APPENDIX I:

Environmental Management Programme for the PV Facility and Associated Infrastructure

CSIR
Touching lives through innovation

CONTENTS

TABLES

FIGURES

1. INTRODUCTION

The Project Developer, Kudu Solar Facility 10 (Pty) Ltd, (hereafter "Project Applicant" or "Project Developer") is proposing to develop a Solar Photovoltaic (PV) power generation facility and associated Electrical Grid Infrastructure (EGI), north-east of the town of De Aar in the Renosterberg Local Municipality and Pixley Ka Seme District Municipality, in the Northern Cape Province. In total 12 Solar PV Facilities are being proposed (each having a separate Project Applicant). The proposed projects are located approximately 50 km from De Aar and 25 km from Petrusville. The proposed Solar PV Facilities will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV Facility will have a range of associated infrastructure, including, but not limited to, an on-site substation complex, Battery Energy Storage System (BESS), and is proposed to connect to the existing Hydra-Perseus 400 kV overhead power line via dedicated proposed 132 kV power lines, an independent Main Transmission Substation (MTS), and a 400 kV Loop-In-Loop-Out (LILO).

Each of the Solar PV Facilities would be its own project and would require its own, separate Environmental Authorisation (EA), Scoping and Environmental Impact Assessment (EIA) Report, and Environmental Management Programme (EMPr). The same applies to the EGI projects, where relevant. The following projects are being proposed:

- **PROJECTS 1 TO 12**: The proposed development of 12 Solar PV Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 to Kudu Solar Facility 12[1]).
- **PROJECTS 13 TO 24**: The proposed development of switching stations and collector stations at each on-site substation complex at each of the 12 Kudu Solar Facilities, and up to 12 x 132 kV overhead power lines running from each Solar PV Facility to the proposed collector stations or up to the proposed MTS.
- **PROJECT 25**: The proposed development of an independent 400/132 kV MTS, including associated infrastructure at the MTS.
- **PROJECT 26**: The proposed development of a 400 kV LILO from the existing Hydra-Perseus 400 kV overhead power line to the proposed MTS.

Projects 13 to 26 will be undertaken at a later stage; whilst Projects 1 to 12 are the subject of the current Applications for EA.

This EMPr has been prepared as part of the requirements of the 2014 National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) EIA Regulations (as amended). **This EMPr covers the proposed Kudu Solar Facility 10 (hereinafter referred to as Kudu Solar Facility or the proposed project) only.** Figure 1 shows the overall locality of the proposed project.

[1] Note that throughout the report the term Solar Facility and PV are used synonymously. For example, Kudu Solar Facility 1 and Kudu PV1 are used interchangeably.

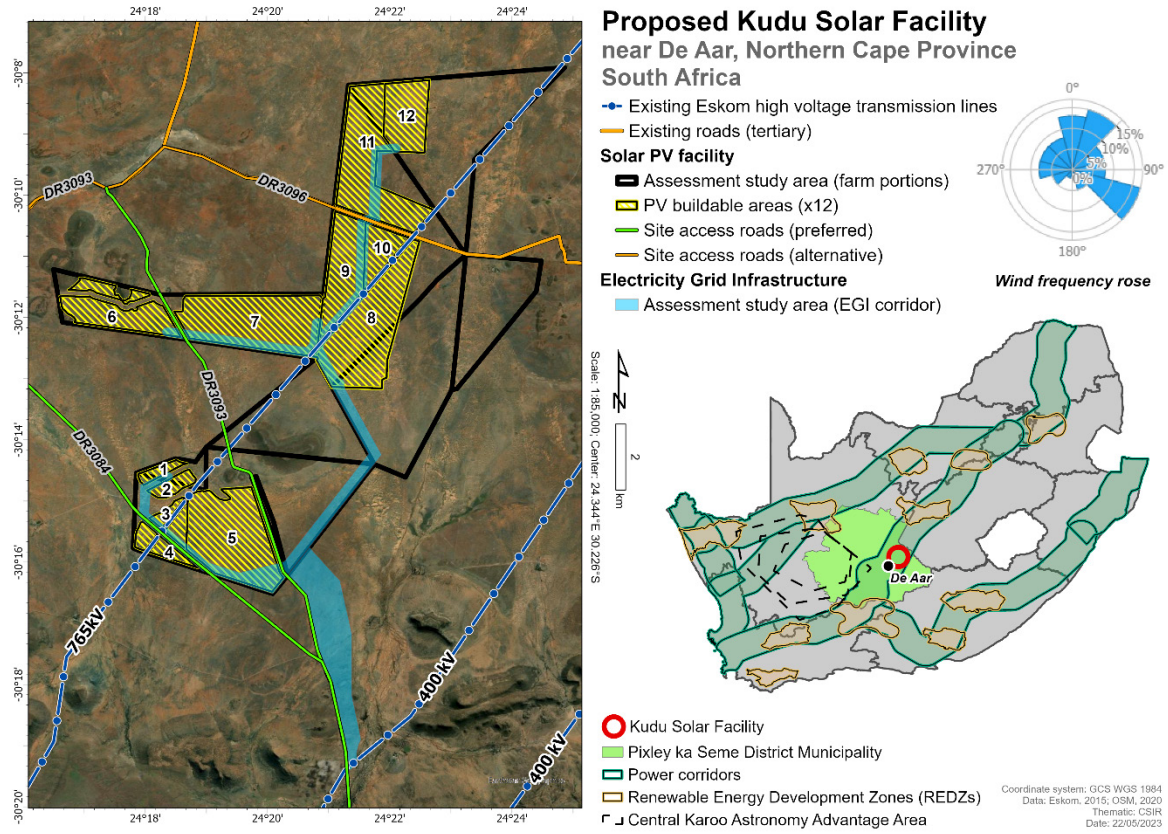


Figure 1: Locality map of the proposed PV Facilities and associated infrastructure situated north-east of the town De Aar in the Northern Cape Province.

1.1 AUTHORS OF THE EMPr

This EMPr has been compiled by the Environmental Assessment Practitioners (EAPs) (Paul Lochner and Rohaida Abed), Environmental Scientist (Helen Antonopoulos), and the various specialists on the team (as indicated in Table 1). The details and expertise of the EAPs and project team members are provided in Appendix A of the EIA Report; whilst those of the specialists are provided in Chapters 6 to 19. The Curriculum Vitae of the EAPs is also included in Appendix A of this EMPr.

Paul Lochner has more than 30 years of experience in environmental assessment and management studies, primarily in the leadership and integration functions. This has included Strategic Environmental Assessments (SEA), EIAs and Environmental Management Plans. Paul is a Registered EAP (2019/745) with the Environmental Assessment Practitioners Association of South Africa (EAPASA). Paul has extensive experience in conducting environmental assessment and management processes throughout South Africa.

Rohaida Abed has 13 years of experience in the Environmental Management field and has been involved in Basic Assessments and EIAs relating to renewable energy, port infrastructure and bulk liquid storage facilities; and has also worked on the SEA for Gas Pipeline and EGI Expansion from

2017 to 2019. She is a registered Professional Natural Scientist (400247/14) with the South African Council for Natural Scientific Professions (SACNASP), and a Registered EAP (2021/4067) with the EAPASA.

Helen Antonopoulos is an Environmental Scientist in the EMS group of the CSIR and holds BSc, BSc Honours, and MSc degrees in Environmental and Geographical Science from the University of Cape Town. She has assisted with compiling BAs and Scoping and EIAs for Solar Facilities in various provinces.

Table 1: Details of the EIA Project Team

NAME	ORGANISATION	ROLE/STUDY TO BE UNDERTAKEN
Environmental Management Services (CSIR)		
Paul Lochner (*Registered EAP* (2019/745))	CSIR	EAP, Technical Advisor and Quality Assurance
Rohaida Abed (*Pr.Sci.Nat.* and *Registered EAP* (2021/4067))	CSIR	EAP and Project Manager
Helen Antonopoulos	CSIR	Project Officer
Sonto Mkize	CSIR	Project Officer
Phindile Mthembu	CSIR	Project Officer
Luanita Snyman van der Walt *(Pr.Sci.Nat.)*	CSIR	GIS Specialist
Lizande Kellerman *(Pr.Sci.Nat.)*	CSIR	Public Participation Specialist
Specialists		
Johann Lanz (*Pr.Sci.Nat.)*	Private	Agriculture and Soils Compliance Statement
Corne Niemandt *(Pr.Sci.Nat.)* Samuel Laurence *(Pr.Sci.Nat.)* Luke Verburgt	Enviro-Insight cc	Terrestrial Biodiversity, Terrestrial Plant Species, and Terrestrial Animal Species
Toni Belcher *(Pr.Sci.Nat.)* Dana Grobler *(Pr.Sci.Nat)*	Private	Aquatic Biodiversity Impact Assessment
Chris van Rooyen Albert Froneman (*Pr.Sci.Nat.)*	Chris van Rooyen Consulting	Avifauna Impact Assessment
Quinton Lawson (*SACAP, 3686*) Bernard Oberholzer (*SACLAP, 87018*)	QARC and BOLA	Visual Impact Assessment
Dr Jayson Orton (*APHP: Member 43; ASAPA CRM Section: Member 233*)	ASHA Consulting (Pty) Ltd	Heritage Impact Assessment (Archaeology and Cultural Landscape)
Dr John Almond *(PSSA and APHP Member)*	Natura Viva cc	Palaeontology Site Sensitivity Verification Report
Tony Barbour and Schalk van der Merwe	Private	Socio-Economic Impact Assessment
Annebet Krige *(Pr Eng)*	Sturgeon Consulting	Traffic Impact Assessment
Debbie Mitchell *(Pr Eng)*	Ishecon cc	Battery Storage High Level Safety, Health and Environment Risk Assessment
Dale Barrow (*Pr.Sci.Nat.)* Christel van Staden (*Cand.Sci.Nat.)* Shane Teek (*Cand.Sci.Nat.)* Louis Jonk (*Pr.Sci.Nat.)* Julian Conrad	GEOSS South Africa (PTY) Ltd	Geohydrology Assessment
Shane Teek (*Cand.Sci.Nat.)* Dale Barrow (*Pr.Sci.Nat.)* Hardy Luttig	GEOSS South Africa (PTY) Ltd	Geotechnical Assessment

NAME	ORGANISATION	ROLE/STUDY TO BE UNDERTAKEN
Julian Conrad		
Rohaida Abed *(Pr.Sci.Nat.* and *Registered EAP (2021/4067))* Helen Antonopoulos Lizande Kellerman *(Pr.Sci.Nat.)*	CSIR	Civil Aviation Site Sensitivity Verification
Rohaida Abed *(Pr.Sci.Nat.* and *Registered EAP (2021/4067))* Helen Antonopoulos Lizande Kellerman *(Pr.Sci.Nat.)*	CSIR	Defence Site Sensitivity Verification

1.2 PROJECT DESCRIPTION

The proposed projects will make use of PV technology to generate electricity from solar energy. Once a Power Purchase Agreement (PPA) is awarded, the proposed facility will generate electricity for a minimum period of 20 years. The construction phase for the proposed project is expected to be up to 12 to 18 months. The components of the proposed project are provided in Table 2 below.

Table 2: Description of the key components of the proposed Solar PV Project

Component	Description
Solar Field	
Type of Technology	Solar Photovoltaic (PV) Technology
Generation Capacity (Maximum Installed)	▪ 150 MWac
Total developable area that includes all associated infrastructure within the fenced off area of the PV facility	**Buildable Area / Fenced off Area:** ▪ 120 ha
PV Panel Structure (with the following possible tracking and mounting systems): ▪ Single Axis Tracking structures (aligned north-south); ▪ Dual Axis Tracking (aligned east-west and north-south); ▪ Fixed Tilt Mounting Structure; ▪ Mono-facial Solar Modules; or ▪ Bifacial Solar Modules.	▪ Height: Approximately 3.5 m (maximum)
Building Infrastructure	
Auxiliary Buildings	▪ Type: These include, but are not limited to, Operation and Maintenance (O&M) building / centre, site office, workshop, staff lockers, bathrooms/ablutions, warehouses, guard houses, etc. ▪ Cumulative Footprint: Approximately up to 5000 m^2 ▪ Height: Up to 10 m
Inverter/Transformer Stations	▪ Preliminary average number of stations: 27 ▪ Height: Approximately 3 m ▪ Footprint: Approximately 220 m^2 each
On-site Substation Complex	▪ Components of the on-site substation complex: ○ On-site Independent Power Producer (IPP) or Facility Substation (~1 ha).

Component	Description
	○ Lithium Ion or Redox Flow Battery Energy Storage System. Refer to the details below. ○ Switching Station and Collector Station (~2 ha). **This forms part of Projects 13 – 24 and will be assessed as part of separate processes**. ▪ Footprint of the on-site substation complex: Up to approximately 8 ha ▪ Height of the on-site substation complex: Up to 10 m ▪ Capacity of the on-site substation complex: This varies according to the detailed design and requirements from potential clients, however a capacity stepping up from 22 kV or 33 kV to 132 kV is estimated.
Associated Infrastructure	
Battery Energy Storage System (BESS)	▪ Technology: Lithium-Ion BESS or Redox Flow BESS (both options have been considered in the Scoping and EIA Process; and both options have been deemed acceptable by the specialists; however the preferred option is Lithium Ion BESS). ▪ Footprint: Approximately 1 ha ▪ Height: Up to 10 m ▪ Capacity: Up to 500 MW / 500 MWh
On-site medium voltage internal cables	▪ Placement: Underground or above ground in certain sections ▪ Capacity: 22 or 33 kV ▪ Depth: Maximum depth of 1.5 m
Underground low voltage cables or cable trays	▪ Depth: Maximum depth of 1.5 m
Access roads (including upgrading and widening of existing roads, where relevant)	▪ Details: Existing roads will be used as far as practically achievable to access the site. The Traffic Specialist has noted that the main roads leading to the proposed project site are of a sufficient width. However, upgrading of the main access point from the R48 will be required. This is specifically at the intersection of the TR38/01 (i.e. R48) and DR3093, which will require an existing island of approximately 60 m^2 to be removed and surfaced to accommodate the turning movements of vehicles.
Internal roads	▪ Details: New internal service roads will need to be established (i.e. new roads within the fenced off area of the PV Facility, and new roads between the closest existing road and the PV Facility to gain access). These would either comprise farm roads (compacted dirt/gravel) or paved roads. ▪ Width: ○ Within the PV Facility: Up to 5 m ○ Between the existing road and PV Facility: Up to 8 m
Fencing around the PV Facility Perimeter	▪ Type: Could be palisade or mesh or fully electrified ▪ Height: Up to 3 m
Storm water channels	▪ Details to be confirmed once the Engineering, Procurement and Construction (EPC) contractor has been selected and the design is finalised. Where necessary, a detailed storm water management plan would need to be developed.
Panel cleaning and maintenance area	▪ The type of panels to be used (and panel cleaning) will be confirmed during detailed design/engineering phase. The

Component	Description
	panel cleaning and maintenance area will form part of the O&M Auxiliary Buildings (located at the on-site substation complex).
Work area during the construction phase (i.e. laydown area)	▪ Temporary Laydown: Up to 7 ha. ▪ The need for a permanent laydown area will be confirmed during the detailed design/engineering phase.
Water Requirements	▪ Approximately 9 000 m^3 of water is estimated to be required per year for the construction phase. ▪ Approximately 1 000 m^3 of water is estimated to be required per year for the operational phase. ▪ Water requirements during the decommissioning phase are unknown at this stage. ▪ Potential sources: Local municipality, third-party water supplier, existing boreholes or drilled boreholes on site.
Construction Period	▪ 12 – 18 months
Operational Period	▪ Once the commercial operation date is achieved, the proposed facility will generate electricity for a minimum period of 20 years.

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

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

Each activity undertaken as part of the above phases may have environmental impacts and, where applicable, has been assessed in the specialist studies (included in Chapters 6 to 19 of this EIA Report). Management and mitigation measures required to address all the impacts are included within this EMPr.

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

- Removal of vegetation for the proposed infrastructure, where necessary, within the approved development footprint to facilitate the construction and/or establishment of infrastructure. Note that vegetation is planned to be trimmed within the PV array area (and not removed completely);
- Excavations for infrastructure and associated infrastructure;
- Establishment of a laydown area for equipment;
- Stockpiling of topsoil and cleared vegetation, where necessary (except for the PV array);
- Creation of employment opportunities;
- Transportation of material and equipment to site, and personnel to and from site; and
- Construction of the solar field, and additional infrastructure.

The following activities will occur during the operational phase of the proposed project:

- The generation of electricity from the proposed solar facility; and
- Maintenance of the solar field and associated infrastructure.

At the end of the operational phase, the PV facility may be decommissioned, or may be repowered i.e. redesigned and refitted so as to operate for a longer period. The main aim of decommissioning is to return the land to its original, pre-construction condition. Should the unlikely need for decommissioning arise i.e. if the facility becomes outdated or the land needs to be used for other purposes, the decommissioning procedures will be undertaken in line with an approved EMPr and relevant legislation at the time, and the site will be rehabilitated and returned to its pre-construction state.

1.3 STRUCTURE OF THE EMPR AND DEFINITION OF STUDY AREA AND SITE

The following EMPrs have been compiled for the proposed project:

- **EMPr for the proposed solar facility and all associated infrastructure (i.e. this EMPr):**
  - This EMPr is included as Appendix I of this EIA Report.
  - This EMPr covers all the key project components listed in Table 2 above, except for the on-site substation complex, switching station and collector station. The latter two components will be addressed in separate processes.
- **EMPr for the on-site substation complex to be located at the proposed project site:**
  - This EMPr is included in Appendix J of this EIA Report, and it complies with the Generic EMPr published for substation development (Government Gazette 42323, GN 435, dated 22 March 2019).

The **study area** for all the proposed Kudu Solar Facilities is the **full extent** of the **eight affected farm properties** on which the proposed PV Facilities are planned to be constructed. These farm properties[2] are listed in Table 3. The full extent of these properties (i.e. 8 150 hectares (ha)) has been assessed by the specialists to identify environmental sensitivities and no-go areas. Refer to Chapter 2 of the EIA Report for a list of affected farm properties for each proposed solar facility.

Table 3: Farm portions associated with the Kudu Solar Facilities

FARM PORTION	SG CODE
Remaining Extent of the Farm Bas Berg No. 88	C05700000000008800000
Remaining Extent of Portion 3 of the Farm Bas Berg No. 88	C05700000000008800003
Portion 4 (Portion of Portion 3) of the Farm Bas Berg No. 88	C05700000000008800004
Remaining Extent of Portion 2 (Middel Plaats) (a Portion of Portion 1) of the Farm Grasspan No. 40	C05700000000004000002
Remaining Extent of the Farm Annex Wolve Kuil No. 41	C05700000000004100000
Portion 1 (Wolve Kuil West) of the Farm Annex Wolve Kuil No. 41	C05700000000004100001
Portion 2 of the Farm Wolve Kuil No. 43	C05700000000004300002
Remaining Extent of the Farm Wolve Kuilen No. 42	C05700000000004200000

[2] The farm property details are based on the information captured in the Title Deeds. All references made to these properties in this report should be considered as such.

In this EMPr, the following spatial parameters apply to the management actions, unless where specified differently:

- The study area is referred to as the larger assessed area (i.e., 8 150 ha);
- The site as the footprint of the proposed solar PV facility, which is the total developable area that includes all associated infrastructure within the fenced off area of the PV facility (i.e., approximately 120 ha), as well as main access roads leading to the PV facility.

Where applicable, each section of the EMPr is divided into the following four phases of the project cycle:

- Planning and Design Phase (Pre-construction Phase);
- Construction Phase;
- Operational Phase; and
- Decommissioning Phase.

The EMPr includes the findings and recommendations of the EIA Process and specialist studies. However, the EMPr is considered a “living” document and must be updated with additional information or actions during the design, construction, operational and decommissioning phases if applicable.

The EMPr follows an approach of identifying an over-arching goal and objectives, accompanied by management actions that are aimed at achieving these objectives (the outcomes). The management actions are presented in a table format in order to show the links between the goal and associated objectives, actions, responsibilities, and monitoring requirements and targets.

The management plans for the design, construction, operational and decommissioning phases consist of the following components:

- **Impact:** The potential positive or negative impact of the development that needs to be enhanced, mitigated, or eliminated.
- **Objectives/Outcomes:** The objectives necessary in order to meet the goal; these take into account the findings of the specialist studies.
- **Mitigation/Management Actions**: The actions needed to achieve the objectives/outcomes of enhancing positive benefits and mitigating or eliminating negative impacts; taking into consideration factors such as responsibility, methods, frequency, resources required and prioritisation.
- **Monitoring**: The key monitoring actions required to check whether the objectives/outcome are being achieved, taking into consideration methodology, frequency, and responsibility.

1.4 ENVIRONMENTAL SENSITIVITIES

Chapters 6 to 19 of the EIA Report provides a detailed description of the environmental features and sensitive areas that were identified and assessed in detail by the specialists for consideration in the layout and location of the proposed project.

Based on the findings of the specialist studies, an environmental sensitivity map has been produced. This map shows the sensitivities on site (e.g., terrestrial, aquatic, avifaunal, visual, agricultural, and heritage features) within the larger assessed area that was identified. Based on this map, the preferred location for the proposed solar facility avoids the sensitive features that were identified by the specialists. Based on the boundaries of the assessed area and the constraints of the environmental sensitivities, a site layout has also been preliminarily determined for this project (Appendix F of this EMPr).

Appendix E of this EMPr includes the environmental sensitivity map for the study area which indicates the environmental sensitive areas and features identified during the EIA Process (as described above). A combined project layout and sensitivity map is included in Appendix G of this EMPr.

1.5 IMPACTS IDENTIFIED DURING THE EIA PROCESS

Based on the specialist studies (as shown in Table 2), the following main direct potential impacts, as indicated in Table 4, were identified and appropriate management and mitigation measures included within the EMPr (where required) to ensure the potential impacts are suitably addressed and managed during all phases of the project. Indirect and cumulative impacts are noted in Sections 4 to 10 of this EMPr, where relevant. It should be noted that other impacts for which specialist studies were not undertaken but where mitigation or management actions may be required, are also included in the EMPr.

Table 4: Impacts identified in the EIA Process

KEY IMPACT	IMPACTS IDENTIFIED
Agriculture	**Negative Impacts** **Construction Phase** ▪ Loss of agricultural potential by occupation of land; ▪ Loss of agricultural potential by soil degradation; and ▪ Loss of agricultural potential by dust generation. **Decommissioning Phase** ▪ Loss of agricultural potential by soil degradation; and ▪ Loss of agricultural potential by dust generation. **Positive Impacts** **Construction, Operational, and Decommissioning Phases** ▪ Increased financial security for farming operations; and ▪ Improved security against stock theft and other crime due to the presence of security infrastructure and security personnel at the energy facility.
Visual	**Construction Phase** ▪ Potential effect of dust and noise from trucks and construction machinery during the construction period, and the effect of this on nearby farmsteads and visitors to the area. ▪ Potential visual effect of haul roads, access roads, stockpiles and construction camps in the visually exposed landscape.

KEY IMPACT	IMPACTS IDENTIFIED
	Operational Phase ▪ Potential visual intrusion of solar arrays and related infrastructure on receptors including glint and glare. ▪ Potential visual impact of an industrial type activity on the pastoral / rural character and sense of place of the area. **Decommissioning Phase** ▪ Potential visual effect of any remaining structures, platforms and disused roads on the landscape.
Heritage and Cultural Landscape	**Construction Phase** ▪ Potential impacts to archaeology; ▪ Potential impacts to graves; and ▪ Potential impacts to the cultural landscape. **Operational Phase** ▪ Potential impacts to the cultural landscape. **Decommissioning Phase** ▪ Potential impacts to the cultural landscape.
Palaeontology	The study area has been confirmed as low to very low palaeo-sensitivity. Provided that the Chance Fossil Finds Protocol is incorporated into the EMPrs and fully implemented during the construction phase of the solar PV facility, there are no objections on palaeontological heritage grounds to authorisation of the proposed project. Pending the discovery of significant new fossil finds before or during construction, no further specialist palaeontological studies, reporting, monitoring or mitigation are recommended for the proposed project. The Chance Fossil Finds Protocol has been incorporated into this EMPr (Appendix C). Other standard palaeontology impact management actions for the construction and decommissioning phases are also covered in Section 10 of this EMPr.
Terrestrial Biodiversity and Species	**Construction Phase** ▪ Fragmentation and loss of habitat and sensitive features; ▪ Loss of protected species; ▪ Introduction and spread of alien invasive species; ▪ Increased erosion and soil compaction; and ▪ Littering and General Pollution. **Operational Phase** ▪ Increase in alien invasive species; ▪ Loss of species composition and diversity; and ▪ Littering and General Pollution. **Decommissioning Phase** ▪ Alien invasive species management; and ▪ Loss of habitat.
Aquatic Biodiversity and Species	**Construction Phase** ▪ Disturbance of aquatic habitat and impact on aquatic biota; ▪ Removal of indigenous aquatic vegetation and associated loss of aquatic ecological integrity and functionality; ▪ Water supply for construction and stress on available water resources; ▪ Road crossing structures may impede flow in the aquatic features; ▪ Alien vegetation infestation within the aquatic features due to disturbance; and ▪ Increased sedimentation and contamination of surface water runoff may result from construction activities.

KEY IMPACT	IMPACTS IDENTIFIED
	Operational Phase ▪ Ongoing disturbance of aquatic features and associated vegetation along access roads or adjacent to the infrastructure that needs to be maintained; ▪ Modified runoff characteristics from hardened surfaces has the potential to result in erosion of adjacent watercourses; and ▪ Water supply and water quality impacts (e.g. contamination from sewage) as a result of the operation of the proposed Solar Facility and associated infrastructure. **Decommissioning Phase** ▪ Increased disturbance of aquatic habitat due to the increased activity; and ▪ Increased sedimentation and contamination of surface water runoff.
Avifauna	**Construction Phase** ▪ Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure. **Operational Phase** ▪ Displacement due to habitat transformation associated with the presence of the solar PV plant and associated infrastructure ▪ Collisions with the solar panels ▪ Entrapment in perimeter fences ▪ Electrocutions in the onsite substation complex ▪ Electrocution of priority species on the internal 33kV powerlines. **Decommissioning Phase** ▪ Displacement due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure.
Socio-Economic	**Negative Impacts** **Construction Phase** ▪ Impacts associated with the presence of construction workers on local communities; ▪ Impacts related to the potential influx of job seekers; ▪ Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site; ▪ Increased risk of grass fires associated with construction related activities; ▪ Nuisance impacts, such as noise, dust, and safety, associated with construction related activities and vehicles; and ▪ Impact on productive farmland. **Operational Phase** ▪ Visual impacts and associated impacts on sense of place; ▪ Potential impact on property values; and ▪ Potential impact on tourism. **Decommissioning Phase** ▪ Social Impacts associated with retrenchment, including loss of jobs and source of income. **Positive Impacts** **Construction Phase** ▪ Creation of employment and business opportunities, and opportunity for skills development and on-site training.

KEY IMPACT	IMPACTS IDENTIFIED
	Operational Phase ▪ Establishment of infrastructure to improve energy security and support renewable sector; ▪ Creation of employment opportunities; ▪ Benefits associated with socio-economic contributions to community development; and ▪ Benefits for local landowners.
Geohydrology	**Construction Phase** ▪ Potential lowering of the groundwater level from construction requirements; ▪ Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages. **Operational Phase** ▪ Potential lowering of the groundwater level from operational requirements. ▪ Potential impact of groundwater quality as a result of using cleaning agents for cleaning the solar panels. ▪ Groundwater quality deterioration as a result of electrolyte that will be used for the Battery Energy Storage System (BESS). **Decommissioning Phase** ▪ Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages. ▪ Potential lowering of the groundwater level from decommissioning requirements.
Geotechnical	**Construction Phase** ▪ Displacement of geologic materials; and ▪ Contamination of geologic materials as a consequence of the construction activities. **Operational and Decommissioning Phase** ▪ Increased unnatural hard surfaces; and ▪ Contamination of geologic materials as a consequence of typical maintenance and decommissioning activities.
Traffic	**Construction** ▪ Potential congestion and delays on the surrounding road network; ▪ Potential impact on traffic safety and increase in accidents with other vehicles or animals; ▪ Potential change in the quality of the surface condition of the roads; and ▪ Potential noise and dust pollution. **Operational** ▪ The traffic generated during the operational phase are mainly related to the staff that will be transported to and from the sites and are not anticipated to have a significant traffic impact on the surrounding road network. **Decommissioning Phases** ▪ Potential congestion and delays on the surrounding road network; ▪ Potential impact on traffic safety and increase in accidents with other vehicles or animals; ▪ Potential change in the quality of the surface condition of the roads; and ▪ Potential noise and dust pollution.
BESS	Various risks were identified in terms of safety, health and the environment due to the proposed BESS. Refer to Appendix D of this EMPr for additional information regarding the risks as well as preventative and mitigation measures for all relevant phases.

2. APPROACH TO PREPARING THE EMPr

2.1 COMPLIANCE WITH RELEVANT LEGISLATION

In terms of legal requirements, a crucial objective of the EMPr is to satisfy the requirements of Appendix 4 of the 2014 NEMA EIA Regulations (as amended), and Section 24N of the NEMA. These regulations regulate and prescribe the content of the EMPr and specify the type of supporting information that must accompany the submission of the report to the authorities. An overview of where the requirements are addressed in this EMPr is presented in Tables 5 and 6.

Table 5: Compliance with Section 24N of NEMA

Requirements of Section 24N of NEMA	Where it is included in this EMPr
2) The environmental management programme must contain- a) information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts or objectives in respect of: (i) planning and design; (ii) pre-construction and construction activities; (iii) the operation or undertaking of the activity in question; (iv) the rehabilitation of the environment; and (v) closure, if applicable;	Columns detailing the impact description, mitigation and management objectives, and mitigation and management actions in Sections 4 to 10 of this EMPr.
b) details of- (i) the person who prepared the environmental management programme; and (ii) the expertise of that person to prepare an environmental management programme;	Section 1.1 and Appendix A of this EMPr. In addition, Appendix A of the EIA Report.
c) a detailed description of the aspects of the activity that are covered by the environmental management programme;	Section 1 and Section 1.2 of this EMPr.
d) information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);	Columns in Section 4 to 10 of the EMPr regarding the monitoring responsibility, including the requirements for monitoring and reporting on compliance and the responsible parties noted in Section 3.
e) information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance;	The columns detailing the mitigation and management actions, and the monitoring methodology, frequency, and responsibility in Sections 4 to 10 of this EMPr.
f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and	Sections 4 to 10 of this EMPr, as applicable to the post-construction, rehabilitation phase and the decommissioning phase.
g) a description of the manner in which it intends to- (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;	The columns detailing the mitigation and management objectives, mitigation and management actions, and the monitoring methodology, frequency, and responsibility in Sections 4 to 10 of this EMPr.

Requirements of Section 24N of NEMA	Where it is included in this EMPr
(ii) remedy the cause of pollution or degradation and migration of pollutants; and (iii) comply with any prescribed environmental management standards or practices.	
3) The environmental management programme must, where appropriate- a) set out time periods within which the measures contemplated in the environmental management programme must be implemented; b) contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of polluted or extraneous water or ecological degradation which may occur inside and outside the boundaries of the operations in question; and c) develop 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; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment.	The columns detailing the mitigation and management actions, and the monitoring methodology, frequency, and responsibility in Sections 4 to 10 of this EMPr. Section 9 of this EMPr includes an Environmental Awareness Plan.
5) The Minister, the Minister responsible for mineral resources or an MEC may call for additional information and may direct that the environmental management programme in question must be adjusted in such a way as the Minister, the Minister responsible for mineral resources or the MEC may require.	Not applicable at this stage.
6) The Minister, the Minister responsible for mineral resources or an MEC may at any time after he or she has approved an application for an environmental authorisation approve an amended environmental management programme.	Not applicable at this stage.
7) The holder and any person issued with an environmental authorisation- a) must at all times give effect to the general objectives of integrated environmental management laid down in section 23; b) must consider, investigate, assess and communicate the impact of his or her prospecting or mining on the environment; c) must manage all environmental impacts (i) in accordance with his or her approved environmental management programme, where appropriate; and (ii) as an integral part of the prospecting or mining, exploration or production operation, unless the Minister responsible for mineral resources directs otherwise; d) must monitor and audit compliance with the requirements of the environmental management programme; e) must, as far as is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and	Throughout the EMPr

Requirements of Section 24N of NEMA	Where it is included in this EMPr
f) is responsible for any environmental damage, pollution, pumping and treatment of polluted or extraneous water or ecological degradation as a result of his or her operations to which such right, permit or environmental authorisation relates.	
8) Notwithstanding the Companies Act, 2008 (Act No. 71 of 2008), or the Close Corporations Act, 1984 (Act No. 69 of 1984), the directors of a company or members of a close corporation are jointly and severally liable for any negative impact on the environment, whether advertently or inadvertently caused by the company or close corporation which they represent, including damage, degradation, or pollution.	Section 3 and Appendix B of this EMPr details the responsibility of the Project Applicant.

Table 6: Compliance with Appendix 4 of the 2014 NEMA EIA Regulations (as amended)

Requirements of Appendix 4 of the 2014 NEMA EIA Regulations (as amended)	Where is it included in this EMPr?
1. (1) An EMPr must comply with section 24N of the Act and include: a) details of: (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1.1 and Appendix A of this EMPr. Appendix A of the EIA Report includes the Curriculum Vitae of the EAPs, and Chapters 6 to 19 include the CVs of the specialists.
b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 1.2 of this EMPr
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;	Appendix E, F and G of this EMPr
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; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities;	Columns detailing the impact description, mitigation and management objectives/outcomes, and mitigation and management actions in Sections 4 to 10 of this EMPr.
f) a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraphs (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;	The columns detailing the mitigation and management actions in Sections 4 to 10 of this EMPr. The outlined management actions in this EMPr do not require any financial provisions for rehabilitation in terms of NEMA.

Requirements of Appendix 4 of the 2014 NEMA EIA Regulations (as amended)	Where is it included in this EMPr?
(iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	
g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	The columns detailing the monitoring methodology in Sections 4 to 10 of this EMPr.
h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	The columns detailing the monitoring frequency in Sections 4 to 10 of this EMPr.
i) an indication of the persons who will be responsible for the implementation of the impact management actions;	The columns detailing the monitoring responsibility in Sections 4 to 10 of this EMPr.
j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	The columns detailing the mitigation and management actions, and the monitoring methodology and frequency in Sections 4 to 10 of this EMPr.
k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	The columns detailing the mitigation and management actions, and the monitoring methodology, frequency, and responsibility in Sections 4 to 10 of this EMPr.
l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Sections 4 to 10 of the EMPr, including the requirements for monitoring and reporting on compliance and the responsible parties noted in Section 3 and Appendix B of this EMPr.
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; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 9 of this EMPr.
n) any specific information that may be required by the competent authority.	Not applicable at this stage
(2) Where a government notice *gazetted* by the Minister provides for a generic EMPr, such generic EMPr as indicated in such notice will apply.	Government Notice 435 includes a gazetted generic EMPr for power lines and substation infrastructure. Separate EMPrs have been compiled in order to comply with Government Notice 435 for the substation component of the proposed project.

2.2 GOAL FOR ENVIRONMENTAL MANAGEMENT

The overall goal for environmental management for the proposed project is to plan, design, construct and operate the project in a manner that:

- Minimises the ecological footprint of the project on the local environment;
- Minimises impacts on fauna, flora and freshwater ecosystems;
- Facilitates harmonious co-existence between the project and other land uses in the area;
- Enhances the socio-economic benefits in the local area; and
- Contributes to the environmental baseline and understanding of environmental impacts of solar energy facility in a South African context.

3. ROLES AND RESPONSIBILITIES

Since the Generic EMPrs are applicable for the on-site substation complex, it is best to adopt the definitions of the roles and responsibilities as captured in the gazette Generic EMPr of GN 435. This will allow consistency of the management of the project from an environmental perspective and will avoid any contradiction in terms of the roles and responsibilities. The generic roles and responsibilities required for key role players are those of the:

- Project Developer / Developer's Project Manager (DPM);
- Developer Site Supervisor (DSS);
- Environmental Control Officer (ECO);
- Developer's Environmental Officer (DEO);
- Contractor; and
- Contractor's Environmental Officer (CEO).

The definitions of the roles and responsibilities are included in Appendix B of this EMPr. Note that the intent of Appendix B of this EMPr is to give a generic outline of what these roles typically require. It is expected that this will be appropriately defined at a later stage.

4. ALIEN INVASIVE VEGETATION MANAGEMENT PLAN

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. PLANNING AND DESIGN PHASE					
4.1. Impacts due to establishment of alien invasive plants as a result of the project	Ensure the appropriate removal of alien invasive vegetation from the proposed project area and minimise the establishment and spread of alien invasive plants due to the project activities. Avoid establishment and reduce the spread of alien invasive plants due to the project activities. Limit the disturbance of aquatic habitats.	▪ Compile a method statement that makes use of alien clearing methods as provided by the Working for Water Programme and outlined on the Department of Forestry, Fisheries and the Environment (DFFE) website[3]. The method statement should also take into account the relevant legislation under the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEM: BA)).	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed method statement.	▪ Once-off during the planning and design phase.	▪ Project Developer, Contractor and ECO
B. CONSTRUCTION PHASE					
4.2. Impacts due to the establishment of and increased spread of alien invasive plants as a result of the project	Avoid establishment and reduce the spread of alien invasive plants due to the project activities.	▪ Invasive alien plant growth should be monitored on an ongoing basis within the project site (120 ha) and immediate surrounds to ensure that the disturbed areas associated within project activities do not become infested with invasive alien plants. ▪ Implement an ongoing monitoring programme for alien invasive vegetation for the	▪ Ongoing monitoring of invasive alien plants within the site should be undertaken according to the approved method statement. Monitoring and control measures should take place at least biannually (every six months) for the construction phase.	▪ As specified	▪ Project Developer, ECO, and Specialist Contractor

[3] https://www.dffe.gov.za/projectsprogrammes/wfw/resources#mannuals

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		construction phase to detect and quantify any alien invasive species that may become established within the construction site.	▪ Herbicide and pesticide used as part of control measures should be approved by the ECO prior to application, taking all sensitive features into account.		
		▪ Ensure proper management of soil stockpiles. Do not import soil stockpiles from areas with alien plants to ensure proper management of stockpiles.	▪ Monitor the presence of alien invasive plants during the construction phase via visual inspections and take action to remove and control these species.	▪ On-going	▪ ECO and Contractor
		▪ Undertake rehabilitation of disturbed areas as soon as possible after construction. Stockpile the shallow topsoil layer separately from the subsoil layers. Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas.	▪ Rehabilitate disturbed areas and monitor the presence of alien invasive species on site.	▪ On-going	▪ ECO and Contractor
		▪ Keep clearance and disturbance of indigenous vegetation to a minimum.	▪ Monitor and manage vegetation clearing by undertaking visual inspections to ensure minimal disturbance and to restrict activities to the demarcated project footprint.	▪ On-going	▪ ECO and Contractor
		▪ Ensure that the footprint required for the proposed project activities (such as temporary stockpiling, earthworks, storage areas, site establishment etc.) is clearly demarcated and kept at a minimum.	▪ Verify that the proposed project area is determined and demarcated prior to the commencement of the construction phase by undertaking visual inspections.	▪ Once-off prior to construction and as required during the construction process.	▪ ECO and Contractor
		▪ The removed alien invasive vegetation should be immediately disposed at a suitable waste disposal facility and should not be kept on site for prolonged periods of time, as this will enhance the spread of these species.	▪ Monitor the removal of the alien vegetation found on site via visual inspections.	▪ As necessary during the construction phase.	▪ ECO
		▪ All construction machinery and plant equipment delivered to site for use during the construction phase should be cleaned in order to limit the introduction of alien species.	▪ Clean machinery and equipment prior to the construction phase. ▪ ECO to conduct visual inspections to verify that machinery and equipment are cleaned, and that materials brought to	▪ Prior to the commencement of construction.	▪ ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Construction materials brought onto the site should be free of alien plant seed. Sources of alien seed should be prevented from being brought onto the site with imported materials.	site are free of alien plant seed and report any non-compliance.	▪ As necessary during the construction phase.	
C. OPERATIONAL PHASE					
4.3. Impacts due to establishment of alien invasive plants. Exotic weed invasion may result in the ousting of natural vegetation and alteration of ecological processes on site, with incremental impacts on the adjacent veld types.	Reduce the establishment and spread of alien invasive plants. To remove exotic weeds as and when they may arise and thereby prevent alteration of local and adjacent habitat forms. Control of invasive alien plants in riparian zones and wetland areas. Avoid establishment and reduce the spread of alien invasive plants due to the project activities.	▪ Implement an ongoing monitoring programme for alien invasive vegetation for the operational phase to detect and quantify any alien invasive species that may become established within the operational site. ▪ Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. Ongoing control of invasive alien plants within the site should be undertaken. ▪ Invasive alien plant material that has been cleared should be removed from the riparian zones and not left on the river banks or burnt within the riparian zone and buffer area. ▪ The removed alien invasive vegetation should be immediately disposed at a suitable waste disposal facility and should not be kept on site for prolonged periods of time, as this will enhance the spread of these species.	▪ Ongoing monitoring of invasive alien plants within the site should be undertaken according to the approved method statement. Monitoring and control measures should take place at least biannually (every six months) for the first 3 years of the project and should be adjusted as required based on the first 3 years results / success rate. ▪ Herbicide and pesticide used as part of control measures should be approved by the ECO prior to application, taking all sensitive features into account. ▪ Monitor the removal of the alien vegetation found on site via visual inspections.	▪ As specified ▪ As required during the operational phase ▪ As required during the operational phase	▪ Environmental Manager, ECO and Contractor
D. DECOMMISSIONING PHASE					
4.4. Exotic weed invasion of the decommissioned site resulting in ecological change.	Avoid establishment and reduce the spread of alien invasive plants due to the project activities.	▪ Implement an ongoing monitoring programme for alien invasive vegetation for the decommissioning phase to detect and quantify any alien invasive species that may become established within the decommissioning site.	▪ Ongoing monitoring of invasive alien plants within the site should be undertaken according to an approved method statement. ▪ After all infrastructure is removed, a final site inspection should be done, and all remaining plants must be cleared.	▪ As required during decommissioning	▪ Contractor, ECO, Project Developer

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Control of invasive alien plants within the site should be undertaken according to the approved method statement. ▪ Mitigation and follow-up monitoring of residual impacts (alien vegetation growth and erosion) may be required.	▪ Herbicide and pesticide used as part of control measures should be approved by the ECO prior to application, taking all sensitive features into account.		
		▪ All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally sourced seed of indigenous grass species that were recorded on site pre-construction.	▪ Final external audit of area to confirm that area is rehabilitated to an acceptable level.	▪ Once off	▪ Contractor with advice from specialist

5. TRAFFIC MANAGEMENT PLAN INCLUDING TRANSPORTATION PLAN

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. PLANNING AND DESIGN PHASE					
5.1. Increased traffic generation	Manage impact that additional traffic generation will have on road network	▪ If abnormal loads need to be transported by road to the site, a permit will need to be applied for in terms of Section 81 of the National Road Traffic Act and authorisation needs to be obtained from the relevant road authorities to modify the road reserve to accommodate turning movements at intersections (if necessary). ▪ It is not anticipated that any widening of the intersection at TR38/01 and DR3093 will be required, however, the existing island will need to be removed (approximately 60 m^2) to accommodate the turning movements of the abnormal load vehicles.	▪ Ensure that the permits are applied for and obtained prior to commencement. ▪ Verify that this has been undertaken by reviewing approved permits.	▪ Once-off	▪ Contractor ▪ ECO
		▪ The route to the sites should be further investigated to ensure that abnormal loads are not obstructed at any point by geometric, height and width limitations along the route.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off	▪ Project Developer and Traffic Specialist
		▪ Discussions must be held with the relevant landowners on which the internal access farm road leading to the sites is located, prior to commencement to confirm requirements and details of the agreement.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off	▪ Project Developer and ECO
		▪ Ensure that the requirements for use of the internal farm access roads leading to the sites are addressed and considered in the design, as and where applicable.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off	▪ Project Developer and ECO
		▪ Provide a Transport Traffic Plan to the Provincial and Municipal Road Department (if required).	▪ Ensure that the plan is compiled and submitted prior to commencement.	▪ Once-off	▪ Contractor ▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			▪ Verify that this has been undertaken by reviewing approved plans.		
5.2. Accelerated degradation of road structure due to construction, operational and decommissioning phase traffic.	Limit the deterioration of the road condition due to construction, operational and decommissioning phase traffic.	▪ A Road Maintenance Plan should be developed for the internal farm access roads (i.e. internal private roads leading off the DR3093) that will be used. The plan should address requirements such as, but not limited to, grading, dust suppressant mechanisms, drainage (where required), signage, and speed limits. The Road Maintenance Plan must ensure regular maintenance of the roads. The Road Maintenance Plan must be communicated with the relevant authorities, where required, and must be provided to the surrounding community forum prior to commencement of construction.	▪ Ensure that the plan is compiled and submitted prior to commencement. ▪ Verify that this has been undertaken by reviewing approved plans.	▪ Once-off	▪ Project Developer, Traffic Specialist and Contractor ▪ ECO
B. CONSTRUCTION PHASE					
5.3. Increased traffic generation during the construction phase resulting in a reduction of road based level of service and potential congestion and delays on the surrounding road network.	Plan the project to spread and reduce the amount of road based traffic and avoid local congestion periods during the construction phase.	▪ Plan and stagger delivery trips and schedule deliveries so that they occur outside of peak traffic periods, where possible.	▪ Monitor and management of traffic generated and when trips are made.	▪ During construction	▪ Contractor and ECO
		▪ Suitable parking areas should be designated for construction trucks and vehicles at the construction site camp in order to promote order and improve safety.	▪ Monitor the placement of the designated parking area for trucks and vehicles via visual inspections and record and report any non-compliance.	▪ Once-off prior to construction and as required during the construction phase.	▪ Project Developer and ECO
		▪ The use of public transport (buses and/or minibus taxis) to convey construction personnel to the site should be encouraged. ▪ Staff trips should occur outside of peak hours, where possible.	▪ Contractor should record the arrival and departure times as well as the number of workers using public transport.	▪ Once a month on a randomly selected day.	▪ Appointed Contractor
		▪ Ensure that the existing island removal at the intersection of TR38/01 and DR3093 is undertaken in an environmental conscious manner, once the relevant authorisations from the road authorities are obtained. Ensure that construction vehicles	▪ Monitor the island removal process via visual inspections and record and report any non-compliance.	▪ As required during the construction phase.	▪ Project Developer and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		always remain within a demarcated area at the intersection, and that local road officials are informed of the planned island removal process.			
5.4. Increased level of road accidents (involving pedestrians, animals, other motorists on the surrounding road network) due to increased traffic during construction.	Minimise the impact of the construction activities on the local traffic and avoid accidents with pedestrians, animals and other drivers on the surrounding roads. Reduce number of road accidents due to increased traffic during construction.	▪ Well maintained vehicles should be used together with well-trained drivers during the construction phase. Vehicle maintenance and driver competency should be monitored. Proof of driver competency as well as the vehicle checks should be verified and undertaken to ensure that vehicles are roadworthy and hence, do not pose a safety risk. The Contractors must ensure that construction vehicles are roadworthy, properly serviced and maintained, and respect the vehicle safety standards implemented by the Project Developer.	▪ Carry out random checks of driver licenses and conduct random visual inspections of construction vehicles for roadworthiness.	▪ Random visual inspection of vehicles weekly.	▪ Contractor
		▪ To ensure reduced speeds along the roads, implement speed control mechanisms within the construction site by means of a stop and go system, implement speed limits and placement of road signage for the speed limits.	▪ Implement speed control mechanisms within the construction site prior to commencement of construction. ▪ Carry out random inspections to verify whether proper speed control is being implemented.	▪ On-going ▪ Random during the construction phase	▪ Contractor and ECO ▪ ECO
		▪ Adhere to all speed limits applicable to all roads used.	▪ Ensure that speed limits are adhered to. ▪ Carry out random visual inspections to verify speed limits and general awareness of vehicle drivers.	▪ Daily ▪ Random during the construction phase	▪ Contractor and ECO ▪ ECO
		▪ Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established.	▪ Appropriate monitoring should be undertaken.	▪ Weekly	▪ Contractor and ECO
		▪ Implement clear and visible signage indicating movement of vehicles at intersections within the construction site and in the vicinity of the nearby farm steads.	▪ Implement clear signalisation. ▪ Carry out random inspections to verify whether proper construction signage is being implemented.	▪ On-going ▪ Random during the construction phase	▪ Contractor and ECO ▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
5.5. Deterioration in the surface condition of the roads and accelerated degradation of road structure due to construction traffic.	Limit the deterioration of the road condition due to construction traffic.	▪ Ensure that there is regular maintenance of the internal farm access roads (i.e. internal private roads leading off the DR3093) that will be used, by the contractor during the construction phase in line with the agreed maintenance plan. ▪ Ensure that the upgrading of the internal farm access roads (i.e. internal private roads leading off the DR3093 that are impacted on by the proposed project and will be used), is undertaken to suitable standards as specified by the civil engineer and in accordance with the maintenance plan. ▪ Ensure that the internal farm access roads (i.e. internal private roads leading off the DR3093 that are impacted on by the proposed project and will be used) are restored to its original pre-construction road condition.	▪ Carry out visual inspections to verify if regular maintenance is being undertaken. ▪ Ensure that the internal farm access road to site is upgraded through photographic surveys and monitoring.	▪ Bi-monthly ▪ Ongoing	▪ Contractor and ECO ▪ Project Developer, Contractor and ECO
		▪ Construction activities will have a higher impact than the normal road activity and therefore the internal farm access roads (i.e. internal private roads leading off the DR3093) to site should be inspected on a weekly basis for structural damage.	▪ Ensure that the access road to site maintains current condition through photographic surveys and monitoring.	▪ Weekly	▪ Contractor and ECO
		▪ Implement management strategies for dust generation e.g. apply dust suppressant on the gravel roads on the construction site, exposed areas and stockpiles. Avoid the use of potable water for dust suppression during the construction phase and consider the use of alternative approved sources, where possible.	▪ Ensure dust management measures are in place to adequately decrease the generation of dust.	▪ On-going	▪ Contractor and ECO
		▪ Vehicles must not be overloaded during the construction phase in order to reduce impacts on the road structures, particularly the access roads leading to the site. Random visual inspection of vehicles should be undertaken in order to monitor for overloading. The inspections should also verify if the trucks are covered with appropriate material (such as tarpaulin) if and where possible.	▪ Perform visual inspection of vehicles during the construction phase.	▪ Random visual inspection of vehicles weekly.	▪ Appointed Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
5.6. Impact on air quality due to dust generation, noise and exhaust emissions from construction vehicles and equipment.	Limit the release of noise, pollutants and dust emissions	▪ Implement management strategies for dust generation e.g. apply dust suppressant on the gravel roads on the construction site, exposed areas and stockpiles. Avoid the use of potable water for dust suppression during the construction phase and consider the use of alternative approved sources, where possible.	▪ Ensure dust management measures are in place to adequately decrease the generation of dust.	▪ On-going	▪ Contractor and ECO
		▪ Postpone or reduce dust-generating activities during periods with strong wind. Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased.	▪ Ensure dust management measures are in place to decrease the dust generated.	▪ On-going	▪ Contractor and ECO
		▪ Avoid using old and unmaintained construction equipment (which generate high sound levels and greater exhaust emissions) and ensure equipment is well maintained.	▪ Manage noise levels and air pollutants from construction vehicles through checking the condition of vehicles.	▪ On-going	▪ Contractor and ECO
C. OPERATIONAL PHASE					
5.7. Increased level of road accidents (involving pedestrians, animals, other motorists on the surrounding tarred/ gravel road network) due to increased (but limited) traffic during the operational phase.	Minimise the impact of the operational activities on the local traffic and avoid accidents with pedestrians, animals and other drivers on the surrounding gravel roads. Reduce number of road accidents due to increased traffic during the operational phase.	▪ Well maintained vehicles should be used together with well-trained drivers during the operational phase, as required. Vehicle maintenance and driver competency should be monitored. Proof of driver competency as well as the vehicle checks should be verified and undertaken to ensure that vehicles are roadworthy and hence, do not pose a safety risk. Vehicles must be roadworthy, visible, adequately marked, properly serviced and maintained, and operated by an appropriately licensed operator.	▪ Carry out random checks of driver licenses and conduct random visual inspections of vehicles for roadworthiness.	▪ Random visual inspection of vehicles weekly.	▪ Project Developer
		▪ Adhere to all speed limits applicable to all roads used.	▪ Ensure that speed limits are adhered to. ▪ Carry out random visual inspections to verify speed limits and general awareness of vehicle drivers.	▪ Daily ▪ Random during the operational phase	▪ Project Developer
		▪ Implement clear and visible signage and signals indicating movement of vehicles at intersections and in the vicinity of the nearby farm steads.	▪ Implement clear signalisation.	▪ Ongoing	▪ Project Developer

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			▪ Carry out random inspections to verify whether proper signage is being implemented.	▪ Random during the operational phase	
		▪ The use of public transport (buses and/or minibus taxis) or carpooling to convey operational personnel to the site should be encouraged.	▪ Monitor the requirements	▪ On-going	▪ Project Developer
		▪ Limit access to the site to personnel.	▪ Maintain a register of visitors and staff that enter site and restrict access to personnel.	▪ On-going	▪ Project Developer
5.8. Accelerated degradation of road structure due to operational traffic.	Limit the deterioration of the road condition due to operational phase traffic.	▪ The main access roads to site should be inspected on a weekly basis for structural damage.	▪ Ensure that the main access road to site maintains current condition through photographic surveys and monitoring.	▪ Weekly	▪ Project Developer
		▪ Ensure that there is regular maintenance of the internal farm access roads (i.e. internal private roads leading off the DR3093) that will be used, by the operator during the operational phase in line with the agreed maintenance plan.	▪ Carry out visual inspections to verify if regular maintenance is being undertaken. ▪ Ensure that the internal farm access road to site is upgraded through photographic surveys and monitoring.	▪ Weekly	▪ Project Developer
		▪ Implement management strategies for dust generation e.g. apply dust suppressant on gravel roads on the operational site, exposed areas and stockpiles.	▪ Ensure dust management measures are in place to adequately decrease the generation of dust.	▪ On-going	▪ Project Developer
		▪ Vehicles must not be overloaded during the operational phase (where applicable) in order to reduce impacts on the road structures. Random visual inspection of vehicles should be undertaken in order to monitor for overloading (where applicable).	▪ Perform visual inspection of vehicles.	▪ Random visual inspection of vehicles weekly.	▪ Project Developer
D. DECOMMISSIONING PHASE					
5.9. Ensure that the construction mitigation and management measures are adhered to during the decommissioning phase.					

6. STORM WATER MANAGEMENT PLAN

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. PLANNING AND DESIGN PHASE					
6.1. Impact of the project if a detailed storm water management plan is not correctly prepared.	To limit the effect of uncontrolled storm water run-off from developed areas onto natural areas	▪ Prepare a detailed stormwater management plan outlining appropriate treatment measures to address runoff from disturbed portions of the site	▪ Check compliance with specified conditions. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during design followed by regular control ▪ During the planning and design phase	▪ Contractor ▪ ECO
B. CONSTRUCTION PHASE					
6.2. Diversion and impedance of surface water flows – Changes to the hydrological regime and increased potential for erosion. Diversion and increased velocity of surface water flows – reduction in permeable surfaces	Prevent interference with natural run-off patterns, diverting flows and increasing the velocity of surface water flows.	▪ The appointed Contractor should compile a Method Statement for Stormwater Management during the construction phase.	▪ Compile a Method Statement for Stormwater Management during the construction phase. ▪ Inspect and verify if a Method Statement for Stormwater Management has been compiled by the Contractor via audits prior to the commencement of the construction phase.	▪ Prior to the construction phase. ▪ Once-off prior to the commencement of the construction phase.	▪ Contractor ▪ ECO
		▪ Erosion and sedimentation into water bodies must be minimised through the effective stabilisation (gabions and Reno mattresses or similar) and the re-vegetation of any disturbed riverbanks.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		▪ Reinforce soil slopes to minimise erosion during rehabilitation (as needed, and once construction in a specific area has ceased).	▪ Monitor activities and record and report non-compliance.	▪ As needed during the construction phase	▪ ECO
		▪ Any irrigation of the development area for landscaping or dust control purposes should be controlled, such that it does not result in any measurable increase in moisture being passed into natural drainage lines.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Drainage along the sides of the roads should be designed so that it does not result in concentrated flows into watercourses.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO
		▪ Perform periodic inspections and maintenance of soil erosion measures and stormwater control structures.	▪ Monitor activities and record and report non-compliance.	▪ As needed during the construction phase	▪ ECO
6.3. Pollution of the surrounding environment as a result of the contamination of stormwater. Contamination could result from the spillage of chemicals, oils, fuels, sewage, solid waste, litter etc.	To prevent contaminated stormwater from entering into and adversely impacting on freshwater ecosystems and reducing the water quality. To reduce sedimentation of nearby water systems. To apply best practice principles in managing risks to storm water pollution.	▪ The appointed Contractor should compile a Method Statement for Stormwater Management during the construction phase.	▪ Compile a Method Statement for Stormwater Management during the construction phase. ▪ Inspect and verify if a Method Statement for Stormwater Management has been compiled by the Contractor via audits prior to the commencement of the construction phase.	▪ Prior to the construction phase. ▪ Once-off prior to the commencement of the construction phase.	▪ Contractor ▪ ECO
		▪ Provide secure storage for fuel, oil, chemicals, and other waste materials to prevent contamination of stormwater runoff. Fuels and chemicals (i.e., any hazardous materials and dangerous goods) used during the construction phase must be stored safely on site and in bunded areas. Fuel and chemical storage containers must be inspected to ensure that any leaks are detected early.	▪ Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents. Monitor if spillages have taken place and if they are removed correctly.	▪ Weekly	▪ ECO
		▪ All stockpiles must be protected from erosion and stored on flat areas where run-off will be minimised. Erosion and sedimentation into water bodies must be minimised through effective stabilisation. No stockpiling should take place within a watercourse. ▪ Stockpiles must be located away from river channels i.e., greater than 32 m.	▪ Monitor the excavations and stockpiling process throughout the construction phase via visual site inspections. Record non-compliance and incidents.	▪ Daily	▪ ECO
		▪ Littering and contamination of water resources during construction must be prevented by effective construction camp management.	▪ Monitor via site audits and record non-compliance and incidents (i.e.,	▪ Weekly	▪ Contractor and ECO

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			by implementing walk through inspections).		
		▪ Emergency plans must be in place to deal with potential spillages (especially those leading to any watercourses).	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		▪ Erosion and sedimentation into water bodies must be minimised through the effective stabilisation (gabions and Reno mattresses or similar) and the re-vegetation of any disturbed riverbanks, as applicable.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		▪ Ensure that the temporary site camp and ablution facilities are established at least 32 m away from the banks of the major drainage lines. The sensitivities captured in the sensitivity map included in Appendix E of this EMPr must also be considered when placing the site camp (the buffers assigned to water courses should also be avoided, where possible in this regard).	▪ Monitor the placement of the site camp via visual inspections, and record and report any non-compliance.	▪ Once-off prior to construction and as required during the construction phase.	▪ ECO
		▪ Ensure that there is no ad-hoc and indiscriminate crossing of watercourses and channels by vehicles during the construction phase. Access routes across the site should be strictly demarcated and selected with a view to minimise impacts on drainage lines. Watercourses where no construction activities are proposed must be considered as no-go areas.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		▪ Ensure that no waste materials or sediments are left in the surrounding drainage lines (as a result of the construction).	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		▪ Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	▪ Monitor via site audits and record non-compliance and incidents (i.e., by implementing walk through inspections).	▪ Weekly	▪ Contractor and ECO

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
C. OPERATIONAL PHASE					
6.4. Stormwater discharge into the surrounding environment during operations	To minimise the contamination of stormwater by uncontrolled release of contaminated or grey water. To protect soil resources and prevent soil erosion.	▪ An operational phase Stormwater Management Plan should be designed and implemented, with a view to prevent the passage of concentrated flows from hardened surfaces and onto natural areas.	▪ Compile a Stormwater Management Plan for the operational phase. ▪ Inspect and verify if a Stormwater Management Plan has been compiled prior to the commencement of the operational phase.	▪ Continuously during operational phase. ▪ Once-off prior to the commencement of the operational phase.	▪ Project Developer
		▪ All release points into the natural environment must have appropriate energy dissipaters to minimise scouring/erosion.	▪ Monitor activities and record and report non-compliance. ▪ Monitor the placement of energy dissipaters via visual inspections, and record and report any non-compliance.	▪ On-going	▪ Project Developer
		▪ As far as reasonably possible, separate “clean” and “dirty” storm water. As far as reasonably possible, capture and contain “dirty” stormwater for appropriate disposal/discharge.	▪ Monitor via site audits and record non-compliance and incidents (i.e., by implementing inspections).	▪ Weekly or as required during operations.	▪ Project Developer
		▪ Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	▪ Undertake regular inspections of the stormwater infrastructure (i.e., by implementing walk through inspections).	▪ Weekly/Monthly	▪ Project Developer
D. DECOMMISSIONING PHASE					
6.5. The proposed solar facility would be expected to run for a minimum period of 20 years, after which it would either be decommissioned, alternatively upgraded or an application submitted to obtain a new license. Should the plant be decommissioned, the solar field would be rehabilitated to its original (pre-development) state. In the (unlikely) event that none of the mitigation measures outlined for the construction and operational phases of the proposed project had been implemented, the period of time for recovery to take place would be extended. In the event that decommissioning occurs, and assuming implementation of mitigation measures, the hydrological regime should fully recover over time to present day conditions.					

7. EROSION MANAGEMENT PLAN

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. PLANNING AND DESIGN PHASE					
7.1. Soil degradation as a result of erosion. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads.	Ensure that disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	▪ Design an effective system of storm water run-off control, where required (e.g., areas with concentrated volumes of run-off). The system must effectively collect and safely disseminate run-off water from all accumulation points and prevent down slope erosion.	▪ Ensure that the storm water run-off control is included in the engineering design.	▪ Once-off during the planning and design phase.	▪ Project Developer
B. CONSTRUCTION PHASE					
7.2. Soil degradation as a result of erosion. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads.	Ensure that disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	▪ Implement an effective system of storm water run-off control, where required. The system must effectively collect and safely disseminate run-off water from all accumulation points and prevent down slope erosion.	▪ Undertake site inspections to verify the effectiveness and integrity of the storm water run-off control system and record any erosion on site or downstream. Corrective action must be implemented to the run-off control system if erosion occurs.	▪ Every 2 months during the construction phase	▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
7.3. Soil degradation as a result of erosion. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads.	Ensure that vegetation clearing does not pose a high erosion risk.	▪ Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.	▪ Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation.	▪ Every 3 months during the construction phase	▪ ECO
7.4. Increased wind erosion and resultant deposition of dust	Prevent wind erosion and resultant deposition of dust on surrounding indigenous vegetation.	▪ Sand, stone, and cement should be stored in demarcated areas, and covered or sealed to prevent wind erosion and resultant deposition of dust on the surrounding indigenous vegetation.	▪ Undertake regular inspections of the via site audits to verify that sand, stone, and cement are stored and handled as instructed.	▪ Daily	▪ ECO and Contractor
		▪ During construction, efforts should be made to retain as much natural vegetation as possible on the site, to reduce disturbed areas and maintain plant cover, thus reducing erosion risks.	▪ Monitor activities via site inspections and record and report non-compliance.	▪ Daily	▪ ECO and Contractor
		▪ All stockpiles must be protected from erosion and stored on flat areas where run-off will be minimised. Erosion and sedimentation into water bodies must be minimised through effective stabilisation.	▪ Monitor the stockpiling process throughout the construction phase via visual site inspections. Record non-compliance and incidents.	▪ Daily	▪ ECO
7.5. Excessive loss of natural vegetation within the development footprint area from erosion	Prevent loss of natural vegetation through erosion.	▪ Vegetation clearing during construction must be restricted to the footprint of the proposed project components and planned infrastructure only. It should be phased to ensure that the minimum area of soil is exposed to potential erosion at any one time.	▪ Monitor vegetation clearing throughout the construction phase via visual site inspections. Record non-compliance and incidents. ▪ Undertake regular monitoring for erosion to ensure is reduced and rectified as soon as possible.	▪ Daily ▪ Daily	▪ ECO and Contractor ▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Stockpile the shallow topsoil layer separately from the subsoil layers. Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas.	▪ Rehabilitate disturbed areas and monitor the presence of alien invasive species on site.	▪ Daily (stockpiling) and once-off for the reinstatement of the topsoil layer	▪ ECO and Contractor
		▪ Re-seed with locally sourced seed of indigenous vegetation species.	▪ Re-seed with seeds of indigenous grass species.	▪ Once off	▪ ECO with advice from a Terrestrial Ecology Specialist (if required)
		▪ Topsoil stockpiles not used in three months after stripping must be seeded to prevent dust and erosion.	▪ Regular monitoring for erosion to ensure that no erosion problems are occurring at the site. All erosion problems observed should be rectified as soon as possible.	▪ Weekly initially and thereafter monthly	▪ ECO and Contractor
7.6. Erosion of surface soils, rilling and gulleys.	Measures to be implemented that address or avoid the loss of surface soils and exacerbates gulley formation.	▪ Identify cause of erosion and possible means of redress (i.e., implement erosion control measures, where applicable), such as the use of geofabric, stone gabions and re-vegetation or similar measures. ▪ Erosion control measures should seek to reduce surface flow velocity and allow for settlement on site of silt laden surface waters. Washaways, excessive loss of soils and gulleys can be considered to be indicative of excessive erosion.	▪ Monitor the erosion on site during construction, as well as the implementation and effectiveness of erosion control on site (such as the use of geofabric, stone gabions and re-vegetation or similar measures).	▪ Ongoing and as required during erosion events.	▪ ECO and Project Developer
C. OPERATIONAL PHASE					
7.7. Soil degradation as a result of erosion. Erosion can occur as a result of the alteration of the land surface run-off characteristics.	Ensure that disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	▪ Maintain the storm water run-off control system. Monitor erosion and remedy the storm water control system in the event of any erosion occurring.	▪ Undertake site inspections to verify the effectiveness and integrity of the storm water run-off control system and record any erosion on site or downstream. Corrective action must be implemented to the run-	▪ Bi-annually	▪ Project Developer

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			off control system if erosion occurs.		
7.8. Soil degradation as a result of erosion. Erosion can occur as a result of the alteration of the land surface run-off characteristics.	That denuded areas are re-vegetated to stabilise soil against erosion.	▪ Facilitate re-vegetation of denuded areas throughout the site.	▪ Undertake a periodic site inspection to record the progress of all areas that require re-vegetation.	▪ Bi-annually	▪ Project Developer
7.9. Excessive loss of natural vegetation in the development footprint area and resulting impacts indigenous vegetation, faunal habitat, and habitat fragmentation.	Prevent loss of natural vegetation and minimise habitat fragmentation and the loss of connectivity as a result of erosion.	▪ The use of silt fences, sandbags or other suitable methods must be implemented in areas that are susceptible to erosion. All erosion control mechanisms need to be regularly maintained.	▪ Monitor efficiency of erosion control measures.	▪ Weekly or monthly	▪ Project Developer
		▪ Conduct regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. Ensure that all erosion problems are rectified as soon as possible.	▪ Undertake regular monitoring for erosion to ensure is reduced and rectified as soon as possible.	▪ Monthly	▪ Project Developer
D. DECOMMISSIONING PHASE					
7.10. Soil degradation as a result of erosion. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by decommissioning related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads.	Ensure that disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	▪ Implement an effective system of storm water run-off control, where required. The system must effectively collect and safely disseminate run-off water from all accumulation points and prevent down slope erosion.	▪ Undertake site inspections to verify the effectiveness and integrity of the storm water run-off control system and record any erosion on site or downstream. Corrective action must be implemented to the run-off control system if erosion occurs.	▪ Every 2 months during the decommissioning phase, and then every 6 months after completion of decommissioning, until final sign-off is achieved.	▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
7.11. Soil degradation as a result of erosion. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by decommissioning related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads.	Ensure that vegetation clearing does not pose a high erosion risk.	▪ Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.	▪ Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation.	▪ Every 4 months during the decommissioning phase, and then every 6 months after completion of decommissioning, until final sign-off is achieved.	▪ ECO

8. HAZARDOUS SUBSTANCES, SPILLS, POLLUTION PREVENTION AND INCIDENTS

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. CONSTRUCTION PHASE					
8.1. Contamination of soil and risk of damage to vegetation and/or fauna through spillage of concrete and cement.	To control concrete and cement batching activities in order to reduce spillages and resulting contamination of soil, groundwater and the vegetation and/or fauna.	▪ If any concrete mixing takes placed on site, this must be carried out in a clearly marked, designated area at the site camp on an impermeable surface (such as on boards or plastic sheeting and/or within a bunded area with an impermeable surface). ▪ Bagged cement must be stored in an appropriate facility and at least 10 m away from any water courses, gullies, and drains. ▪ A washout facility must be provided for washing of concrete associated equipment. Water used for washing must be restricted. ▪ Empty cement bags must be secured with adequate binding material if these will be temporarily stored on site. Empty cement bags must be collected from the construction area at the end of every day. Sand and aggregates containing cement must be kept damp to prevent the generation of dust. ▪ Hardened concrete from the washout facility or concrete mixer can either be reused or disposed of at an appropriate licenced disposal facility. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes. ▪ Any excess sand, stone and cement must be removed from site at the completion of the construction period and disposed at a licenced waste disposal facility. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes.	▪ Monitor the handling and storage of sand, stone and cement as instructed. ▪ Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Daily ▪ Monthly	▪ Project Developer Contractor and ECO ▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
8.2. Contamination of soil and risk of damage to vegetation and/or fauna through spillage of fuels and oils.	To control and eliminate fuel and oil spillages which may result in soil contamination and damage to vegetation and/or fauna.	▪ Ensure that adequate containment structures are provided for the temporary storage of liquid dangerous goods and hazardous materials on site (such as chemicals, oil, fuel, hydraulic fluids, lubricating oils etc.). Appropriate bund areas must be provided for the storage of these materials at the site camp. Bund areas should contain an impervious surface in order to prevent spillages from entering the ground. Bund areas should have a capacity of 110 % of the volume of the largest tank in the bund (tanks include storage of fuel/diesel). Leak detection monitoring systems must be implemented.	▪ Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents.	▪ Weekly	▪ Contractor and ECO
		▪ Monitor and inspect construction equipment and vehicles to ensure that no fuel spillage takes place. Ensure that drip trays are provided for construction equipment and vehicles as required.	▪ Monitor the construction equipment and vehicles and monitor the occurrence of spills and the management process thereof. ▪ Record all spills and lessons learnt.	▪ Daily ▪ During spill events	▪ Contractor and ECO ▪ ECO
		▪ Contractor to compile a Method Statement for refuelling activities under normal and emergency situations. If on-site servicing and refuelling is required in emergency situations, a designated area must be created at the construction site camp for this purpose. Drip trays or similar impervious materials must be used during these procedures.	▪ Verify if a Method Statement is compiled by reviewing approved and signed off reports. ▪ Monitor the refuelling/ servicing process and record the occurrence of any spillages.	▪ Once-off prior to commencement of construction. ▪ During emergency refuelling and servicing activities.	▪ ECO ▪ ECO
		▪ Spilled fuel, oil or grease must be retrieved, and contaminated soil removed, cleaned, and replaced. Record and report all significant fuel, oil, hydraulic fluid, or electrolyte spills or leaks so that appropriate clean-up measures can be implemented. A copy of these records must be made available to authorities on request throughout the project lifecycle.	▪ Monitor the handling and storage of fuels and oils via site audits and monitor and record if spillages have taken place and if so, are removed correctly and reported to authorities if significant. Monitor waste disposal slips and waybills via site audits	▪ Daily (or during spills)	▪ Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			and record non-compliance and incidents.		
		▪ Contaminated soil to be collected by the Contractor (under observation of the ECO) and disposed of at a registered waste facility designated for this purpose. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes.	▪ Monitor the correct removal of contaminated soil. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Daily (or during spills)	▪ Contractor and ECO
		▪ A Spill Response Method Statement must be compiled by the Contractor for the construction phase in order to manage potential spill events.	▪ Compile a Spill Response Method Statement. ▪ Audit signed and approved Spill Response Method Statement.	▪ Once-off (and thereafter updated as required during the construction phase). ▪ Once-off (and thereafter as required during the construction phase).	▪ Contractor and Project Developer, ECO
		▪ The Contractor must ensure that adequate spill containment and clean-up equipment are provided on site for use during spill events.	▪ Monitor via site audits and record incidents and non-compliance.	▪ Daily/Weekly	▪ ECO and Contractor
		▪ Portable bioremediation kit (to remedy chemical spills) is to be held on site and used as required.	▪ Ensure that a well-maintained portable bioremediation kit is available on site and that construction personnel and contractors are aware of its location and instructions	▪ Daily	▪ Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree and level of contamination, excavation and removal to a hazardous waste disposal facility could be necessary. If the spillage is widespread and the soil is considered to be significantly contaminated, a specialist will need to be immediately appointed to address the spillage. This will usually entail the collection of samples of the contaminated soil followed by analysis in terms of the 2014 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (i.e., GN 331). If the soil is determined to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant, including notifying the Minister of Environment, Forestry and Fisheries of the significant contamination.	▪ Ensure that a suitably qualified specialist is appointed to collect and analyse the contaminated soil samples in terms of the 2014 Norms and Standards (i.e., GN 331) in order to determine if the soil is significantly contaminated or not. ▪ If the contaminated soil is considered to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant.	▪ During spill events	▪ Project Developer
		▪ The Northern Cape Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform is to be immediately duly notified of any incident in terms of Section 30 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA). In terms of Section 30 of NEMA, an “incident” means an unexpected, sudden, and uncontrolled release of a hazardous substance, including from a major emission, fire, or explosion, that causes, has caused, or may cause significant harm to the environment, human life, or property. ▪ The Department of Human Settlements, Water and Sanitation must be immediately notified of any pollution to surface water or groundwater resources due to the proposed project activities.	▪ Ensure that this is undertaken via onsite inspections and reported to the authorities when required.	▪ Throughout construction	▪ ECO and Project Developer
		▪ The Contractor must record and document all significant spill events.	▪ Monitor documentation and records of significant spill events via audits and record non-compliance and incidents.	▪ During spill events	▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
8.3. Impacts as a result of emergencies or incidents	Emergency procedures are in place to enable a rapid and effective response to all types of environmental emergencies	▪ Compile an Emergency Response Action Plan (ERAP) prior to the commencement of the proposed project; ▪ The Emergency Plan must deal with accidents, potential spillages and fires in line with relevant legislation; ▪ All staff must be made aware of emergency procedures as part of environmental awareness training; ▪ The relevant local authority must be made aware of a fire as soon as it starts; ▪ In the event of emergency necessary mitigation measures to contain the spill or leak must be implemented.	▪ Compile an ERAP ▪ Ensure that this is adhered to via onsite inspections and reported to the authorities when required. ▪ Ensure that this is undertaken via onsite inspections and reported to the authorities when required. ▪ Have emergency response drills to ascertain readiness and preparedness in terms of an Emergency response.	▪ Once-off (and thereafter updated as required during the construction phase). ▪ Throughout construction ▪ Throughout construction	▪ Contractor and Project Developer, ECO ▪ Contractor and Project Developer, ECO ▪ Throughout construction
8.4. Impacts to the environment and injuries to people as a result of fires	Prevention of uncontrollable fires.	▪ Firefighting equipment must be available on all vehicles located on site; ▪ The local Fire Protection Agency (FPA) must be informed of construction activities; ▪ Contact numbers for the FPA and emergency services must be communicated in environmental awareness training and displayed at a central location on site; ▪ Two way swop of contact details between ECO and FPA.	▪ Ensure that this is in place via vehicle and onsite inspections and reported to the authorities when required. ▪ Inform the FPA of construction activities and swop contact details between ECO and FPAs	▪ Throughout construction ▪ At the start of construction	▪ ECO and Project Developer ▪ ECO
8.5. Risk of injury to public	All precautions are taken to minimise the risk of injury, harm or complaints.	▪ Identify fire hazards, demarcate and restrict public access to these areas as well as notify the local authority of any potential threats e.g. large brush stockpiles, fuels etc.; ▪ All unattended open excavations must be adequately fenced or demarcated; ▪ Adequate protective measures must be implemented to prevent unauthorised access to and climbing of partly constructed towers and protective scaffolding; ▪ Ensure structures vulnerable to high winds are secured; ▪ Maintain an incidents and complaints register in which all incidents or complaints involving the public are logged.	▪ Ensure all precautions and measures are in place to ensure the safety of the public ▪ Maintain and check an incidents and complaints register	▪ Throughout construction ▪ Throughout construction on a daily or weekly basis as applicable	▪ ECO and Project Developer ▪ ECO to report all incidents and complaints to the Project Developer

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
B. OPERATIONAL PHASE					
8.6. Contamination of soil and risk of damage to vegetation and/or fauna through spillage of fuels and oils	To control and eliminate fuel and oil spillages which may result in soil contamination and damage to vegetation and/or fauna.	▪ Monitor and inspect maintenance equipment and vehicles to ensure that no fuel spillage takes place.	▪ Implement specifications for maintenance equipment use as specified by the maintenance Contractor.	▪ Monthly	▪ Project Developer
		▪ Spilled fuel, oil or grease is retrieved during operations where possible and contaminated soil removed, cleaned, and replaced. ▪ Record and report all significant fuel, oil, hydraulic fluid, or electrolyte spills or leaks so that appropriate clean-up measures can be implemented. A copy of these records must be made available to authorities on request throughout the project lifecycle.	▪ Monitor the handling and storage of fuels and oils via site audits and monitor and record if spillages have taken place and if so, are removed correctly and reported to authorities if significant. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ During spills	▪ Project Developer
		▪ Contaminated soil to be collected by the Contractor and disposed of at a registered waste facility designated for this purpose. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes.	▪ Monitor the correct removal of contaminated soil. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ During spills	▪ Project Developer
		▪ A Spill Response Plan must be compiled for the operational phase in order to manage potential spill events.	▪ Compile a Spill Response Plan. ▪ Audit signed and approved Spill Response Method Statement.	▪ Once-off (and thereafter updated as required). ▪ Once-off (and thereafter as required).	▪ Project Developer ▪ Facility Manager
		▪ Ensure that adequate spill containment and clean-up equipment are provided on site for use during spill events. Portable bioremediation kit (to remedy chemical spills) is to be held on site and used as required.	▪ Ensure that a well-maintained portable bioremediation kit is available on site and that operational personnel are aware of its location and instructions.	▪ Weekly	▪ Facility Manager

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree and level of contamination, excavation and removal to a hazardous waste disposal facility could be necessary. If the spillage is widespread and the soil is considered to be significantly contaminated, a specialist will need to be immediately appointed to address the spillage. This will usually entail the collection of samples of the contaminated soil followed by analysis in terms of the 2014 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (i.e., GN 331). If the soil is determined to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant, including notifying the Minister of Forestry, Fisheries and the Environment, of the significant contamination. ▪ In the event of a spill, contaminated soil must be collected in containers and stored in a central location and disposed of according to the National Environmental Management: Waste Act 59 of 2008. Refer to Section 5.7 for procedures concerning storm and wastewater management and 5.8 for solid and hazardous waste management.	▪ Ensure that a suitably qualified specialist is appointed to collect and analyse the contaminated soil samples in terms of the 2014 Norms and Standards (i.e., GN 331) in order to determine if the soil is significantly contaminated or not. ▪ If the contaminated soil is considered to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant.	▪ During spill events	▪ Project Developer
		▪ An Alphabetical Hazardous Chemical Substance (HCS) control sheet must be drawn up and kept up to date on a continuous basis; ▪ All hazardous chemicals that will be used on site must have Material Safety Data Sheets (MSDS);	▪ Hazardous Chemical Substance (HCS) control sheet ▪ Material Safety Data Sheets (MSDS);	▪ Monthly and updated as required). ▪ Updated as required.	▪ Facility Manager ▪ Environmental Manager
		▪ The Northern Cape Department of Environmental Affairs and Nature Conservation is to be immediately duly notified of any incident in terms of Section 30 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA). In terms of Section 30 of NEMA, an “incident” means an unexpected, sudden, and uncontrolled release of a hazardous substance, including from a major emission, fire, or explosion, that causes, has	▪ Ensure that this is undertaken via onsite inspections and reported to the authorities when required.	▪ Throughout operations	▪ Environmental Manager

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		caused, or may cause significant harm to the environment, human life, or property. ▪ The Department of Human Settlements, Water and Sanitation must be immediately notified of any pollution to surface water or groundwater resources due to the proposed project activities.			
		▪ Ensure that adequate containment structures are provided for the temporary storage of liquid dangerous goods and hazardous materials on site (such as chemicals, oil, fuel, hydraulic fluids, lubricating oils etc.). Appropriate bund areas must be provided for the storage of these materials at the PV facility. Bund areas should contain an impervious surface in order to prevent spillages from entering the ground. Bund areas should have a capacity of 110 % of the volume of the largest tank in the bund (tanks include storage of fuel/diesel). Leak detection monitoring systems must be implemented. The floor of the bund must be sloped, draining to an oil separator. Bunded areas to be suitably lined with a SABS approved liner. ▪ Provision must be made for refueling at the storage area by protecting the soil with an impermeable groundcover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained; ▪ All empty externally dirty drums must be stored on a drip tray or within a bunded area; ▪ No unauthorised access into the hazardous substances storage areas must be permitted; ▪ No smoking must be allowed within the vicinity of the hazardous storage areas; ▪ Adequate fire-fighting equipment must be made available at all hazardous storage areas; ▪ Where refueling away from the dedicated refueling station is required, a mobile refueling unit must be used. Appropriate ground protection such as drip trays must be used;	▪ Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents.	▪ Weekly	▪ Facility Manager

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ An appropriately sized spill kit kept onsite relevant to the scale of the activity/s involving the use of hazardous substance must be available at all times; ▪ The responsible operator must have the required training to make use of the spill kit in emergency situations; ▪ An appropriate number of spill kits must be available and must be located in all areas where activities are being undertaken;			
8.7. Potential risk to employees due to incorrect handing of hazardous waste	Prevent injuries to employees	▪ All employees working with HCS must be trained in the safe use of the substance and according to the safety data sheet; ▪ Employees handling hazardous substances / materials must be aware of the potential impacts and follow appropriate safety measures. Appropriate personal protective equipment must be made available;	▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Environmental Manager ▪ Facility Manager
8.8. Impacts due to management solid and liquid wastes disposed of on the site during operational phase.	Prevent environmental impacts as a result of the operational phase such as pollution.	▪ All operation waste to be removed from the site by an appointed service provider.	▪ Waste removal and disposal to be monitored throughout operation.	▪ Monthly	▪ Facility Manager
		▪ All liquid waste or spills (used oil, paints, lubricating compounds and grease from vehicles passing through the entrance facility) to be packaged and disposed appropriately at a registered landfill site.	▪ Monitor the correct removal of liquid waste or spills. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ During spills	▪ Project Developer
		▪ Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided in order to avoid spillages.	▪ Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents.	▪ Weekly	▪ Facility Manager
C. DECOMMISSIONING PHASE					
8.9. No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area.					

9. ENVIRONMENTAL AWARENESS AND FIRE MANAGEMENT PLAN

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. PLANNING AND DESIGN PHASE					
9.1. Potential impacts resulting from the lack of overall compliance with the conditions of the EA (issued by the DFFE)	Ensure compliance with all environmental conditions of approval (issued by the DFFE as part of the EA).	▪ Audit the implementation of the EMPr requirements.	▪ Audit report on compliance with actions and monitoring requirements.	▪ Weekly	▪ Project Developer
		▪ Establish clear and transparent reporting of the activities undertaken with regard to all recommendations included in the EMPr.	▪ Audit report on compliance with actions and monitoring requirements.	▪ Weekly	▪ Project Developer
B. CONSTRUCTION PHASE					
9.2. Potential risk of fire due to construction activities or behaviour of staff on site during the construction phase	Prevent fire on site resulting of workers smoking or starting fires (i.e., cooking, heating purposes).	▪ Designate smoking areas, as well as areas for cooking, where the fire hazard could be regarded as insignificant.	▪ Ad-hoc checks to ensure workers are smoking or cooking in designated areas only.	▪ Daily	▪ ECO and Contractor
		▪ Educate workers on the dangers of open and/or unattended fires.	▪ Ensure fire safety requirements are well understood and respected by construction personnel. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Ongoing. ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ ECO and Contractor ▪ Contractor/ ECO ▪ ECO
		▪ Prohibit open fires. Appropriate fire safety training should also be provided to staff that are to be on the site for the duration of the construction phase.	▪ Ensure fire safety requirements are well understood and respected by construction personnel. Provide basic fire safety training.	▪ On-going	▪ ECO and Contractor
		▪ Ensure that cooking takes place in a designated area shown on the site map. Ensure that no firewood or kindling may be gathered from the site or surrounds.	▪ Check compliance with specified conditions using a report card and allocate fines when necessary.	▪ On-going	▪ ECO and Contractors

Impact		Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
				Methodology	Frequency	Responsibility
			▪ Fire-fighting equipment must be made available at various appropriate locations on the construction site.	▪ Ensure fire safety requirements are well understood and respected by workers. ▪ Assurance of functionality of fire extinguishers via inspections and certification by an accredited fire service company.	▪ On-going ▪ Bi-annually	▪ ECO and Contractor ▪ Contractor
9.3.	Inappropriate behaviour of civil contractors and sub-contractors during the construction phase	Prevent unnecessary impacts on the surrounding environment by ensuring that contractors are aware of the requirements of the EMPr. Ensure that contractors and sub-contractors do not induce impacts on the surrounding environment as a result of unplanned pollution on site. Ensure that actions by on-site contractors and sub-contractors and workers are properly managed in order to minimise impacts to surrounding environment.	▪ Ensure that the EMPr and the EA (should it be granted), are included in all tender documentation and contractors and sub-contractors' contracts.	▪ Check compliance with specified conditions using a report card and allocate fines when necessary.	▪ On-going	▪ ECO and Contractors
			▪ Contractors and sub-contractors must use the ablution facilities situated in a designated area within the site; and no bathing/washing should be permitted outside the designated area. ▪ Portable chemical toilet/s (ablution facilities) at the construction camp, must be serviced weekly for the duration of the construction phase. ▪ Care should be taken with the installation of conservancy tanks to prevent cracks that could lead to leaks over time. Proper and regular servicing must be scheduled to prevent possible groundwater contamination.	▪ Check compliance with specified conditions using a report card and allocate fines when necessary.	▪ On-going	▪ ECO and Contractor
			▪ All litter will be deposited in a clearly labelled, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.	▪ Check compliance with specified conditions using a report card and allocate fines when necessary.	▪ On-going	▪ ECO and Contractors
			▪ No person other than qualified specialist or personnel authorised by the Project Developer, will disturb, or remove plants outside the demarcated construction area.	▪ Check compliance with specified conditions using a report card and allocate fines when necessary.	▪ On-going	▪ ECO and Contractors
			▪ No person other than qualified specialist or personnel authorised by the Project Developer, will disturb animals on the site.	▪ Check compliance with specified conditions using a report card and allocate fines when necessary.	▪ On-going	▪ ECO and Contractors

Impact		Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
				Methodology	Frequency	Responsibility
			▪ Educate workers on site about suitable behaviour on site and initiate environmental awareness. Staff must be informed that no trapping, snaring, or feeding of any animal will be allowed.	▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Contractor/ ECO ▪ ECO
9.4.	Inappropriate planning of site camp establishment.	Ensure that environmental issues are taken into consideration in the planning for site establishment.	▪ All construction activities, materials, equipment, and personnel must be restricted to the actual construction area specified (as required to undertake the construction work), which includes the project footprint area and access roads. The construction area must be demarcated by the Contractor (excluding the access roads).	▪ Monitor compliance and record non-compliance and incidents.	▪ Before construction	▪ ECO
			▪ The Contractor should install and maintain Construction Site Information Boards in the position, quantity, design, and dimensions specified by the Project Developer.	▪ Monitor compliance and record non-compliance and incidents.	▪ Before construction	▪ ECO
			▪ General building materials should be stored in appropriate designated areas on site such that there will be no runoff from these areas towards sensitive systems. The site camp must be removed after construction.	▪ Monitor compliance and record non-compliance and incidents.	▪ Before construction	▪ ECO
9.5.	Increased animal road mortality	Reduction in animal mortality	▪ The construction staff should be made aware of the presence of fauna and within the proposed project area. The construction personnel and staff must also be made aware of the general speed limits on site and must be alert at all times for potential crossings and should be trained on how to react in these situations.	▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Contractor/ ECO ▪ ECO
			▪ To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the site camp must be kept clean on a daily basis.	▪ Monitor the activities via visual inspections, and record and report any non-compliance.	▪ Daily	▪ Contractor and ECO

Impact		Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
				Methodology	Frequency	Responsibility
			▪ Establish a monitoring programme to record the number of faunal road mortalities and collisions. If it is established that the number of collisions and faunal fatalities increase within a specific area, then identify appropriate actions such as additional road signage and driver education to raise awareness.	▪ Appropriate monitoring and recording of mortalities should be undertaken. ▪ Additional signage and driver education to be implemented if required.	▪ Weekly ▪ As required	▪ ECO ▪ ECO and Contractor
9.6.	Increased energy consumption during the construction phase.	Reduce energy consumption where possible.	▪ Encourage the use of energy saving equipment at the site camp site (such as low voltage lights and low pressure taps) and promote recycling. Construction personnel must be made aware of energy conservation practices as part of the Environmental Awareness Training programme.	▪ Contractor to monitor energy usage via audits. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Monthly ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Contractor ▪ Contractor/ ECO ▪ ECO
9.7.	Impact on the regional water balance as a result of increased water usage.	Reduce water usage during the construction phase.	▪ Water conservation should be practiced as follows: ▪ Cleaning methods utilised for cleaning vehicles, floors, etc. should aim to minimise water use (e.g., sweep before wash-down). ▪ Ensure that regular audits (i.e., twice weekly) of water systems and all water-related infrastructure (e.g., pipes, pumps, reservoirs, toilets, taps, etc.) are conducted to identify possible water leakages. Such infrastructure must be immediately repaired. ▪ Avoid the use of potable water for dust suppression during the construction phase and consider the use of alternative approved sources, where possible.	▪ Monitor via site audits and record non-compliance and incidents.	▪ Monthly	▪ ECO
			▪ Make construction personnel aware of the importance of limiting water wastage, as well as reducing water use.	▪ Carry out Environmental Awareness Training with a discussion on water usage and conservation. ▪ Conduct audits of the signed attendance registers.	▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Contractor/ ECO ▪ ECO

Impact		Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
				Methodology	Frequency	Responsibility
C. OPERATIONAL PHASE						
9.8.	Potential risk of fire due to behaviour of staff on site during the operational phase	Ensure appropriate and efficient fire prevention during the operational phase.	▪ Designate smoking areas as well as areas for cooking, where the fire hazard could be regarded as insignificant.	▪ Random inspections during a month to ensure workers are smoking or starting fires in designated areas only.	▪ Monthly	▪ Facility Manager
			▪ Educate workers on the dangers of open and/or unattended fires.	▪ Ensure fire safety requirements are well understood and respected by operational personnel. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Ongoing ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Facility Manager ▪ Facility Manager ▪ Facility Manager
			▪ Prohibit open fires. Appropriate fire safety training should also be provided to staff that are to be on the site for the duration of the operational phase.	▪ Ensure fire safety requirements are well understood and respected by operational personnel. Provide basic fire safety training.	▪ On-going	▪ Project Developer
			▪ Ensure that adequate fire-fighting equipment is available and easily accessible on site.	▪ Ensure fire safety requirements are well understood and respected by workers. ▪ Assurance of functionality of fire extinguishers via inspections and certification by an accredited fire service company.	▪ On-going ▪ Bi-annually	▪ Facility Manager ▪ Project Developer
9.9.	Increased energy consumption during the operational phase.	Reduce energy consumption where possible.	▪ Encourage the use of energy saving equipment at the PV facility (such as low voltage lights and low-pressure taps) and promote recycling. Operational personnel must be made aware of energy conservation practices as part of the environmental awareness training programme.	▪ Monitor energy usage via site investigations. ▪ Conduct training for all operational personnel.	▪ Monthly ▪ As and when required and ensure that all new staff are inducted.	▪ Facility Manager ▪ Project Developer
9.10.	Impact on the regional water balance as a result of increased water usage.	Reduce water usage during operations.	▪ Water conservation to be practiced in line with Energy Saving Policies as follows: ▪ Cleaning methods utilised for cleaning vehicles, floors, the offices etc. should aim to minimise water use (e.g., sweep before wash-down). ▪ Where possible, encourage the re-use of water.	▪ Record water usage during the operational phase, conduct audits and record non-compliance and incidents.	▪ Monthly	▪ Facility Manager

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Ensure that regular audits (i.e., twice weekly) of water systems and all water-related infrastructure (e.g., pipes, pumps, reservoirs, toilets, taps, etc.) are conducted to identify possible water leakages. Such infrastructure must be immediately repaired. ▪ Consider installing water saving devices (e.g., dual flush toilets, automatic shut-off taps, etc.).			
		▪ Carry out environmental awareness training with a discussion on water usage and conservation and make operational personnel aware of the importance of limiting water wastage.	▪ Conduct training for all operational personnel.	▪ As and when required during operations and ensure that all new staff are inducted.	▪ Facility Manager
9.11. Non respect of waste management practices	Minimise the production of general waste. Ensure compliance with relevant waste management legislation. Minimise pollution of the environment.	▪ Control and implement waste management plans. Ensure that relevant legislative requirements are respected. ▪ Determine specific areas on site for temporary management of waste.	▪ Control of waste management practices throughout operation phase.	▪ Monthly	▪ Facility Manager
		▪ Promote waste reduction, re-use, and recycling opportunities on site during the operational phase. ▪ Ensure an adequate and sustainable use of resources.	▪ Monitor waste generation and collection throughout operation.	▪ Monthly	▪ Facility Manager
9.12. Excessive generation of wastewater on site during the operation phase	Maintain reasonable levels of wastewater generation	▪ Wastewater must be collected and disposed of at a suitable licenced disposal facility. Proof of disposal (i.e., waste disposal slips or waybills) should be retained on file for auditing purposes.	▪ Wastewater generation to be monitored throughout the operational phase. ▪ Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Quarterly	▪ Facility Manager
D. DECOMMISSIONING PHASE					
9.13. Ensure that the construction mitigation and management measures are adhered to during the decommissioning phase.					

10. SPECIFIC PROJECT RELATED ENVIRONMENTAL IMPACTS

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. PLANNING AND DESIGN PHASE					
A.1. AGRICULTURE AND SOILS IMPACTS					
10.1. Erosion	That disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	▪ Design an effective system of stormwater run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points and it must prevent any potential down slope erosion. This is included in the stormwater management plan.	▪ Ensure that the stormwater run-off control is included in the engineering design.	▪ Once-off during the design phase.	▪ Holder of the EA
A.2. VISUAL IMPACTS					
10.2. Potential visual intrusion of construction and operational activities on visual receptors.	Minimise exposure of visual receptors to visual impacts.	▪ Review signed off designs to ensure that: o The substation and BESS are located in an unobtrusive low-lying area, away from public roads, where possible. o Muted natural colours and non-reflective finishes are used for structures generally. o Internal access roads are designed to be as narrow as possible, and existing roads or tracks used as far as possible. o Outdoor/security lighting to be fitted with reflectors to obscure the light source, and minimise light spillage. o Internal powerlines (i.e. 22 kV or 33 kV) to be located underground where possible (in certain cases, such as stream crossings, internal	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ During the planning and design phase and before construction commences.	▪ Project Developer and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		powerlines may need to be aboveground). ○ Outdoor signage to be discrete and commercial / billboard signage avoided.			
A.3. TERRESTRIAL BIODIVERSITY AND SPECIES IMPACTS					
10.3. Impact and loss of fauna as a result of operational activities	To reduce the loss of and impact on fauna	▪ Provide critter paths through the fence line to allow species access to site and in order to escape. ▪ Ensure that the live electrical fence wire is not placed at ground level. ▪ Reduce direct mortalities by allowing for fauna to cross the roads. Where applicable, this can be achieved by constructing fauna underpasses under the roads (large culverts or large open-ended concrete pipes laid into the raised roads). These underpasses should be used in conjunction with "fauna barriers" which prevent the most susceptible small fauna from crossing the roads on the surface by directing them towards the underpasses where they can cross under the roads safely. It is important to note that utilization of underpasses is strongly dependent on animal body size (larger culverts are more successful) and the surrounding habitat. ▪ Reduce exterior lighting to that necessary for safe operation and implement operational strategies to reduce spill light. Use down-lighting from non-UV lights* where possible, as light emitted at one wavelength has a low level of attraction to insects. This will reduce the likelihood of attracting insects and their predators. Insects generally see 3 colours of light, Ultraviolet (UV), blue and green. Bright white or bluish lights (mercury vapor, white	▪ Identify where fauna may be affecting operations of site (burrows etc.). Consider redress if necessary. ▪ Include paths through the fence line, where appropriate. Generally, this should be done towards natural areas and away from construction sites and busy roads. ▪ Ensure that this is taken into consideration during the design phase by reviewing the signed off plans for such underpasses, where possible. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off	▪ Project Developer, Engineers

Impact		Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
				Methodology	Frequency	Responsibility
			incandescent and white florescent) are the most attractive to insects. Yellowish, pinkish, or orange (sodium vapor, halogen, dichroic yellow) are the least attractive to most insects.			
10.4.	Destruction / clearance of indigenous and protected vegetation	Ensure compliance with relevant Provincial and National legislation in respect of habitat and species permits.	▪ Ensure the necessary permits or licenses are identified and applied for as applicable for removal of indigenous vegetation, especially for protected species. Provincially protected species must be avoided during the construction activities where it will be impacted on by construction activities. Alternatively, permits for the rescue i.e. removal and translocation or destruction, where relevant, of any of these protected species must be applied for and granted by the provincial authority. ▪ Await response and provision of permit (as required) from the relevant Authorities prior to the removal of the indigenous species (if required). Once these permits are obtained, search and rescue must be undertaken for the relevant indigenous species prior to the commencement of construction activities.	▪ Review the findings of the Specialist Assessments and consider legislative requirements in respect of loss of indigenous and protected vegetation. ▪ Review the approved site plan with the ECO and appoint a suitable terrestrial ecologist to undertake a walk-through of the final approved site layout prior to construction. ▪ Contact the relevant Provincial and National Environmental Authorities to discuss and confirm if any protected species need to be relocated or rescued and undertake the required permit application processes. ▪ Appoint a suitable specialist and/or contractor to undertake plant search and rescue for the plants earmarked for removal and/or relocation as per the approved permits.	▪ Once-off	▪ Project Developer and ECO/Specialist/ Contractor
10.5.	Impact on ecological succession and animal re-colonisation	Allow for ecological succession and animal re-colonisation.	▪ Apply appropriate space between consecutive PV panels to allow for sunlight to reach the basal vegetation and monitor ecological succession and animal re-colonisation.	▪ Implement appropriate spacing between consecutive PV panels and verify that this is undertaken by reviewing the approved designs.	▪ Once-off	▪ Project Developer
10.6.	Loss of natural vegetation in and outside development footprint	Reduced loss of natural vegetation and veld degradation within the	▪ Ensure that the footprint required for the proposed project activities is kept at a minimum.	▪ Verify that the proposed project area is determined and outlined prior to the commencement of	▪ Once-off	▪ Project Developer, ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
area and veld degradation.	development footprint and the surrounding area.		the construction phase by undertaking visual inspections.		
		▪ No BESS is located in a sensitive area, but all are located within the grassland. Accordingly, the necessary measures need to be put in place to limit potential fires, including *considering* a fire break, *if possible*, around each Kudu PV facility (**this is a worst-case scenario**). A fire break is considered as a natural or constructed barrier used to stop or check fires that may occur.	▪ Potentially consider this during the planning and design phase.	▪ During the design cycle and before construction commences.	▪ Project Developer
A.4. AQUATIC BIODIVERSITY AND SPECIES IMPACTS					
10.7. Potential impact on freshwater ecology as a result of the proposed PV and associated infrastructure.	Limit the disturbance of aquatic habitats. Minimise potential to modify flow/hydraulics-related impacts and increase the potential for erosion.	▪ Ensure the final layout of the PV facility and associated infrastructure avoids watercourses and recommended buffers as far as possible; utilisation should be made of existing disturbed areas where possible. The medium-sensitivity aquatic habitats should be avoided in the layout design, with only low-sensitivity habitats being disturbed during construction. Note that this has been achieved in the EIA Phase, whereby the recommended development setbacks (i.e. recommended setback from the wider floodplain adjacent to the larger rivers) have been adopted in the identification of the development footprints. The recommended avoidance areas have been avoided. ▪ Some access roads do cross water courses for the entire project, which would be acceptable provided the recommended mitigation is implemented. For road crossings, the sensitivities are not regarded as no-go. ▪ Construction sites and laydown areas should be located within the assessed buildable areas/development footprints.	▪ Ensure that this is taken into consideration during the planning and design phase.	▪ During the design cycle and before construction commences.	▪ Holder of the EA

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ A comprehensive stormwater management plan should be compiled for the compacted surfaces within the site by the project engineer with input from the freshwater specialist. The plan should aim to reduce the intensity of runoff from the developed area, particularly on the steeper slopes and reduce the intensity of the discharge into the adjacent drainage lines. Where necessary measures to dissipate flow intensity or protect erosion should be included in the plan. The plan should encourage infiltration rather than runoff and should prevent the impedance of surface or sub-surface flows. The plan should also mitigate any contaminated runoff from the construction and operation activities from being discharged into any of the aquatic features within the site. ▪ Stormwater run-off infrastructure must be designed to mitigate both the flow and water quality impacts of any stormwater leaving the developed areas. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate shaping of the road with berms or channels and swales adjacent to hardened surfaces where necessary. Should any erosion features develop, they should be stabilised immediately. ▪ Adequate erosion mitigation measures should be incorporated into designs. ▪ Use existing crossings, as best as possible and where allowable. The existing road infrastructure, particularly within the floodplain, should be utilised as far as possible to access new infrastructure to minimise the overall disturbance. It is recommended that any new			

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		linear type of infrastructure crossings over watercourses be placed where there are existing structures or road crossings within the watercourse corridors, where possible. For any new infrastructure placed within the watercourses: The structure should not impede or concentrate the flow in the watercourse, and should prevent blockages and erosion. It is recommended that low-water crossings should be utilised. Any rubble or waste associated with the construction works within the aquatic features should be removed once construction is complete. ▪ A sustainable water supply should be sought. Water consumption requirements for the construction and operation of the proposed project if not obtained from an authorised water user within the area, must be authorised by the Department of Water and Sanitation (DWS). ▪ No liquid waste should be discharged into any of the aquatic features within the site without the approval of the DWS. Wastewater should be properly contained on-site and removed to a licensed wastewater treatment facility that can treat the wastewater.			
A.5. AVIFAUNA IMPACTS					
10.8. Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Prevent mortality of avifauna	▪ A single perimeter fence should be used[4].	▪ Design the facility with a single perimeter fence.	▪ Once-off during the planning phase.	▪ Project Developer

[4] If a fence is used consisting of an outer diamond mesh fence and inner electric fence with a separation distance of approximately 100 mm or less, it should not pose any risk of entrapment for large terrestrial species and can be considered a single fence.

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
10.9. Displacement of avifauna due to disturbance during construction activities.	Prevent displacement of avifauna	▪ A 1 km all infrastructure exclusion zone around the Verreaux's Eagle nest at -30.227660° 24.329773° must be implemented to provide unhindered access to the nest (Refer to the sensitivity maps provided in the Avifauna Specialist Assessment Report). ▪ Where possible, surface water (pans, dams and water troughs) must be buffered by a minimum of 50m to ensure unhindered access of priority species to the water. No PV panels should be constructed in this zone (Refer to the sensitivity maps provided in the Avifauna Specialist Assessment Report). Note that some of the waterpoints in the study area[5] may be removed (as discussed and agreed with the landowners), however, since the minimum circular solar panel exclusion zone of 50m will be applied, the removal of some of the waterpoints will therefore not be a significant impact.	▪ Design the facility with a 1km all infrastructure exclusion zone around the Verreaux's Eagle nest at -30.227660° 24.329773° to provide unhindered access to the nest. ▪ Design the facility with minimum 50m buffer zones around pans, dams and selected water troughs as delineated by the avifauna specialist.	▪ Once-off during the planning phase.	▪ Project Developer
10.10. Electrocution of priority species on the internal 33kV network.	Prevention of electrocution mortality	▪ Design the facility with underground cables as much as possible. ▪ A raptor-friendly pole design must be used, and the pole design must be approved by the avifaunal specialist.	▪ Design the facility with underground cabling and where impractical, use a bird friendly pole design approved by the avifaunal specialist.	▪ Once-off during the planning phase.	▪ Project Developer
A.6. SOCIO-ECONOMIC IMPACTS					
10.11. Creation of local employment, training, and business opportunities and impact of construction workers on local communities	Maximise potential job creation and business opportunities for locals	▪ Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. ▪ Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the	▪ Review the labour and contractor policy	▪ Once-off during the planning and design phase.	▪ Project Developer

[5] Note that waterpoints may be removed from the development footprint for Kudu Solar Facility 4, Kudu Solar Facility 5, Kudu Solar Facility 7, Kudu Solar Facility 8 and Kudu Solar Facility 10 specifically.

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area. ▪ Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. ▪ Before the construction phase commences (i.e. during the planning phase), the proponent should meet with representatives from the Renosterberg Local Municipality (RLM) and Emthanjeni Local Municipality (ELM) to establish the existence of a skills database for the area. If such as database exists, it should be made available to the contractors appointed for the construction phase. ▪ The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project. ▪ Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase. ▪ The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. ▪ The proponent should liaise with the RLM and ELM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste			

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		collection companies, security companies etc.) prior to the commencement of the tender process for construction service providers. These companies should be notified of the tender process and invited to bid for project-related work.			
A.7. IMPACTS RESULTING FROM THE BATTERY ENERGY STORAGE SYSTEMS (BESS)					
10.12. Safety, health and environmental impacts as a result of the Solid State Lithium Ion Battery Energy Storage System (BESS) and Redox Flow BESS	Minimise the safety, health and environmental risks associated with the BESS	▪ Consider the findings and recommendations of the High-Level Safety, Health and Environment Risk Assessment compiled for the BESS. Refer to Appendix D of this EMPr for a detailed list of preventative and mitigation measures for the BESS.	▪ Conduct audits to verify if the preventative and mitigation measures have been considered and implemented, where relevant and required, during the design phase. Report any non-compliance.	▪ As required during the design phase	▪ Project Developer and ECO
A.8. GEOHYDROLOGICAL IMPACTS **Note from the CSIR: The use of existing boreholes to source groundwater (if available and suitable) is only the third most likely water use option. Water sourced from the local municipality is the first option in terms of viability and the second is to source water from a third party, but consideration of other options is vital. Potential environmental impacts pertaining to local groundwater resources have been considered in the EIA, and various management inputs have been recommended to ensure safe and sustainable management of the groundwater resources in the area. However, these impact management actions are not mandatory if water is indeed sourced from the local municipality or via a third party. The recommendations in this section only apply if groundwater will be used for the project. The management inputs are captured in two phases. Phase 1 will be required to determine if the groundwater is of a suitable quality and quantity; and Phase 2 will only be required if the groundwater quality and quantity are determined more accurately and confirmed it is suitable for use.**					
10.13. Lowering of groundwater levels as a result of over-abstraction	Avoid over-abstraction of groundwater resources.	▪ Undertake a **Phase 1** programme to determine if the groundwater is of a suitable quality and quantity for use during construction, operations and decommissioning. The following should be undertaken: • Undertake a full laboratory analysis to confirm that the groundwater can be used for potable and domestic purposes, and determine the treatment required. This Geohydrology Assessment has confirmed that the groundwater is generally of good quality in terms of pH, EC and TDS. • The water quality is not considered suitable for panel washing as it will result	▪ Ensure that this is taken into consideration and that a Geohydrology Specialist with suitable qualifications and experience is appointed to undertake relevant tests by reviewing signed minutes of meetings or signed reports or the appointment letter. ▪ Ensure that the borehole parameters are documented to ensure trends and consumption can be monitored.	▪ As required	▪ Project Developer, Specialist, and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		in salts precipitating on the panels. The salts could be removed from the groundwater by thermal distillation (i.e. boiling since salt has a much higher boiling point than water) or by membrane separation (commonly reverse osmosis). Confirm what mechanisms could be used to remove the salts from the groundwater for panel cleaning. This will entail undertaking a financial viability investigation / feasibility study. • Undertake necessary tests to confirm if the groundwater is suitable for construction and concrete batching. • Conduct scientific yield tests to determine sustainable abstraction volumes from boreholes that are to be utilised. ▪ Undertake a **Phase 2** programme once the groundwater quality and quantity are determined more accurately and confirmed it is suitable for use. The following steps will be required for sustainable management of ground water resources: • Acquire any historical monitoring data for the region. • Determine the volume of groundwater abstracted by farmers annually prior to construction by flow meters. • Ensure water saving techniques are instated and adhered to. • Ensure that proper bunding and secondary containment measures are in place for BESS facilities and are designed by an appropriate competent person.	▪ Undertake an audit to verify if the monitoring programme is being implemented.		

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		• Ensure that environmentally safe cleaning agents that breakdown naturally and do not cause adverse effects are used. • In the event that the entire Kudu Solar Facility development is constructed simultaneously, adherence to the recommended mitigation measures should be strictly followed to prevent over-abstraction. • Instate an appropriate monitoring program including monitoring of groundwater quality, water levels (ideally by water level loggers and hand readings using a dip meter), and abstracted volumes. These data should be reported on at the least biannually. • Yield test all monitoring boreholes according to SANS 10299-4:2003, Part 4 – Test pumping of water boreholes. This includes a Step Test, Constant Discharge Test and recovery monitoring.			
10.14. Potential impact on groundwater quality as a result of electrolyte that will be used for the BESS	Minimise the potential of groundwater contamination	▪ It is recommended that all BESS is placed a minimum of 50m from any borehole.	▪ Ensure that this is taken into consideration in the design (note this has already been complied with)	▪ Once-off during the design phase	▪ Project Developer
A.9. GEOTECHNICAL IMPACTS					
10.15. Displacement of geologic material	Manage displacement of geological materials, and thus disturbance of existing soil conditions, impact on vegetation and potential soil erosion.	▪ Stormwater Management Plan must be developed in the pre-construction phase by a qualified professional. It should detail the stormwater structures and management interventions that must preferably be installed to manage the increase of surface water flows directly into any natural systems, where possible and lawful (in consultation with suitably qualified professionals). Effective stormwater management must include	▪ Ensure that this is taken into consideration during the design phase by appointing the relevant specialists, and reviewing the signed off stormwater management plan and detailed designs.	▪ Once off prior to construction	▪ Project Developer and Specialist

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		effective stabilisation (e.g., gabions and Reno mattresses) of exposed soil. ▪ Ensure that the design allows for suitable stormwater management systems to be installed along roads and other areas in order to divert water away from zones where the solar infrastructure is to be constructed. Drainage systems should be designed by an appropriately qualified professional. Drainage in the region should be designed appropriately.			
		▪ Investigate and confirm the geotechnical suitability of each structure (or other appropriate level of investigation) prior to construction (i.e., determine that soil with an adequate bearing capacity is obtained beneath each footing). Such investigations would not be required to fulfil the requirements of this Environmental Impact Assessment (EIA) process. However, it would be necessary prior to construction. ▪ The seismicity in the region should be considered during design. ▪ Favour dolerite as an aggregate (as opposed to Karoo sandstones and mudstones). Subject to investigation. ▪ Any road cuttings should be designed by and appropriately qualified professional.	▪ Ensure that this is taken into consideration during the design phase by appointing the relevant specialists and contractors, and reviewing the signed off geotechnical reports and designs.	▪ Once off prior to construction	▪ Project Developer, Contractor and Specialist
10.16. Contamination of geologic materials	To minimize the contamination of geologic materials caused by spillages/leakages	▪ Suitably designed bunding structures, double containment and leak detection to be implemented at the BESS to mitigate potential electrolyte spillage. It is recommended that the design should be approved by a qualified professional.	▪ Ensure that this is taken into consideration during the design phase.	▪ Once off prior to construction	▪ Project Developer
B. CONSTRUCTION PHASE					
B.1. AGRICULTURE AND SOILS IMPACTS					

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
10.17. Erosion	That disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	▪ Implement an effective system of stormwater run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points and it must prevent any potential down slope erosion.	▪ Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the stormwater run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	▪ Every 2 months during the construction phase	▪ ECO
10.18. Erosion	That vegetation clearing does not pose a high erosion risk.	▪ Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.	▪ Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation.	▪ Every 4 months during the construction phase	▪ ECO
10.19. Topsoil loss	That topsoil loss is minimised	▪ If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	▪ Record GPS positions of all significant occurrences (that is an area of greater than 25 square metres) of below-surface soil disturbance (e.g., excavations). Record the date of topsoil stripping and replacement. Check that topsoil covers the entire disturbed area.	▪ As required, whenever areas are disturbed.	▪ ECO
B.2. VISUAL IMPACTS					
10.20. Potential visual effect of construction activities, haul roads, access roads, stockpiles and construction camps in the visually exposed landscape and the potential effect of dust and noise from trucks and construction machinery during the construction period, and the	To minimise visual impacts on the exposed landscape, nearby farmsteads and visitors to the area	▪ Ensure that visual management measures are included as part of the EMPr and monitored by an ECO. ▪ Ensure construction camps, stockpiles, temporary laydown areas and batching plants are located in visually unobtrusive areas, away from public roads and outside of identified no-go areas unless otherwise approved by the visual specialists.	▪ Conduct site inspections to monitor implementation and report any non-compliance.	▪ Weekly	▪ ECO / Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
effect of this on nearby farmsteads and visitors to the area.		▪ Implementation of dust suppression and litter control measures. ▪ Rehabilitation efforts to commence immediately after construction activities are completed.			
B.3. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
10.21. Damage or destruction of archaeological sites or graves	Rescue information, artefacts or burials before extensive damage occurs	▪ Reporting chance finds of graves and dense clusters of artefacts as early as possible to an archaeologist and/or the South African Heritage Resources Agency (SAHRA) (https://www.sahra.org.za/contact/), protect in situ and stop work in immediate area and appoint archaeologist to exhume or sample as needed (where relevant).	▪ Inform staff to be vigilant and carry out inspections of all new excavations	▪ Ongoing basis ▪ Whenever on site (at least weekly)	▪ Construction Manager or Contractor ▪ ECO
10.22. Visible landscape scarring	Minimise landscape scarring	▪ Ensure disturbance is kept to a minimum and does not exceed project requirements. Minimise the duration of the activities. At the end of the construction period, rehabilitate areas, not needed during operation.	▪ Monitoring of surface clearance relative to approved layout	▪ Ongoing basis ▪ As required	▪ Construction Manager or Contractor ▪ ECO
B.4. PALAEONTOLOGY IMPACTS					
10.23. Damage or destruction of palaeontological materials in excavations *Note: The study area is deemed Low to Very Low palaeosensitivity in general. However, the potential for rare, largely unpredictable fossil sites (e.g. mammalian bones, teeth, horncores, non-marine molluscs, calcretised termitaria) of High palaeosensitivity associated with older alluvial and pan deposits hidden in the subsurface cannot be discounted.*	Safeguarding, recording, and sampling of palaeontological materials encountered or exposed during construction (Chance Fossil Finds)	▪ If any fossiliferous deposits are exposed by surface clearance or excavations during the construction phase of the development, the Chance Fossils Finds Protocol outlined in Appendix C of this EMPr must be fully implemented. The ECO must familiarise themselves with the Chance Fossils Finds Protocol and ensure that it is kept on file on site. ▪ The ECO should be made aware of the possibility of important fossil remains being found or unearthed during the construction phase. Ensure that monitoring of all bedrock excavations (> 1 m) and major cleared sites for fossil remains is undertaken on an on-going	▪ Ensure that the Chance Fossil Finds Protocol is implemented if any fossiliferous deposits are exposed or during chance fossil finds. Undertake inspections and report any non-compliance. ▪ Regular visual inspection of substantial excavations (> 1 m) and cleared areas for fossil remains. ▪ The immediate area of the fossil find must be safeguarded with security tape / fence / sand bags if necessary.	▪ Ongoing during the construction phase	▪ ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		basis by the ECO during the construction phase. ▪ Significant fossil finds should be safeguarded and reported as soon as possible to the South African Heritage Resources Agency (SAHRA) (Contact details: 111 Harrington Street, Cape Town, 8001. PO Box 4637, Cape Town, 8000. Tel: 021 462 4502. Fax: 021 462 4509. Email: info@sahra.org.za).			
B.5. TERRESTRIAL BIODIVERSITY AND SPECIES IMPACTS					
10.24. Loss of natural vegetation in and outside development footprint area and veld degradation.	Reduced loss of natural vegetation and veld degradation within the development footprint and the surrounding area.	▪ Sensitive habitats and areas outside of the project development area should be clearly demarcated as no go areas during the construction phase to avoid accidental impacts. ▪ Vegetation clearing close to the watercourse should be minimised and where necessary, appropriate storm water management should be put in place to limit erosion potential of exposed soil, such as placing sedimentation trapping to prevent exposed soils from spilling into the watercourse (if necessary). ▪ The watercourse and its buffer areas should be demarcated and fenced off prior to construction to exclude the watercourse from development activities. ▪ Workers should not be allowed outside the demarcated construction areas or camps or beyond the boundaries of the solar PV facility itself, i.e. they will not be allowed to wander across the undeveloped parts of each site. No development or activities should take place in the high sensitivity areas. ▪ Buffer zones are allocated to sensitive or important habitat features to alleviate the effect of habitat loss, habitat fragmentation,	▪ Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. ▪ ECO must monitor activities and record and report non-compliance. ▪ Strict control and proper education of staff to prevent misconduct. If ECO is absent, there should be a designated Environmental Officer (EO) present to deal with any urgent issues.	• Daily	• ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		disturbances, increased isolation and edge effects. No development should take place within High sensitivity areas or buffer zones. Accordingly, the Koppies habitat (where relevant) should be avoided. ▪ No construction related activities, such as the site camp, storage of materials, temporary roads or ablution facilities may be located in the high sensitivity areas. ▪ Minimise loss of natural vegetation. ▪ Only clear areas designated for development.			
		▪ The proposed project footprint must be demarcated to reduce unnecessary disturbance beyond the proposed project area	▪ Carry out visual inspections to ensure strict control over the behaviour of staff in order to restrict activities to within demarcated areas.	• Weekly	• ECO
		▪ Unnecessary impacts on surrounding natural vegetation must be avoided during construction. No construction vehicles should be allowed to drive around the veld. All construction vehicles should strictly remain on properly demarcated roads.	• Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. ▪ Include periodical site inspection in environmental performance reporting that specifically records occurrence or not of off-road vehicle tracks in specific areas.	• Daily	• ECO and Contractor
		▪ Undertake re-vegetation and rehabilitation of disturbed areas as soon as possible after construction. Stockpile the shallow topsoil layer separately from the subsoil layers. Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas. Re-seed with locally-sourced seed of indigenous grass	▪ Undertake audits following the construction phase and report any non-compliance.	• Daily	• ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		species that were recorded on site during the pre-construction phase.			
		• The collection, hunting or harvesting of any plants (or 'veldkos'), fuel wood or animals at the site during construction should be strictly forbidden and the staff should be educated to prevent this from happening. ▪ Indigenous vegetation must not be removed or damaged.	• Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. • Carry out Environmental Awareness Training. • Conduct audits of the signed attendance registers. • Issue fines where relevant as per specifications in their contracts. ▪ Ensure that environmental awareness programmes are implemented.	• Once-off training and ensure that all new staff is inducted. ▪ Weekly during construction phase.	▪ ECO and Contractor
		• Fires should only be allowed within fire-safe demarcated areas. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on site for the duration of the construction phase.	• Strict control over the behaviour of construction workers, restricting activities to within demarcated areas. ▪ Ensure fire safety requirements are well. understood and respected by workers (by providing basic fire safety training).	• Daily	• ECO and Contractor
10.25. Loss of provincially protected species and their habitats	Minimise impacts on protected species.	• A plant rescue operation must be initiated to confirm that no SSC are located within the development footprint. • Should any of the listed / protected species need to be removed, the requisite provincial and/or national permits must be obtained prior to the removal of the species.	• Project Developer must ensure that a suitable terrestrial ecologist is appointed to undertake a final walk-through of the final approved site prior to commencement of construction to identify SCC requiring Search and Rescue or avoidance. • Monitor activities and record and report non-compliance.	• Once-off prior to the commencement of construction • Daily monitoring required	• Project Developer, Specialist and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			• Apply for relevant permits with relevant authorities.		
10.26. Disturbance of terrestrial fauna and flora on site due to construction workers and activities, including the impact of littering and pollution	To advise construction staff of the requirements in respect of management of flora and fauna on site during the construction phase. Minimise the disturbance to flora and fauna in the surrounding area as a result of littering and pollution. Reduce the amount of littering and pollution within and around the construction site	▪ Establish a recording method in order to monitor the construction activities, including species presence within site, mortalities and observations.	• Establish database of species, observations, conditions, impacts etc. • Construction personnel should advise on the findings and presence of fauna on site.	• Daily to weekly	• ECO
		▪ All staff should be subjected to an induction training program where appropriate conservation principles, safety procedures, snake bite avoidance and first aid treatment are taught. Several staff members should complete a snake handling course to safely remove snakes from construction areas. ▪ All staff operating motor vehicles must undergo an environmental induction training course that includes instruction on the need to comply with speed limits, to respect all forms of wildlife (especially reptiles and amphibians) and, wherever possible, prevent accidental road kills of fauna. Drivers not complying with speed limits should be subject to penalties.	• Hold induction training programs as specified. All new staff should be inducted. Attendance registers should be monitored and kept on file. • Verify that penalties are enforced during non-compliance by undertaken audits and inspections.	• As required	• ECO and Contractor
		• Excavated trenches must be left open for as short a time as possible to avoid acting as dispersal barriers or traps. • All open excavated trenches must have escape points with an angle of less than 45° to allow for trapped animals to escape.	• Conduct visual inspections to verify compliance and report any non-compliance.	• Weekly	• ECO and Contractor
		• Equipment with low noise emissions must be used to not disrupt ecological life cycles (breeding, migration, feeding) of animals. Do not unnecessarily disturb faunal species, especially during the breeding season and juveniles.	• Conduct visual inspections to verify compliance and report any non-compliance.	• Weekly	• ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		• The site camp must not be located in high sensitivity areas and their buffer zones. • Ablution facilities must be located outside sensitive areas and their buffer zones. • Dangerous goods may not be stored within 100 m of a watercourse.	• Monitor the placement of the site camp, ablution facilities and dangerous goods via visual inspections, and record and report any non-compliance.	• Once-off prior to construction and as required during the construction phase.	• ECO
		▪ Sufficient waste disposal bins must be available on site and clearly marked. Skip bins may be required during the construction phase which must be emptied on a regular basis by an approved/licenced waste disposal contractor. Proof of disposal to be kept on file.	• Monitor general waste generation by construction staff and collection, as well as the provision of bins and/or skips via audits throughout the construction phase. • Monitor the handling of general waste on site via site audits and record non-compliance and incidents. • Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	• Daily or Weekly	• ECO and Contractor
		• Portable ablution facilities must be regularly cleaned and maintained in good working condition. • Any spillage from ablution facilities must be cleaned up immediately and disposed of in an appropriate manner.	• Conduct visual inspections to verify that portable ablution facilities are cleaned and maintained regularly, and report any non-compliance. • Monitor if spillages have taken place and if so, are removed immediately and correctly. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	• Daily • During spills	• ECO
		• Hydrocarbon fuels must be stored in a secure, bunded area. • Vehicles must be in good working condition, with no oil, water, or fuel leaks. Vehicles must	• Monitor the storage and handling of dangerous goods and hazardous materials on site via	• Weekly	• ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		be regularly inspected, and any problems corrected. • Refuelling may only take place in an appropriate, bunded area. Refuelling may not take place in sensitive areas. • Hydrocarbon spills must be contained and cleaned up immediately. Spill kits must be available on site in case of accidental spillage.	site audits and record non-compliance and incidents. • Undertake visual inspections to ensure that vehicles are in good working condition with no leaks, and that they are regularly serviced. Record non-compliance and incidents • Monitor the refuelling process and its location and record the occurrence of any spillages. • Monitor if spillages have taken place and if they are removed correctly.		
10.27. Increased erosion and soil compaction	Reduced erosion and soil compaction caused by construction activities	• Utilise existing access routes as far as possible. • Confine the movement of vehicles to the access routes to and from the site and to the construction areas. • Do not drive in the natural veld.	• Construction access roads must be demarcated clearly. Undertake site inspections to verify. • Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. • Include periodic site inspection in environmental performance reporting that specifically records occurrence or not of off-road vehicle tracks in specific areas.	• Weekly	• ECO and Contractor
		• Rehabilitate new vehicle tracks and areas where the soil has been compacted as soon as possible. • Monitor the entire site for signs of erosion.	• Ensure that this is taken into consideration during the construction and record any non-compliance. • Undertake regular monitoring for erosion to ensure is reduced and rectified as soon as possible.	• Weekly	• Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		• Refer to the Aquatic Biodiversity Specialist Assessment Report for mitigation measures relevant to watercourse crossings and development close to watercourses.	• Ensure that this is taken into consideration during the construction and record any non-compliance.	• Monthly	• ECO and Contractor
10.28. Faunal road mortality as a result of increased vehicles travelling to and within the site.	Minimise loss of fauna as a result of road mortalities.	• To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the site camp must be kept clean on a daily basis.	• Monitor the activities via visual inspections, and record and report any non-compliance.	• Daily	• ECO and Contractor
		• All vehicle speeds associated with the project should be monitored and should be limited to 40 km/h (maximum) during the construction phase. • Conduct inspections of the fence line to address any animals that may be affected by the fence, i.e. stuck or casualties.	• Carry out Environmental Awareness Training. • Conduct audits of the signed attendance registers. • Conduct weekly inspections of the fence line to address any animals that may be affected by the fence.	• Once-off training and ensure that all new staff are inducted. • Monthly. ▪ Weekly record keeping. A register of all faunal sightings indicating date of siting; species affected; position of species (specific or indicative) and other observations should be established.	▪ Project Developer, ECO and Contractor
		• A roadkill monitoring programme (inclusive of wildlife collisions record keeping) should be established. Where needed, Animex fences must be installed to direct animals to safe road crossings. Finally, mitigation should be adaptable to the onsite situation which may vary over time.	▪ Appropriate monitoring should be undertaken.	▪ Weekly	▪ Contractor and ECO
10.29. Impact and loss of fauna as a result of the fence line and exclusion of fauna from site resulting in	To reduce incidental mortality and injury of fauna within the construction area.	• Conduct inspections of the fence line to address any animals that may be affected by the fence, i.e. stuck or casualties.	• As above (refer to the last point above)	• As above (refer to the last point above)	• Project Developer and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
ecological change within the site					
10.30. Loss of vegetation by increased degradation and reduced ecosystem services	Rehabilitation post-construction by replacing topsoil and re-seeding. Refer to vegetation type for list of dominant species.	• Re-vegetation of disturbed surfaces must occur immediately after construction activities are completed. Allow natural vegetation recruitment from the topsoil unless the vegetation cover is insufficient. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction or by using a commercial seed mix indigenous to the area.	• Compare vegetation establishment on rehabilitated areas to surroundings natural vegetation. • Rehabilitate the following areas: - Road verges after road construction is completed. - transformed portions of the site not developed. - Areas where pockets of alien invasive species have been removed. • A list of indigenous plants used during rehabilitation must be approved by the ECO prior to commencement of rehabilitation activities.	• As recommended by the specialist / ECO	• Appointed Botanist and ECO
B.6. AQUATIC BIODIVERSITY AND SPECIES IMPACTS					
10.31. Potential impact on freshwater ecology as a result of the proposed PV and associated infrastructure.	Limit the disturbance of aquatic habitats. Limit the potential for contamination/pollution of aquatic ecosystems.	▪ Avoid disturbing aquatic habitats as far as possible. ▪ Minimise works within aquatic ecosystems as far as possible. ▪ For all project-related components within the site, the aquatic features of medium sensitivity should be treated as no-go areas during the construction phase. ▪ Any activities that require construction within the delineated aquatic features and the recommended buffers should be described in method statements that are approved by the Environmental Control Officer (ECO). ▪ Rehabilitation of any disturbed areas within the aquatic features and the recommended buffer areas should be undertaken immediately	▪ Monitoring that no-go areas and buffer areas are adhered to should be undertaken on an ongoing basis for the duration of the construction phase. ▪ Ongoing monitoring of the implementation of method statements should be undertaken. ▪ Ongoing monitoring of any rehabilitation measures, where required, should be undertaken. ▪ Ongoing visual inspections to ensure that no spills or risk of surface water contamination occur.	• Ongoing during construction	• Proponent/ contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		following completion of the disturbance activity according to rehabilitation measures as included in a method statement for that specific activity as described above. ▪ Any works within aquatic features should be undertaken in the dry season where possible. ▪ Sediment traps should be used where necessary. ▪ Ablution facilities should not be placed within 100m of any of the aquatic features delineated within the site; ▪ Liquid dispensing receptacles (e.g. lubricants, diesel, shutter oil etc.) must have drip trays beneath them/beneath the nozzle fixtures. Material safety data sheets (MSDS) must be available on site (if required) where products are stored so that in the event of an incident, the correct action can be taken. Depending on the types of materials stored on site during the construction activities, suitable product recovery materials must be readily available. Vehicles should ideally be washed at their storage yard as opposed to on site. ▪ Proper waste management should be undertaken within the site with facilities provided for the on site disposal of waste and the removal of stored waste to the nearest registered solid waste disposal facility. ▪ Clearing of indigenous vegetation should not take place within the aquatic features and the recommended buffers. ▪ Rehabilitate disturbed aquatic habitats once construction works are complete by revegetating them with suitable local indigenous vegetation.	▪ Ongoing visual inspections to ensure that no sedimentation or solid water from the construction activities occur in adjacent surface water ecosystems.		

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Water use for construction should be minimised as much as possible. The water should be obtained from an existing water allocation or other viable water sources for construction purposes. ▪ Good housekeeping and site management measures must be implemented at the laydown areas and the construction site as per the project Environmental Management Programme (EMPr) and monitored by the appointed ECO. ▪ Rationalise infrastructure as far as possible by sharing the infrastructure or using existing disturbed areas. ▪ Manage stormwater impacts.			
B.7. AVIFAUNA IMPACTS					
10.32. The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	▪ A site-specific CEMPr must be implemented, which gives an appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: o No off-road driving; o Maximum use of existing roads, where possible and the construction of new roads should be kept to a minimum as far as practical; o Measures to control noise and dust according to latest best practice; o Restricted access to the rest of the property, the activity should as far as possible be restricted to the development footprint;	▪ Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. ▪ Ensure that construction personnel are made aware of the impacts relating to off-road driving. ▪ Construction access roads must be demarcated clearly. Undertake site inspections to verify. ▪ Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. ▪ Ensure that the construction area is demarcated clearly and that	▪ On a daily basis ▪ Monthly ▪ Monthly ▪ Monthly ▪ Monthly	▪ Contractor and ECO ▪ Contractor and ECO ▪ Contractor and ECO ▪ Contractor and ECO ▪ Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		○ Strict application of all recommendations in the ecological and botanical specialist studies, especially pertaining to the limitation of the footprint.	construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		
B.8. SOCIO-ECONOMIC IMPACTS					
10.33. Creation of employment and business opportunities during the construction phase	Maximize potential job creation for locals	▪ Implement the SEP during the construction phase. ▪ Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area. ▪ Where feasible, efforts should be made to employ local contactors that are compliant with BBBEE criteria. ▪ If a skills database for the RLM and ELM exists, ensure that it is being considered by contractors appointed for the construction phase.	▪ Composition of workforce to be monitored during construction to assess the number of local residents employed. Review of the registers held by the contractors. ▪ Undertake inspections to monitor compliance.	▪ Monthly or bi-monthly ▪ Monthly	▪ Project Developer and ECO
10.34. Potential impacts on family structures and social networks associated with the presence of construction workers in the area	Minimise the increase of social ills and risky behaviours associated with workforce influx to the area.	▪ Implement the SEP during the construction phase. ▪ Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. ▪ The SEP and CHSSP should include a Grievance Mechanism that enables stakeholders to report and resolve incidents. ▪ Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories.	▪ Undertake audits to ensure that the SEP is compiled, and that dates and outcomes of stakeholder engagement are reviewed. Report non-compliance. ▪ Undertake audits to ensure that the CHSSP is compiled and implemented. Report non-compliance. ▪ Undertake inspections to verify if the SEP and CHSSP includes a Grievance Mechanisms. Record non-compliances.	▪ Monthly ▪ Monthly ▪ Monthly or bi-monthly ▪ Monthly ▪ Monthly ▪ Monthly ▪ Once-off training and ensure that all new staff are inducted. ▪ Annually ▪ Monthly ▪ As required ▪ Weekly ▪ As required	▪ Project Developer and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ The proponent should consider the option of establishing a Monitoring Committee (MC) for the construction phase that include representatives from local landowners, farming associations, and the local municipality. This MC should be established prior to commencement of the construction phase and form part of the SEP. ▪ The proponent and contractor should develop a Code of Conduct (CoC) for construction workers. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be subject to appropriate disciplinary action and/or dismissed. All dismissals must comply with the South African labour legislation. The CoC should be signed by the proponent and the contractors before the contractors move onto site. The CoC should form part of the CHSSP. ▪ The proponent and the contractor should implement an HIV/AIDS, COVID-19, and Tuberculosis (TB) awareness programme for all construction workers at the outset of the construction phase. The programmes should form part of the CHSSP. ▪ The contractor should provide transport for workers to and from the site on a daily basis. This will enable the contactor to effectively manage and monitor the movement of construction workers on and off the site. ▪ The contractor must ensure that all construction workers from outside the area are transported back to their place of residence within 2 days for their contract coming to an end.	▪ Composition of workforce to be monitored during construction to assess the number of local residents employed. Review of the registers held by the contractors. ▪ Verify if an MC is developed and is being implemented with written proof kept on file. ▪ Verify that a Code of Conduct is developed and is being implemented with written proof kept on file. ▪ Hold Environmental Awareness Training to discuss social issues. All new staff should be inducted. Attendance registers should be monitored and kept on file. ▪ Verify that HIV/AIDS, COVID-19, and TB awareness programme is developed and part of the CHSSP, and is being implemented with written proof kept on file. ▪ Hold relevant training sessions and ensure that all staff attend. Dates, duration, and content outline of prevention of disease training and register of attendance reviewed. ▪ Monitor that transport of staff to and from site is provided and report non-compliances. ▪ Verify that workers are transported to their place of	▪ Weekly	

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.	residence following contract closure. ▪ Security records must be reviewed to verify no personnel stay over on site. Record and report any non-compliance.		
10.35. Influx of job seekers	Maximise potential job creation for locals.	▪ Implement the SEP during the construction phase. ▪ Preparation and implementation of a CHSSP prior to and during the construction phase. ▪ The proponent, in consultation with the LM, should investigate the option of establishing a MC to monitor and identify potential problems that may arise due to the influx of job seekers to the area. ▪ The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities. ▪ The proponent should implement a policy that no employment will be available at the gate.	▪ Undertake audits to ensure that the SEP is compiled, and that dates and outcomes of stakeholder engagement are reviewed. Report non-compliance. ▪ Undertake audits to ensure that the CHSSP is compiled and implemented. Report non-compliance. ▪ Verify if an MC is developed and is being implemented with written proof kept on file. ▪ Composition of workforce to be monitored during construction to assess the number of local residents employed. Review of the registers held by the contractors. ▪ Undertake inspections to monitor compliance.	▪ Monthly ▪ Monthly ▪ Monthly ▪ Monthly or bi-monthly ▪ Monthly	▪ Project Developer and ECO
10.36. Potential risk to farmers and farm workers, livestock and damage to farm infrastructure associated with the presence and activities of construction workers on site	Minimise the impact of the construction activities on the safety, livestock and farm workers and infrastructure.	▪ Implement the SEP during the construction phase. ▪ Preparation and implementation of a CHSSP prior to and during the construction phase. ▪ The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property as a result of the construction phase will be compensated for.	▪ Undertake audits to ensure that the SEP is compiled, and that dates and outcomes of stakeholder engagement are reviewed. Report non-compliance. ▪ Undertake audits to ensure that the CHSSP is compiled and	▪ Monthly ▪ Monthly ▪ Monthly ▪ Monthly ▪ Weekly ▪ Monthly ▪ Monthly ▪ Monthly ▪ Weekly	▪ Project Developer, Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		The agreement should be signed before the construction phase commences. ▪ All farm gates must be closed after passing through. ▪ Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site. ▪ The proponent should establish a MC and CoC for workers (see above). ▪ The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to project construction workers. This should be contained in the CoC to be signed between the proponent, the contractors, and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below). ▪ The proponent should implement a Grievance Mechanism that provides local farmers with an effective and efficient mechanism to address issues related to damage to farm infrastructure, stock theft and poaching etc. ▪ The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested. ▪ Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained in the CoC, specifically consequences of stock theft and trespassing on adjacent farms.	implemented. Report non-compliance. ▪ Undertake an audit to verify if an agreement with local farms has been made and agreed to, and monitor non-compliance. ▪ Undertake inspections to monitor compliance. ▪ Monitor that transport of staff to and from site is provided and report non-compliances. ▪ Verify if an MC is developed and that a Code of Conduct is developed and being implemented with written proof kept on file. ▪ Verify if the CoC includes measures for compensating farmers and communities for any stock losses and/or damage to farm infrastructure linked to project construction workers. Record and report any non-compliance. ▪ Undertake inspections to verify a Grievance Mechanism is in place. Record non-compliances. ▪ Review EMPr to ensure that relevant information on waste management is included. ▪ Undertake awareness training on the conditions contained in the CoC, specifically regarding stock theft and trespassing. Attendance registers should be monitored and kept on file.	▪ Once-off training and ensure that all new staff are inducted. ▪ As required ▪ Weekly	

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Contractors appointed by the proponent must ensure that construction workers who are found guilty (by the courts) of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the CoC. All dismissals must be in accordance with South African labour legislation. ▪ It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.	▪ Monitor any dismissal processes and report and record any non-compliance. ▪ Security records must be reviewed to verify no personnel stay over on site. Record and report any non-compliance.		
10.37. Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires	Minimise risk of grass fires	▪ Implement the SEP during the construction phase. ▪ Preparation and implementation of a CHSSP prior to and during the construction phase. ▪ The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property as a result of the construction phase will be compensated for. The agreement should be signed before the construction phase commences. ▪ Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas. ▪ Smoking on site should be confined to designated areas. ▪ Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months.	▪ Undertake audits to ensure that the SEP is compiled, and that dates and outcomes of stakeholder engagement are reviewed. Report non-compliance. ▪ Undertake audits to ensure that the CHSSP is compiled and implemented. Report non-compliance. ▪ Undertake an audit to verify if an agreement with local farms has been made and agreed to, and monitor non-compliance. ▪ Undertake inspections to monitor compliance. ▪ Undertake inspections to monitor compliance during fire risk conditions. ▪ Undertake visual inspections to verify the provision of adequate fire-fighting equipment. ▪ Verify fire-fighting training has been undertaken by signing off	▪ Monthly ▪ Monthly ▪ Monthly ▪ Weekly ▪ As required ▪ Monthly ▪ As required ▪ Monthly ▪ Monthly ▪ Monthly	▪ Project Developer, Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Contractor should provide adequate fire-fighting equipment on-site, including a fire fighting vehicle and fire extinguishers placed at designated locations across the site. ▪ Contractor should provide fire-fighting training to selected construction staff. ▪ No construction staff, with the exception of security staff, to be accommodated on site overnight. ▪ As per the conditions of the Code of Conduct, in the event of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused by the project to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities.	on attendance registers and certificates. ▪ Security records must be reviewed to verify no personnel stay over on site. Record and report any non-compliance. ▪ Undertake inspections to monitor compliance. ▪ Verify that a Code of Conduct is developed and is being implemented with written proof kept on file.		
10.38. Potential noise, dust and safety impacts associated with construction related activities	Minimise noise, dust, safety impacts and damage to roads due to the heavy construction activities.	▪ Implement the SEP during the construction phase. ▪ Preparation and implementation of a CHSSP prior to and during the construction phase. ▪ Timing of construction activities should be planned to avoid / minimise impact on key farming activities. ▪ The proponent should establish a MC to monitor the construction phase and the implementation of the recommended mitigation measures. The MC should be established before the construction phase commences, and should include key stakeholders, including representatives from local farmers and the contractor(s). The MC should also address issues associated with damage to roads and other construction related impacts.	▪ Undertake audits to ensure that the SEP is compiled, and that dates and outcomes of stakeholder engagement are reviewed. Report non-compliance. ▪ Undertake audits to ensure that the CHSSP is compiled and implemented. Report non-compliance. ▪ Undertake inspections to monitor compliance. ▪ Verify if an MC is developed and that a Code of Conduct is developed and being implemented with written proof kept on file. ▪ Undertake inspections to monitor compliance.	▪ Monthly ▪ Monthly ▪ Once-off ▪ Monthly ▪ Weekly ▪ Monthly ▪ Monthly ▪ As required ▪ As required ▪ Random visual inspection of vehicles weekly.	▪ Project Developer and Contractor ▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Ongoing communication with landowners and road users during construction period. This should be outlined in the SEP. ▪ The proponent should implement a Grievance Mechanism that provides local farmers and other road users with an effective and efficient mechanism to address issues related to construction related impacts, including damage to local gravel farm roads. ▪ Implementation of a road maintenance programme throughout the construction phase to ensure that the affected private roads are maintained in a good condition and repaired once the construction phase is completed (for roads where the developer/contractor has legal mandate to undertake such maintenance). ▪ Repair of all affected road portions at the end of construction period where required (for roads where the developer/contractor has legal mandate to undertake such repairs). In the event of damage to public roads affected by construction traffic the proponent should engage with the relevant road authorities to ensure that damage is repaired before the operational phase commences. ▪ Dust suppression measures must be implemented on un-surfaced roads, such as wetting on a regular basis and ensuring that vehicles used to transport building materials are fitted with tarpaulins or covers. ▪ All vehicles must be roadworthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.	▪ Undertake inspections to verify a Grievance Mechanism is in place. Record non-compliances. ▪ Ensure that the road maintenance programme is undertaken during construction. ▪ Undertake audits to verify compliance in terms of road repair. ▪ Undertake inspections to monitor implementation of dust control. ▪ Carry out random checks of driver licenses and conduct random visual inspections of construction vehicles for roadworthiness.		

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
10.39. Impacts associated with the loss of farmland	Reduce the risk of incurring damage to farmland and grazing	▪ The loss of high-quality agricultural land should be avoided and or minimised by careful planning of the final layout of the proposed facility. The recommendations of the agricultural / soil assessment should be implemented. *Note: During the EIA Phase, no sensitive areas for avoidance were identified by the Agricultural specialist. The study area is predominately low to medium sensitivity from an agricultural perspective.* ▪ Affected landowners should be consulted about the timing of construction related activities in advance. ▪ The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised. ▪ An ECO should be appointed to monitor the establishment phase of the construction phase. ▪ All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. ▪ The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be included in the EMPr. ▪ The implementation of the Rehabilitation Programme should be monitored by the ECO.	▪ Undertake audits and inspections to monitor compliance with the management actions stipulated.	▪ As required during the construction phase	▪ Project Developer, Contractor and ECO
B.9. IMPACTS RESULTING FROM THE BATTERY ENERGY STORAGE SYSTEMS (BESS)					
10.40. Safety, health and environmental impacts as a result of the Solid State Lithium Ion Battery Energy	Minimise the safety, health and environmental risks associated with the BESS	▪ Consider the findings and recommendations of the High-Level Safety, Health and Environment Risk Assessment compiled for the BESS. Refer to Appendix D of this EMPr for a detailed	▪ Conduct audits to verify if the preventative and mitigation measures have been considered and implemented, where relevant and required,	▪ Ongoing	▪ Project Developer, Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
Storage System (BESS) and Redox Flow BESS		list of preventative and mitigation measures for the BESS.	during the construction phase. Report any non-compliance.		
B.10. GEOHYDROLOGICAL IMPACTS **Note from the CSIR: The use of existing boreholes to source groundwater (if available and suitable) is only the third most likely water use option. Water sourced from the local municipality is the first option in terms of viability and the second is to source water from a third party, but consideration of other options is vital. Potential environmental impacts pertaining to local groundwater resources have been considered in the EIA, and various management inputs have been recommended to ensure safe and sustainable management of the groundwater resources in the area. However, these impact management actions are not mandatory if water is indeed sourced from the local municipality or via a third party. The recommendations in this section only apply if groundwater will be used for the project. The management inputs are captured in two phases. Phase 1 will be required to determine if the groundwater is of a suitable quality and quantity; and Phase 2 will only be required if the groundwater quality and quantity are determined more accurately and confirmed it is suitable for use.**					
10.41. Lowering of groundwater levels as a result of over-abstraction	Avoid over-abstraction of groundwater resources.	▪ Adhere to the borehole's safe yield and to monitor water levels and flow. Boreholes must be correctly yield tested according to the National Standard (SANS 10299-4:2003, Part 4 – Test pumping of water boreholes). This includes a Step Test, Constant Discharge Test and recovery monitoring. ▪ A monitoring program needs to be adhered to so as to determine and remain below safe abstraction rates. This monitoring programme must only be implemented if groundwater will be used on site for construction purposes.	▪ Ensure that this is taken into consideration and that a Geohydrology Specialist with suitable qualifications and experience is appointed to undertake relevant tests by reviewing signed minutes of meetings or signed reports or the appointment letter. ▪ Ensure that the borehole parameters are documented to ensure trends and consumption can be monitored. ▪ Undertake an audit to verify if the monitoring programme is being implemented.	▪ As required	▪ Project Developer, Specialist, and ECO
10.42. Accidental oil spillage / fuel leakage	Minimise potential ground water contamination.	▪ Vehicles must be regularly serviced and maintained to check and ensure there are no leakages. ▪ Any engines that stand in one place for an excessive length of time must have drip trays. Diesel fuel storage tanks, if required, should be above ground on an impermeable surface in a bunded area. ▪ Vehicles and equipment should also be refuelled on an impermeable surface. A	▪ Construction vehicles and equipment need to be monitored throughout the construction phase. Monitor via site audits and record non-compliance and incidents. ▪ Monitor the placement of fuel storage tanks and engines and use of drip trays at the site camp via visual inspections. Monitor	▪ Four times per annum for the construction period. ▪ Weekly ▪ Weekly ▪ Weekly ▪ As necessary	▪ Project Developer, Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		designated area should be established at the construction site camp for this purpose, if off-site refuelling is not possible. ▪ If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilled material, and reported. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes	the usage of spill containment measures and record and report non-compliance. ▪ Monitor the placement and designation of the area for refuelling at the site camp via visual inspections. Monitor the occurrence of potential spills and the usage of spill containment measures and record and report non-compliance. ▪ Monitor the refuelling/ servicing process and record the occurrence of any spillages. ▪ Monitor the correct disposal of spilled material or contaminated soil and audit the waybills. Record and report non-compliance.		
B.11. GEOTECHNICAL IMPACTS					
10.43. Displacement of geologic materials	To minimise soil erosion by appropriately managing the displacement of geological materials, thereby minimising disturbance of existing soil conditions.	▪ Drainage in the region should be managed appropriately. ▪ Stormwater systems should be monitored throughout the first few months of use during the construction phase during which any erosion/sedimentation must be resolved through any additional interventions that may be necessary (e.g., extension, energy dissipaters, spreaders, etc.). It is recommended that rehabilitation commence soon after construction at the optimal time for vegetation establishment. ▪ Only strip vegetation necessary for the next phase of construction.	▪ Monitor activities via onsite inspections and report any non-compliance.	▪ On-going	▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Install temporary drainage to divert stormwater away from active construction activities, where required. ▪ Where impacted through construction-related activities, all sloped areas must be stabilised to ensure proper rehabilitation is effected and erosion is controlled. ▪ Sloped areas stabilised using designed structures or vegetation as specified in the design to prevent erosion of embankments. The contract design specifications must be adhered to and implemented strictly. ▪ Any rehabilitation should be scheduled to ensure rehabilitation can take place at the optimal time for vegetation establishment. ▪ Where earthwork is being undertaken near any watercourses, slopes must be stabilised using suitable materials, e.g., sandbags or geotextile fabric, to prevent sand and rock from entering the channel. ▪ Appropriate rehabilitation and re-vegetation measures for any disturbed watercourse banks must be implemented timeously. In this regard, the banks should be appropriately and incrementally stabilised as soon as development allows.			
10.44. Contamination of geologic materials	To minimise the contamination of geologic materials caused by spillages/leakages	▪ During the execution of the works, appropriate measures to prevent pollution and contamination of the riparian environment must be implemented, e.g. including ensuring that construction equipment is well maintained. ▪ Provision must be made for refuelling at the storage area by protecting the soil with an impermeable groundcover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained.	▪ Monitor activities and report any non-compliance.	▪ On-going	▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Where refuelling away from the dedicated refuelling station is required, a mobile refuelling unit must be used. Appropriate ground protection such as drip trays must be used. ▪ If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilt material, as reported. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes.			
B.12. WASTE MANAGEMENT					
10.45. Pollution of the surrounding environment (including drainage lines) as a result of the handling, temporary stockpiling and disposal of general waste.	▪ Reduce environmental impacts such as soil, surface water and groundwater contamination as a result of incorrect storage, handling and disposal of general waste. ▪ Minimise the production of waste. ▪ Ensure compliance with waste management legislation.	▪ General waste (i.e., construction waste, building rubble, discarded concrete, bricks, tiles, wood, glass, windowpanes, air conditioners, plastic, metal, excavated material, packaging material, paper and domestic waste etc.) generated during the construction phase should be stockpiled temporarily (i.e., once-off) on site in a designated area within suitable waste collection bins and skips (or similar). Waste collection bins and skips should be covered with suitable material, where appropriate.	▪ Monitor the strategic placement of the temporary, designated waste stockpiling area at the site camp via visual inspections, and record and report any non-compliance. ▪ Monitor the temporary storage and handling of general waste on site via site audits and record non-compliance and incidents (i.e., conduct visual inspections of the temporary waste storage area).	▪ Once-off prior to the commencement of the construction phase and as required as the construction phase process evolves. ▪ Daily	▪ ECO and Contractor ▪ ECO
		▪ Should the on-site stockpiling of general waste exceed 100 m^3 and a period of 90 days, then the National Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) must be adhered to.	▪ Record the amount of general waste that is temporarily stockpiled at the designated area on site, as well as the duration and record non-compliance and incidents. ▪ Monitor the duration and amounts of general waste that is temporarily stockpiled at the designated area on site via site audits and record non-compliance and incidents (i.e.,	▪ Daily ▪ Weekly ▪ Monthly	▪ Contractor ▪ ECO ▪ Project Developer

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			conduct visual inspections of the temporary waste storage area). ▪ Audit compliance with the Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) if the storage amounts are exceeded (i.e., only if required).		
		▪ Ensure that the designated stockpiling area for general waste (i.e., skips and waste collection bins) is inspected on a daily basis to verify its condition and integrity, particularly after rainfall events.	▪ Monitor the temporary, designated waste stockpiling area at the site camp, as well as the handling of general waste on site via site audits and record non-compliance and incidents.	▪ Daily	▪ ECO
		▪ Ensure that general waste generated during the construction phase is removed from the site on a regular basis, and safely disposed of at an appropriate, licenced waste disposal facility by an approved waste management Contractor. Waste disposal slips or waybills should be kept on file as proof of disposal. As a general principle, waste manifests must be obtained to prove legal disposal of waste.	▪ Ensure that a suitable Waste Management Contractor is appointed to remove and dispose the general waste at an appropriate, licenced waste disposal facility. ▪ Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	▪ Once-off prior to the construction phase. ▪ Weekly	▪ Project Developer and ECO
		▪ Ensure that the construction site is kept clean at all times and that construction personnel are made aware of correct waste disposal methods. Littering must be prevented through effective site camp management.	▪ Monitor the condition of the site camp throughout the construction phase via visual site inspections. Record non-compliance and incidents. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Daily ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ ECO and Contractor ▪ ECO and Contractor ▪ ECO
		▪ Sufficient general waste disposal bins must also be provided for use by construction	▪ Monitor general waste generation by construction staff and collection via audits	▪ Daily or Weekly	▪ ECO and Contractor.

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		personnel throughout the site. These bins must be emptied on a regular basis.	throughout the construction phase.		
		▪ Ensure that all general waste emanating from the construction phase is removed from site prior to the commencement of the rehabilitation and operational phases.	▪ Undertake a final inspection at the end of the construction phase in order to verify and ensure that all general waste is removed from site and correctly disposed, prior to the commencement of the rehabilitation and operational phases.	▪ At the end of the construction phase.	▪ ECO and Contractor.
		▪ Promote waste reduction, re-use, and recycling opportunities on site during the construction phase.	▪ Monitor waste generation and collection throughout construction. ▪ Investigate if any complaints have been expressed by the surrounding community regarding waste handling.	▪ Weekly or bi-weekly	▪ ECO and Contractor
		▪ Ensure an adequate and sustainable use of resources.	▪ Monitor waste generation and collection throughout construction.	▪ Weekly or bi-weekly	▪ ECO and Contractor
		▪ Control and implement waste management plans provided by contractors. Ensure that relevant legislative requirements are respected.	▪ Control of waste management practices throughout construction phase	▪ Weekly or bi-weekly	▪ ECO and Contractor
10.46. Pollution of the surrounding environment as a result of the handling, temporary stockpiling and disposal of hazardous waste.	Reduce environmental impacts such as soil, surface water and groundwater contamination as a result of incorrect storage, handling and disposal of hazardous waste.	▪ Hazardous waste (i.e., empty tins, oils, fuel spillages, spilled materials, and chemicals etc.) generated during the construction phase should be stockpiled temporarily (i.e., once-off) on site in a designated area in suitable waste collection bins and leak-proof storage skips (or similar). Waste collection bins and skips should be covered with suitable material, where appropriate. Hazardous waste must be stored separately from all other general waste. The designated stockpiling area must be labelled correctly.	▪ Monitor the strategic placement of the temporary, designated waste stockpiling area at the site camp via visual inspections, and record and report any non-compliance. ▪ Monitor the temporary storage and handling of hazardous waste on site via site audits and record non-compliance and incidents (i.e., conduct visual inspections	▪ Once-off prior to the commencement of the construction phase and as required as the construction process evolves. ▪ Daily	▪ ECO and Contractor ▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			of the temporary waste storage area).		
		▪ Should the on-site stockpiling of hazardous waste exceed 80 m3, then the National Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) must be adhered to.	▪ Record the amount of hazardous waste that is temporarily stockpiled at the designated area on site, as well as the duration and record non-compliance and incidents. ▪ Monitor the duration and amounts of hazardous waste that is temporarily stockpiled at the designated area on site via site audits and record non-compliance and incidents (i.e., conduct visual inspections of the temporary waste storage area). ▪ Audit compliance with the Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) if the storage amounts are exceeded (i.e., only if required).	▪ Daily ▪ Weekly ▪ Monthly	▪ Contractor ▪ ECO ▪ Project Developer
		▪ Ensure that the designated stockpiling area for hazardous waste (i.e., leak proof skips and waste collection bins) is inspected on a daily basis to verify its condition and integrity, particularly after rainfall events.	▪ Monitor the temporary, designated waste stockpiling area at the site camp, as well as the handling of hazardous waste on site via site audits and record non-compliance and incidents.	▪ Daily	▪ ECO
		▪ Ensure that all hazardous waste is removed from the site on a regular basis, and safely disposed at an appropriate, licenced hazardous waste disposal facility by an approved waste management Contractor.	▪ Ensure that a suitable Waste Management Contractor is appointed to remove and dispose the hazardous waste at an appropriate, licenced hazardous waste disposal facility.	▪ Once-off prior to the construction phase. ▪ Weekly	▪ Project Developer/ Contractor ▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			▪ Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.		
		▪ Ensure that the construction site is kept clean at all times and that construction personnel are made aware of correct waste disposal methods. Littering must be prevented through effective site camp management.	▪ Monitor the condition of the site camp throughout the construction phase via visual site inspections. Record non-compliance and incidents. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Daily ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ ECO and Contractor ▪ ECO and Contractor ▪ ECO
		▪ Ensure that all hazardous waste emanating from the construction phase is removed from site prior to the commencement of the rehabilitation and operational phases.	▪ Undertake a final inspection at the end of the construction phase in order to verify and ensure that all general waste is removed from site and correctly disposed, prior to the commencement of the rehabilitation and operational phases.	▪ At the end of the construction phase.	▪ ECO and Contractor.
		▪ All liquid waste (used oil, paints, lubricating compounds and grease) to be packaged and disposed of by appropriate means.	▪ Waste removal and disposal to be monitored throughout construction	▪ Weekly or bi-weekly	▪ ECO and Contractor
		▪ Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided as to avoid spillages.	▪ Waste removal and disposal to be monitored throughout construction	▪ Weekly or bi-weekly	▪ ECO and Contractor
		▪ Wastewater from construction and painting activities must be collected in a designated container and disposed of at a suitable disposal point off site.	▪ Waste removal and disposal to be monitored throughout construction	▪ Weekly or bi-weekly	▪ ECO and Contractor
		▪ Control and implement waste management plans provided by contractors. Ensure that relevant legislative requirements are respected.	▪ Control of waste management practices throughout construction phase.	▪ Weekly or bi-weekly	▪ ECO and Contractor
B.13. HUNTING PRACTICES ON ADJACENT FARMS					

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
10.47. Potential impact on construction activities and personnel as a result of hunting practices on nearby or adjacent farms.	To ensure safety of construction activities and personnel as a result of hunting operations on nearby or adjacent farms.	▪ Ensure that an open communication strategy is created and maintained between the Project Developer, Contractor and owners (or managers) of nearby or adjacent farms where hunting takes place in order to ensure that the Project Developer and Contractor are made aware of planned hunts. ▪ Ensure that construction personnel are made aware of the planned hunts and are trained on the necessary protocols to be taken.	▪ Monitor and record the notifications received from the owners (or managers) of the adjacent farms where hunting takes place. ▪ Carry out Environmental Awareness Training and ensure that safety aspects are discussed in terms of hunting operations on adjacent farms. Conduct audits of the signed attendance registers. ▪ Carry out random inspections to ensure that planned hunts are being communicated to the Project Developer and that construction personnel are being duly informed.	▪ On-going ▪ Once-off at the commencement of construction and ensure that all new staff are inducted ▪ Monthly	▪ Project Developer, ECO and Contractor ▪ Project Developer, ECO and Contractor ▪ Project Developer, ECO and Contractor
C. OPERATIONAL PHASE					
C.1. AGRICULTURE AND SOILS IMPACTS					
10.48. Erosion	That existence of hard surfaces causes no erosion on or downstream of the site.	▪ Maintain the stormwater run-off control system. Monitor erosion and remedy the stormwater control system in the event of any erosion occurring.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the stormwater run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	▪ Bi-annually	▪ Facility Environmental Manager
10.49. Erosion	That denuded areas are re-vegetated to stabilise soil against erosion	▪ Facilitate re-vegetation of denuded areas throughout the site	Undertake a periodic site inspection to record the progress of all areas that require re-vegetation.	▪ Bi-annually	▪ Facility Environmental Manager
C.2. VISUAL IMPACTS					
10.50. Potential visual intrusion of solar arrays and related infrastructure on receptors	To reduce the visual intrusion of the operation infrastructure on the	▪ Ensure that visual mitigation measures are monitored by management on an on-going basis, including the maintenance of	Conduct site inspections to monitor implementation and report any non-compliance.	▪ Weekly	▪ Solar Farm Operator and

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
including glint and glare; and potential visual impact of an industrial type activity on the pastoral / rural character and sense of place of the area.	surrounding landscape and receptors.	rehabilitated areas, as well as control of any signage, lighting and waste at the proposed solar project, with interim inspections by the responsible Environmental Officer or Manager.			Environmental Officer / Manager
C.3. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
10.51. Damage or destruction of archaeological sites or graves	Rescue information, artefacts or burials before extensive damage occurs	▪ Reporting chance finds of graves and dense clusters of artefacts as early as possible to an archaeologist and/or the South African Heritage Resources Agency (SAHRA) (https://www.sahra.org.za/contact/), protect in situ and stop work in immediate area and appoint archaeologist to exhume or sample as needed (where relevant)	Inform staff to be vigilant and carry out inspections of all new excavations	▪ Ongoing basis ▪ Whenever on site (at least weekly)	▪ Environmental Manager ▪ ECO
10.52. Intrusion into cultural landscape	Minimise intrusion into the cultural landscape	▪ Ensure that all maintenance vehicles and operational activities stay within designated areas.	Undertake visual inspections and report non-compliance	▪ As required	▪ Environmental Manager
10.53. Intrusion into cultural landscape	Minimise contrast and light pollution	▪ Paint buildings in earthy colours to reduce contrast. Make use of motion detectors and downlighting to reduce night-time light pollution.	Monitor that this has been considered in the design and operation of the facility	▪ Once off	▪ Project Developer
C.4. TERRESTRIAL BIODIVERSITY AND SPECIES IMPACTS					
10.54. Vegetation management on site and loss of species composition and diversity	Manage vegetation throughout the site to avoid conflict with operations of the proposed PV facility and reduce ecological degradation.	▪ Monitor rehabilitation efforts post-construction phase.	Compare vegetation establishment on rehabilitated areas to surroundings natural vegetation	▪ At the end of the growing season and then as recommended by the specialist	▪ Appointed Botanist and ECO
10.55. Impact and loss of fauna as a result of operational activities	To reduce the loss of and impact on fauna	• Avoidance of damage to infrastructure by faunal activity as well as impact on fauna as a result of the site infrastructure. • Identify impact of burrowing and other faunal activities on the fence line and operations activities.	• Identify where fauna may be affecting operations of site (burrows etc.). Consider redress if necessary. • Conduct regular (daily) inspections of the fence line to	• Daily to weekly record keeping. • A register of all faunal sightings indicating date of siting; species affected; position of	▪ ECO and Operations and Maintenance Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		• Undertake the management of faunal intrusion through the fence, including possible mortalities. • Conduct inspections of the fence line to address any animals that may be affected by the fence. ▪ Promote and support faunal presence and activities within the proposed PV facility, where possible.	address any animals that may be affected by the fence. • Monitor the activities via visual inspections, and record and report any non-compliance. • Induction / toolbox talks should be promoted where general awareness is created to prevent faunal disturbance.	species (specific or indicative) and other observations should be established.	
10.56. Impact and loss of fauna as a result of the fence line and exclusion of fauna from site resulting in ecological change within the site.	To reduce the impact and loss of fauna from site as a result of their exclusion from the area due to fencing	▪ Conduct inspections of the fence line to address any animals that may be affected by the fence, i.e. stuck or casualties.	• Conduct weekly inspections of the fence line to address any animals that may be affected by the fence.	▪ Weekly record keeping. A register of all faunal sightings indicating date of siting; species affected; position of species (specific or indicative) and other observations should be established.	▪ Project Developer and ECO
10.57. Impact of electrical light pollution (ELP) around the site	The avoidance of electrical light pollution through prudent positioning of external lighting.	• The operational personnel and staff should be made aware of the presence of fauna within the proposed project area. ▪ Driving is not allowed at night, where possible.	• Carry out Environmental Awareness Training. • Conduct audits of the signed attendance registers.	• Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ ECO and Operations and Maintenance Contractor
10.58. Faunal and avifaunal road mortality as a result of increased vehicles travelling to and within the site.	Minimise loss of fauna as a result of road mortalities.	• To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the offices must be kept clean on a daily basis.	• Monitor the activities via visual inspections, and record and report any non-compliance.	▪ Daily	▪ ECO and Operations and Maintenance Contractor
10.59. Disturbance of terrestrial fauna and flora on site due to operational workers and activities, including the impact of littering and pollution	Minimise the disturbance to flora and fauna in the surrounding area as a result of littering and pollution.	▪ Sufficient waste disposal bins must be available on site and clearly marked.	• Monitor general waste generation by operational staff and collection, as well as the provision of bins and/or skips via audits throughout the operational phase.	▪ Daily or Weekly	▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
	Reduce the amount of littering and pollution within and around the operational site	• Vehicles must be in good working condition, with no oil, water, or fuel leaks. • Vehicles must be regularly inspected, and any problems corrected. • Refuelling may only take place in an appropriate, designated bunded area. • Any spillages must be reported immediately and dealt with appropriately. ▪ Spill kits must be available on site in case of accidental spillage.	• Undertake visual inspections to ensure that vehicles are in good working condition with no leaks, and that they are regularly serviced. Record non-compliance and incidents • Monitor the refuelling process and its location and record the occurrence of any spillages. • Monitor if spillages have taken place and if they are removed correctly.	▪ Weekly	▪ ECO
C.5. AQUATIC BIODIVERSITY AND SPECIES IMPACTS					
10.60. Potential impact on freshwater ecology as a result of the proposed PV and associated infrastructure.	Limit the disturbance of aquatic habitat. Minimise potential to modify flow/ hydraulics-related impacts and increase the potential for erosion. Limit the potential for contamination/pollution of aquatic ecosystems	▪ Ongoing monitoring of the road crossing structures, in particular before the rainfall period, should be undertaken to ensure that the integrity of the structures is intact and that they are not blocked with sediment or debris. Ongoing monitoring post large rainfall events should also be undertaken to identify and address any erosion occurring within the watercourses. ▪ Sewage generated within the site should be discharged to a conservancy tank that is properly serviced and regularly evacuated to nearby wastewater treatment works. ▪ Limit disturbance and rehabilitate disturbed areas. ▪ Ensure there is sufficient stormwater management to prevent erosion of watercourses. ▪ Limit and monitor water use.	▪ Monitoring that no-go areas and buffer areas are adhered to should be undertaken on an ongoing basis. ▪ Ongoing monitoring of any rehabilitation measures, where required, should be undertaken. ▪ Ongoing visual inspections to ensure that no spills or risk of surface water contamination occur. ▪ Ongoing visual inspections to ensure that no sedimentation or solid water from the construction activities occur in adjacent surface water ecosystems.	▪ Ongoing during operation	▪ Proponent/ contractor
C.6. AVIFAUNA IMPACTS					
10.61. Total or partial displacement of avifauna due to habitat	Prevent unnecessary displacement of avifauna by ensuring that the	▪ The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation	▪ Appointment of rehabilitation specialist to develop HRP.	▪ Once-off ▪ Once a year	▪ Project Developer

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
transformation associated with the vegetation clearance and the presence of the solar PV plants and associated infrastructure.	rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned. ▪ Develop a Habitat Restoration Plan (HRP). ▪ Monitor rehabilitation via site audits and site inspections to ensure compliance. ▪ Record and report any non-compliance.	▪ Site inspections to monitor progress of HRP. ▪ Adaptive management to ensure HRP goals are met.	▪ As and when required	▪ Facility Environmental Manager ▪ Project Developer and Facility Operational Manager
10.62. Electrocution of priority species in the onsite substation complex.	Prevention of electrocution mortality	▪ It is recommended that if on-going impacts are recorded as part of routine inspections once operational, site-specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List priority species are unlikely to frequent the substation and be electrocuted.	▪ Site-specific mitigation (insulation) be applied reactively	▪ As and when required.	▪ Project Developer and Facility Operational Manager
C.7. SOCIO-ECONOMIC IMPACTS					
10.63. Development of infrastructure to improve energy security and support renewable sector	Improve energy security in South Africa by generating additional energy	▪ Maximise the number of employment opportunities for local community members. ▪ Implement training and skills development programs for members from the local community. ▪ Maximise opportunities for local content and procurement.	▪ Composition of workforce to be monitored during operations to assess the number of local residents employed. Review of the employment registers. ▪ Record of skills training to be reviewed. Register of attendance reviewed.	▪ Monthly or Bi-monthly ▪ As required	▪ Project Developer
10.64. Creation of employment opportunities	Maximize potential job creation for locals	▪ The enhancement measures to enhance local employment and business opportunities during the construction phase also apply to the operational phase. ▪ The proponent should investigate providing training and skills development to enable locally based service providers to provide the required services for the operational phase.	▪ Composition of workforce to be monitored during construction to assess the number of local residents employed. Review of the registers held by the contractors. ▪ Undertake audits to monitor compliance.	▪ Monthly or Bi-monthly ▪ Monthly	▪ Project Developer and ECO
10.65. The generation of additional income represents a significant benefit for the local affected farmer(s) and	Enhance benefits for affected landowner	▪ Enter into and implement rental agreements with affected landowners for the use of the land for the establishment of the proposed PV facility.	▪ Undertake inspections to monitor compliance.	▪ Monthly	▪ Project Developer, Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
reduces the risks to their livelihoods		▪ The loss of high-quality agricultural land should be avoided and/or minimised by careful planning in the final layout of the proposed PV facility. The recommendations of the agricultural / soil assessment should be implemented. Note: During the EIA Phase, no sensitive areas for avoidance were identified by the Agricultural specialist. The study area is predominately low to medium sensitivity from an agricultural perspective.			
10.66. Benefits associated with support for local communities from Socio-economic development (SED) contributions.	Enhance benefits for local communities	▪ The RLM or PKSDM should be consulted as to the structure and identification of potential trustees to sit on the Community Trust. The key departments in the RLM or PKSDM that should be consulted include the Municipal Managers Office, IDP Manager and LED Manager, where possible. ▪ Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community. ▪ Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the Solar PV plant.	▪ Ensure that the Community Trust is audited.	▪ Annually	▪ Project Developer and Contractor
10.67. Visual impact associated with the proposed PV facility and associated infrastructure and the potential impact on the areas rural sense of place; potential impact on property values; and potential impact of the	Minimise visual impact and impact on sense of place, potential impact on property values, and potential impact on tourism.	▪ The recommendations contained in the VIA should be implemented.	▪ Undertake inspections to monitor compliance.	▪ Once-off	▪ Project Developer and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
proposed PV facility on local tourism.					
C.8. IMPACTS RESULTING FROM THE BATTERY ENERGY STORAGE SYSTEMS (BESS)					
10.68. Safety, health and environmental impacts as a result of the Solid State Lithium Ion Battery Energy Storage System (BESS) and Redox Flow BESS	Minimise the safety, health and environmental risks associated with the BESS	▪ Consider the findings and recommendations of the High-Level Safety, Health and Environment Risk Assessment compiled for the BESS. Refer to Appendix D of this EMPr for a detailed list of preventative and mitigation measures for the BESS.	▪ Conduct audits to verify if the preventative and mitigation measures have been considered and implemented, where relevant and required, during the operational phase. Report any non-compliance.	▪ As required during the design phase	▪ Project Developer and ECO
C.9. GEOHYDROLOGICAL IMPACTS **Note from the CSIR: The use of existing boreholes to source groundwater (if available and suitable) is only the third most likely water use option. Water sourced from the local municipality is the first option in terms of viability and the second is to source water from a third party, but consideration of other options is vital. Potential environmental impacts pertaining to local groundwater resources have been considered in the EIA, and various management inputs have been recommended to ensure safe and sustainable management of the groundwater resources in the area. However, these impact management actions are not mandatory if water is indeed sourced from the local municipality or via a third party. The recommendations in this section only apply if groundwater will be used for the project. The management inputs are captured in two phases. Phase 1 will be required to determine if the groundwater is of a suitable quality and quantity; and Phase 2 will only be required if the groundwater quality and quantity are determined more accurately and confirmed it is suitable for use.**					
10.69. Lowering of groundwater levels as a result of over-abstraction	Avoid over-abstraction of groundwater resources.	▪ Adhere to the borehole's safe yield and to monitor water levels and flow. ▪ Boreholes must be correctly yield tested according to the National Standard (SANS 10299-4:2003, Part 4 – Test pumping of water boreholes). This includes a Step Test, Constant Discharge Test and recovery monitoring.	▪ Ensure that this is taken into consideration and that a Geohydrology Specialist with suitable qualifications and experience is appointed to undertake relevant tests by reviewing signed minutes of meetings or signed reports or the appointment letter. ▪ Ensure that the borehole parameters are documented to ensure trends and consumption can be monitored.	▪ As required	▪ Project Developer, Specialist, and Environmental Manager
10.70. Potential impact on groundwater quality as a result of using cleaning agents	Minimise the potential of groundwater contamination	▪ Use environmentally safe cleaning agents that breakdown naturally and do not cause adverse effects.	▪ Ensure that these mitigation measures are monitored on an ongoing basis, and any non-compliances reported.	▪ Ongoing	▪ Project Developer and Environmental Manager

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
10.71. Potential impact on groundwater quality as a result of electrolyte that will be used for the BESS	Minimise the potential of groundwater contamination	▪ Ensure that all electrolyte or chemicals stored or used on site have secondary containment systems in place with reliable leak detection, annunciation in place. Ensure that all chemicals are handled on concrete bunded surfaces and not on bare soil. ▪ Any waste products produced from the BESS systems should be removed and disposed of appropriately. ▪ Waste water produced by fire hydrants should not be allowed to runoff into the environment. ▪ It is recommended that all BESS's are placed a minimum of 50m from any borehole.	▪ Monitor the placement and storage of electrolyte and chemicals via visual inspections. Monitor the implementation of spill containment measures and record and report non-compliance. ▪ Waste removal and disposal to be monitored. Monitor via site audits and record non-compliance and incidents. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents. ▪ Undertake inspections during usage of fire hydrants to ensure compliance and report any concerns.	▪ Ongoing and as required during the operational phase	▪ Project Developer and Environmental Manager
C.10. GEOTECHNICAL IMPACTS					
10.72. Increased unnatural hard surfaces	To minimise erosion caused by the creation of unnatural hard surfaces i.e., road surfaces and stormwater drainage.	▪ Install drainage to divert stormwater away from activities, roads/tracks, structures and erected structures, where required. ▪ Implement the stormwater management plan. Generic management for typical infrastructure of the proposed development, including similar erosion control and stormwater management during the construction phase, and no regular maintenance activities to take place outside of the authorised footprint and all vehicles to remain on authorised roads and tracks.	▪ Monitor activities and report any non-compliance.	▪ On-going	▪ ECO
10.73. Contamination of geologic materials	To minimise the contamination of geologic materials caused by spillages/leakages	▪ During the execution of the operations, appropriate measures to prevent pollution and contamination of the riparian environment must	▪ Monitor activities and report any non-compliance.	▪ On-going	▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		be implemented e.g. including ensuring that construction equipment is well maintained. ▪ Provision must be made for refuelling at the storage area by protecting the soil with an impermeable groundcover/bunding. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained. ▪ Where refuelling away from the dedicated refuelling station is required, a mobile refuelling unit must be used. Appropriate ground protection such as drip trays must be used. ▪ Electrolyte spillage to be mitigated through leak detection, double containment and suitably designed bunding for the structure, approved by a qualified professional. ▪ If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilled material, as reported. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes. ▪ The maintenance of solar panels must be closely monitored and the use of hazardous chemical products must be avoided when solar panels are cleaned.			
C.11. WASTE MANAGEMENT					
10.74. Pollution of the surrounding environment as a result of the handling, temporary storage and disposal of solid waste (general and hazardous).	Reduce soil and groundwater contamination as a result of incorrect storage, handling and disposal of general and hazardous waste.	▪ Sufficient waste collection bins and skips (or similar) should be provided at the PV facility. Waste collection bins and skips should be covered with suitable material and correctly labelled, and should be kept in a designated, demarcated area, where access control is monitored and managed.	▪ Monitor waste generation and collection throughout the operational phase.	▪ Weekly	▪ Facility Manager
		▪ Segregation of hazardous waste from general waste to be in place. Waste separation is	▪ On-site inspection of waste segregation.	▪ Weekly ▪ Weekly	▪ Facility Manager ▪ Facility Manager

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		encouraged and therefore receptacles should be labelled to reflect the different waste types.	▪ Control of waste management practices throughout operational phase.		
		▪ General waste and hazardous waste should be removed from the site on a regular basis and disposed of at an appropriate, licenced waste disposal facility. Hazardous waste should be removed by an approved waste management Contractor. General solid waste could be removed from the site by municipal services. Waste disposal slips or waybills should be kept on file for auditing purposes as proof of disposal, as applicable	▪ Inspection of the waste storage area. ▪ Monitor via site audits and record non-compliance and incidents. Facility Manager to monitor and audit disposal slips.	▪ Daily ▪ Monthly	▪ Facility Manager
		▪ Ensure that the PV facility is kept clean at all times and that operational personnel are made aware of correct waste disposal methods.	▪ Conduct training for all operational personnel. ▪ Monitor the state of PV facility via site audits and record non-compliance and incidents.	▪ Once-off during operations and ensure that all new staff are inducted. ▪ Daily	▪ Facility Manager
		▪ No solid waste may be burned or buried on site.	▪ Monitor via site audits and record non-compliance and incidents.	▪ Daily	▪ Facility Manager
		▪ Waste amounts shall be recorded on a monthly basis.	▪ Waste amounts to be documented.	▪ Monthly	▪ Facility Manager
		▪ All operational waste (concrete, steel, rubbles etc.) to be removed from the site and waste hierarchy of prevention, as the preferred option, followed by reuse, recycling, recovery must be implemented, where possible. ▪ Other non-hazardous solid waste (e.g., packaging material) to be disposed of at a licensed landfill. ▪ All liquid waste (used oil, paints, lubricating compounds and grease) to be packaged and disposed of by appropriate means. ▪ Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided as to avoid spillages.	▪ Waste removal and disposal to be monitored	▪ Monthly	▪ Facility Manager

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Wastewater from operations and painting activities must be collected in a designated container and disposed of at a suitable disposal point off site.			
C.12. HUNTING PRACTICES ON ADJACENT FARMS					
10.75. Potential impact on operational activities and personnel as a result of hunting practices on nearby or adjacent farms.	To ensure safety of operational activities and personnel as a result of hunting operations on nearby or adjacent farms.	▪ Ensure that an open communication strategy is created and maintained between the Project Developer and owners (or managers) of nearby or adjacent farms where hunting takes place in order to ensure that the Project Developer are made aware of planned hunts. ▪ Ensure that operational personnel are made aware of the planned hunts and are trained on the necessary protocols to be taken.	▪ Monitor and record the notifications received from the owners (or managers) of the adjacent farms where hunting takes place. ▪ Carry out Environmental Awareness Training and ensure that safety aspects are discussed in terms of hunting operations on adjacent farms. Conduct audits of the signed attendance registers. ▪ Carry out random inspections to ensure that planned hunts are being communicated to the Project Developer and that operational personnel are being duly informed.	▪ On-going ▪ Once-off at the commencement of operations and ensure that all new staff are inducted ▪ Monthly	▪ Facility Manager
D. DECOMMISSIONING PHASE					
D.1. AGRICULTURE AND SOILS IMPACTS					
10.76. Erosion	That disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	▪ Implement an effective system of stormwater run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points and it must prevent any potential down slope erosion.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the stormwater run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	▪ Every 2 months during the decommissioning phase, and then every 6 months after completion of decommissioning, until final sign-off is achieved.	▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
10.77. Erosion	That vegetation clearing does not pose a high erosion risk.	▪ Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.	Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation.	▪ Every 4 months during the decommissioning phase, and then every 6 months after completion of decommissioning, until final sign-off is achieved.	▪ ECO
10.78. Topsoil loss	That topsoil loss is minimised	▪ If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	Record GPS positions of all significant occurrences (that is an area of greater than 25 square metres) of below-surface soil disturbance (e.g., excavations). Record the date of topsoil stripping and replacement. Check that topsoil covers the entire disturbed area.	▪ As required, whenever areas are disturbed.	▪ ECO
D.2. VISUAL IMPACTS					
10.79. Potential visual effect of any remaining structures, platforms and disused roads on the landscape	Minimise exposure of visual receptors to impacts associated with decommissioning.	▪ Ensure that procedures for the removal of structures, such as the solar arrays and stockpiles during decommissioning are implemented, including recycling of materials and rehabilitation of the site to a visually acceptable standard, and signed off by the delegated authority. ▪ It is assumed that some access roads and concrete pads would remain. Those that are not required should be ripped and regraded, and vegetation or cropland reinstated to match the surroundings. ▪ Exposed or disturbed areas to be revegetated to blend with the surroundings.	▪ Conduct site inspections to verify the implementation of mitigation measures and ensure good housekeeping is maintained. Record and report any non-compliance.	▪ Weekly, as well as a prescribed maintenance period thereafter (usually one year).	▪ ECO / Contractor / qualified rehabilitation ecologist or horticulturist.
D.3. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
10.80. Damage or destruction of archaeological sites or graves	Rescue information, artefacts or burials before extensive damage occurs	▪ Reporting chance finds of graves and dense clusters of artefacts as early as possible to an archaeologist and/or the South African Heritage Resources Agency (SAHRA) (https://www.sahra.org.za/contact/), protect in situ and stop work in immediate area and appoint archaeologist to exhume or sample as needed (where relevant)	Inform staff to be vigilant and carry out inspections of all new excavations	▪ Ongoing basis ▪ Whenever on site (at least weekly)	▪ Construction Manager or Contractor ▪ ECO
10.81. Visible landscape scarring	Minimise landscape scarring	▪ Ensure disturbance is kept to a minimum and does not exceed project requirements. Minimise the duration of the activities. Rehabilitate the entire site once the infrastructure has been removed.	▪ Monitoring of surface clearance relative to approved layout ▪ Undertake visual inspections and report non-compliance	▪ Ongoing basis ▪ As required	▪ Construction Manager or Contractor ▪ ECO
D.4. PALAEONTOLOGY IMPACTS					
10.82. Damage or destruction of palaeontological materials.	Safeguarding, recording, and sampling of palaeontological materials encountered or exposed during decommissioning (Chance Fossil Finds)	▪ If any fossiliferous deposits are exposed by surface clearance or excavations during the decommissioning phase of the development, the Chance Fossils Finds Protocol outlined in Appendix C of this EMPr must be fully implemented. The ECO must familiarise themselves with the Chance Fossils Finds Protocol and ensure that it is kept on file on site. ▪ The ECO should be made aware of the possibility of important fossil remains being found or unearthed during the decommissioning phase. Ensure that monitoring of all bedrock excavations (> 1 m) and major cleared sites for fossil remains is undertaken on an on-going basis by the ECO during the decommissioning phase. ▪ Significant fossil finds should be safeguarded and reported as soon as possible to the South African Heritage Resources Agency (SAHRA) (Contact details: 111 Harrington Street, Cape Town, 8001. PO Box 4637, Cape Town, 8000.	▪ Ensure that the Chance Fossil Finds Protocol is implemented if any fossiliferous deposits are exposed or during chance fossil finds. Undertake inspections and report any non-compliance. ▪ Regular visual inspection of substantial excavations (> 1 m) and cleared areas for fossil remains. ▪ The immediate area of the fossil find must be safeguarded with security tape / fence / sand bags if necessary.	▪ Ongoing during the decommissioning	▪ ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		Tel: 021 462 4502. Fax: 021 462 4509. Email: info@sahra.org.za).			
D.5. TERRESTRIAL BIODIVERSITY AND SPECIES IMPACTS					
10.83. Rehabilitation of flora on site	Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to construction.	• The loss of vegetation is unavoidable within the approved layout development footprint, but sensitive areas must be avoided. • Implement appropriate rehabilitation measures to restore each habitat to a natural state after decommissioning. • The effort must benefit the potential faunal species that may find refuge on the site. • All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction. ▪ Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas.	• Monitor the placement of decommissioning activities via visual inspections, and record and report any non-compliance. • Final external audit of area to confirm that area is rehabilitated to an acceptable level.	▪ Once-off	▪ Project Developer with advice from specialist
D.6. AQUATIC BIODIVERSITY AND SPECIES IMPACTS					
10.84. Potential impact on freshwater ecology as a result of the potential decommissioning of the proposed PV and associated infrastructure.	Limit the disturbance of aquatic habitats.	▪ For all project-related components within the site, the aquatic features of medium sensitivity should be demarcated by the appointed ECO before the commencement of the decommissioning activities and treated as no-go areas during the decommissioning phase. ▪ Minimise works within aquatic ecosystems. If the project layout avoided these areas, the decommissioning works would also be able to avoid aquatic habitats as delineated. Note that all aquatic areas recommended for avoidance have been avoided in the EIA phase layout identification. ▪ Any activities that require decommissioning activities within the delineated aquatic features and the recommended buffers should be	▪ Monitoring that no-go areas are adhered to should be undertaken on an ongoing basis for the duration of the decommissioning phase. ▪ Ongoing monitoring of the implementation of method statements and rehabilitation measures should be undertaken in the decommissioning phase.	▪ Ongoing during decommissioning	▪ Proponent/ contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		described in method statements that are approved by the ECO. ▪ Rehabilitate and revegetate disturbed areas, where required. ▪ Rehabilitation of any disturbed areas within the aquatic features and the recommended buffer areas should be undertaken immediately following the completion of the disturbance activity according to rehabilitation measures as included in a method statement for that specific activity. ▪ The road network should be returned to that resembling pre-construction, with all additional roads removed where possible. ▪ Decommissioning activities within aquatic features should be undertaken in the dry season where possible. ▪ Sediment traps should be used where necessary. ▪ Laydown areas should be placed within the approved PV footprint and layout. ▪ Good housekeeping measures should be implemented as per the project EMPr and monitored by the appointed ECO. This should specifically address on-site stormwater management and prevention of pollution during decommissioning. Any stormwater that does arise within the decommissioning site must be handled appropriately to trap sediments and pollutants.			
D.7. AVIFAUNA IMPACTS					
10.85. The noise and movement associated with the activities at the Study Area will be a source of disturbance which would	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the	▪ A site-specific Decommissioning EMPr (DEMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the DEMPr and	▪ Implementation of the DEMPr. Oversee activities to ensure that the DEMPr is implemented and enforced via site audits and	▪ On a daily basis ▪ Weekly ▪ Weekly ▪ Weekly ▪ Weekly	▪ Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
lead to the displacement of avifauna from the area.	requirements of the Decommissioning EMPr.	should apply good environmental practice during decommissioning. The DEMPr must specifically include the following: o No off-road driving; o Maximum use of existing roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical; o Measures to control noise and dust according to latest best practice; o Restricted access to the rest of the property, the activity should as far as possible be restricted to the development footprint; o Strict application of all recommendations in the ecological and botanical specialist studies, especially as far as limitation of the activity footprint is concerned.	inspections. Report and record any non-compliance. ▪ Ensure that decommissioning personnel are made aware of the impacts relating to off-road driving. ▪ Access roads must be demarcated clearly. Undertake site inspections to verify. ▪ Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. ▪ Ensure that the decommissioning area is demarcated clearly and that personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		
D.8. SOCIO-ECONOMIC IMPACTS					
10.86. Social impacts associated with retrenchment including loss of jobs, and source of income.	Minimise job losses	▪ The proponent should ensure that retrenchment packages are provided for all staff retrenched when the plant is decommissioned. ▪ All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning. ▪ Revenue generated from the sale of scrap metal during decommissioning should be allocated to aid in funding closure and rehabilitation of disturbed areas.	▪ Verify that retrenchment practices are compliant with South African labour legislation. ▪ Verify that the Project Developer implemented succession training of locally employed staff before the plant is decommissioned.	▪ Once-off during the decommissioning phase	▪ Contractor and ECO
D.9. IMPACTS RESULTING FROM THE BATTERY ENERGY STORAGE SYSTEMS (BESS)					
10.87. Safety, health and environmental impacts as a result of the Solid State	Minimise the safety, health and environmental risks associated with the BESS	▪ Consider the findings and recommendations of the High-Level Safety, Health and Environment Risk Assessment compiled for the BESS.	▪ Conduct audits to verify if the preventative and mitigation measures have been considered	▪ As required during the design phase	▪ Project Developer, Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
Lithium Ion Battery Energy Storage System (BESS) and Redox Flow BESS		Refer to Appendix D of this EMPr for a detailed list of preventative and mitigation measures for the BESS.	and implemented, where relevant and required, during the decommissioning phase. Report any non-compliance.		
D.10. GEOHYDROLOGICAL IMPACTS **Note from the CSIR: The use of existing boreholes to source groundwater (if available and suitable) is only the third most likely water use option. Water sourced from the local municipality is the first option in terms of viability and the second is to source water from a third party, but consideration of other options is vital. Potential environmental impacts pertaining to local groundwater resources have been considered in the EIA, and various management inputs have been recommended to ensure safe and sustainable management of the groundwater resources in the area. However, these impact management actions are not mandatory if water is indeed sourced from the local municipality or via a third party. The recommendations in this section only apply if groundwater will be used for the project. The management inputs are captured in two phases. Phase 1 will be required to determine if the groundwater is of a suitable quality and quantity; and Phase 2 will only be required if the groundwater quality and quantity are determined more accurately and confirmed it is suitable for use.**					
10.88. Lowering of groundwater levels as a result of over-abstraction	Avoid over-abstraction of groundwater resources.	▪ Adhere to the borehole's safe yield and to monitor water levels and flow. ▪ Boreholes must be correctly yield tested according to the National Standard (SANS 10299-4:2003, Part 4 – Test pumping of water boreholes). This includes a Step Test, Constant Discharge Test and recovery monitoring.	▪ Ensure that this is taken into consideration and that a Geohydrology Specialist with suitable qualifications and experience is appointed to undertake relevant tests by reviewing signed minutes of meetings or signed reports or the appointment letter. ▪ Ensure that the borehole parameters are documented to ensure trends and consumption can be monitored. ▪ Undertake an audit to verify if the monitoring programme is being implemented.	▪ As required	▪ Project Developer, Specialist, and ECO
10.89. Accidental oil spillage / fuel leakage	Minimise potential ground water contamination.	▪ Vehicles must be regularly serviced and maintained to check and ensure there are no leakages. ▪ Any engines that stand in one place for an excessive length of time must have drip trays. Diesel fuel storage tanks, if required, should be above ground on an impermeable surface in a bunded area.	▪ Construction vehicles and equipment need to be monitored throughout the construction phase. Monitor via site audits and record non-compliance and incidents. ▪ Monitor the placement of fuel storage tanks and engines and	▪ Four times per annum for the construction period. ▪ Weekly ▪ Weekly ▪ Weekly ▪ As necessary	▪ Project Developer, Contractor and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the construction site camp for this purpose, if off-site refuelling is not possible. ▪ If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilled material, and reported. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes	use of drip trays at the site camp via visual inspections. Monitor the usage of spill containment measures and record and report non-compliance. ▪ Monitor the placement and designation of the area for refuelling at the site camp via visual inspections. Monitor the occurrence of potential spills and the usage of spill containment measures and record and report non-compliance. ▪ Monitor the refuelling/ servicing process and record the occurrence of any spillages. ▪ Monitor the correct disposal of spilled material or contaminated soil and audit the waybills. Record and report non-compliance.		
D.11. GEOTECHNICAL IMPACTS					
10.90. Increased unnatural hard surfaces	Minimise erosion caused by the creation of unnatural hard surfaces i.e., road surfaces and stormwater drainage.	▪ Only drive and park vehicles where necessary. ▪ It is recommended that the natural topography to be reinstated and land rehabilitation to near natural state is achieved, i.e., removal of foundations and backfilling of any resultant voids within the soil, as well as removal of hard surfaced areas. Replacement soil should be sourced locally to ensure homogeneity. ▪ Reinstate natural topography where cut-to-fill embankments have been constructed. ▪ Implement generic environmental management procedures for infrastructure.	▪ Monitor activities and report any non-compliance.	▪ On-going	▪ ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
10.91. Contamination of geologic materials	To minimise the contamination of geologic materials caused by spillages/leakages	▪ During the execution of the decommissioning, appropriate measures to prevent pollution and contamination of the riparian environment must be implemented e.g., including ensuring that equipment is well maintained. ▪ Provision must be made for refuelling at the storage area by protecting the soil with an impermeable groundcover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained. ▪ Where refuelling away from the dedicated refuelling station is required, a mobile refuelling unit must be used. Appropriate ground protection such as drip trays must be used. ▪ If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilled material, as reported. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes.	▪ Monitor activities and report any non-compliance.	▪ On-going	▪ ECO
D.12. WASTE MANAGEMENT					
10.92. Generation of waste due to disassembly of the solar facility.	Avoid substantial negative impacts at the decommissioning phase due to insufficient planning.	▪ Suitable receptacles must be provided for the temporary storage of various waste types such as scrap metal and concrete, until it is removed to the nearest licensed landfill. ▪ Waste separation is encouraged and therefore receptacles should be labelled to reflect the different waste types.	▪ Audit the implementation of mitigation measures recommended for the decommissioning phase.	▪ During the decommissioning phase	▪ ECO

APPENDIX A: CV OF THE EAP

CV OF PAUL LOCHNER

Employer: Council for Scientific and Industrial Research (CSIR)
PO Box 320, Stellenbosch, 7600, South Africa
Phone: +27 21 888 2486 (w)
Email: plochner@csir.co.za
Date of Birth: 13 June 1969
Nationality: South African

BIOSKETCH

Paul Lochner is an environmental assessment practitioner at the CSIR in Stellenbosch, with 29 years of experience in a wide range of environmental assessment and management studies. His particular experience is in environmental planning and assessment for renewable energy, electricity grid infrastructure, desalination, oil & gas, wetlands & coastal zone management, and industrial & port development. He has been closely involvement in the research and application of Strategic Environmental Assessment in South Africa, and also has wide experience in Environmental & Social Impact Assessment, Environmental Management Programs and Environmental Screening Studies. For the past 13 years he has been the leader of a group of approximately 10 to 20 environmental scientists that has been at the forefront of advancing environmental assessment in South Africa.

PROFESSIONAL PROFILE

- Commenced work at CSIR in 1992, after completing a B.Sc. degree in Civil Engineering and a Masters in Environmental Science, both at the University of Cape Town. CSIR is a national science council. His initial work at focused on wetlands and estuarine management; environmental engineering in the coastal zone; and coastal zone management plans.
- As the market for environmental assessment work grew, he led Environmental Impact Assessments (EIAs), in particular for coastal and large-scale industrial developments; Strategic Environmental Assessments (SEAs) for new industrial development zones; and Environmental Management Plans (EMPs) for wetlands, estuaries and coastal developments. He has been the project leader for several SEAs and EIAs over the past 28 years.
- In 1998-2000, he was the project manager for CSIR's three year research program into Strategic Environmental Assessment (SEA). This led to him being a lead author of the *Guideline Document for SEA* in South Africa, published by CSIR and the national Department of Environmental Affairs (DEA) in February 2000.
- In 1999-2000, he was project manager for the legal, institutional, policy, financial and socio-economic component of the Cape Action Plan for the Environment ("CAPE"), a large-scale GEF-funded study to ensure sustainable conservation of the Cape Floral Kingdom. It was prepared for WWF-South Africa and required extensive interaction with experts, government and civil society.
- Over the past 24 years has been closely involved with several environmental studies for industrial and port-related projects in the Coega Industrial Development Zone (IDZ), near Port Elizabeth. This included the SEA for the establishment of the Coega IDZ in 1996/7.
- He is a leading expert in Environmental Management Programs (EMPs), both the preparation of EMPs as well as overseeing the implementation thereof. In recognition of his experience in this domain, he was appointed by the Western Cape government to write the *Guidelines for EMPs* that is still being used in the province.
- He has prepared EMPs for wetlands and estuaries, such as for the establishment of the Rietvlei Nature Reserve and Intaka Island Nature Reserve, both in Cape Town.
- He has experience in overseeing the implementation of EMPs, and has been the chairperson of the Environmental Monitoring Committee for the Intaka Island Nature Reserve in Cape Town since 1996. He is also Chairperson of the Intaka Island Environmental Trust.
- He has undertaken more than 30 environmental assessments for the renewable energy sector, in particular for wind and solar photovoltaic energy projects.
- He has been part of almost all environmental studies for medium to large scale reverse osmosis sea water desalination plants conducted in the past 10 years in South Africa and Namibia. This includes site selection study and EIA for the Namwater desalination plant near Swakopmund in Namibia, the two Umgeni Water plants at Tongaat and Lovu on the KwaZulu-Natal coast, and desalination plants at Coega, Saldanha and Cape Town.
- Since 2008, Paul has been the leader and manager of the Environmental Management Services (EMS) group within CSIR. This group consists environmental scientists, planners and engineers, with offices in Stellenbosch, Cape Town and Durban.
- He has extensive experience in conducting environmental assessments in accordance with requirements of international lenders, such as the World Bank performance requirements, International Finance Corporation (IFC) performance standards and the Equator Principles.

- Over the past eight years, he has been project leader on national-scale SEAs being conducted for national DEA and other government departments in support of the Strategic Integrated Projects (SIPs) of government and the National Development Plan for South Africa. These SEAs provided strategic geospatial planning for new large-scale national infrastructure priorities. The SEA methodology applied was highly innovative and has received national and international awards. The studies have generated new environmental planning tools to support responsible decision-making, and the SEA outcomes have been converted into national legislation and informed policy-making.
- He has authored more than 15 international journal publications, peer reviewed conference proceedings and published national guidelines (a publications record is available on request).

PERSONAL SKILLS AND CAPABILITIES

- Holistic understanding of environmental and social aspects at policy, program and project levels
- Ability to lead, inspire and motivate a team of environmental scientists in a consulting business
- Coordination of experts from diverse disciplines to support evidence-based decision-making
- Ability to integrate of environmental, social and economic aspects within a systems model
- Design of innovative processes to respond effectively to proposals and meet needs of clients
- Review and quality assurance for environmental assessment processes and reports
- Project management, financial management, report writing and communication skills.

EDUCATION

- BSc (Civil Engineering) awarded with Honours, *University of Cape Town*, 1990
- MPhil (Environmental Science), *University of Cape Town,* 1992

EMPLOYMENT

- Environmental scientist at CSIR (Stellenbosch) from October 1992 to present.
- Group Leader of CSIR Environmental Management Services since August 2008.

PROFESSIONAL REGISTRATION

- Environmental Assessment Practitioners Association of South Africa (EAPASA), Registration no. 2019/745.
-

PROFESSIONAL MEMBERSHIP AND POSITIONS HELD

- Member of the International Association for Impact Assessment (IAIA)
- 1996 to 1999: Committee Member of the Western Cape Branch of the International Association for Impact Assessment (IAIA) and Chairperson in 1997-1998.
- 1996 to present: Chairperson of Blouvlei Intaka Island Environmental Committee at Century City, Cape Town, which oversees management of the Intaka Island Nature Reserve
- 2010 to present: Chairperson of Intaka Island Environmental Trust, that oversees the operation of the Eco-centre and education program at the Intaka Island Nature Reserve
- 2017: Conference Organising Committee member and Program Director for IAIA South Africa national conference, August 2017, Goudini.

RECENT PROFESSIONAL AWARDS

- 2018: International Association for Impact Assessment (IAIA) regional award for contribution to the development of Strategic Environmental Assessment in South Africa, awarded at the annual international conference of IAIA in May 2018, held in Durban, South Africa.
- 2017: CSIR Implementation Unit “Directors award” for outstanding contribution by an individual.
- 2017: CSIR Implementation Unit award for Collaboration, for the role of the Shale Gas SEA team in coordinating expertise from across CSIR.
- 2015: CSIR Implementation Unit award for “outstanding contribution by a team” for the Wind and Solar Photovoltaic SEA and Electricity Grid SEA.

TRACK RECORD OF PROFESSIONAL EXPERIENCE

This is an abbreviated record of experience. A full record is available on request. Projects are located in South Africa unless otherwise stipulated.

Duration	Project description	Role	Client
2023 - ongoing	**Power-to-X (PtX) Pathways Grant** for green hydrogen analysis to support policy development and private sector investment for south Africa	Co-author & researcher	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
2022 - ongoing	**Green hydrogen market opportunities** for South Africa: Analyses of lighthouse projects and guidance for Environmental & Social Impact Assessments	Co-author & researcher	GIZ (CSIR is part of consulting team with GFA)

Duration	Project description	Role	Client
2022 - ongoing	**EIA and Basic Assessments** for 1760 MW of wind and solar PV facilities near Beaufort West	Project leader	Genesis Eco-Energy Developments (Pty) Ltd
2022-2023	**EIAs** for 720 MW Kaladokhwe wind energy facilities (x3) near Cradock	Project leader	Atlantic Energy Partners
2022-2023	**Environmental Screening** for 1GW offshore wind energy planning off KwaZulu Natal, South Africa	Reviewer	Progression Energy, USA
2022-2023	**Environmental assessment training and support (phase 2)** for renewable energy planning and the IPP sector for the Eastern Cape province	Project leader	Dept of Economic Development, Environmental Affairs & Tourism, Eastern Cape
2022 – 2023	**EIA and Basic Assessment** for the Enertrag Vhuvhili 300 MW solar PV facility and electricity grid connection for Sasol, Secunda	Project leader	Enertrag (to supply green energy under contract to Sasol)
2022 - ongoing	**Review of permitting and governance** for the Mogalakwena Mine, Limpopo	Project leader	Anglo American Platinum
2021- ongoing	**Advisory services for environmental permitting** for Anglo American's Carbon Neutrality and Smart Power projects in South Africa, Namibia, Botswana and Zimbabwe	Project leader	Anglo American Platinum
2021- ongoing	**Permitting strategy for innovative pilot projects** for the Mogalakwena platinum mine	Project leader	Anglo American Platinum
2022	**Opportunities and constraints analysis for offshore wind potential for South Africa -** inventory and collation of spatial data	Project leader	World Bank
2021-2022	**Environmental assessment training and support (phase 1)** to provincial government in the independent power producer sector in the Eastern Cape province	Project leader	Dept of Economic Development, Environmental Affairs & Tourism, Eastern Cape
2021	**Renewable Energy Feasibility Plan** for the Atlantis Special Economic Zone, Cape Town	Lead co-leader	Atlantis Special Economic Zone
2021	**Basic Assessment** for 1350 MW Aardvark solar PV facilities near Copperton	Project leader	ABO Wind renewable energies (Pty) Ltd
2020-2021	**Basic Assessments** for 1575 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure near Touws River, Western Cape	Project leader	Veroniva
2020	**Independent expert review** of appeals against the EA for exploration drilling for oil and gas within Offshore Block ER236 off the coast of KwaZulu-Natal	Lead author	DEFF Appeals Directorate
2020	**Independent expert review** of the appeals against the EA issued for the Inyanda-Roodeplaat Wind Energy Facility of 187 MW proposed near Port Elizabeth	Lead author	DEFF Appeals Directorate
2019-2020	**Environmental scoping** for a Desalination Plant and Water Carriage System for water supply to Windhoek and the central coastal area of Namibia	Project author	NamWater (Namibia) and KfW Development Bank (Germany)
2019-2020	**Environmental Performance Compliance Study** for Foundries in South Africa	Project reviewer	National Foundries Technology Network
2019	**Independent Expert review** of the ecology study as part of the EIA and EMPR for diamond prospecting at Bloemhof Dam Nature Reserve, North West province	Independent reviewer	DEA Appeals Office
2018-2019	**Greater Saldanha Bay Strategic Environmental Assessment (SEA):** Phase 1 Monitoring and Decision Support System	Project leader	Western Cape provincial government
2018-2019	**Environmental Screening Study** for a proposed 100 to 150 megalitre/day desalination facility for City of Cape Town, Phase 1: Pre-feasibility study	Project co-leader	City of Cape Town and iX Engineers
2018-2019	**EIA for 150 MW wind power project in Ghana**	Proposal and EIA Quality Assurance	Volta River Authority and Seljen Consult Ltd
2019	**Environmental Assessment** for the Kenhardt solar PV facility and electrical infrastructure (100 MW x 3), Northern Cape	Project leader	Scatec Solar Africa (Pty) Ltd

Duration	Project description	Role	Client
2017-2019	**SEA for Wind & Solar Photovoltaic Energy** development in South Africa (Phase 2)	Project reviewer	DEA & national Dept of Energy (DOE)
2017-2019	**SEA for Energy Corridors** and development of a gas pipeline network for South Africa	Project reviewer	DEA, DOE, iGas, Eskom (national electricity utility)
2017-2019	**SEA for Aquaculture** Development in South Africa (marine and freshwater)	Project leader	DEA and national Dept of Agriculture Forestry and Fisheries (DAFF)
2018	**Environmental Assessments** for the Vryburg Solar project (115 MW x 3) in the Vryburg Renewable Energy Development Zone (REDZ)	Co-project manager and co-author	Veroniva & Scatec
2018	**EIA** for West Bank Waste Water Treatment works **marine outfall pipeline,** East London	Independent reviewer	WSP and Buffalo City Municipality
2017-2018	**Site selection and environmental screening** for a proposed 120 – 150 ML/day desalination plant for the City of Cape Town	Project leader	City of Cape Town and iX Engineers
2017-2018	**EIA and EMP for Icyari Coltan Mine**, Rwanda	Project reviewer	Mawarid Mining Rwanda Ltd (MMRL), UAE
2016-2017	**SEA for the Square Kilometre Array** radio-telescope in the Karoo, South Africa	Project leader	DEA and DST
2016-2017	**SEA for Shale Gas Development** in the Karoo region of South Africa	Project co-leader	DEA and other government departments
2015-2016	**SEA for the development of Electrical Grid Infrastructure** for South Africa	Project leader	DEA and Eskom (national electricity utility)
2017	EIA for the 75 MW x 12 **solar photovoltaic** energy projects near Dealesville, Free State	Project leader	Mainstream Renewable Power SA
2014-2015	EIA for Ishwati Emoyeni 140 MW **wind energy project** and supporting electrical infrastructure at Murraysburg, Western Cape	Project leader	Windlab South Africa
2012-2015	**SEA for identification of renewable energy zones** for wind and solar photovoltaic projects in South Africa	Project leader	DEA and other national government departments
2012-2013	**Environmental Screening Study (ESS) for a desalination plant** for the City of Cape Town	Project leader	City of Cape Town & WorleyParsons
2012-2013	EIA for the **desalination plant** for the Saldanha area	Project leader	West Coast District Municipality & WorleyParsons
2012-2013	EIA for the **manganese export terminal** at the Port of Ngqura and Coega Industrial Development Zone (IDZ)	Project leader	Transnet
2011 - 2012	EIA (x2) for **100 MW solar photovoltaic** project at Blocuso and 100 MW solar PV project at Roode Kop in the Northern Cape	Project leader	Mainstream Renewable Power
2011 – 2012	EIA (x2) for 75 MW **solar photovoltaic project** at GlenThorne and 75 MW project at Valleydora, in the Free State	Project leader	Solaire Direct
2010-2011	More than 10 Basic Environmental Assessments (BAs) for **solar photovoltaic projects** in the Western Cape, Northern Cape, Eastern Cape and Free State	Project leader	Conducted for Dutch, German, French and South African companies
2010/2011	**EIA for a 100 MW wind project at Zuurbron and a 50 MW wind project Broadlands** in the Eastern Cape	Project leader	WindCurrent SA (German-based company)
2010/2011	**EIA for the proposed 143 MW Biotherm wind energy project near Swellendam**, Western Cape, South Africa	Project leader	Biotherm South Africa (Pty) Ltd
2010-2011	**EIAs (x4) for the proposed InnoWind wind energy projects near Swellendam, Heidelberg, Albertinia and Mossel Bay (totalling approx 210 MW),** Western Cape, South Africa	Project leader	InnoWind South Africa (Pty) Ltd
2009-2010	**EIA for the proposed Electrawinds wind energy facility** of 45-75 MW capacity in the Coega IDZ, Eastern Cape	Project leader	Electrawinds N.V. (Belgium)
2009-2010	**EIA for proposed 180 MW Jeffreys Bay wind energy project,** Eastern Cape	Project Leader and co-author	Mainstream Renewable Power South Africa
2009-2010	**EIA for the proposed 70 megalitre/day desalination plant** at Mile 6 near Swakopmund, Namibia	Project leader	NamWater, Namibia
2009	**ESS for a proposed Deepwater Port,** Container Hub and Industrial Development Zone, Ghana	Project Manager	Project Management International Pty Ltd

Duration	Project description	Role	Client
2009	**EMP for the Operational Phase of the Berg River Dam**, Franschoek, South Africa	Project leader and report co-author	TCTA (national water supply utility), South Africa
2006	**Environmental Impact Assessment** (**EIA)** for extension of Port of Ngqura, Eastern Cape	Project Leader and co-author	Transnet National Port Authority
2004-2005	**Environmental and Social Impact Assessment (ESIA) report** for the proposed alumina refinery near Sosnogorsk, Komi Republic, Russia	Project manager and co-author	Komi Aluminium Russia, IFC, European Bank for Reconstruction & Development (EBRD)
2005	**Guideline for Environmental Management Plans (EMPs)** for the Western Cape province	Author	Dept of Environmental Affairs & Development Planning, Western Cape
2003	**Environmental Management Plan** for the Operational Phase of the wetlands and canals at Century City, Cape Town	Project leader and lead author	Century City Property Owners' Association
2002	**Environmental Impact Assessment** for the proposed Pechiney aluminium smelter at Coega, South Africa	Project Manager and lead author	Pechiney, France
1999-2000	**Cape Action Plan for the Environment**: a biodiversity Strategy and Action Plan for the Cape Floral Kingdom - legal, institutional, policy, financial and socio-economic component	Project manager and contributing writer	World Wide Fund for Nature (WWF): South Africa and Global Environment Facility (GEF)
1999	**Management Plan** for the coastal zone between the Eerste and Lourens River, False Bay, South Africa	Project manager and lead author	Heartland Properties and Somchem (a Division of Denel)
1998	**Environmental Assessment** of the Mozal Matola Terminal Development proposed for the Port of Matola, Maputo, Mozambique	Project manager and author	SNC-Lavalin-EMS
1996-1997	**Strategic Environmental Assessment (SEA)** for the proposed Industrial Development Zone and Harbour at Coega, Port Elizabeth, South Africa	SEA project manager and report writer	Coega IDZ Initiative Section 21 Company
1995-1996	**Environmental Impact Assessment and EMP** for Development Scenarios for Thesen Island, Knysna, South Africa	Project manager and report writer	Thesen and Co.
1996	**Environmental Impact Assessment** for the Blouvlei wetlands at Century City, Cape Town	Project manager and report writer	Ilco Homes Ltd (now Monex Ltd)
1995	**Environmental Impact Assessment** for the Saldanha Steel Project, South Africa	Report author and project manager	Saldanha Steel Project
1994	**Environmental Impact Assessment** for the upgrading of resort facilities on Frégate Island, Seychelles	Project management, co-author, process facilitator	Schneid Israelite and Partners
1994	**Environmental Impact Assessment** for exploration drilling in offshore Area 2815, Namibia	Project manager and lead author	Chevron Overseas (Namibia) Limited
1994	**Management Plan** for the Rietvlei Wetland Reserve, Cape Town	Project manager and lead author	Southern African Nature Foundation (now WWF-SA)

RECENT JOURNAL PUBLICATIONS AND PEER REVIEWED PAPERS

A comprehensive list of publications including recent journal publications, book chapters and peer reviewed conference papers, is available on request.

CV VERSION: Paul Lochner, May 2023

CV OF ROHAIDA ABED

Name of firm **CSIR**
Name of staff **Rohaida Abed**
Profession **Environmental Assessment Practitioner**
Position in firm **Environmental Assessment Practitioner**
Nationality **South African**

BIOGRAPHICAL SKETCH

Rohaida Abed is an Environmental Assessment Practitioner in the CSIR Environmental Management Services team based in Durban. She has 12 years of experience in the Environmental Management field, and has been involved in various transport infrastructure related projects as an Environmental Control Officer, which included monitoring compliance with Environmental Authorizations and Environmental Management Plans. She has also been conducting Environmental Assessments relating to Port infrastructure, Bulk Liquid Storage facilities and renewable energy in the capacity of Project Manager.

She has been involved in Screening Studies, Applications for Amendments to Environmental Authorisations, Environmental Management Programmes, Legislative Reviews and reviewing Specialist Studies. She was also the Project Manager for the Gas Pipeline and Electricity Grid Infrastructure Expansion Strategic Environmental Assessment (SEA) for the National DEA, DOE, DPE, iGas, Transnet and Eskom.

TERTIARY EDUCATION

Year	Degree	Institution
2007 - 2009	Master of Science (Environmental Science)	University of KwaZulu-Natal
2006 - 2006	Bachelor of Science Honours (Environmental Science)	University of KwaZulu-Natal
2003 - 2005	Bachelor of Science (Environmental Science)	University of KwaZulu-Natal

PROFESSIONAL REGISTRATION

- Registered Professional Natural Scientist (Pr.Sci.Nat.) in Environmental Science (Registration Number: 400247/14) with the South African Council of Natural Scientific Professions (SACNASP) in July 2014.
- Environmental Assessment Practitioners Association of South Africa (EAPASA), Registration Number 2021/4067
- Member of the International Association for Impact Assessment South Africa (IAIAsa) – Membership number: 5840

EMPLOYMENT RECORD

Period	Employer	Position
October 2011 – to present	CSIR	Environmental Assessment Practitioner
May 2010 – September 2011	Henwood & Nxumalo Consulting Engineers	Environmental Scientist
March 2010 – April 2010	EnAq Consulting	Environmental Officer
2006 – 2008	University of KwaZulu-Natal	Academic Demonstrator

LIST OF KEY PROJECT EXPERIENCE

Date	Project Description	Role	Client
2022- ongoing	Review of permitting and governance for the Mogalakwena Mine, Limpopo (Confidential)	Project Manager	Anglo American
2021 – current	Advisory services for environmental permitting for Anglo American's Carbon Neutrality and Smart Power projects in South Africa, Namibia, Botswana and Zimbabwe (Confidential)	Project Manager and Lead Author	Anglo American
2021 – current	Pilot Study on Permitting (Confidential)	Project Manager and Author	Anglo American
2021 – current	Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities (Kudu Solar Facility 1 to 12), near De Aar in the Northern Cape Province	Project Manager and Author	ABO Wind renewable energies (Pty) Ltd

Date	Project Description	Role	Client
2021 - current	Scoping and Environmental Impact Assessment Processes for the Proposed Development of six Solar Photovoltaic (PV) Facilities; Aardvark Solar 1, Aardvark Solar 2, Aardvark Solar 3, Aardvark Solar 4, Aardvark Solar 5 and Aardvark Solar 6, near Copperton in the Northern Cape Province	Project Leader and Project Reviewer	ABO Wind renewable energies (Pty) Ltd
2021 - current	Basic Assessment Processes for electricity grid infrastructure to support the six Solar Photovoltaic (PV) Facilities; Aardvark Solar 1, Aardvark Solar 2, Aardvark Solar 3, Aardvark Solar 4, Aardvark Solar 5 and Aardvark Solar 6, near Copperton in the Northern Cape Province	Project Leader and Project Reviewer	ABO Wind renewable energies (Pty) Ltd
2021 – current	Environmental Compliance and Performance Improvement for Foundries: Phase 2	Project Team Member	NFTN and NCPC
2021	EMPr Update and Financial Close Gap Analysis for the Gemsbok Solar PV2, Gemsbok Solar PV5 and Gemsbok Solar PV6 projects near Kenhardt, Northern Cape	Project Reviewer, Author and Team Member	Mulilo Total Coega (PTY) Ltd
2020 – current	Basic Assessment for the Proposed Square Kilometre Array (SKA) fibre optic cable between Beaufort West and Carnarvon,	Project Reviewer and Contributor	South African National Research Network
2020 – current	Scoping and Environmental Impact Assessment Processes for the Proposed Development of three Wind Energy Facilities; Kwagga 1, Kwagga 2, and Kwagga 3, near Beaufort West in the Western Cape Province	Project Reviewer and Team Member	ABO Wind renewable energies (Pty) Ltd
2020 – current	Basic Assessment Processes for the Proposed Development of seven Solar Photovoltaic (PV) Energy Facilities; namely Rinkhals 1, Rinkhals 2, Rinkhals 3, Rinkhals 4, Rinkhals 5, Rinkhals 6, and Rinkhals 7, near Kimberley in the Free State and Northern Cape Provinces	Project Reviewer and Team Member	ABO Wind renewable energies (Pty) Ltd
2020 - current	Four Basic Assessments for the Proposed Gromis and Komas Wind Energy Facilities and Power Lines in the Northern Cape	Project Reviewer, Author and Team Member	Enertrag
2020 - 2021	Four Basic Assessment Processes for the Proposed Development of nine 175 MW Solar Photovoltaic Facilities, associated Infrastructure, and Electrical Grid Infrastructure (i.e. Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape	Project Manager and Lead Author	Veroniva (PTY) Ltd
2020	Independent review of an EIA Project (Confidential)	Project Manager and Lead Author	National DFFE Appeals Directorate
2020	Two Integrated Social & Ecological Screening Study to assess the suitability of two sites for the development of a Seawater Desalination Facility (Reverse Osmosis) and associated infrastructure	Project Reviewer and Author	iX Engineers (Pty) Ltd
2020	Amendment to the Environmental Authorisations for the Development of the Kenhardt PV 1, PV 2 and PV 3 Solar Energy Facilities near Kenhardt, Northern Cape Province	Project Manager	Scatec Solar SA 163 (PTY) Ltd
2019 – 2021	Environmental Compliance and Performance Improvement for Foundries: Phase 1	Project Team Member	NFTN and NCPC
2019	Equator Principles Review of the Final EIA Report for the proposed Bulk Liquid Storage and Handling Facility in Zone 8 of the Coega IDZ, Port of Ngqura	Project Manager	Oiltanking Grindrod Calulo (PTY) Ltd
2019	Three Basic Assessment Processes: Proposed development of three Distribution Lines and electrical grid infrastructure to connect to the proposed Sutherland WEF, Sutherland 2 WEF and Rietrug WEF to the National Grid, near Sutherland in the Northern and Western Cape	Co-Project Manager	South Africa Mainstream Renewable Power Developments (Pty) Ltd

Date	Project Description	Role	Client
2019	Three Applications for Substantive Amendment to the Environmental Authorisations for the proposed Sutherland WEF, Sutherland 2 WEF and Rietrug WEF, near Sutherland in the Northern and Western Cape	Project Team Member	South Africa Mainstream Renewable Power Developments (Pty) Ltd
2019	Three Basic Assessment Processes for the proposed development of three 100 MW Solar PV Facilities (Kenhardt PV 4, PV 5, and PV 6) and associated Electricity Grid Infrastructure on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape.	Project Advisor and Reviewer	Scatec Solar SA 163 (PTY) Ltd
2019	Notification of Environmental Authorisation Process for the Proposed Construction, Operation and Decommissioning of a Seawater Reverse Osmosis Plant and Associated Infrastructure at Tongaat on the KwaZulu-Natal North Coast.	Project Manager	Umgeni Water Amanzi
2018	Three Basic Assessment Processes for the proposed development of three transmission Lines and three 115 MW Solar PV Facilities (Vryburg PV 1, PV 2, and PV 3) near Vryburg, North-West.	Project Advisor and Mentor	Veroniva (Pty) Ltd; and ABO Wind renewable energies (Pty) Ltd
2017 – 2019	Strategic Environmental Assessment (SEA) for a Phased Gas Pipeline Network for South Africa	Project Manager	National DEA, DOE, DPE, Transnet, iGas and Eskom
2017 – 2019	Strategic Environmental Assessment (SEA) for the expansion of Electricity Grid Infrastructure (EGI) for South Africa	Project Manager	National DEA, DOE, DPE, Transnet, iGas and Eskom
2017	Application for the non-substantive Amendment to the Environmental Authorisation for the proposed Bulk Liquid Storage and Handling Facility at Maydon Wharf, Port of Durban, KwaZulu-Natal	Project Manager	Oiltanking Grindrod Calulo (PTY) Ltd
2017	Notification of the outcome of the Appeal Processes and Re-Issued EAs for the three 75 MW Solar PV Facilities (Kenhardt PV 1, PV 2, and PV 3) and three transmission Lines and electrical infrastructure (i.e. Kenhardt PV 1 – Transmission Line, Kenhardt PV 2 – Transmission Line, and Kenhardt PV 3 – Transmission Line), north-east of Kenhardt, Northern Cape.	Project Manager	Scatec Solar SA 163 (PTY) Ltd
2016 – 2017	Basic Assessment Processes: Proposed development of three Distribution Lines and electrical grid infrastructure to connect to the proposed Sutherland WEF, Sutherland 2 WEF and Rietrug WEF to the National Grid, near Sutherland in the Northern and Western Cape	Project Manager	South Africa Mainstream Renewable Power Developments (Pty) Ltd
2016 - 2017	Screening Assessment for the proposed storage of Dangerous Goods at an existing Storage Terminal at Maydon Wharf, Port of Durban, KwaZulu-Natal	Project Manager	Oiltanking Grindrod Calulo Terminals (PTY) Ltd
2016	Application for the non-substantive Amendment to the Environmental Authorisation for the proposed Bulk Liquid Storage and Handling Facility in Zone 8 of the Coega IDZ, Port of Ngqura	Project Manager	Oiltanking Grindrod Calulo (PTY) Ltd
2016	Application for the non-substantive Amendment to the Environmental Authorisation for the proposed Victoria West Renewable Energy Facility, Northern Cape	Project Manager	South Africa Mainstream Renewable Power Developments (Pty) Ltd
2016	Scoping and EIA Process: Proposed Development of the Teekloof WEF, near Victoria West, Northern Cape.	Project Assistant	South Africa Mainstream Renewable Power Developments (Pty) Ltd
2016	Scoping and EIA Process: Proposed Development of the Platberg WEF, near Victoria West, Northern Cape.	Project Assistant	South Africa Mainstream Renewable Power Developments (Pty) Ltd
2016	Appeal Processes for the three 75 MW Solar PV Facilities (Kenhardt PV 1, PV 2, and PV 3) and three transmission Lines and electrical infrastructure (i.e. Kenhardt PV 1 – Transmission Line, Kenhardt PV 2 – Transmission Line, and	Project Consultant	Scatec Solar SA 163 (PTY) Ltd

Date	Project Description	Role	Client
	Kenhardt PV 3 – Transmission Line), north-east of Kenhardt, Northern Cape.		
2015 – ongoing	Environmental Management Plan for the Proposed Construction of a Bulk Liquid Storage and Handling Facility in the Port of Cape Town, Western Cape	Project Manager	Oiltanking Grindrod Calulo Terminals (PTY) Ltd
2015 – 2016	Basic Assessment Process for the Proposed development of three Transmission Lines and electrical infrastructure to connect to the proposed 75 MW Solar PV Facilities (Kenhardt PV 1, PV 2, and PV 3) on the remaining extent of Onder Rugzeer Farm 168, and the remaining extent of Portion 3 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape.	Project Manager	Scatec Solar SA 163 (PTY) Ltd
2015 – 2016	Scoping and EIA Process for the Proposed development of three 75 MW Solar PV Facilities (Kenhardt PV 1, PV 2, and PV 3) on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape.	Project Manager	Scatec Solar SA 163 (PTY) Ltd
2015 – 2016	EIA for a Gas-To-Power project and associated infrastructure, forming part of the proposed Uyekraal Gas-to-Power Development, Saldanha Bay, Western Cape	Project Manager	Mulilo Thermal Developments
2015 - 2016	Environmental Impact Assessment Process for the Proposed Construction, Operation and Decommissioning of a Seawater Reverse Osmosis Plant and Associated Infrastructure at Tongaat and Lovu on the KwaZulu-Natal North Coast and South Coast	Project Assistant	Umgeni Water Amanzi
2015	Public Participation Process for the Application for non-substantive Amendment to the Environmental Authorisation for the proposed Landside Structures and Infrastructure to the Bulk Liquid Storage and Handling Facility in the Port of Ngqura	Project Manager	Transnet Capital Projects
2014 – 2016	Basic Assessment for the Proposed Decommissioning and Upgrade of a Bulk Liquid Storage and Handling Facility at Maydon Wharf, Port of Durban, KwaZulu-Natal	Project Manager	Oiltanking Grindrod Calulo Terminals (PTY) Ltd
2013 – 2016	Basic Assessment for the decommissioning of unused infrastructure at the Port of Ngqura	Project Manager	Transnet Capital Projects
2013 – 2014	Environmental Impact Assessment for the Provision of Marine Infrastructure, including a General Cargo Berth and Liquid Bulk Berths at the Port of Ngqura	Project Manager	Transnet Capital Projects
2012 - 2014	Environmental Impact Assessment for the proposed Manganese Export Terminal in Zones 8, 9 and 11 of the Coega IDZ, including the Port of Ngqura, and surrounding area	Project Assistant	Hatch Africa (PTY) Ltd c/o Transnet
2012 - 2014	Basic Assessment for the Provision of Landside Structures and Infrastructure to the Bulk Liquid Storage and Handling Facility in the Port of Ngqura	Project Manager	Eastern Cape Infrastructure Joint Venture c/o Transnet Capital Projects
2011 - 2014	Environmental Impact Assessment for the proposed Bulk Liquid Storage and Handling Facility in Zone 8 of the Coega IDZ, Port of Ngqura	Project Manager	Oiltanking Grindrod Calulo (PTY) Ltd
2010 – 2011	The Repair and Rehabilitation of the Umzinto River Bridge Number 823 on the South Coast of KwaZulu-Natal	Environmental Control Officer	KwaZulu-Natal Department of Transport
2010 – 2011	The Construction of the Kwahlongwa Bridge Number 3257 over the Kwa-Malukaka River on D297 near Umzumbe, South Coast of KwaZulu-Natal	Environmental Control Officer	KwaZulu-Natal Department of Transport
2010 – 2011	The Construction of a bridge and approach roads across the Indaka River at Eludimbi, within the Msinga Local Municipality, KwaZulu-Natal	Environmental Control Officer	KwaZulu-Natal Department of Transport
2010 – 2011	The Extension of the Lion Park Pipeline along the P566 and D2173 in the Manyavu area, KwaZulu-Natal	Environmental Control Officer	Umgeni Water

Date	Project Description	Role	Client
2010 – 2011	The Construction of a bridge and approach roads across the Tugela River at Thulwane, within the Nkandla Local Municipality, KwaZulu-Natal	Environmental Control Officer	KwaZulu-Natal Department of Transport
2010 – 2011	The Construction of a bridge and approach roads across the Mona River at Nqolotshe, within the Hlabisa and Nongoma Local Municipalities, KwaZulu-Natal	Environmental Control Officer	KwaZulu-Natal Department of Transport
2010 – 2011	The Construction of the Mdloti River Bridge (Northbound) on the R102, within the eThekwini Municipality, KwaZulu-Natal.	Environmental Control Officer	KwaZulu-Natal Department of Transport
2010 – 2011	The Upgrade of the R102 from the Duffs Road Interchange to King Shaka International Airport, within the eThekwini Municipality, KwaZulu-Natal.	Environmental Control Officer	KwaZulu-Natal Department of Transport
2010 – 2011	The Construction of the P701 Provincial Road from Ulundi to Empangeni, KwaZulu-Natal	Environmental Control Officer	KwaZulu-Natal Department of Transport
2010	Environmental Impact Assessment for the construction of a bridge and approach roads across the Mona River at Nqolotshe, within the Hlabisa and Nongoma Local Municipalities, KwaZulu-Natal	Project Assistant	KwaZulu-Natal Department of Transport

APPENDIX B: ROLES AND RESPONSIBILITIES

Responsible Person(s)	Role and Responsibilities
Developer's Project Manager (DPM)	Role The Project Developer is accountable for ensuring compliance with the EMPr and any conditions of approval from the competent authority (CA). Where required, an environmental control officer (ECO) must be contracted by the Project Developer to objectively monitor the implementation of the EMPr according to relevant environmental legislation, and the conditions of the environmental authorisation (EA). The Project Developer is further responsible for providing and giving mandate to enable the ECO to perform responsibilities, and he must ensure that the ECO is integrated as part of the project team while remaining independent. Responsibilities - Be fully conversant with the conditions of the EA; - Ensure that all stipulations within the EMPr are communicated and adhered to by the Developer and its Contractor(s); - Issuing of site instructions to the Contractor for corrective actions required; - Monitor the implementation of the EMPr throughout the project by means of site inspections and meetings. Overall management of the project and EMPr implementation; and - Ensure that periodic environmental performance audits are undertaken on the project implementation.
Developer Site Supervisor (DSS)	Role The DSS reports directly to the DPM, oversees site works, liaises with the contractor(s) and the ECO. The DSS is responsible for the day to day implementation of the EMPr and for ensuring the compliance of all contractors with the conditions and requirements stipulated in the EMPr. Responsibilities - Ensure that all contractors identify a contractor's Environmental Officer (cEO); - Must be fully conversant with the conditions of the EA. Oversees site works, liaison with Contractor, DPM and ECO; - Must ensure that all landowners have the relevant contact details of the site staff, ECO and cEO; - Issuing of site instructions to the Contractor for corrective actions required; - Will issue all non-compliances to contractors; and - Ratify the Monthly Environmental Report.
Environmental Control Officer (ECO)	Role The ECO should have appropriate training and experience in the implementation of environmental management specifications. The primary role of the ECO is to act as an independent quality controller and monitoring agent regarding all environmental concerns and associated environmental impacts. In this respect, the ECO is to conduct periodic site inspections, attend regular site meetings, pre-empt problems

Responsible Person(s)	Role and Responsibilities
	and suggest mitigation and be available to advise on incidental issues that arise. The ECO is also required to conduct compliance audits, verifying the monitoring reports submitted by the cEO. The ECO provides feedback to the DSS and Project Manager regarding all environmental matters. The Contractor, cEO and dEO are answerable to the Environmental Control Officer for non-compliance with the Performance Specifications as set out in the EA and EMPr. The ECO provides feedback to the DSS and Project Manager, who in turn reports back to the Contractor and potential and Registered Interested &Affected Parties' (RI&AP's), as required. Issues of non-compliance raised by the ECO must be taken up by the Project Manager, and resolved with the Contractor as per the conditions of his contract. Decisions regarding environmental procedures, specifications and requirements which have a cost implication (i.e. those that are deemed to be a variation, not allowed for in the Performance Specification) must be endorsed by the Project Manager. The ECO must also, as specified by the EA, report to the relevant CA as and when required. <u>Responsibilities</u> The responsibilities of the ECO will include the following: - Be aware of the findings and conclusions of all EA related to the development; - Be familiar with the recommendations and mitigation measures of this EMPr; - Be conversant with relevant environmental legislation, policies and procedures, and ensure compliance with them; - Undertake regular and comprehensive site inspections / audits of the construction site according to the generic EMPr and applicable licenses in order to monitor compliance as required; - Educate the construction team about the management measures contained in the EMPr and environmental licenses; - Compilation and administration of an environmental monitoring plan to ensure that the environmental management measures are implemented and are effective; - Monitoring the performance of the Contractors and ensuring compliance with the EMPr and associated Method Statements; - In consultation with the Developer Site Supervisor order the removal of person(s) and/or equipment which are in contravention of the specifications of the EMPr and/or environmental licenses; - Liaison between the DPM, Contractors, authorities and other lead stakeholders on all environmental concerns; - Compile a regular environmental audit report highlighting any non-compliance issues as well as satisfactory or exceptional compliance with the EMPr; - Validating the regular site inspection reports, which are to be prepared by the contractor Environmental Officer (cEO); - Checking the cEO's record of environmental incidents (spills, impacts, legal transgressions etc.) as well as corrective and preventive actions taken; - Checking the cEO's public complaints register in which all complaints are recorded, as well as action taken; - Assisting in the resolution of conflicts; - Facilitate training for all personnel on the site – this may range from carrying out the training, to reviewing the training programmes of the Contractor;

Responsible Person(s)	Role and Responsibilities
	- In case of non-compliances, the ECO must first communicate this to the Senior Site Supervisor, who has the power to ensure this matter is addressed. Should no action or insufficient action be taken, the ECO may report this matter to the authorities as non-compliance; - Maintenance, update and review of the EMPr; - Communication of all modifications to the EMPr to the relevant stakeholders.
developer Environmental Officer (dEO)	Role The dEOs will report to the Project Manager and are responsible for implementation of the EMPr, environmental monitoring and reporting, providing environmental input to the Project Manager and Contractor's Manager, liaising with contractors and the landowners as well as a range of environmental coordination responsibilities. Responsibilities - Be fully conversant with the EMPr; - Be familiar with the recommendations and mitigation measures of this EMPr, and implement these measures; - Ensure that all stipulations within the EMPr are communicated and adhered to by the Employees, Contractor(s) ; - Confine the development site to the demarcated area; - Conduct environmental internal audits with regards to EMPr and authorisation compliance (on cEO); - Assist the contractors in addressing environmental challenges on site; - Assist in incident management: - Reporting environmental incidents to developer and ensuring that corrective action is taken, and lessons learnt shared; - Assist the contractor in investigating environmental incidents and compile investigation reports; - Follow-up on pre-warnings, defects, non-conformance reports; - Measure and communicate environmental performance to the Contractor; - Conduct environmental awareness training on site together with ECO and cEO; - Ensure that the necessary legal permits and / or licenses are in place and up to date; - Acting as Developer's Environmental Representative on site and work together with the ECO and contractor.
Contractor	Role The Contractor appoints the cEO and has overall responsibility for ensuring that all work, activities, and actions linked to the delivery of the contract are in line with the EMPr and that Method Statements are implemented as described. External contractors must ensure compliance with this EMPr while performing the onsite activities as per their contract with the Project Developer. The contractors are required, where specified, to provide Method Statements setting out in detail how the impact management actions contained in the EMPr will be implemented during the development or expansion of substation infrastructure for the transmission and distribution of electricity activities.

Responsible Person(s)	Role and Responsibilities
	Responsibilities - project delivery and quality control for the development services as per appointment; - employ a suitably qualified person to monitor and report to the Project Developer's appointed person on the daily activities on-site during the construction period; - ensure that safe, environmentally acceptable working methods and practices are implemented and that equipment is properly operated and maintained, to facilitate proper access and enable any operation to be carried out safely; - attend on site meeting(s) prior to the commencement of activities to confirm the procedure and designated activity zones; - ensure that contractors' staff repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained in EMPr, to the satisfaction of the ECO.
contractor Environmental Officer (cEO)	Role Each Contractor affected by the EMPr should appoint a cEO, who is responsible for the on-site implementation of the EMPr (or relevant sections of the EMPr). The Contractor's representative can be the site agent; site engineer; a dedicated environmental officer; or an independent consultant. The Contractor must ensure that the Contractor's Representative is suitably qualified to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other site Contractors, labourers, the Environmental Control Officer and the public. As a minimum the cEO shall meet the following criteria: Responsibilities - Be on site throughout the duration of the project and be dedicated to the project; - Ensure all their staff are aware of the environmental requirements, conditions and constraints with respect to all of their activities on site; - Implementing the environmental conditions, guidelines and requirements as stipulated within the EA, EMPr and Method Statements; - Attend the Environmental Site Meeting; - Undertaking corrective actions where non-compliances are registered within the stipulated timeframes; - Report back formally on the completion of corrective actions; - Assist the ECO in maintaining all the site documentation; - Prepare the site inspection reports and corrective action reports for submission to the ECO; - Assist the ECO with the preparing of the monthly report; and - Where more than one Contractor is undertaking work on site, each company appointed as a Contractor will appoint a cEO representing that company.

APPENDIX C: CHANCE FOSSIL FIND PROTOCOL FOR PALAEONTOLOGICAL RESOURCES

<table>
<tr><th colspan="3">CHANCE FOSSIL FINDS PROTOCOL: Proposed Kudu Solar PV Facilities and Associated Infrastructure near De Aar</th></tr>
<tr><td>Province & region:</td><td colspan="2">Northern Cape: Pixley Ka Seme District</td></tr>
<tr><td>Responsible Heritage Resources Agency</td><td colspan="2">SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za).</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Early to Middle Permian Tierberg and Waterford Formation (Ecca Group), Late Caenozoic calcrete hardpans, alluvium, aeolian sands, pan sediments, surface gravels (Kalahari Group)</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Trace fossil assemblages, petrified wood, microvertebrate remains within Ecca Group sediments.
Potential for concentrations of mammalian fossil remains (bones, teeth, horncores), trace fossils, non-marine molluscs in association with calcrete hardpans.
Fossil mammal bones, teeth, horn cores, freshwater molluscs, plant material in Late Caenozoic alluvium and pan deposits.</td></tr>
<tr><td rowspan="5">Environmental Control Officer (ECO) protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
• Context – describe position of fossils within stratigraphy (rock layering), depth below surface
• Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
• Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
• Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
• Photograph fossils against a plain, level background, with scale
• Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
• Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.</td></tr>
</table>

APPENDIX D: BATTERY ENERGY STORAGE SYSTEM RECOMMENDATIONS

CONSTRUCTION PHASE

This phase applies to:

FOR SOLID STATE BESS – Excluding commissioning which involves starting and testing the installed equipment, i.e. powering up the batteries.
FOR REDOX FLOW BESS - Excluding commissioning i.e. filling the system with electrolyte, testing and initial powerup of the batteries

Receptor	Description	Preventative and Mitigative Measures
Human Health - chronic exposure to toxic chemical or biological agents	Causes - Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc. Consequences - Employee / contractor illness.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. • SHEQ policy in place. • A detailed construction Risk Assessment to be undertaken prior to work. • SHE procedure in place. • PPE to be specified. • SHE appointees in place. • Contractor's safety files in place and up to date. • All necessary health controls/ practices to be in place, e.g., ventilation of welding and painting areas. • SHE monitoring and reporting programs in place. • Emergency response plan to be in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.
Human Health - exposure to noise	Causes - Drilling, piling, generators, air compressors. Consequences - Adverse impact on hearing of workers. Possible nuisance factor in near-by areas.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • OHS Act Noise Induced Hearing Loss Regulations. • Health Risk Assessment to determine if equipment noise exceeds 85dB at workstation and 61dB at boundary of the site. • Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.
Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Cold in winter. Consequence - Heat stroke. Hypothermia.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993, specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. • Adequate potable water for employees to be provided during all phases of the project. • Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the BESS installation staff during all phases of the project. Geohydrology Assessment has been conducted during the EIA Phase to assess the impact of the use of groundwater.
Human Health - exposure to psychological stress	Causes - Large projects bring many contractor workers into a small, isolated community. Consequences – Lack of sufficient accommodation, entertainment etc. Increase in alcohol abuse, violence	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Refer to the Socio-Economic Specialist Study undertaken as part of the EIA for this project.
Human Health – exposure to ergonomic stress	Causes – Lifting heavy equipment. Awkward angles during construction. Consequences – Back and other injuries.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Training in lifting techniques. • Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise, employees may revert to unsafe practices. Ensure this is in place prior to project commencement. • Ensure first aid provision on site.
Human and Equipment Safety - exposure to fire radiation	Causes – Involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g., tyre fire). Fire due to uncontrolled welding or other hot-work	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Fuels stored on site in dedicated, demarcated and bunded areas. • Suitable fire-fighting equipment on site near source of fuel, e.g., diesel tank, generators, mess, workshops etc.

Receptor	Description	Preventative and Mitigative Measures
	Consequences - Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire.	• The company responsible for the facility at this stage is to have: 1. Emergency plan to be in place prior to commencement of construction. 2. Fuel spill containment procedures and equipment to be in place. 3. Hot-work permit and management system to be in place.
Human and Equipment Safety - exposure to fire radiation	Causes - Solid state battery containers damaged on route e.g., dropped in port (drops do happen about 1/2000 containers) and importing possibly up to 700 containers for the site. With this it is possible, although unlikely, that one will be dropped, traffic accident on-route. Involvement in an external fire e.g., at the port or on route. Consequences – Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire (refer to noxious smoke in Appendix A of the BESS Risk Assessment for the major impact).	**<u>The following is applicable to Solid State Lithium Ion BESS:</u>** • Solid state battery design includes abuse tests such as drop test, impact, rapid discharge etc. • Propagation tests for systems, e.g., heat insulating materials between cells/modules. • Factory acceptance test prior to prior to leaving manufacture. • Batteries are usually stored at 50% charge to prolong life but may be shipped fully discharged. This level of detail should be understood so as to assess the risk during transport and storage. • The company responsible for the battery installation should ensure suitably competent transport companies are appointed. The company responsible for transportation should ensure: 1) Compliance with National Road Traffic Act Regulation 8 – dangerous goods. 2) Port Authorities should be alerted to the overall project and the hazardous nature of the contents of battery containers being imported. Note. If, as per one of the typical suppliers (Tesla) indications, the containers are classified as IMDG Class 9 – the containers will not receive any special care in the ports and may be stored next to flammables. Port emergency response in particular need training on mitigating battery hazards. • Prior to bringing any containers into the country, the company responsible for the battery installation (possibly via appointed contractors) should ensure that an emergency response plan is in place for the full route from the ship to the site. Drivers trained in the hazards of containerized batteries. • The Emergency response plan must determine and address: ○ What gases would be released in a fire and are there inhalation hazards. ○ Extinguishing has two important elements, put out fire and to provide cooling. Different approaches may be needed for small fire – e.g., put out, and for large fires e.g., cool with copious quantities of water. Note inert gases and foam may put out the initial fire but fail to control thermal runaway or to cool the batteries resulting in reignition. ○ What initial fire extinguishing medium should be used. ○ Whether there are any secondary gases or residues from use of extinguishers. ○ If water is appropriate, determine if the system needs outside connections to sprinklers inside the container. ○ First responders need to know what media to use, especially if water totally unsuitable and if there are no connection points for water etc. ○ Must the container be left unopened or opened. ○ PPE to be specified including possible exposure to chemicals and fumes as well as radiate heat. ○ Containment of residues/water/damaged equipment. ○ Suitable safe making and disposal plan for after the event i.e. how do responders deal with partially charged damage units, contaminated surfaces (e.g., HF residues).
Human and Equipment Safety - exposure to explosion over pressures	Causes - With solid state lithium containers, flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Consequences - Potential fatalities amongst first responders. Damage to container, transport truck or other nearby items, e.g., other container in the port.	**<u>The following is applicable to Solid State Lithium Ion BESS:</u>** • During transport this is only likely to happen due to possible inappropriate emergency response, e.g., opening containers when they may be the type that should be left to burn out. • For simplicity one transport route would be preferable. The route needs to be assessed in terms of responding local services, rest places for drivers, refuelling if required, break down services available etc. • Once an import route has been chosen, e.g., N10 from Port of Ngqura, then the appointed transport company should ensure key emergency services on route could be given awareness training in battery fire/accident response. Emergency response planning and training referred to above may be important for key locations such as the mountain passes / tunnels.
Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc.	**<u>The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:</u>** • All necessary good hygiene practices to be in place, e.g., provision of sanitation facilities, eating areas, infectious disease controls. • Policies and practice for dealing with known vectors of disease such as AIDS, TB, COVID 19 and others. • Awareness training for persons on site, safety induction to include animal hazards. First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. • Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.

Receptor	Description	Preventative and Mitigative Measures
Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes - Damaged solid-state batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals. Thermal runaway and hazardous fumes released. Consequences - Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage.	**The following is applicable to Solid State Lithium Ion BESS:** • Appointed transport company to ensure transport in accordance with Regulation 8 of the National Road Traffic Act 93 of 1996, Dangerous Goods. Not permitted to transport prescribed goods in manner not consistent with the prescriptions, e.g., consignor and consignee responsibilities. • Prescription found in SANS 10228/29 and international codes for battery transport etc. Transportation of BESS components in sealed packages that are kept upright, protected from movement damage etc. • Also packaged to ensure no short-circuiting during transport. • Transport to prevent excessive vibration considerations as battery internal components may be damaged leading to thermal run-away during commissioning. • Pre-assembled containers will most likely be supplied. These will be fitted with the necessary protective measures by the supplier considering marine and road transport as well as lifting, setting down etc. • Route selection to consider possible incidents along the way and suitable response, e.g., satellite tracking, mobile communication, 24/7 helpline response. • Standard dangerous goods requirements for Hazmat labels, Transport Emergency Data i.e. Trem cards, driver trained in the hazards of the load. • Likelihood similar to fire above.
Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Causes - Construction moving equipment, heavy loaded, elevated loads, working at heights Consequences - Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. • SHEQ policy in place. • A detailed construction Risk Assessment to be undertaken prior to work. • SHE procedure in place. • PPE to be specified. • SHE appointees in place. • Contractors safety files in place and up to date. • SHE monitoring and reporting programs in place. • Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc. • Civil and building structures to comply with the National Building Regulations and building Standards Act 103 of 1977, SANS 10400 and other relevant codes. • Other constructions such as roads, sewers etc also to comply with relevant SANS standards. All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc to be in place before construction begins. • Emergency response plan to be in place before construction begins.
Human and Equipment Safety - exposure to electromagnetic waves	Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage to electrical equipment.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Standard maintenance of condition of electrical equipment and safe operating instructions. • Ability to shut off power to systems in use on site. • If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, and installations to be suitably designed and maintained. • Outside work must be stopped during thunderstorms. • Lighting conductors may be required for the final installation, to be confirmed during design phase. **The following is applicable to Redox Flow BESS:** • Risk to and from electricity transmission pylons, suggest separation at least the pylon fall height, e.g. >10m for 10m tall pylons.
Environment - emissions to air	Causes - Dust from construction and generally hot dry area. Consequences - Adverse impact on employee health.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • May need to use dampening on roads etc. as per normal construction practices. • May need PPE (dust masks) for specific construction workers.
Environment - emissions to water	Causes - Diesel for equipment, paints and solvents. Transformer oil spills. Sewage and kitchen/mess area wastewater.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Normal construction site practices for preventing and containing fuels/paint/oil etc spills.

Receptor	Description	Preventative and Mitigative Measures
	Consequences - Environmental damage, particularly to the surface and underground water in the area.	• Bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area is particularly important. • Spill clean-up procedures to be in place before commencing construction. • Sewage and any kitchen liquids - containment and suitable treatment/disposal
Environment - emissions to earth	Causes - Mess area and other solid waste. Consequences - Environmental damage.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance. • There will need to be waste segregation (e.g., electronic equipment, chemicals) and management on the site.
Environment - waste of resources e.g., water, power etc	Causes - Water usage not controlled. Battery containers damaged. Consequences - Delays.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Water usage to be monitored on site during construction. • Handling protocols to be provided by battery supplier. • Water management plan and spill containment plans to be in place. **The following is applicable to Solid State Lithium Ion BESS:** • End of Life plan needs to be in place before any battery containers enter the country as there may be damaged battery unit from day 1.
Public - Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Refer to the visual impact assessment undertaken as part of the EIA.
Investors - Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Design by experienced contractors using internationally recognized and proven technology. • Project management with deviation monitoring.
Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. • The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g., Skull and Cross Bones or other signs. • Isolated location both helps and hinders security. • Night lighting to be provided both indoors and outdoors where necessary.
Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • All safety measures listed above. • Emergency procedures need to be practiced prior to commencement of construction. **The following is applicable to Solid State Lithium Ion BESS:** • If batteries are stored at 50% charge, thermal run away can happen while in storage on site waiting for installation. In addition, if involved in an external fire thermal run away can happen even with uncharged batteries. Except during shipping, ideally the units should not be stored any closer to each other than they would be in the final installation so that propagation is prevented, i.e. laydown area needs to be considered. • The company in charge of the containers at each stage in the transport process needs to be very clear so that responsibility for the integrity of the load and protection of the persons involved in transfer and coordination of emergency response on-route. E.g., if purchased from Tesla where does hand over occur to the South African contractor / owner, at the factory door in USA, at the port in RSA, at the site fence. For example, who will be accountable if there's thermal runway event on a truck with a container that stops in a small town for driver refreshments.
Investors - Legal	Causes - Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using "cheaper supplier or less developed technology".	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. • Where reasonably practicable ensure only "state of the art" battery systems are used and not old technologies prone to fires/explosions etc.

OPERATIONAL PHASE

Many potential problems manifest during the commissioning phase when units are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures etc. that would be in place for full operation should be in place before commissioning commences.

This phase applies to:

FOR SOLID STATE BESS – Including Commissioning – i.e. initial testing of the systems and first powerup of batteries.
FOR REDOX FLOW BESS - Including Commissioning - e.g. filling the electrolyte into the tanks, testing the electrics, powering up the battery systems

Receptor	Description	Preventative and Mitigative Measures
Human Health - chronic exposure to toxic chemical or biological agents	Causes - Operation and maintenance materials spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases etc. Consequences - Occupational illness.	**<u>The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:</u>** • The operation and maintenance phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993. • SHEQ policy in place. • A detailed Risk Assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning. • SHE procedure in place, e.g., PPE specified, management of change, integrity monitoring. • SHE appointees in place. • Training of staff in general hazards on site. • All necessary health controls/ practices to be in place, e.g., ventilation of confined areas, occupational health monitoring if required and reporting programs in place. • Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as: - appointment of emergency controller, - emergency isolation systems for electricity, - -emergency isolation and containment systems for electrolyte, - provision of PPE for hazardous materials response, - provision of emergency facilities for staff at the main office building, - provision of first aid facilities, • - first responder contact numbers etc.
Human Health - chronic exposure to toxic chemical or biological agents	Causes - Compromised battery compartments vapours accumulate in the containers, solids/liquids on surfaces. Maintenance of battery components, corrosive and mildly toxic liquid on surfaces. Consequences - Dermatitis, skin /eye/lung irritation.	**<u>The following is applicable to Solid State Lithium Ion BESS:</u>** • Solid state batteries sealed, individual batteries in modules which are also sealed, pre-packed in the container. • Possible detectors with local alarms if regulated occupational exposure limits are exceeded etc prior to entry for inspection of battery containers. • There needs to be careful thought given to procedures to be adopted before entering into the BESS or a container particularly • after a Battery management System (BMS) shut down where there may be flammable or toxic gases present, a fire etc. **<u>The following is applicable to Redox Flow BESS:</u>** • VRFB Batteries facilities normally within buildings but may be containerized **<u>The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:</u>** • Maintenance procedures will be in place should equipment need to be opened, e.g., pumps drained and decontaminated prior to repair in workshop etc. • PPE will be specified for handling battery parts and other equipment on site. • Training of staff in hazards of chemicals on site. • Labelling of all equipment. • Confined space entry procedures if entering tanks.

Receptor	Description	Preventative and Mitigative Measures
		• Safety Data Sheets (SDSs) to be available on site. • Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. • Maintenance manuals with make safe, decontamination and repair procedures. • Proposed maintenance schedules e.g., checklists for weekly, monthly, annual etc. • Provided portable equipment for calibration and for testing/verification of defective equipment, e.g., volt/current meters, infrared camera
Human Health - exposure to noise	Causes - Moving parts inside containers, buildings, pumps, compressors, cooling systems etc. Consequences - Adverse impact on hearing of workers. Nuisance factor at near-by residences or other activities.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Design to ensure continuous noise does not exceed 85dB within the facilities or at any other location on site or 61 dB at the site boundary, e.g., emergency generator, air compressor etc. • Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.
Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Batteries generate heat within enclosed building / containers. Cold in winter. Night work requires lighting. Consequences - Heat stroke. Hypothermia.	**The following is applicable to Solid State Lithium Ion BESS:** • Ensure containers are temperature controlled as required to remain within the optimal battery operating temperature range. • Lighting to be provided inside any buildings, inside the containers, possibly linked to the door opening and outdoors where necessary. **The following is applicable to Redox Flow BESS:** • Night work is likely for VRFB. Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure. **The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. • Adequate potable water to be provided during all phases of the project. • Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure. • PPE for operations and maintenance staff to be suitable for the weather conditions.
Human Health - exposure to psychological stress	Causes - Isolated workstation and monotonous repetitive work. Consequences - Low performance, system productivity suffers.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Staff rotation to other activities within the site may be necessary. • Performance monitoring of inspections / maintenance tasks in particular will be necessary.
Human Health - exposure to ergonomic stress	Causes - Lifting heavy equipment. Awkward angles during maintenance, stretching reaching to high level and bending to low level. Working at height if equipment located on top of roofs or elevated electrical equipment (e.g., pylons) [or electrolyte tanks in the case of Flow BESS]. Consequences - Back and other injuries.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Training in lifting techniques. • Training in working at heights. • If equipment is at height (see OHS Act General Safety Regulation 6), ensure suitable safe (electrically and physically) ladders / harnesses etc. are available. • Working at height procedure to be in place.
Human and Equipment Safety - exposure to fire radiation	Causes – Involvement in an external fire e.g., veld fire, maintenance vehicle fire, electrical systems fire. Manufacturing defects or damage to battery leading to shorting and heating. High humidity condensation of water or ingress of water or flooding leading to shorting. Dust accumulation on electrical parts leading to overheating. Excessive electrical loads - surges Operator abuse BMS failure or software failure. Incorrect extinguishing medium, escalate the fire. Consequences - Contaminated run off. Radiation burns. Damaged equipment.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Grass cutting and fire breaks around the BESS installations to prevent veld fires. • There are BESS design codes from the USA and standards of practice that can be used e.g., UL9540, NFPA 855 and DNV GL RP 43. • Detailed Failure Modes and Effect Analysis (FMEA)/Hazop/Bowtie to be done during design at the component level and system levels. • Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. Site Acceptance Testing as part of commissioning of each unit and the overall system • BMS should be checking individual cell voltage as well as stack, module, container, system voltages/current etc. BMS tripping the cell and possibly the stack/ building unit or module/rack/container, if variations in voltage. Diagnostics easily accessible. Diagnostics able to distinguish cell from stack or cell from module faults. **The following is applicable to Solid State Lithium Ion BESS:** • No combustible materials to be stored in or near the batteries or electrical infrastructure. Separation of site diesel tank, transformers from BESS and vice versa. Suggested minimum separation from substation is 20m.

Receptor	Description	Preventative and Mitigative Measures
	Fire spreads to other units or offsite if grass/vegetation not controlled.	• Abuse tests conducted by supplier. • Protective systems are only as good as their reliability and functionality testing is important, e.g., testing that all battery trips actually work. Fire resistant barrier between the batteries and the PCS side if in the same container, or separate containers. • Suitable ingress protection level provided for electrical equipment, e.g., IP55 - 66. If air cooling into container, suitable dust filters to be provided. Smoke detectors linked to BMS & alerts in control room. • Effects of battery aging to be considered. Solid state battery life starts to be impacted above 40 deg C and significant impacts above 50 deg C with thermal run away starting at 65-70 deg C. BMS trips system at 50 deg C. Temperature monitoring to be in place. Regular infrared scanning. Data needs to be stored for trend analysis. • Data indicates an event frequency of 0.001 per installation and with up to 700 units this would mean an event once 2 years, i.e. a high probability event. Most events will be small not resulting in injuries, but this is possible if the event is not controlled. • Prior to commencement of cold commissioning, emergency plan from transport and construction phase to be extended to operational phase and to include the hazards of the electrically live system. Procedure to address solid state container fires – extinguishing, ventilating, entering as appropriate or not. PPE for container firefighting include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. • A planned fire response to prevent escalation to an explosion or an environmental event. • Suitable supply of fire extinguishing medium and cooling medium • Consider fire water for cooling adjacent equipment – BESS units. • Can use fogging nozzles to direct smoke. • Ensure procedures in place for clean up after event Lingering HF and other toxic residues in the soil and on adjacent structures. • Procedures to be in place for Infra-red (IR) scanning (or other suitable method) to determine if batteries are still smouldering / are sufficient cooled to handle as batteries may still be active some weeks after an event. • Smoke or gas detector systems that are not part of the original battery container package, need to be linked to the main control panel for the entire system so that issues can be detected and responded to rapidly. **<u>The following is applicable to Redox Flow BESS:</u>** • No combustible materials to be stored in or near the batteries or electrical infrastructure, e.g., separation of site diesel tank and separation from substations. In this case the risk is from the substation to the BESS and not vice versa. Apply normal electrical separation distances of substation to other independent infrastructure. • Fire resistant barrier between the batteries and the PCS side if in the same container. • Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. Site Acceptance Testing as part of commissioning of each unit and the overall system. • As per SANS Standards, suitable ingress protection (IP) level provided for electrical equipment, e.g., IP55 - 66. If air cooling into container / building, suitable dust filters to be provided if needed. Smoke detectors may be needed linked to BMS and alerts in the main control room. • Effects of battery aging to be considered. Temperature monitoring, regular infrared scanning. Data stored for trend analysis. • Protective systems functionality testing. • Prior to commencement of cold commissioning, emergency plan from transport and construction phase to extended to operational phase and to include the hazards of the electrically live system. Procedure to address suitable extinguishing media, ventilating, entering container as appropriate or not. PPE for firefighting may need to include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. A planned fire response to prevent escalation to an environmental event is critical. Suitable fire extinguishing medium, cooling medium and adequate supply of both is critical e.g., cooling adjacent equipment and can use fogging nozzles to direct smoke. Ensure procedures in place to clean up after event Lingering toxic residues in the soil and on adjacent structures.
Human and Equipment Safety - exposure to fire radiation	Causes - Power Conversion System (PCS – DC to AC) cooling failure, electrical fire. Consequences - Fire starts in PCS or another section or room and spreads to battery area.	**<u>The following is applicable to Solid State Lithium Ion BESS:</u>** • Modern lithium container design places the PCS in another part of the container with a fire rated wall separating it from the battery. Alternately the PCS in another container altogether. **<u>The following is applicable to Redox Flow BESS:</u>** • VRFB building systems PCS in another area separating it from the batteries and other equipment

Receptor	Description	Preventative and Mitigative Measures
Human and Equipment Safety - exposure to explosion over pressures	**The following is applicable to Solid State Lithium Ion BESS:** Cause 1 - Transformer shorting / overheating / explosion. Cause 2 - Flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Lithium Cobalt Oxide generates O2 during decomposition – escalation. Consequences - Potential fatalities amongst first responders. Damage to container or other nearby items, e.g., other container. **The following is applicable to Redox Flow BESS:** Transformer shorting / overheating / explosion. Consequences - Potential fatalities, e.g., amongst first responders. Damage to nearby equipment.	**The following is applicable to Solid State Lithium Ion BESS:** • Electrical equipment will be specified to suit application. • Emergency response plan and employee training referred to above is to be in place. This is only really likely to happen due to possible inappropriate emergency response, e.g., opening containers when they may be the type that should be left to burn out. • Modern state of the art containers have ventilation systems for vapours. • Undertake a hazardous area classification of the inside of the container to confirm the rating of electrical equipment, due to possible leaks of electrolyte or generation of flammable gases under thermal run away. • Emergency response plan and employee training referred to above is critical. • Suitable training of selected emergency responders who may be called out to the facilities is critical. • NOTE. Refer to Appendix A of the Risk Assessment for an initial approximation of worst-case possible explosion impact zones. **The following is applicable to Redox Flow BESS:** • Electrical equipment will be specified to suit application. • Emergency response plan and employee training referred to above is to be in place.
Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • All necessary good hygiene practices to be in place, e.g., provision of sanitation facilities, eating areas, infectious disease controls. • Policies and practice for dealing with known vectors of disease such as AIDS, TB, COVID 19 and others. • Awareness training for persons on site, safety induction to include animal hazards. • First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. • Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts
Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes - Damaged batteries components, leak electrolyte, are completely broken exposing hazardous chemicals. Hazardous fumes released on thermal run away see fire above. Consequences - Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure. In the case of toxic fumes, serious lung damage (Solid State BESS only).	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • PPE to be increased (e.g., full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g., sampling, maintenance. • All operators/maintenance staff trained in the hazards of chemicals on site. • 24/7 helpline response. • Standard dangerous goods requirements for Hazmat labels. • All operators/maintenance staff trained in the hazards. **The following is applicable to Solid State Lithium Ion BESS:** • Acid resistant PPE (e.g., overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas. • Batteries contained, modules contained and all inside a container that acts as bund. • Refer to fire above as all the protective measures apply to prevent toxic smoke. • Refer to fire above as all the measures apply to mitigate toxic smoke. • NOTE Refer to Appendix A of the Risk Assessment for an initial approximation of worst case possible noxious smoke impact zones. **The following is applicable to Redox Flow BESS:** • Corrosion resistant PPE (e.g., overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas. • Electrolyte contained, modules contained inside a building that is bunded.
Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Causes - Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights. Traffic accidents. Earthquake / tremor. Consequences - Injury. Fatality in unlikely worst case, e.g., traffic accidents or fall from heights. Damage to equipment, spills, environment pollution	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Apart from pumps, no major moving parts during operation. • Maintenance equipment to be serviced and personnel suitably trained in the use thereof. • Normally just small vehicles on site, bakkies, grass cutting, cherry-pickers etc. Possibly large cranes if large equipment or elevated structure removed/replaced. • Traffic signs, rules etc in place on site. • All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works etc to be in place.

Receptor	Description	Preventative and Mitigative Measures
		• Emergency response plan. • Civil design to take seismic activity into account.
Human and Equipment Safety - exposure to electromagnetic waves	Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Codes and guidelines for electrical insulation. • Suitable PPE to be specified. • Ensure trained personnel and refer to guideline – IEE 1657 – 2018. • Ensure compliance with Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. • Electromagnetic fields, impact on other equipment e.g., testing devices, mobile phones – malfunction, permanent damage. • Software also need to be kept as update to date as reasonably practicable. • Consider suitably located Emergency stop buttons for the facility and the other equipment on site. • PPE to consider static accumulation for entering the facility, and particularly the battery containers especially after a high temperature shut down where there could possibly be flammable materials. • The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment inside and how to protect personnel who may enter to respond. • All outside work must be stopped during thunder storms. • Lightning conductors may be required for the installation, to be confirmed during design **The following is applicable to Solid State Lithium Ion BESS:** • Risk to and from electricity transmission pylons, suggest separation at least the pylon fall height, e.g. >10m for 10m tall pylons. **The following is applicable to Redox Flow BESS:** • Low voltage equipment (e.g., batteries) separated from high voltage (e.g., transmission to grid). Risk of pylons to BESS, suggest at least the pylon fall height, e.g. >10m for 10m tall pylons.
Environment - emissions to air	Not expected on a normal basis. Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** Especially after any warning alarms have gone off, but possibly even normally the container could be treated as entering a confined space and similar procedures could be in place, e.g., do not enter alone, gas testing prior to entering, ensure adequate ventilation.
Environment - emissions to water	Causes - Cooling water blow-down. Laboratory waste (if included in the design). Maintenance waste, e.g., oils. Spills from batteries, coolant system, diesel trucks, transformers. Parked vehicles – oil drips. Fire water runoff control. Kitchen waste and sewage. Refrigerant release. VRFB electrolyte purging (Redox Flow BESS only). Consequences - Pollution if not contained. Excessive disposal costs if emissions not limited.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Bunding under any outdoors tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area is particularly important. • Sewage and any kitchen liquids - containment and suitable treatment/disposal. • Procedures for dealing with damaged/leaking equipment as well as clean-up of spills. • Normal site practices for preventing and containing diesel/paint etc spills. • Waste management plan to be in place e.g., liquid waste treatment or suitable removal and disposal will be provided. • Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, hazmat disposal. • The National Environment Management Act (NEMA) Section 30, the DEA Guidelines have a list of hazard categories with Reportable spill Quantities, ensure compliance with this by listing all materials on site, their hazard categories and determining the spill thresholds for reporting. • **The following is applicable to Redox Flow BESS:** • Electrolyte areas fully bunded to 110% of largest tank, or more. • The National Environment Management Act (NEMA) Section 30, the DEA Guidelines have a list of hazard categories with Reportable spill Quantities, ensure compliance with this by listing all materials on site, their hazard categories and determining the spill thresholds for reporting. This is particularly relevant for liquid filled systems such as RFB. • Process controls in place to prevent contamination and deterioration of electrolyte leading to excessive purging. • Ensure proposed locations of the BESS facilities are a suitable distance from the closest water course. Relevant recommendations have been made by the Aquatic Specialist and Groundwater Specialists, and this has been factored into the layout. Refer to the

Receptor	Description	Preventative and Mitigative Measures
		relevant studies for additional information. In the event of a major spill if this is too close it may not allow time for mitigation to be taken. Adequate secondary and possibly tertiary containment systems may then be needed on site.
Environment - emissions to earth	Causes - Mess area and other solid waste. Disposal of solid-state batteries (for Solid State BESS). Disposal of battery components (Redox Flow BESS). Consequences - Environmental damage.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Implement waste segregation (e.g., electronic equipment, chemicals, domestic) and management on the site. **The following is applicable to Redox Flow BESS:** • During commissioning there will be a need for bulk transport of electrolyte to site and transfer of electrolyte into the tanks within the containers. Suitable secondary containment of possible spills / overfills etc. during this transfer process will need to be in place.
Environment - waste of resources e.g., water, power etc	Causes - Similar to construction phase. Disposal of batteries or components. Disposal of containers. Water usage not controlled. Excessive purging of deteriorated or contaminated electrolyte (Redox flow only). Consequences - Delays. Excessive costs and disposal of large volumes of hazardous waste.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Water usage to be monitored on site. • Water management plan and spill containment plans to be in place. **The following is applicable to Solid State Lithium Ion BESS:** • Handling protocols to be provided by supplier of batteries. • Investigate end of Life plan for solid state batteries - reuse / recovery / reconditioning. • Similarly, for decommissioned containers – reuse / recovery / repurpose. **The following is applicable to Redox Flow BESS:** • Handling protocols to be provided by supplier of electrolyte. • Investigate End of Life plan for electrolyte - reuse / recovery / reconditioning. • Similarly, for decommissioned containers / equipment – reuse / recovery / repurpose
Public - Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Refer to the Visual Impact Assessment undertaken as part of the EIA.
Investors - Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Operation by experienced personnel using internationally recognized and proven technology operating procedures. • Operations management with deviation monitoring.
Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. • Consider motion detection lights and CCTV. • The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g., Skull and Cross Bones or other signs. • Isolated location both helps and hinders security. • Night lighting to be provided both indoors and outdoors where necessary.
Employees and investors - Security	Causes - Cyber security attacks aimed at the National Electricity Grid. Consequences - Ransom of the National Electricity Grid.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • Cyber security needs monitoring. Remote access to system needs to be negotiated and controlled e.g. Password controls, levels of authority etc. to ensure protection of the National Electricity Grid from Cyber-attacks accessing through the BESS. • Cyber emergency procedures – should be in place prior to commissioning.
Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	**The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:** • All safety measures listed above. • Emergency procedures need to be practiced prior to commencement of operations. • More than one exit from buildings. **The following is applicable to Solid State Lithium Ion BESS:** • Escape doors should swing open outwards and not into the container. Doors should be able to be hooked open when persons are inside the container, i.e. they should not be automatically self-closing. • Storage of spare batteries (e.g., in stores on site or elsewhere) also needs to consider possible thermal run away.

Receptor	Description	Preventative and Mitigative Measures
		<u>The following is applicable to Redox Flow BESS:</u> • Escape doors should swing open outwards and not into the building/container.
Investors - Legal	Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using "cheaper supplier or less developed technology".	**<u>The following is applicable to both Solid State Lithium Ion and Redox Flow BESS:</u>** • Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. • Where reasonably practicable ensure only "state of the art" battery systems are used and not old technologies prone to fires/explosions etc.

DECOMMISSIONING PHASE - VANADIUM REDOX FLOW BATTERY ENERGY STORAGE SYSTEMS and SOLID STATE LITHIUM-ION BATTERY ENERGY STORAGE SYSTEMS

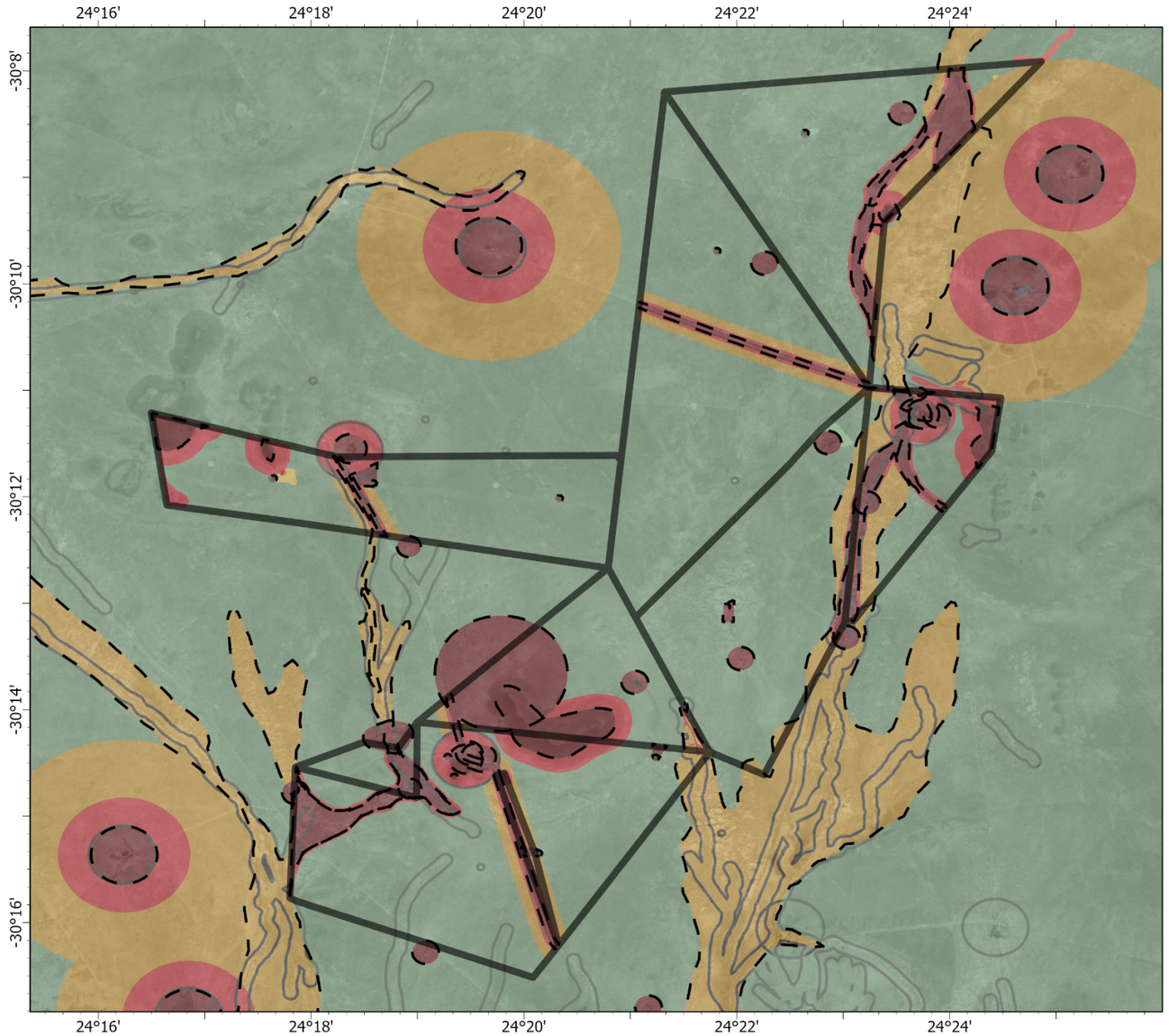
Battery components may have a limited lifespan, there are damaged equipment, waste electrolyte etc. There could already be "waste" on the first day of commissioning and plans should be in place to deal with this. Ideally an End-of-Life plan needs to be in place before the first electrolyte / BESS container / equipment is brought on site. All decommissioning activities must comply with the relevant regulations at the time. Most preventative and mitigation measures are as per the construction and operational phases listed above, and should be considered where relevant (and have not been repeated below).

Receptor	Description	Preventative and Mitigative Measures
Environment - emissions to earth	Causes - Batteries / equipment reached end of life and may leak. Consequences - Environment damage from heavy metal ions.	• End of Life shutdown procedure including a Risk Assessment of the specific activities involved. • Where possible re-purpose the batteries / containers and equipment with associated environmental impact considered. • Disposal according to local regulations and other directives such as the European Batteries Directive, where relevant. • End of life, which is affected by temperature and time, cycles etc, should be predefined and the monitoring should be in place to determine if it has been reached.
Investors - Legal	Disposal of hazardous "waste" is rife with difficulties and numerous regulations that need to be complied with.	• Applicants should seek the opinion from a waste consultant on how to correctly dispose of hazardous waste.

APPENDIX E: SENSITIVITY MAP FOR THE STUDY AREA

Proposed Kudu Solar PV facility (1 - 12)

near De Aar, Northern Cape Province
South Africa

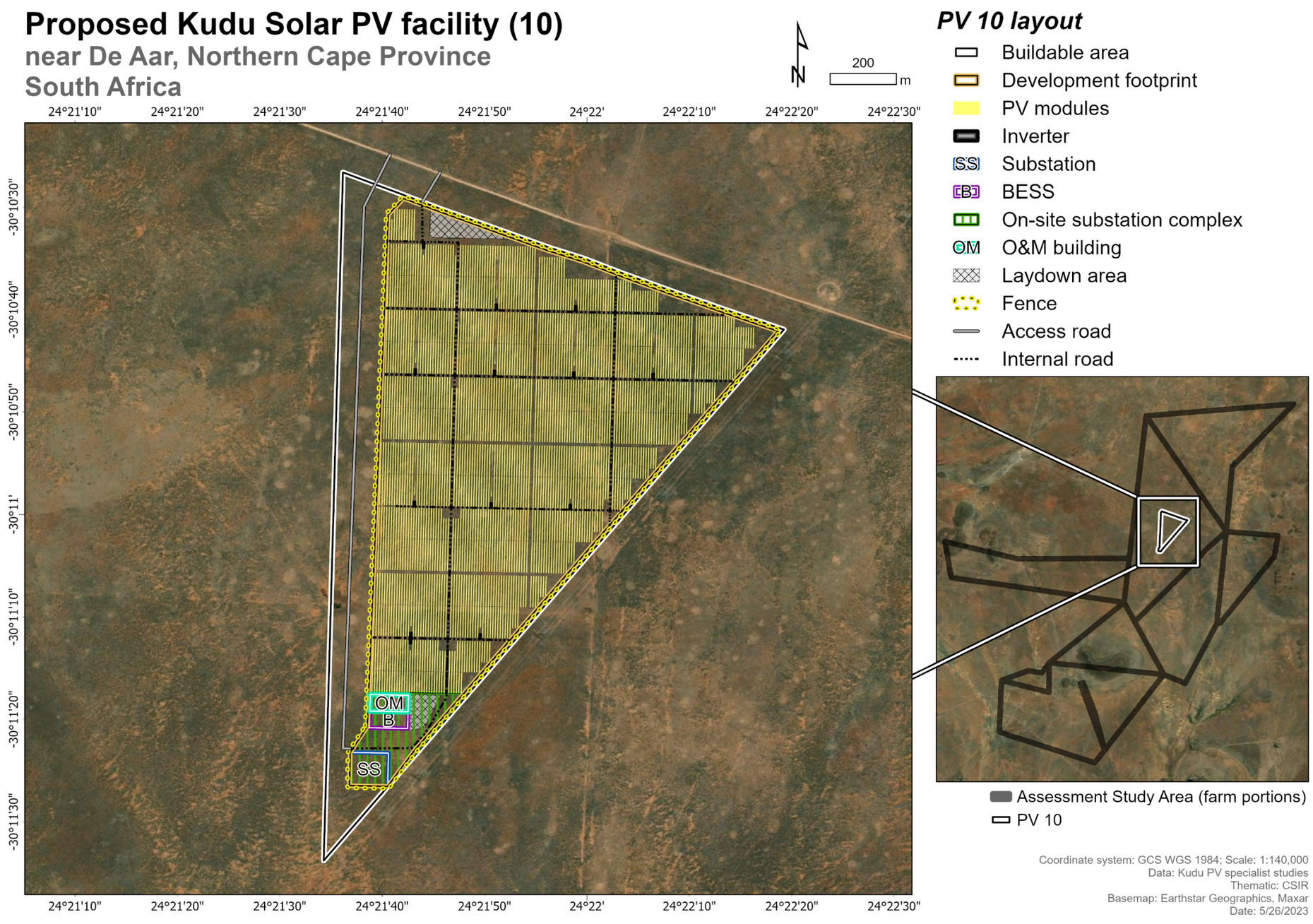


Combined sensitivity

- Assessment Study Area (farm portions)
- Very high
- High
- Medium
- Low
- Potentially sensitive features (BESS only)
- No-go buffer (PV only)

Coordinate system: GCS WGS 1984
Data: Kudu PV specialist assessments
Thematic: CSIR
Basemap: Earthstar Geographics
Date: 11/05/2023

APPENDIX F: LAYOUT MAP



APPENDIX G: COMBINED LAYOUT AND SENSITIVITY MAP