the proliferation of alien and invasive species	Contractor	Construction
The use of herbicides and pesticides and other related horticultural chemicals should be carefully controlled and only applied by personnel adequately certified to apply pesticides and herbicides. It must be ensured that WHO Recommended Classification of Pesticides by Hazard Class 1a (extremely hazardous) or 1b (highly hazardous) are not purchased, stored or used on site along with any other nationally or internationally similarly restricted/banned products.	Contractor	Construction

Performance Indicator	» Low abundance of alien plants. For each alien species: number of plants and aerial cover of plants within the site and immediate surroundings.
Monitoring	» On-going monitoring of area by EO during construction.

	» Annual audit of development footprint and immediate surroundings by qualified botanist. » If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants. » The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the site. » The environmental manager/site agent should be responsible for driving this process. » Reporting frequency depends on legal compliance framework.

OBJECTIVE 6: Effective Stormwater Management

The stormwater management is covered under the Pre-construction and Construction Phase management, but aspects thereof will also continue into the Operation Phase. It is important that the engineers and contractors responsible for the detailed design of the stormwater systems consider the requirements of this EMPr, as well as the recommendations by the participating specialists.

Project Component/s	» PV array » Access roads » BESS » Underground cabling » Associated buildings and services » Onsite substation
Potential Impact	» Introduction of sediment into surrounding watercourses
Activities/Risk Sources	» Compaction of catchment area.
Mitigation: Target/Objective	» Avoidance / minimisation of the disturbance and degradation of vegetation and ecosystems

Mitigation: Action/Control	**Responsibility**	**Timeframe**
No activities are permitted within the watercourses in the area and associated buffer areas (refer to **Figure 2.2**).	Project manager, Environmental Officer	Planning and Construction phase
Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash.	Project manager, Environmental Officer	Planning and Construction phase
Landscape and re-vegetate all unnecessarily denuded areas as soon as possible	Project manager, Environmental Officer	Planning and Construction phase

Performance Indicator	» No evidence of erosion or sedimentation as a result of the project within watercourses.
Monitoring	» Daily during the construction phase for all mitigation

OBJECTIVE 7: Protection of heritage resources

Project Component/s	» PV panels » Access roads » BESS » Underground cabling » Associated buildings » Onsite substation
Potential Impact	» Heritage objects or artefacts found on site are inappropriately managed or destroyed.
Activity/Risk Source	» Site preparation and earthworks. » Foundations or plant equipment installation. » Mobile construction equipment movement on site.
Mitigation: Target/Objective	» To ensure that any heritage objects found on site are treated appropriately and in accordance with the relevant legislation.

Mitigation: Action/control	Responsibility	Timeframe
Contractors must be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow if they find sites. All staff should also be familiarised with procedures for dealing with heritage objects/sites.	Contractor, ESA and heritage specialist	Duration of contract, particularly during excavations
Areas required to be cleared during construction must be clearly marked in the field to avoid unnecessary disturbance of adjacent areas.	Contractor	Construction
If fossils resources are discovered during excavations, immediately stop excavation in the vicinity of the potential material. Mark (flag) the position and also spoil material that may contain fossils. Inform the site foreman and the EO. EO to inform the Developer; the Developer contacts the standby archaeologist and/or palaeontologist. EO to describe the occurrence and provide images by email.	Contractor and EO	Construction
Should any buried archaeological resources or human remains or burials be uncovered during development activities, work must cease in the vicinity of these finds. The SAHRA must be contacted immediately, to determine an appropriate way forward.	Contractor and EO	Construction
Should any previously unrecorded palaeontological resources be identified during construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.	Contractor and EO	Construction
The Chance Fossil Finds Procedure developed by the heritage Specialist (Appendix xx) must be implemented.	Contractor and EO	Construction
A 100m Buffer is implemented around site TK001 (Tafelkop Farm Werf).	Contractor and EO	Construction

Performance Indicator	» No disturbance outside of designated work areas. » All heritage items located are dealt with as per the legislative guidelines.
Monitoring	» Observation of excavation activities by the EO throughout construction phase. » Supervision of all clearing and earthworks. » Due care taken during earthworks and disturbance of land by all staff and any heritage objects found reported.

	» Appropriate permits obtained from SAHRA prior to the disturbance or destruction of heritage sites (if required). » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE 8: Management of dust and emissions to air

During the construction phase, limited gaseous or particulate emissions are anticipated from exhaust emissions from construction vehicles and equipment on-site; and vehicle entrained dust from the movement of vehicles on the main and internal access roads.

Project component/s	» PV panels » Access roads » BESS » Underground cabling » Associated buildings » Onsite substation
Potential Impact	» Dust generation and particulates from vehicle movement to and on-site, foundation excavation, road construction activities, road maintenance activities, temporary stockpiles, and vegetation clearing affecting the surrounding residents and visibility. » Release of minor amounts of air pollutants (for example NO_2, CO and SO_2) from vehicles and construction equipment. » Noise Pollution due to increase in traffic volumes.
Activity/risk source	» Clearing of vegetation and topsoil. » Excavation, grading, scraping, levelling, digging, drilling and associated construction activities. » Transport of materials, equipment, and components on internal access roads and the associated increased traffic. » Vehicle movement on gravel roads. » Re-entrainment of deposited dust by vehicle movements. » Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces. » Fuel burning vehicle and construction engines.
Mitigation: Target/Objective	» To ensure emissions from all vehicles and construction engines are minimised, where possible, for the duration of the construction phase. » To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements for the duration of the construction phase. » Suppression of dust, pollution control and minimise dust generation. » Minimise impacts on road network and surrounding communities.

Mitigation: Action/control	Responsibility	Timeframe
Implement appropriate dust suppression measures on a regular basis along the access road and on the proposed site.	Contractor	Construction
Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Contractor	Construction
Areas to be cleared in a progressive manner. Road surfaces and other infrastructure to be constructed as soon as possible after	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
vegetation clearing in order to minimise exposed ground surfaces, specifically roads which carry traffic.		
Roads must be maintained to a manner that will ensure that nuisance to the community from dust emissions from road or vehicle sources is not visibly excessive.	Contractor	Construction
Haul vehicles moving outside the construction site carrying material that can be wind-blown will be covered with suitable material tarpaulins shade cloth.	Contractor	Construction
Speed of construction vehicles must be restricted to 40km/hr on all roads within the site.	Contractor	Duration of contract
Dust-generating activities or earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased during periods of high winds if visible dust is blowing toward nearby residences outside the site.	Contractor	Duration of contract
Disturbed areas must be re-vegetated as soon as practicable in line with the progression of construction activities.	Contractor	Completion of construction
Vehicles and equipment must always be maintained in a road-worthy condition.	Contractor	Duration of contract
All vehicles and containers used for moving waste must encapsulate the waste, which prevents the waste from causing odours and escaping or blowing around the site. This will also prevent leachate material from spilling out of the containers, which is hazardous.	Contractor	Duration of contract
Should a batching plant be required, this must be enclosed with shade cloth to reduce the amount of cement particulates/ particles released into the environment.	Contractor	Duration of contract

Performance Indicator	» No complaints from affected residents or community regarding dust or vehicle emissions. » Visual presence of dust and air quality. » Dust does not cause health (inhaling, eye irritation) and safety risks (low visibility). » Dust suppression measures implemented for all heavy vehicles that require such measures during the construction phase. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed. » All heavy vehicles equipped with speed monitors before they are used in the construction phase in accordance with South African vehicle legislation. » Road worthy certificates in place for all heavy vehicles at outset of construction phase. » A complaints register must be maintained, in which any complaints from neighbouring farmers will be logged, and thereafter complaints will be investigated and, where appropriate, acted upon.
Monitoring	Monitoring must be undertaken to ensure emissions are not exceeding the prescribed levels via the following methods: » Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager. » A complaints register must be maintained, in which any complaints from residents/the community will be logged, and thereafter complaints will be investigated and, where appropriate, acted upon.

	» An incident and non-conformance register must be used to record incidents and non-conformances to the EMPr. » A complaints register must be used to record grievances by the public.

OBJECTIVE 9: Minimise impacts related to traffic management and transportation of equipment and materials to site

Project Component/s	» Delivery of any component required for the construction phase of the facility.
Potential Impact	» Impact of heavy construction vehicles on road surfaces, and possible increased risk in accidents involving people and animals. » Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted. » Deterioration of road pavement conditions (both surfaced and gravel road) due to abnormal loads.
Activities/Risk Sources	» Construction vehicle movement. » Speeding on local roads. » Degradation of local road conditions. » Site preparation and earthworks. » Foundations or plant equipment installation. » Transportation of ready-mix concrete to the site. » Mobile construction equipment movement on-site.
Mitigation: Target/Objective	» Minimise impact of traffic associated with the construction of the facility on local traffic volumes, existing infrastructure, property owners, animals, and road users. » To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction. » To ensure all vehicles are roadworthy and all materials/equipment are transported appropriately and within any imposed permit/licence conditions.

Mitigation: Action/Control	Responsibility	Timeframe
Stagger component delivery to site.	Developer	Planning prior to commencement of construction and during construction
Any low hanging overhead lines (lower than 5.1m) e.g., Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles, if required.	Developer	Prior to commencement of construction and during
Assess the preferred route and undertake a dry run to test.	Developer	Prior to commencement of construction and construction
Staff and general trips should occur outside of peak traffic periods as far as possible.	Developer	Construction
Reduce the construction period as far as possible.	Contractor	Construction
Make use of mobile batch plants and quarries near the site in order to decrease impact on the surrounding road network.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
Adequate traffic accommodation signage must be erected and maintained on either side of the access, on the trafficked routes, throughout the construction period	Contractor	Pre-construction
Undertake regular maintenance of gravel roads by the Contractor during the construction phase.	Contractor	Construction
Implement penalties for reckless driving, to enforce compliance to traffic rules.	Contractor	Construction
The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if damaged (i.e. wear and tear) due to construction activities.	Developer Contractor	Construction
Should abnormal loads have to be transported by road to the site, a permit must be obtained from the relevant Provincial Government if required. Alert traffic authorities well in advance of any heavy loads that will be transported on local roads and elicit their assistance in controlling traffic associated with the transportation of these loads.	Contractor (or appointed transportation contractor)	Pre-construction
Ensure that, at all times, people have access to their properties as well as to social facilities.	Developer Contractor	Construction
Limit the need for transportation over long distances by sourcing as many materials and goods as is feasible from local suppliers.	Contractor	Construction
Heavy vehicles used for construction purposes should be inspected regularly to ensure their roadworthiness.	Contractor	Construction
Strict vehicle safety standards should be implemented and monitored.	Contractor	Construction
No deviation from approved transportation routes must be allowed, unless roads are closed for whatever reason outside the control of the contractor.	Contractor	Construction
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor (or appointed transportation contractor)	Construction
Heavy construction vehicles should be restricted to off-peak periods where possible. Schedule the delivery hours to avoid peak hour, weekends and evening traffic and stagger component delivery to site if feasible.	Contractor	Construction
When upgrading, constructing and maintaining the access road ensure that proper hazard warnings signage and traffic control mechanisms such as flags men and traffic control barriers, chevrons and traffic cones separating the road from the worksite are in place at all times	Contractor	Construction
Visible signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards). Signage must be appropriately maintained throughout the construction period.	Contractor	Construction
All vehicles of the contractor travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
All construction vehicles must remain on properly demarcated roads. No off-road driving to be allowed.	Contractor	Construction
The contractors must ensure that there is a dedicated access and an access control point to the site.	Contractor	Construction
Provide clearly defined roadway, parking and pedestrian walkway areas within the site with adequate lighting	Contractor	Construction
All construction vehicles must be road worthy.	Contractor	Construction
All construction vehicle drivers must have the relevant licenses for the use of the vehicles and need to strictly adhere to the rules of the road.	Contractor	Construction
Heavy construction vehicles should be restricted to off-peak periods.	Contractor	Construction
Abnormal load vehicles require specific permit for transporting loads, and require liaison with relevant road authorities to ensure route suitability.	Contractor	Construction

Performance Indicator	» Vehicles keeping to the speed limits. » Vehicles are in good working order and safety standards are implemented. » Local residents and road users are aware of vehicle movements and schedules. » No construction traffic related accidents are experienced. » Local road conditions and road surfaces are up to standard. » Complaints of residents are not received (e.g. concerning the speeding of heavy vehicles).
Monitoring	» Developer and or appointed EO must monitor indicators listed above to ensure that they have been implemented.

OBJECTIVE 10: Appropriate handling and management of waste

The construction of the PV will involve the generation of various wastes. To manage the wastes effectively, guidelines for the assessment, classification, and management of wastes, along with industry principles for minimising construction wastes must be implemented. The main wastes expected to be generated by the construction activities include:

» general solid waste
» hazardous waste
» inert waste (rock and soil)
» liquid waste (including grey water and sewage)

Project Component/s	» PV panels » Access roads » BESS » Underground cabling » Associated buildings » Onsite substation
Potential Impact	» Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices.

Activity/Risk Source	» Packaging. » Other construction wastes. » Hydrocarbon use and storage. » Spoil material from excavation, earthworks and site preparation.
Mitigation: Target/Objective	» To comply with waste management legislation. » To minimise production of waste. » To ensure appropriate waste storage and disposal. » To avoid environmental harm from waste disposal. » A waste manifests should be developed for the ablutions, showing proof of disposal of sewage at appropriate water treatment works.

Mitigation: Action/Control	Responsibility	Timeframe
Construction method and materials should be carefully considered in view of waste reduction, re-use, and recycling opportunities.	Contractor	Duration of contract
Construction contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	Duration of contract
Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises be placed, dumped or deposited on adjacent/surrounding properties, and that the waste is disposed of at dumping site, as approved by the Council.	Contractor	Duration of contract
Waste disposal at the construction site must be avoided by separating and trucking out of waste.	Contractor	Construction
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap), and contaminated waste, as required. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.	Contractor	Duration of contract
Where practically possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc.).	Contractor	Duration of contract
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract
Uncontaminated waste must be removed at least weekly for disposal, if feasible; other wastes must be removed for recycling/ disposal at an appropriate frequency.	Contractor	Duration of contract
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area and clearly labelled.	Contractor	Duration of contract
Any broken PV panels must be returned to the supplier, recycled or disposed of at an appropriately licensed waste disposal facility.	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
Waste must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Duration of contract
No liquid waste, including grey water, may be discharged into any water body or drainage line. All sewage disposal to take place at a registered and operational wastewater treatment works. Slips of disposal to be retained as proof of responsible disposal.	Contractor	Maintenance: duration of contract within a particular area
All liquid wastes should be contained in appropriately sealed vessels/ponds within the footprint of the development, and be disposed of at a designated waste management facility after use.	Contractor	Duration of contract
Ensure compliance with all national, regional and local legislation regarding the storage, handling and disposal of hydrocarbons, chemicals, solvents and any other harmful and hazardous substances and materials. The onus is on the Contractor to identify and interpret the applicable legislation. Hazardous waste to be disposed of at a registered landfill site.	Contractor	During and post construction.
A hydrocarbon spill management plan must be put in place, to ensure that should there be any chemical spill it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays, or any form of oil absorbent material, must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment may occur on site, unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.), in such a way as to prevent them leaking and entering the environment.	Contractor	During Contract
Documentation (waste manifest) must be maintained, detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor	Duration of contract
SABS approved spill kits to be available and easily accessible.	Contractor	Duration of contract
Regularly serviced chemical toilet facilities and/or septic tank must be used to ensure appropriate control of sewage.	Contractor	Duration of contract
Daily inspection of all chemical toilets and septic tanks must be performed by environmental representatives on site.	Contractor	Duration of contract
In the event where sewage is discharged into the environment, all contaminated vegetation/ rock and soil must be removed immediately and treated as hazardous waste.	Contractor	Duration of construction
Ensure that the below ground storage of the septic tank can withstand the external forces of the surrounding pressure. The area above the tank must be demarcated to prevent any vehicles or heavy machinery from driving around the tank.	Contractor	Duration of construction
Under no circumstances may waste be burnt on site.	Contractor	Duration of construction

Mitigation: Action/Control	Responsibility	Timeframe
Where a registered waste site is not available close to the construction site, provide a method statement with regard to waste management.	Contractor	Duration of construction
Waste manifests must be provided for all waste streams generated on site, and must be kept on site.	Contractor	Duration of construction
Implement an integrated waste management approach that is based on waste minimisation and incorporates reduction, recycling, re-use and disposal where appropriate. Where solid waste is disposed of, such disposal shall only occur at a landfill licensed in terms of section 20(b) of the National Environmental Management Waste Act, 2008 (Act 59 of 2008).	Contractor	Duration of construction
Upon the completion of construction, the area must be cleared of potentially polluting materials. Spoil stockpiles must also be removed and appropriately disposed of; or the materials re-used for an appropriate purpose.	Contractor	Completion of construction
Upon the completion of construction, all sanitation facilities (including chemical toilets) and the associated waste must be removed and disposed of at a registered waste disposal site.	Contractor	Completion of construction
Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly, or at an appropriate frequency, at registered waste disposal sites.	Contractor	Duration of construction
All building rubble, solid and liquid waste etc. generated during the construction activities must be disposed of, as necessary at an appropriately licensed refuse facility.	Contractor	Duration of construction
Ensure that no refuse wastes are burnt on the premises or on surrounding premises. No fires will be allowed on site.	Contractor	Duration of construction
Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises be placed, dumped or deposited on adjacent/surrounding properties during or after the construction period of the project and that the waste is disposed of at dumping site, as approved by the Council.	Contractor	Duration of construction

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping. » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests for all waste streams.
Monitoring	» Observation and supervision of waste management practices throughout construction phase. » Waste collection will be monitored regularly. » Waste documentation completed. » Proof of disposal of sewage at an appropriate wastewater treatment works. » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE 11: Appropriate handling and storage of chemicals and/or hazardous substances

The construction phase may involve the storage and handling of a variety of chemicals, including adhesives, abrasives, oils and lubricants, paints and solvents.

Project Component/s	» Laydown areas. » Temporary hydrocarbon and chemical storage areas.
Potential Impact	» Release of contaminated water from contact with spilled chemicals. » Generation of contaminated wastes from used chemical containers. » Soil pollution.
Activity/Risk Source	» Vehicles associated with site preparation and earthworks. » Construction activities of area and linear infrastructure. » Hydrocarbon spills by vehicles and machinery during levelling, vegetation clearance and transport of workers, materials and equipment and fuel storage tanks. » Accidental spills of hazardous chemicals. » Polluted water from wash bays and workshops. » Pollution from concrete mixing.
Mitigation: Target/Objective	» To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons. » To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons. » Prevent and contain hydrocarbon leaks. » Undertake proper waste management. » Store hazardous chemicals safely in a bunded area.

Mitigation: Action/Control	Responsibility	Timeframe
Implement an emergency preparedness plan during the construction phase.	Contractor	Duration of Contract
Any liquids stored on site, including fuels and lubricants, should be stored in accordance with applicable legislation.	Contractor	Duration of Contract
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Contractor	Duration of contract
Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment must be contained using a drip tray with plastic sheeting filled with absorbent material when not parked on hard standing.	Contractor	Construction
Establish an appropriate Hazardous Stores, which is in accordance with the Hazardous Substance Act 15 of 1973. This should include but not be limited to: » Designated area; » All applicable safety signage; » Firefighting equipment; » Enclosed by an impermeable bund; » Protected from the elements, » Lockable; » Ventilated; and	Contractor	Duration of Contract

Mitigation: Action/Control	Responsibility	Timeframe
» Has adequate capacity to contain 110% of the largest container contents.		
Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible; and implementing preventive measures. Where required, a NEMA Section 30 report must be submitted to DFFE within 14 days of the incident.	Contractor	Duration of contract
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified, as per the notification of emergencies/incidents.	Contractor	Duration of contract
Spilled concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site. Check vehicles and machinery daily for oil, fuel and hydraulic fluid leaks and undertake regular high standard maintenance on vehicles.	Contractor	Duration of contract
Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately, in line with procedures by trained staff with the appropriate equipment.	Contractor	Duration of contract
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles must not take place on-site (except for emergencies). If repairs of vehicles must take place, an appropriate drip tray must be used to contain any fuel or oils.	Contractor	Duration of contract
All stored fuels to be maintained within an appropriate bund and on a sealed surface, as per the requirements of SABS 089:1999 Part 1 and any relevant by-laws.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly, to ensure bund stability, integrity, and function.	Contractor	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
The storage of flammable and combustible liquids, such as oils will be in designated areas which are appropriately bunded, and stored in compliance with Material Safety Data Sheets (MSDS) files.	Contractor	Duration of contract
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	Contractor	Duration of contract
The sediment control and water quality structures used on-site must be monitored and maintained in an operational state at all times.	Contractor	Duration of contract
An effective monitoring system must be put in place to detect any leakage or spillage of all hazardous substances during their transportation, handling, installation and storage.	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
Precautions must be in place to limit the possibility of oil and other toxic liquids from entering the soil or clean stormwater system.	Contractor	Construction
As much material must be pre-fabricated and then transported to site, to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site.	Contractor	Construction
All chemicals and toxicants used during construction must be stored in bunded areas.	Contractor	Construction
All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site (pre-use inspection).	Contractor	Construction
All servicing and re-fuelling of machines and equipment must either take place off-site, or in controlled and bunded working areas.	Contractor	Construction
Have appropriate action plans on site, and training for contactors and employees in the event of spills, leaks and other potential impacts to the aquatic systems. All waste generated on-site during construction must be adequately managed.	Contractor	Construction
Should a chemical spill take place, an aquatic ecologist must be contracted to identify the extent of the impact and assist with additional mitigation measures.	Contractor	Construction
Minimise fuels and chemicals stored on site.	Contractor	Construction
Install bunds on storage areas and take other precautions to reduce the risk of spills.	Contractor	Construction
Implement a contingency plan to handle spills, so that environmental damage is avoided.	Contractor	Construction
No refuelling, servicing of plant/equipment or chemical substance storage allowed outside of designated areas.	Contractor	Construction
Drip trays should be used during all fuel/chemical dispensing.	Contractor	Construction
Drip trays to be placed beneath standing machinery/plant.	Contractor	Construction
In the case of petrochemical spillages, the spill should be collected immediately and stored in a designated area until it can be disposed of in accordance with the Hazardous Chemical Substances Regulations, 1977 (Government Notice R453 in Government Gazette 5467) (Regulation 15).	Contractor	Construction
Implement a regional (industrial area-wide) emergency response plan with involvement by the local authorities as well as alarms and communication systems which allow for fast and effective communication to neighbouring facilities. The area around the site is sparsely populated, so any impact would not be experienced by many people.	Contractor	Construction
Ensure battery transport and installation by accredited staff / contractors.	Contractor	Construction
Compile (and adhere to) a procedure for the safe handling of battery cells during transport and installation.	Contractor	Construction

Performance Indicator	» No chemical spills outside of designated storage areas. » No water or soil contamination by spills. » No complaints received regarding waste on site or indiscriminate dumping.

	» Safe storage of hazardous chemicals.
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase. » A complaints register must be maintained, in which any complaints from the community will be logged. » An incident reporting system will be used to record non-conformances to the EMPr. » On-going visual assessment to detect polluted areas and the application of clean-up and preventative procedures. » Monitor hydrocarbon spills from vehicles and machinery during construction continuously and record volume and nature of spill, location and clean-up actions. » Monitor maintenance of drains and intercept drains weekly. » Analyse soil samples for pollution in areas of known spills or where a breach of containment is evident when it occurs. » Records of accidental spills and clean-up procedures and the results thereof must be audited annually by the ECO. » Records of all incidents that caused chemical pollution must be kept and a summary of the results must be reported to management annually.

OBJECTIVE 12: Effective management of concrete batching plant (if required)

Concrete is required during the construction of the PV facility. In this regard there could be a need to the establishment a batching plant within the site. Turbid and highly alkaline wastewater, dust emissions and noise are the key potential impacts associated with concrete batching plants. Concrete batching plants, cement, sand and aggregates can produce dust. Potential pollutants in batching plant wastewater and storm-water include cement, sand, aggregates, chemical additive mixtures, fuels and lubricants.

Project component/s	» Batching plant. » Stormwater system.
Potential Impact	» Dust emissions. » Release of contaminated water. » Generation of contaminated wastes from used chemical containers. » Inefficient use of resources, resulting in excessive waste generation.
Activity/risk source	» Operation of the batching plant. » Packaging and other construction wastes. » Hydrocarbon use and storage.
Mitigation: Target/Objective	» To ensure that the operation of the batching plant does not cause pollution to the environment or harm to persons.

Mitigation: Action/control	Responsibility	Timeframe
Concrete batching plants should be sited such that impacts on the environment or the amenity of the local community from noise, odour or polluting emissions are minimised.	Contractor	Construction phase
Concrete batching plants should be sited away from identified sensitive areas.	Contractor	Construction phase

Mitigation: Action/control	Responsibility	Timeframe
Where there is a regular movement of vehicles, access and exit routes for heavy transport vehicles should be planned to minimise noise and dust impacts on the environment.	Contractor	Construction phase
Good maintenance practices must be implemented, including regular sweeping, to prevent dust build-up.	Contractor	Construction phase
The prevailing wind direction should be considered to ensure that bunkers and conveyors are sited in a sheltered position to minimise the effects of the wind.	Contractor	Construction phase
Aggregate material should be delivered in a damp condition, and water sprays or a dust suppression agent should be correctly applied to reduce dust emissions and water usage.	Contractor	Construction phase
Process wastewater collected from the entire batching plant area should be diverted to an impervious settling tank or pond. Water should be reused in the concrete batching process, where possible.	Contractor	Construction phase
A contaminated storm-water system must be specifically designed for the batching plant to ensure effective control of contaminated storm water originating from the batching plant and prevent contamination to the surrounding environment.	Contractor	Construction phase
Where possible, waste concrete should be used for construction purposes at the batching plant or project site.	Contractor	Construction phase
Artificial wind barriers must be installed around the batching plant, to minimise air, land and water pollution. Wind barriers must enclose the entire batching plant and not allow fly ash and other dusts from moving through the barrier. The artificial barrier must be maintained daily for any defects and corrected, when necessary.	Contractor	Pre-construction/ construction
The concrete wash bay structure must be constructed in a double brick arrangement or be reinforced to maintain its integrity throughout operation.	Contractor	Construction phase

Performance Indicator	» No complaints regarding dust » No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase. » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon. » An incident and non-conformance register will be used to record incidents and non-conformances to the EMPr. » The appointed ECO must monitor indicators listed above, to ensure that they have been met for the construction phase.

OBJECTIVE 13: Ensure appropriate rehabilitation of disturbed areas such that residual environmental impacts are remediated or curtailed

Areas requiring rehabilitation will include areas disturbed during the construction phase and that are not required for regular operation and maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.

Project Component/s	» PV panels » Access roads » BESS » Underground cabling » Associated buildings and services » Onsite substation
Potential Impact	» Environmental integrity of the site undermined resulting in reduced visual aesthetics, erosion and increased runoff; and the requirement for on-going management intervention.
Activity/Risk Source	» Temporary construction areas. » Temporary access roads/tracks. » Other disturbed areas/footprints.
Mitigation: Target/Objective	» Ensure and encourage site rehabilitation of disturbed areas. » Ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed.

Mitigation: Action/Control	Responsibility	Timeframe
Implement an appropriate Revegetation and Rehabilitation Plan.	Contractor	Following execution of the works
All temporary facilities, equipment, and waste materials must be removed from site as soon as construction is completed.	Contractor	Following execution of the works
All temporary fencing and danger tape must be removed once the construction phase has been completed.	Contractor	Following completion of construction activities in an area
Laydown areas and construction camps are to be checked for spills of substances such as oil, paint, etc. Any spills recorded must be cleaned up and the contaminated soil appropriately disposed of.	Contractor	Following completion of construction activities in an area
All voids must be backfilled. Any gullies or dongas must also be backfilled.	Contractor	Following completion of construction activities in an area
Where disturbed areas are not to be used during the operation of the PV Facility, these areas must be rehabilitated/re-vegetated with appropriate natural indigenous vegetation and/or local seed mix. A seed mix must be applied to rehabilitated and bare areas. No exotic plants must be used for rehabilitation purposes. No grazing must be permitted to allow for the recovery of the area.	Contractor in consultation with rehabilitation specialist	Following completion of construction activities in an area

Mitigation: Action/Control	Responsibility	Timeframe
The area must be shaped to a natural topography. Trees (or vegetation stands) removed must be replaced.	Contractor	Following completion of construction activities in an area
No planting or importing any listed invasive alien plant species (all Category 1a, 1b and 2 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.	Contractor	Following completion of construction activities in an area
Compacted areas must be ripped (perpendicularly) to a depth of 300mm, and the area shall be top soiled and re-vegetated.	Contractor	Following completion of construction activities in an area
Temporary roads must be closed and access across these blocked. The temporary access roads must be rehabilitated.	Contractor	Following completion of construction activities in an area
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following completion of construction activities in an area
Topsoil from all excavations and construction activities must be salvaged and reapplied during reclamation. Soils must be replaced in the correct sequence / profile.	Contractor	Following completion of construction activities in an area
Re-vegetated areas may need to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Contractor in consultation with rehabilitation specialist	Post-rehabilitation
Erosion control measures should be used in sensitive areas such as steep slopes, hills, and drainage systems if necessary.	Contractor in consultation with EO and rehabilitation specialist (if required)	Post-rehabilitation
On-going alien plant monitoring and removal must be undertaken on all areas of natural vegetation on an annual basis.	Contractor	Post-rehabilitation

Performance Indicator	» All portions of the site, including construction equipment camp and working areas, cleared of equipment and temporary facilities. » Topsoil replaced on all areas and stabilised where practicable or required after construction and temporally utilised areas. » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites. » Completed site free of erosion and AIP.
Monitoring	» Rehabilitated areas should be monitored (responsibility of EO) on a weekly basis throughout the construction phase and monthly thereafter and to the point where the area has rehabilitated to a satisfactory level. » On-going inspection of rehabilitated areas to determine effectiveness of rehabilitation measures implemented during the operational lifespan of the facility. » On-going alien plant monitoring and removal should be undertaken annually.

7.2 Detailing Method Statements

OBJECTIVE 14: Ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMPr will be met. That is, the Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Site Manager and ECO.

A Method Statement is defined as "a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications". The Method Statement must cover applicable details regarding:

- Responsible person/s;
- Construction 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 Specifications; and
- Any other information deemed necessary by the Site Manager.

Method Statements must be compiled for all activities which affect any aspect of the environment and should be applied consistently to all activities. Specific areas to be addressed in the method statement: pre, during and post construction include:

- Site establishment (which explains all activities from induction training to offloading, construction sequence for site establishment and the different amenities be established etc. Including a site camp plan indicating all of these).
- Preparation of the site (i.e. clearing vegetation, compacting soils and removing existing infrastructure and waste).
- Soil management/stockpiling and erosion control.
- Excavations and backfilling procedure.
- Stipulate norms and standards for water supply and usage (i.e. comply strictly to licence and legislation requirements and restrictions).
- Storm-water method statement.
- Ablution facilities (placement, maintenance, management and servicing).
- Solid Waste Management:

    - Description of the waste storage facilities (on site and accumulative).
    - Placement of waste stored (on site and accumulative).
    - Management and collection of waste process.
    - Recycle, re-use and removal process and procedure.
- Liquid waste management.
- Design, establish, maintain and operate suitable pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into the surrounding environment. Should grey water (i.e. water from basins, , kitchen sinks etc.) need to be disposed of, link into an existing facility where possible. Where no facilities are available, grey water runoff must be controlled to ensure no seepage into the surrounding environment occurs.
- Dust and noise pollution:
    - Describe the necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels.
    - Procedure to always control dust at all times on the site, access roads and spoil sites (dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments). These impacts include visual pollution, decreased safety due to reduced visibility, negative effects on human health and the ecology due to dust particle accumulation.
- Hazardous substance storage (ensure compliance with all national, regional and local legislation regarding the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, cement, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply).
    - Lists of all potentially hazardous substances to be used.
    - Appropriate handling, storage and disposal procedures.
    - Prevention protocol of accidental contamination of soil at storage and handling areas.
    - All storage areas for harmful substances must be appropriately bunded, with a suitable collection point for accidental spills and drip trays underneath dispensing mechanisms, including leaking engines/machinery).
- Fire prevention and management measures on site.
- Fauna and flora protection process on and off site (i.e. removal to reintroduction or replanting, if necessary).
    - Rehabilitation, re-vegetation process and bush clearing.
- Incident and accident reporting protocol.
- General administration.
- Designate access road and the protocols while roads are in use.
- Requirements on gate control protocols.

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Site Manager (with input from the ECO), except in the case of emergency activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract. Failure to submit a method statement may result in suspension of the activity concerned until a method statement has been submitted and approved.

7.3 Awareness and Competence: Construction Phase

OBJECTIVE 15: To ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm

To achieve effective environmental management, it is important that all personnel involved in the project are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The ECO is responsible for monitoring compliance pre, during and post construction. The contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained to execute the works in a manner that will minimise environmental impacts.

The Contractors obligations in this regard include the following:

- All employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment. This includes the discussion/explanation of site environmental matters during toolbox talks.
- The content and requirements of Method Statements are to be clearly explained to all plant operators and general workers. All staff acting in a supervisory capacity are to have copies of the relevant Method Statements and be aware of the contents thereof.
- Ensuring that a copy of the EMPr is readily available on-site, and that all senior site staff are aware of the location and have access to it. Senior site staff will be familiar with the EMPr's requirements and the environmental specifications as they apply to the construction of the PV Facility.
- Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness training session. The training session must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
    - Records must be kept of those that have completed the relevant training.
    - Training should be done either in a written or verbal format but must be appropriate for the receiving audience.
    - Refresher sessions must be held, as often as practically possible, to ensure the contractor staff are aware of their environmental obligations as practically possible.
- All sub-contractors must have a copy of the EMPr and sign a declaration/ acknowledgement that they are aware and familiar with the contents and requirements of the EMPr and that they will conduct work in such a manner as to ensure compliance with the requirements of the EMPr.
- Contractors and main sub-contractors should have a basic training in the identification of archaeological sites/objects, and protected flora and fauna that may be encountered on the site.
- Awareness of any other environmental matters, which are deemed to be necessary by the ECO.
- Ensuring that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) are erected at prominent locations throughout the site.

Therefore, prior to the commencement of construction activities on site and before any person commences with work on site thereafter, adequate environmental awareness and responsibility are to be appropriately presented to all staff present onsite, clearly describing their obligations towards environmental controls and methodologies in terms of this EMPr. This training and awareness will be achieved in the following ways:

7.3.1 Environmental Awareness and Induction Training

The EO, in consultation with the contractor, shall ensure that all construction workers receive an induction presentation and on-going environmental education and awareness, on the importance and implications of the EMPr and the environmental requirements it prescribes. The presentation shall be conducted, as far as is possible, in the employees' language of choice. The contractor should provide a translator from their staff for the purpose of translating, should this be necessary.

As a minimum, induction training should include:

- Explanation of the importance of complying with the EMPr and EA;
- Discussion of the potential environmental impacts of construction activities;
- Awareness regarding sensitivities on the site, including sensitive plant species (including the use of visual aids and on-site identification);
- The benefits of improved personal performance;
- Employees' roles and responsibilities, including emergency preparedness (this should be combined with this induction, but presented by the contractor's Health and Safety Representative);
- Explanation of the mitigation measures that must be implemented when carrying out their activities; and
- Explanation of the specifics of this EMPr and its specification (no-go areas, etc.).

Environmental Awareness training must take the form of an on-site talk and demonstration by the EO/ECO before the commencement of site establishment and construction on site. The education/awareness programme should be aimed at all levels of management and construction workers within the contractor team. A record of attendance of this training must be maintained by the EO/ECO on site. Proof of awareness training should be kept on record. Environmental induction training must be presented to all persons who are to work on the site – be it for short or long durations; Contractor's or Engineer's staff; administrative or site staff; sub-contractors or visitors to site.

This induction training should be undertaken by the Contractor's Environmental Officer and should include discussing Akuo Energy Afriqueenvironmental policy and values, the function of the EMPr and Contract Specifications and the importance and reasons for compliance to these. The induction training must highlight overall do's and don'ts on site and clarify the repercussions of not complying with these. The non-conformance reporting system must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the EO/ECO on site.

7.3.2 Toolbox Talks

Toolbox talks should be held on a scheduled and regular basis (at least twice a month) where foremen, environmental and safety representatives of different components of the works and sub-consultants hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and ones recommended by the on-site EO and the prevention of reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

7.4 Monitoring Programme: Construction Phase

OBJECTIVE 16: To monitor the performance of the control strategies employed against environmental objectives and standards

A monitoring programme must be in place not only to ensure conformance with the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the EA (once issued). Where this is not clearly dictated, the Developer will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Technical Director/ Project Manager will ensure that the monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to monitor the implementation of the specified environmental specifications, to:

- Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications
- Ensure adequate and appropriate interventions to address non-compliance
- Ensure adequate and appropriate interventions to address environmental degradation
- Provide a mechanism for the lodging and resolution of public complaints
- Ensure appropriate and adequate record keeping related to environmental compliance
- Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, to enhance the efficacy of environmental management on site
- Aid in communication and feedback to authorities and stakeholders

All documentation e.g. audit/monitoring/compliance reports and notifications, required to be submitted to the DFFE in terms of the EA, must be submitted to the Director: Compliance Monitoring of the DFFE.

Records relating to monitoring and auditing must be kept on site and made available for inspection to any relevant and CA in respect of this project.

7.4.1. Non-Conformance Reports

All supervisory, staff including Foremen, Engineers, and the ECO must be provided the means to be able to submit non-conformance reports to the Site Manager. Non-conformance reports will describe, in detail, the cause, nature and effects of any environmental non-conformance by the Contractor.

The non-conformance report will be updated on completion of the corrective measures indicated on the finding sheet. The report must indicate that the remediation measures have been implemented timeously and that the non-conformance can be closed-out to the satisfaction of the Site Manager and ECO.

7.4.2. Monitoring Reports

A monitoring report will be compiled monthly by the ECO and must be submitted to the Director: Compliance Monitoring at DFFE for their records. This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents recorded, corrective action required, and details of those non-conformances or incidents which have been closed out. The contractor must ensure that all waste manifests are provided to the ECO monthly, to inform and update the DFFE regarding waste related activities.

7.4.3. Audit Reports

The holder of the EA must, for the period during which the EA and EMPr remain valid, ensure that project compliance with the conditions of the EA and the EMPr are audited, and that the audit reports are submitted to the Director: Compliance Monitoring of the DFFE.

An environmental internal audit must be conducted and submitted every 3 months and an external audit must be conducted once a year and submitted to DFFE until the completion of the construction and rehabilitation. This report must be compiled in accordance with Appendix 7 of the EIA Regulations, 2014, as amended, and indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the EA conditions and EMPr requirements.

7.4.4. Final Audit Report

A final environmental audit report must be compiled by an independent auditor and be submitted to DFFE upon completion of the construction and rehabilitation activities. The report must be submitted within 30 days of completion of rehabilitation activities. This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the EA conditions and the requirements of the EMPr.

CHAPTER 8: OPERATION MANAGEMENT PROGRAMME

Overall Goal: To ensure that the operation of the Project does not have unforeseen impacts on the environment and all impacts are monitored; and the necessary corrective action taken in all cases. To address this goal, it is necessary to operate the facility in a way that ensures that operation activities:

» are properly managed in respect of environmental aspects and impacts.
» to be undertaken without significant disruption to other land uses in the area.

8.1. Objectives

To meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE 1: Limit the ecological footprint of the PV Plant

Indirect impacts on vegetation and terrestrial fauna during operation could result from maintenance activities and the movement of people and vehicles on site. To ensure the long-term environmental integrity of the site following construction, maintenance of the areas rehabilitated post-construction must be undertaken until these areas have successfully re-established.

Project Component/s	» PV facility » Access roads » BESS » Underground cabling » Associated buildings and services » Onsite substation
Potential Impact	» Disturbance to or loss of vegetation and/or habitat in surrounding areas. » Environmental integrity of the site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention.
Activities/Risk Sources	» Avifaunal collisions with PV panels » Fauna entrapped along perimeter fencing » Human presence » Movement of vehicles to and from the site. » Presence of the PV infrastructure and site fencing.
Mitigation: Target/Objective	» Maintain minimised footprints of disturbance of vegetation/habitats on-site. » Ensure and encourage plant regrowth in non-operational areas of post-construction rehabilitation.

Mitigation: Action/Control	Responsibility	Timeframe
Rehabilitate disturbed areas should the previous attempt be unsuccessful.	Developer	Operation
Access to adjacent areas to be strictly controlled.	Developer	Operation

Mitigation: Action/Control	Responsibility	Timeframe
All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises, nocturnal and crepuscular species.	Developer	Operation
Maintain and augment natural vegetation around the proposed project site.	Developer	Operation
Vegetation control should be by manual clearing and herbicides should not be used, except to control alien plants in the prescribed manner.	Developer	Operation
The use of herbicides and pesticides and other related horticultural chemicals should be carefully controlled and only applied by personnel adequately certified to apply pesticides and herbicides. It must be ensured that WHO Recommended Classification of Pesticides by Hazard Class 1a (extremely hazardous) or 1b (highly hazardous) are not purchased, stored or used on site, along with any other nationally or internationally similarly restricted/banned products.	Developer	Operation
Soil surfaces where no revegetation seems possible will have to be covered with gravel or small rock fragments to increase porosity of the soil surface, slow down runoff and prevent wind and water erosion.	Developer	Operation
Any vegetation clearing that needs to take place as part of the maintenance activities must be done in an environmentally friendly manner, including avoiding the use of herbicides and using manual clearing methods, wherever possible.	Developer	Operation
If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects.	Developer	Operation
Maintenance of the perimeter fencing must ensure that it minimises impacts on species susceptible to entrapment.	Developer	Operation
Vehicle movements must be restricted to designated access roads.	Developer	Operation
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	Developer	Operation
Maintain erosion control measures implemented during the construction phase (i.e. run-off attenuation on slopes (bags, logs), silt fences, storm water catch-pits, and shade nets).	Developer	Operation
Develop and implement an appropriate stormwater management plan for the operation phase of the PV Facility.	Developer	Operation
Site access should be controlled and only authorised staff and contractors should be allowed on-site.	Developer	Operation
No harvesting of plants for firewood, medicinal or any other purposes are to be permitted	Developer	Operation
No killing and poaching of any wild animal to be allowed. This should be clearly communicated to all employees, including subcontractors.	Developer	Operation
Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities must be removed to a safe location.	Developer	Operation

Mitigation: Action/Control	Responsibility	Timeframe
An on-going alien plant monitoring and eradication programme must be implemented, where necessary.	Developer	Operation
Annual site inspection for erosion or water flow regulation problems – with follow up remedial action where problems are identified.	Developer	Operation
Develop and implement a systematic operation phase monitoring programme to record fauna and avifauna movement through the development footprint; and record fatalities. The monitoring programme must include carcass counts. Carcass surveys with a minimum of 2 x 3 day surveys during a six month period (including the peak wet season).	Developer	Operation

Performance Indicator	» Limited soil erosion around site. » Limited disturbance to vegetation or avifauna and terrestrial faunal habitats. » Continued improvement of rehabilitation efforts. » Removal to safety of entrapped/injured fauna or avifauna encountered during routine maintenance. » Low impact on nocturnal and crepuscular species along roads
Monitoring	» Observation of vegetation on-site by environmental manager. » Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas. » Regular inspections to monitor bird mortalities

OBJECTIVE 2: Erosion Management

The disturbance created during construction would leave the site vulnerable to erosion. The site is steep in some areas, the disturbance created at construction will render the impacted areas highly vulnerable to erosion and measures to limit erosion will need to be implemented. This impact is likely to manifest during construction and would persist into the operation phase; and should therefore be assessed for both phases.

Project component/s	» PV facility » Access roads » BESS » Underground cabling » Associated buildings » Onsite substation
Potential Impact	» Disturbance to or loss of vegetation and/or habitat. » Loss of soil resources. » Sedimentation of water resources
Activity/Risk Source	» Stormwater runoff from panels and roads. » Runoff of wash water during cleaning of panels
Mitigation: Target/Objective	» Implement appropriate erosion control measures to minimise risk of erosion.

Mitigation: Action/Control	Responsibility	Timeframe
Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan.	O&M Operator	Operation phase
All roads and other hardened surfaces should have runoff control features, which redirect water flow and dissipate any energy in the water which may pose an erosion risk.	O&M Operator	Operation phase
Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance must be undertaken, as per the Erosion Management and Rehabilitation Plans for the project.	O&M Operator	Operation phase
All erosion problems observed must be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.	O&M Operator	Operation phase
All cleared areas must be revegetated with indigenous perennial shrubs and succulents from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	O&M Operator	Operation phase

Performance Indicator	» No erosion problems resulting from operational activities within the PV Facility.
Monitoring	» Regular inspections to monitor erosion within the site and along access roads.

OBJECTIVE 3: Minimise the establishment and spread of alien invasive plants

Major factors contributing to invasion by alien invader plants include high disturbance activities and negative grazing practices. Consequences of this may include:

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

Project Component/s	» PV facility » Access roads » BESS » Underground cabling » Associated buildings » Onsite substation
Potential Impact	» Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species. » Impacts on soil.

	» Impact on faunal habitats. » Degradation and loss of agricultural potential.
Activities/Risk Sources	» Transport of construction materials to site. » Movement of construction machinery and personnel. » Site preparation and earthworks causing disturbance to indigenous vegetation. » Construction of site access roads. » Stockpiling of topsoil, subsoil and spoil material. » Routine maintenance work – especially vehicle movement.
Mitigation: Target/Objective	» To significantly reduce the presence of weeds and eradicate alien invasive species. » To avoid the introduction of additional alien invasive plants to the site. » To avoid distribution and thickening of existing alien plants in the site. » To complement existing alien plant eradication programs in gradually causing a significant reduction of alien plant species throughout the site.

Mitigation: Action/Control	Responsibility	Timeframe
Develop and implement an IAP Control and Eradication Programme.	Developer	Operation
Avoid creating conditions in which alien plants may become established: » Keep disturbance of indigenous vegetation to a minimum. » Rehabilitate disturbed areas as quickly as possible. » Do not import soil from areas with alien plants.	Developer	Operation
Annual monitoring for alien plant species - with follow up clearing as needed – or as per the frequency stated in the alien invasive management plan to be developed for the site. When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur.	Developer	Operation
Eradicate all weeds and AIP as far as practically possible and ensure that material from invasive plants are adequately destroyed and not further distributed.	Developer	Operation
Any AIP vegetation removed should be taken to a registered landfill site to prevent the proliferation of AIP.	Developer	Operation
The use of herbicides and pesticides and other related horticultural chemicals should be carefully controlled and only applied by personnel adequately certified to apply pesticides and herbicides. It must be ensured that WHO Recommended Classification of Pesticides by Hazard Class 1a (extremely hazardous) or 1b (highly hazardous) are not purchased, stored or used on site along with any other nationally or internationally similarly restricted/banned products.	Developer	Operation

Performance Indicator	» Low abundance of alien plants. For each alien species: number of plants and aerial cover of plants within the site and immediate surroundings.
Monitoring	» On-going monitoring of area by EO during construction. » Annual audit of development footprint and immediate surroundings by qualified botanist. » If any AIP are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants.

	» The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the site. » The environmental manager/site agent should be responsible for driving this process. » Reporting frequency depends on legal compliance framework.

OBJECTIVE 4: Minimise dust and emissions to air

During the operation phase, limited gaseous or particulate emissions are anticipated from exhaust emissions (i.e. from operational vehicles). Windy conditions and the movement of vehicles on site may lead to dust creation.

Project Component/s	» Gravel roads and surfaces. » On-site vehicle movement.
Potential Impact	» Dust and particulates from vehicle movement to and on-site. » Release of minor amounts of air pollutants (for example NO_2, CO and SO_2) from vehicles.
Activities/Risk Sources	» Re-entrainment of deposited dust by vehicle movements. » Wind erosion from unsealed roads and surfaces. » Fuel burning vehicle engines.
Mitigation: Target/Objective	» To ensure emissions from all vehicles are minimised, where possible. » To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements. » To ensure emissions from the power generation process are minimised.

Mitigation: Action/Control	Responsibility	Timeframe
Implement appropriate dust suppression measures on a regular basis in any exposed surfaces.	Developer	Operation
Re-vegetation of cleared areas as soon as practically feasible.	Developer	Operation
Speed of vehicles must be restricted on site to 40km/hr.	Developer	Operation
Vehicles and equipment must be maintained in a road-worthy condition at all times.	Developer	Operation

Performance Indicator	» No complaints from affected residents or community regarding dust or vehicle emissions. » Dust suppression measures implemented where required. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed.
Monitoring	» Immediate reporting by personnel of any potential or actual issues with nuisance or dust to the PV Facility Manager. » A complaints register must be maintained, in which any complaints from residents/the community will be logged, and thereafter complaints will be investigated and, where appropriate, acted upon. » An incident reporting system must be used to record non-conformances to the EMPr.

OBJECTIVE 5: Ensure the implementation of an appropriate fire management plan and general management measures during the operation phase

The following recommendations below must be considered with regards to fire protection on site:

» AIP should be completely eradicated in order to decrease the fire risk associated with the site.
» Cigarette butts may not be thrown in the veld, but must be disposed of correctly. Designated smoking areas must be established with suitable receptacles for disposal.
» In case of a fire outbreak, contact details of the local fire and emergency services must be readily available.
» Contractors must ensure that basic firefighting equipment is available on site 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 environmental induction training prior to commencement of construction.
» The contractor must also comply with the requirements of the Occupational Health and Safety Act 85 of 1993 with regards to fire protection.

The following below can be used as a guide for appropriate fire management (also refer to **Appendix M9**):

Project Component/s	» PV facility » Access roads » BESS » Underground cabling » Associated buildings and services » Onsite substation
Potential Impact	» Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences. In addition, fire can pose a risk to the PV Facility infrastructure.
Activities/Risk Sources	» The presence of operation and maintenance personnel and their activities on the site can increase the risk of veld fires.
Mitigation: Target/Objective	» To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

Mitigation: Action/Control	Responsibility	Timeframe
Provide adequate firefighting equipment on site and establish a fire-fighting management plan during operation.	O&M Contractor	Operation
Provide fire-fighting training to selected operation and maintenance staff.	O&M Contractor	Operation
Ensure that appropriate communication channels are established, to be implemented in the event of a fire.	O&M Contractor	Operation
Fire breaks should be established where and when required. Cognisance must be taken of the relevant legislation when planning and burning firebreaks (in terms of timing, etc.).	Contractor	Operation
Upon completion of the construction phase, an emergency evacuation plan must be drawn up, to ensure the safety of the staff and surrounding land users in the case of an emergency.	O&M Contractor	Operation
Contact details of emergency services should be prominently displayed on site.	O&M Contractor	Operation

Mitigation: Action/Control	Responsibility	Timeframe
Road borders must be regularly maintained, to ensure that vegetation remains short, to serve as an effective firebreak.	O&M Contractor	Operation

Performance Indicator	» Firefighting equipment and training provided before the operation phase commences. » Appropriate fire breaks in place. » Appropriate procedures followed in the event of replacement of PV panels.
Monitoring	» The O&M operator must monitor indicators listed above, to ensure that they have been met.

OBJECTIVE 6: Appropriate handling and management of hazardous substances, waste and dangerous goods

The operation of the PV facility will involve the storage of chemicals and hazardous substances; and the generation of limited waste products. The main wastes expected to be generated by the operation activities includes general solid waste, hazardous waste and sewage waste.

Project Component/s	» PV facility » BESS » Onsite substation » Septic tanks » Associated infrastructure
Potential Impact	» Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices. » Contamination of water or soil because of poor materials management.
Activity/Risk Source	» Transformers, switchgear and supporting equipment. » Workshop / control room.
Mitigation: Target/Objective	» Comply with waste management legislation. » Minimise production of waste. » Ensure appropriate waste disposal. » Avoid environmental harm from waste disposal. » Ensure appropriate storage of chemicals and hazardous substances.

Mitigation: Action/Control	Responsibility	Timeframe
Hazardous substances (such as used/new transformer oils, etc.) must be stored in sealed containers within a clearly demarcated designated area.	Developer	Operation
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Developer	Operation and maintenance
Storage areas for hazardous substances must be appropriately sealed and bunded.	Developer	Operation
Under no circumstances shall rubble, earth or other material be dumped within the servitude restriction area. The developer shall maintain the area concerned to Eskom's satisfaction. The developer shall be liable to Eskom for the cost of any remedial action which has to be carried out by Eskom.	Developer	Operation

Mitigation: Action/Control	Responsibility	Timeframe
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, according to the nature of the spill.	Developer	Operation
All structures and/or components replaced during maintenance activities (including broken PV panels) must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling.	Developer	Operation
Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and bunded area. Should any accidental spillage take place, it must be cleaned up according to specified standards regarding bioremediation.	Developer	Operation and maintenance
All food waste and litter at the site should be placed in bins with lids and removed from the site on a regular basis.	Developer	Operation
Waste handling, collection, and disposal operations must be managed and controlled by a waste management contractor.	Developer	Operation
All sewage disposal to take place at a registered and operational wastewater treatment works. Proof of disposal to be retained as proof of responsible disposal.	Developer	Operation
Used oils and chemicals: » Appropriate disposal must be arranged with a licensed facility, in consultation with the administering authority. » Waste must be stored and handled according to the relevant legislation and regulations.	Developer	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	Developer	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	Developer	Operation
All servicing and re-fuelling of machines and equipment must either take place off-site, or in controlled and bunded working areas.	Developer	Operation
Separation and recycling of different waste materials should be supported.	Developer	Operation
Should a chemical spill take place, an aquatic ecologist must be contracted to identify the extent of the impact and assist with additional mitigation measures.	Developer	Operation
Immediately report significant spillages and initiate an environmental site assessment for risk assessment and remediation if necessary.	Developer	Operation
Regular quality monitoring of waste before discharge.	Developer	Operation
The dirty water dam will need to be lined, to prevent any seepage of waste water.	Developer	Operation
Emergency response arrangements and systems must be implemented, such as foam pourers, fire-fighting systems and cooperation with emergency responders. Preventive measures	Developer	Operation

Mitigation: Action/Control	Responsibility	Timeframe
could include maintenance procedures to prevent the occurrence of a catastrophic loss of containment; and strict control of ignition sources and other measures which may be required, according to standards such as those prescribed by the South African National Standards system.		
Should panels be required to be replaced, the following will apply: » Materials and panels are to be stored within the previously disturbed construction laydown area. No disturbance of areas outside of these areas should occur. » Full clean-up of all materials must be undertaken after the removal and replacement of the solar panel arrays and associated infrastructure is complete, and disturbed areas appropriately rehabilitated. » Most of the materials used for solar panel systems can be recycled; and the glass and semiconductor materials recovered and re-used or recycled. Recyclable materials must be transported off-site by truck and managed at appropriate facilities, in accordance with relevant waste management regulations. No waste materials may be left on-site. » Waste material which cannot be recycled shall be disposed of at an appropriately licensed waste disposal site or as required by the relevant legislation.	O&M Contractor	Operation

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping. » Internal site audits identifying that waste segregation recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests. » No contamination of soil or water.
Monitoring	» Waste collection must be monitored on a regular basis. » Waste documentation must be completed and available for inspection. » An incidents/complaints register must be maintained, in which any complaints from the community must be logged. » Complaints must be investigated and, if appropriate, acted upon. » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the O&M operator. » All appropriate waste disposal certificates must accompany the monthly reports.

OBJECTIVE 7: Appropriate operation and maintenance of Battery Energy Storage System

Project Component/s	» Battery Energy Storage System
Potential Impact	» Fire and safety risks » Leakages and impacts on soils and water resources
Activities/Risk Sources	» Inappropriate operation and maintenance of BESS
Mitigation: Target/Objective	» To avoid and or minimise the potential risk of associated with the operation and maintenance of the BESS.

Mitigation: Action/Control	Responsibility	Timeframe
Compile a procedure for the safe handling of battery cells	O&M Contractor/ Project Company	Operation
Ensure that battery supplier user guides, safety specifications and MSDS are filed on site at all times.	O&M Contractor / Project Company	Operation
Operate, maintain and monitor the BESS as per supplier specifications.	O&M Contractor / Project Company	Operation
Compile method statements for approval by the Technical/SHEQ Manager for battery cell, electrolyte and battery cell/ container replacement. Maintain method statements on site.	O&M Contractor / Project Company	Operation
Ensure that all maintenance contractors/ staff are familiar with the supplier's specifications and suitably trained.	O&M Contractor / Project Company	Operation
Provide signage on site specifying the types of batteries in use and the risk of exposure to hazardous material and electric shock.	O&M Contractor / Project Company	Operation
Provide signage on site specifying how electrical and chemical fires should be dealt with by first responders, and the potential risks to first responders (e.g. toxic fumes).	O&M Contractor / Project Company	Operation
Maintain suitable firefighting equipment on site.	O&M Contractor / Project Company	Operation
Maintain strict access control to the BESS area.	O&M Contractor / Project Company	Operation
Undertake regular visual checks on BESS equipment to identify signs of damage or leaks.	O&M Contractor / Project Company	Operation
Provide environmental awareness training to all personnel on site, including discussion of: • Potential impact of electrolyte spills on groundwater; • Suitable disposal of waste and effluent; • Key measures in the EMPr relevant to workers' activities; • How incidents and suggestions for improvement can be reported. Ensure that all attendees remain for the duration of the training and on completion sign an attendance register that clearly indicates participants' names.	O&M Contractor / Project Company	Operation

Performance Indicator	» BESS operated and maintained in accordance with supplier specifications. » Appropriate signage on site. » Employees appropriately trained. » Required documentation available on site. » Firefighting equipment and training provided before the operation phase commences.
Monitoring	» The O&M contractor/ Project Company must monitor indicators listed above, to ensure that they have been met.

CHAPTER 9: MANAGEMENT PROGRAMME: DECOMMISSIONING

The Project's lifespan will be 20 – 25 years. Equipment associated with this PV Facility would only be decommissioned once it has reached the end of its economic life or if it is no longer required. The lifespan could be extended, depending on the condition of the infrastructure. An assessment will be undertaken prior to the end of the lifecycle of the plant, to determine whether it should be decommissioned or if the operation of the plant should continue.

It is most likely that decommissioning activities of the PV Facility discussed in the EIA process would comprise the disassembly, removal and disposal of the infrastructure. Decommissioning activities will involve disassembly of the production units and ancillary infrastructure, demolishing of buildings, removal of waste from the site and rehabilitation to the desired end-use. Future use of the site after decommissioning of the Project could possibly form part of an alternative industry that would be able to utilise some of the existing infrastructure associated with the Facility. This would however be dependent on the development plans of the area at the time.

As part of the decommissioning phase the developer will undertake the required permitting processes applicable at the time of decommissioning.

The relevant mitigation measures contained under the construction section should be applied during decommissioning and therefore are not repeated in this section.

9.1. Objectives

Within a period of at least 12 months prior to the decommissioning of the PV Facility, a Decommissioning Method Statement must be prepared and submitted to the Local Planning Authority, as well as the Provincial and National Environmental Authority. This Method Statement must cover site restoration, soil replacement, landscaping, conservation, and a timeframe for implementation. Furthermore, this decommissioning must comply with all relevant legal requirements administered by any relevant and competent authority at that time.

The objectives of the decommissioning phase of the proposed project are to:

- Follow a process of decommissioning that is progressive and integrated into the short- and long-term project plans that will assess the closure impacts proactively at regular intervals throughout project life.
- Implement progressive rehabilitation measures, beginning during the construction phase.
- Leave a safe and stable environment for both humans and animals and make their condition sustainable.
- Return rehabilitated land-use to a standard that can be useful to the post-project land user.
- Where applicable, prevent any further soil and surface water contamination by maintaining suitable storm-water management systems.
- Maintain and monitor all rehabilitated areas following re-vegetation, and if monitoring shows that the objectives have been met, apply for closure.

9.2. Approach to the Decommissioning Phase

It is recommended that planning of the decommissioning of the project and rehabilitation of the site should take place well in advance (at least two years) of the planned decommissioning activities. Important factors that need to be taken into consideration are detailed below.

Two possible scenarios for this decommissioning phase are detailed below:

SCENARIO 1: TOTAL DECOMMISSIONING OF PV FACILITY

If the decision is taken at the end of the project lifespan to totally decommission the PV Facility, i.e. make the land available for an alternative land use, the following should take place:

- All concrete and imported foreign material must be removed from the PV Facility (i.e. panels, support structures etc).
- The holes where the panel support structures are removed must be levelled and covered with subsoil and topsoil.
- Infrastructure not required for the post-decommissioning use of the site must be removed and appropriately disposed of.
- Access roads and servitudes not required for the post-decommissioning use of the site must be rehabilitated. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.
- 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) and topsoil replaced.
- All ancillary buildings and access points are to be removed unless they can be used for the future land use.
- Underground electric cables are to 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.
- The CA may grant approval to the owner not to remove the landscaping and underground foundations.
- The site must be seeded with locally sourced indigenous vegetation (unless otherwise dictated by the future land use) to allow revegetation of the site.
- Monitor rehabilitated areas quarterly for at least three years (expected) following decommissioning and implement remedial action as and when required.

SCENARIO 2: PARTIAL DECOMMISSIONING OF ENERGY FACILITY

Should more advanced technology become available, it may be decided to continue using the site as a PV facility. Much of the existing infrastructure is likely to be re-used in the upgraded facility. In this case, all infrastructure that will no longer be required for the upgraded facility must be removed, as described for Scenario 1. The remainder of the infrastructure should remain in place or upgraded, depending on the requirements of the new facility. Any upgrades to the PV Facility at this stage must comply with relevant legislation.

9.2.1. Identification of structures for post-closure use

Access roads should be assessed in conjunction with the future land users, to determine if these could be used. Where not required, these access roads should be decommissioned and rehabilitated.

9.2.2. Removal of infrastructure

All infrastructure must be dismantled and removed. Inert material must be removed from site and disposed of at a suitably registered landfill site. The PV Facility and BESS components must be removed and recycled where possible or disposed of at a suitably registered landfill site. All foundations must be removed to a depth of 1m. Hard surfaces must be ripped to a depth of 1m and vegetated.

Waste handling, storage collection, and disposal operations must be managed and controlled by a waste management contractor, and must be undertaken in accordance with the relevant legislative requirements at the time of decommissioning.

As waste is likely to be the main issue of concern during decommissioning, the below table outlines the measures to ensure the appropriate handling and management of waste (including that of the project components such as the solar panels, battery storage equipment etc.). These should be revisited and updated as applicable at the time of decommissioning to ensure compliance with the relevant legislation.

Mitigation: Action/Control	Responsibility	Timeframe
Decommissioning contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	prior to commencing with decommissioning activities
Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises be placed, dumped or deposited on adjacent/surrounding properties, and that the waste is disposed of at an appropriately licensed waste disposal site.	Contractor	Decommissioning
Where practically possible, waste and decommissioned components (including PV panels and battery components) must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams.	Contractor	Decommissioning
Disposal of waste, such as the solar panels and batteries once they have reached the end of their life-cycle, must be in accordance with relevant legislative requirements at the time of decommissioning, including the use of licensed contractors.	Contractor	Decommissioning
Decommissioned PV panels and batteries must be returned to the supplier (where possible), recycled or disposed of at an appropriately licensed waste disposal facility.	Contractor	Decommissioning
Documentation (waste manifest) must be maintained, detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor	Decommissioning
Where a suitably registered waste site is not available close to the construction site, provide a method statement with regard to waste management.	Contractor	Decommissioning

Mitigation: Action/Control	Responsibility	Timeframe
All decommissioned components and associated materials must be removed on completion of decommissioning activities. No dumping of waste material in surrounding open areas.	Contractor	Decommissioning

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping. » Internal site audits ensuring that waste segregation, recycling and reuse of project components, such as the solar panels or battery storage equipment, is occurring appropriately. » Provision of all appropriate waste manifests for all waste streams.
Monitoring	» Observation and supervision of waste management practices throughout decommissioning phase. » Waste collection to be monitored regularly. » Waste documentation completed. » An incident reporting system must be used to record non-conformances to the EMPr.

9.2.3. Soil rehabilitation

The steps that should be taken during the rehabilitation of soils are as follows:

» Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately, in line with procedures by trained staff with the appropriate equipment.
» Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.
» The deposited soils must be ripped, to ensure reduced compaction;
» An acceptable seed bed should be produced by surface tillage;
» Restore soil fertility;
» Incorporate the immobile fertilisers in to the plant rooting zone before ripping; and
» Apply maintenance dressing of fertilisers on an annual basis until the soil fertility cycle has been restored.

9.2.4. Establishment of vegetation

The objective is to restore the project site to a self-sustaining cycle, i.e. to realise the re-establishment of the natural nutrient cycle with ecological succession initiated.

The objectives for the re-vegetation of reshaped and top-soiled land are to:

» Prevent erosion;
» Restore the land to the agreed land capability;
» Re-establish eco-system processes, to ensure that a sustainable land use can be established without requiring fertilizer additions; and
» Restore the biodiversity of the area as far as possible.

9.2.5. Maintenance

Established vegetation requires regular maintenance. If the growth medium consists of low-fertility soils, then regular maintenance will be required until the natural fertility cycle has been restored.

9.2.6. Monitoring

The purpose of monitoring is to ensure that the objectives of rehabilitation are met and that the rehabilitation process is followed. Decommissioning activities should be monitored to ensure appropriate implementation of required specifications and adherence to relevant legislation at the time. The physical aspects of rehabilitation should be carefully monitored during the progress of establishment of desired final ecosystems.

APPENDIX M1:
FACILITY LAYOUT AND SENSITIVITY MAPS

APPENDIX M2:
GRIEVANCE MECHANISM FOR COMPLAINTS AND ISSUES

APPENDIX M3:
OPEN SPACE MANAGEMENT PLAN

APPENDIX M4:
RE-VEGETATION AND HABITAT REHABILITATION PLAN

APPENDIX M5:
PLANT RESCUE AND PROTECTION PLAN

APPENDIX M6:
TRAFFIC AND TRANSPORTATION MANAGEMENT PLAN

APPENDIX M7:
STORMWATER AND EROSION MANAGEMENT PLAN

APPENDIX M8:
WASTE MANAGEMENT PLAN

APPENDIX M9:
EMERGENCY PREPARDENESS, RESPONSE AND FIRE MANAGEMENT PLAN

APPENDIX M10:
HERITAGE CHANCE FINDS PROCEDURE

APPENDIX M11:
CURRICULCUM VITAE OF THE PROJECT TEAM