Environmental Management Programme

Proposed Boshoek Solar 1 Solar Energy Facility and associated Infrastructure, North West Province

PREPARED FOR

Boshoek Solar 1 (Pty) Ltd

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Environmental Management Programme

Proposed Boshoek Solar 1 Solar Energy Facility and associated Infrastructure, North West Province

0697978

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
BESS	Battery Energy Storage System
CA	Competent Authority
CARA	Conservation of Agricultural Resources, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
dB	Decibel
DFFE	Department of Forestry, Fisheries and the Environment (National)
DMRE	Department of Mineral Resources and Energy
DoE	Department of Energy
DHSWS	Department of Human Settlement, Water and Sanitation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act, 1989 No. 73 of 1989)
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ESA	Ecological Support Area
ESA	Early Stone Age
ESKOM	Eskom Holdings SOC Limited
EWT	Endangered Wildlife Trust
GNR	Government Notice Regulation
HIA	Heritage Impact Assessment
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kV	Kilovolt
kWh	Kilowatt Hours
LSA	Late Stone Age

Acronyms	Description
MSA	Middle Stone Age
MW	Megawatt
NCR	Noise Control Regulations
NDP	National Development Plan
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NPAES	National Protected Area Expansion Strategy
NSD	Noise-sensitive Development
NWA	National Water Act, 1998 (Act No. 36 of 1998)
OES	Ostrich Eggshell
PAOI	Project Area of Influence
PES	Present Ecological State
PPP	Public Participation Process
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SANS	South African National Standards
SAWS	South African Weather Service
SCADA	Supervisory Control and Data Acquisition
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SEF	Solar Energy Facility
SEI	Site Ecological Importance
SIA	Social Impact Assessment
SR	Scoping Report
WULA	Water Use License Application

1. INTRODUCTION

Boshoek Solar 1 (Pty) Ltd ('the Project Applicant') is applying for environmental authorisation (EA) to construct and operate the up to 150 MW Boshoek Solar 1 Solar Energy Facility (SEF) and its associated Grid Connection Infrastructure (hereafter referred to as the proposed Boshoek Solar 1 / the 'proposed development').

The proposed development is located approximately 12 km west of the town of Boshoek within the Rustenburg Municipality in the North West Province.

In terms of Chapter 5 of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA), and the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended), the Project Applicant appointed Environmental Resources Management Southern Africa (Pty) Ltd (ERM), to act as the project manager and to undertake the Scoping and Environmental Impact Assessment (S&EIA) process for Environmental Authorisation (EA).

This EMPr is prepared as part of the requirements of the EIA Regulations promulgated under the National Environmental Management Act, 1998 (NEMA, Act 107 of 1998), as amended. The EMPr outlines measures to be implemented in order to minimise adverse environmental degradation associated with the various phases of the development. It serves as a guide for the contractor and the construction workforce on their roles and responsibilities concerning environmental management on site, and it provides a framework for environmental monitoring throughout the life cycle of the development, i.e., from Design phase until after Decommissioning phase.

This document must be seen as dynamic, and be updated when and if required, throughout the lifecycle of the project.

1.1 DETAILS OF THE DEVELOPER AND THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

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1.2 PURPOSE AND AIM OF THIS DOCUMENT

An EMPr for the proposed development is required in terms of the Appendix 4 of the National Environmental Management Act, 1998 (Act 107 of 1998), EIA Regulations of 2014 (GNR 326), as amended.

According to the Western Cape's Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for Environmental Management Plans (Lochner 2005), the *over-arching objectives of an EMPr is (1) to ensure compliance with regulatory authority stipulations and guidelines, (2) to ensure sufficient allocation of resources on the project budget, (3) to verify environmental performance through information on impacts as they occur, (4) to respond to changes in project implementation not considered in the EIA, (5) to respond to unforeseen events and (6) to provide feedback for continual improvement in environmental performance.*

The aim of this EMPr is to achieve the above objectives by:

- Defining the environmental management objectives to be realised during the life of the project, in order to enhance benefits and minimise adverse environmental impacts;
- Describing detailed actions needed to achieve these objectives, and mechanisms that address changes in the project implementation, emergencies and unexpected events;
- Clarifying institutional structures, roles, communication and reporting processes;
- Describing the link between the EMPr and associated legislated requirements; and
- Describing requirements for record keeping, reporting, review and auditing.

The purpose of the EMPr is to:

- Encourage good management practices through planning and commitment to environmental issues;
- Define how the management of the environment is reported and performance evaluated;
- Provide rational and practical environmental guidelines to:
- Minimise disturbance of the natural environment;
- Prevent pollution of land, air and water;
- Protect indigenous flora and fauna;
- Prevent soil erosion and facilitate re-vegetation;

- Comply with all applicable laws, regulations, standards and guidelines for the protection of the environment;
- Adopt the best practicable means available to prevent or minimise adverse environmental impacts;
- Identify and mitigate against any potential impact on ecology;
- Describe all monitoring procedures required to identify impacts on the environment; and
- Train employees and contractors with regard to environmental obligations.

It should be considered critical that the EMPr be updated to include site-specific information and specifications as required throughout the life-cycle of the facility - this will ensure that project activities are planned and implemented taking into account a changing environment and sensitive environmental features. The EMPr includes site specific requirements and mitigation measures for planning Construction, Operation and Decommissioning Phases. Additionally, the number of Management Plans related to site activity at are stipulated in Sections 11 – 23.

TABLE 1-1 CONTENT OF THE EMPR IN TERMS OF THE NEMA AND APPENDIX 4 OF THE EIA REGULATIONS, 2014 (AS AMENDED)

Appendix 4 Requirements NEMA, 1998 (Act No. 107 of 1998)		**EMPr Reference**
(1) An EMPr must comply with section 24N of the Act and include-details of		
(a)	*(i) the EAP who prepared the EMPr; and* *(ii) the expertise of the EAP to prepare an EMPr, including a curriculum vitae;*	Section 1.1
(b)	*A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;*	Section 3
(c)	*a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitives of the preferred site, indicating any areas that should be avoided, including buffers;*	Figure 2
(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 processed for all phased 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;*	Section 4 - 23
(f)	*a description of proposed impact management actions, identifying the manner in which the impact management outcomes and contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to-*	Section 4 - 23

Appendix 4 Requirements NEMA, 1998 (Act No. 107 of 1998)		EMPr Reference
	(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;	
	(ii) comply with any prescribed environmental management standards or practices;	
	(iii) comply with any applicable provisions of the Act regarding closure, whre applicable; and	
	(iv) comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	
(g)	*the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);*	Section 4 - 23
(h)	*the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);*	Section 4 - 23
(i)	*an indication of the persons who will be responsible for the implementation of the impact management actions;*	Section 4 - 23
(j)	*the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;*	Section 4 - 23
(k)	*the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);*	Section 4 - 23
(l)	*a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;*	Section 4 - 23
(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 4 - 23
(n)	*any specific information that be required by the competent authority.*	Section 4 - 23

2. THE PROPOSED BOSHOEK SOLAR 1 DEVELOPMENT

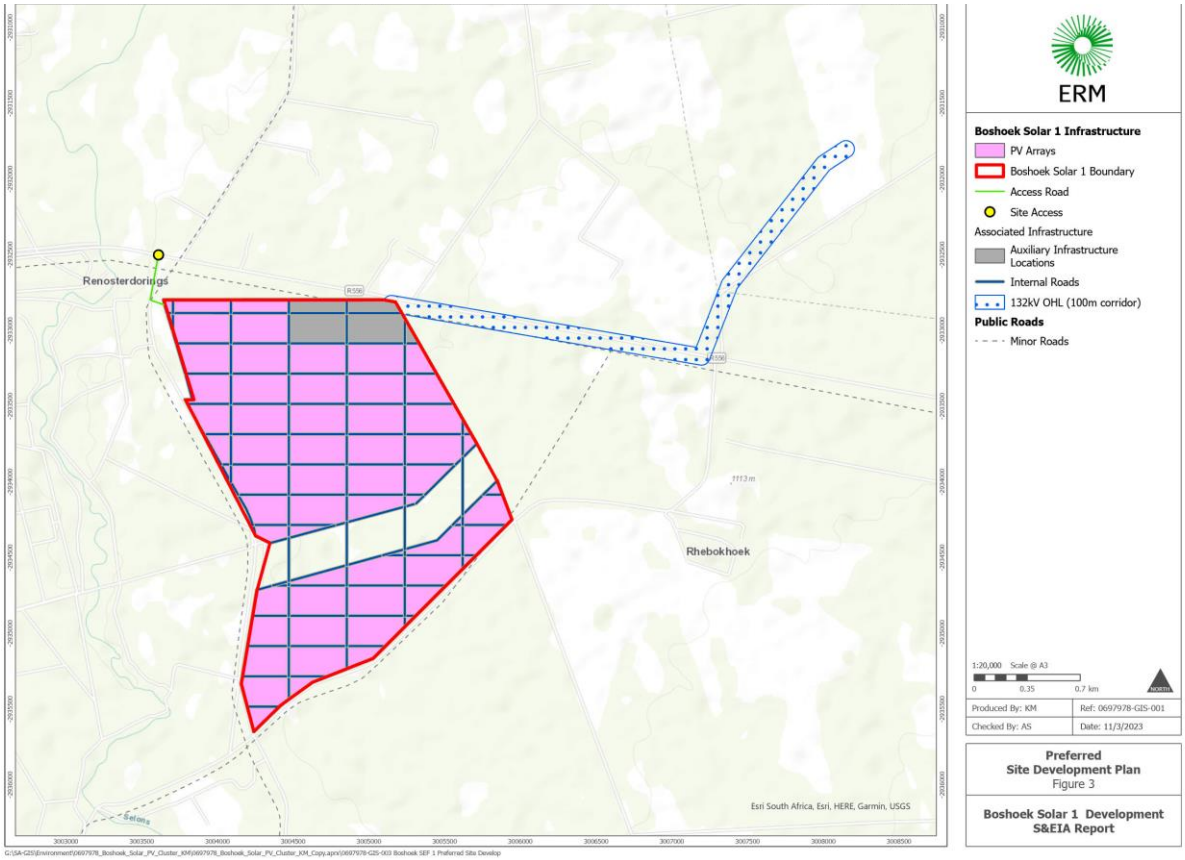
The Boshoek Solar 1 SEF is located approximately 33 km northwest of Rustenburg within the Kgetlengrivier and Rustenburg Local Municipalities and the Bojanala Platinum District Municipality, in the North West Province.

The proposed Boshoek Solar 1 SEF will consist of the components listed below. It is important to note at the outset that the exact specifications of the proposed project components will be determined during the detailed engineering design phase prior to construction (subsequent to the issuing of an Environmental Authorization, should such an authorisation be granted), but that the information provided below is seen as the worst-case scenario.

Boshoek Solar 1 SEF and Grid Connection components: – 150 MW

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;
- Auxiliary buildings (switch room, gatehouse and security, control center, office, warehouse, canteen & visitors center, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
  - Underground medium-voltage cabling between the project components and the facility substation.
  - Up to 132 kV facility on-site substation.
  - Up to 132 kV on-site switching station.
  - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.

FIGURE 2-1 BOSHOEK SOLAR 1 SEF FINAL SITE LAYOUT



2.1 BOSHOEK SOLAR 1 COMPONENTS

It should be noted that because the design of the proposed development is not yet finalised, all dimensions are maximums (i.e. – worst case scenario) as is required by the EIA process. The final design may include infrastructure, which is of equal or less than dimensions to those stated below, but not more than.

2.1.1 SOLAR PV TECHNOLOGY

PV technology produces direct current (DC), which is converted to alternating current (AC) via power electronic inverters. PV cells are made from semi-conductor materials that are able to release electrons when exposed to solar radiation. This is called the photo-electric effect. Several PV cells are grouped together through conductors to make up one module. Modules can be connected together to produce power in large quantities. In PV technology, the power conversion source is via PV modules that convert light directly to electricity.

Solar panels produce DC electricity; therefore, PV systems require conversion equipment to convert this power to AC, that can be fed into the electricity grid.

2.1.2 ELECTRICAL CABLING AND ON-SITE SUBSTATION

Medium-voltage (MV) power lines internal to the SEF will be entrenched and located adjacent to the access roads and /or within the footprint of the internal roads to an on-site substation.

The general height of the substation will be a maximum of 10 m and approximately 100 m x 200 m (2 ha), however will include switchgear portals up to 15 m in height and lightning masts up to 25 m in height.

2.1.3 BATTERY ENERGY STORAGE AND SYSTEM

The BESS will be placed on a concrete footprint of up to 5 ha. The BESS will be located in close proximity to the on-site switching station, will be fenced off and will be linked to the substation via internal cables and will not have any additional office / operation / maintenance infrastructure as those of a substation.

2.1.4 LAYDOWN AREAS AND SITE OFFICES

An area of up to 1 ha will be occupied by buildings, which will include (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control center.

2.1.5 INTERNAL SITE ACCESS ROADS

Most of the access road will follow existing, gravel farm roads that may require widening up to 10 m (inclusive of *stormwater* infrastructure). Where new sections of road need to be constructed (lengthened), this will be gravel/hard surfaced access road and only tarred if necessary.

A network of gravel internal access roads and a perimeter road (cumulatively up to 33 km in length), each with a width of up to ~ 6 m, will be constructed to provide access to the various components of the PV development.

Site access is proposed directly off an unnamed gravel road surrounding the site; however, this will be confirmed based on the outcome of the traffic impact assessment.

2.2 SERVICE PROVISION

2.2.1 HEALTH AND SAFETY

The IFC guidelines for Health and Safety are based on the Occupational Health and Safety Act (OHSA) of America and are subsequently aligned with South African legislation (OHS Act no 85 of 1993). It is understood that the project infrastructure and equipment will be designed to good industry standards to minimise risks personnel working at the proposed development site.

Boshoek Solar 1 (Pty) Ltd will institute a Health and Safety (H&S) Plan prior to construction, for all persons working at the proposed development site. The policy will need to evaluate the risks and impacts to the health and safety of the affected community during the design, construction and operation of the proposed development, and establish preventive measures to address them in a manner commensurate with the identified risks and impacts within this assessment. Such measures need to adhere to the precautionary principle for the prevention or avoidance of risks and impacts over minimization and reduction.

2.2.2 WATER REQUIREMENTS

Water will be sourced from either the Local Municipality, supplied from a contractor and trucked in, from existing boreholes located within the application site or from a new licensed borehole (if feasible) if none of these options are available. Note, however, that should municipal water

supply not be confirmed, the Applicant will investigate other water sources considering any necessary and relevant legal requirements.

Water will be utilized throughout both the construction and operational phases of Boshoek Solar 1. The anticipated water usage for the proposed project for the duration of the construction phase includes the following:

- Drinking;
- Ablution facilities;
- Access Road construction;
- Dust suppression;
- Fire-fighting reserve;
- Cleaning of facilities; and
- Construction of foundations for the SEF infrastructure, i.e., PV panels and substation, etc.

The water use requirement during the operational phase will be primarily for PV panel cleaning (do we have a rough estimate of the volumes potentially required for washing purposes), human consumption and sanitation purposes.

2.2.3 PANEL CLEANING

During operation, water will be required for the cleaning of panels. The cleaning process will strictly utilize clean water (without any cleaning products) or non-hazardous biodegradable cleaning products. Wastewater produced from panel washing will either be gathered and reused for subsequent cleaning sessions or, if an environmentally friendly, non-hazardous biodegradable cleaning product is employed, allowed to runoff beneath the panels.

2.2.4 STORMWATER MANAGEMENT

Stormwater drainage systems will be constructed and kept separate from the sewerage effluent system on site to ensure that *stormwater* run-off from site is appropriately managed. Water from these systems is not likely to contain any chemicals or hazardous substances and will be released into the surrounding environment based on the natural drainage contours.

Wastewater and sludge will be managed by local authorities and service providers. All wastewater will be handled in accordance with the Guidelines for the Utilisation and Disposal of Wastewater Sludge Volumes 1 to 6 (Herselmann & Snyman, 2006).

2.2.5 WASTE

During the construction phase, it is estimated that the SEF would generate solid waste which includes (but is not limited to) packaging material, building rubble, discarded bricks, wood, concrete, plant debris and domestic waste. Solid waste will be collected and temporarily stockpiled within designated areas on site during construction, and thereafter removed and disposed of at a nearby registered waste disposal facility on a regular basis as per agreement with the local municipality. Where possible, recycling and re-use of materials will be encouraged.

During the operational phase, the SEF will typically produce minor quantities of general non-hazardous waste mainly resulting from the O&M and office areas. General waste will be collected and temporarily stockpiled in skips in a designated area on site and thereafter removed and disposed of at a nearby registered waste disposal facility (or registered landfill) on a regular

basis as per agreement with the local municipality. Where possible, recycling and re-use of materials will be encouraged.

Any hazardous waste such as chemicals or contaminated soil as a result of spillages, which may be generated during the construction and operational phases, will be temporarily stockpiled within a designated area on site and thereafter removed off site by a suitable service provider for safe disposal at a registered hazardous waste disposal facility.

2.2.6 SEWAGE

The SEF will require sewage services during the construction and operational phases. Low volumes of sewage or liquid effluent are estimated during both phases. Liquid effluent will be limited to the ablution facilities during the construction and operational phases. Portable sanitation facilities (i.e. chemical toilets) will be used during the construction phase, which will be regularly serviced and emptied by a registered contractor on a regular basis.

The Applicant may consider a conservancy tank system which will be employed on site during the operational phase for which a registered company will be contracted to store and transport sewage from site to an appropriate municipal wastewater treatment facility.

2.2.7 ELECTRICITY FOR CONSTRUCTION PHASE

Electricity on site will be from on-site diesel generators as well as sourced from the national grid distribution networks.

2.3 SUMMARY OF PROJECT INFORMATION

TABLE 2-1 SEF TECHNICAL DETAILS

SEF Technical Details Components	Description/Dimensions
Maximum Generation Capacity	Up to 150 MW
Type of technology	Onshore Solar
Area occupied by both permanent and construction laydown areas	4ha Temporary 1ha permanent
Operations and maintenance buildings (O&M building) with parking area	1 ha which will include (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control center.
Site Access	Site access is proposed directly off an unnamed gravel road surrounding the site; however, this will be confirmed based on the outcome of the traffic impact assessment.
Area occupied by inverter transformer stations/substations	Up to 132 kV on-site facility substation and switching station
Capacity of on-site substation and switching station	Up to 132 kV
Battery Energy Storage System footprint	up to 5 ha
Length of internal roads	up to 33 km
Width of internal roads	up to 6 m

SEF Technical Details Components	Description/Dimensions
Proximity to grid connection	A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.
Internal Cabling	Medium voltage cables (up to 33 kV)
Height of fencing	Up to 3.5 m
Type of fencing	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.

Proposed Boshoek Solar 1 SEF Site Boundary and Associated Infrastructure		
Aspect	**Latitude**	**Longitude**
Centre Point	25° 28’ 26.74”	26° 59’ 24.39”
North West corner	25° 27’ 49.54”	26° 58’ 55.96”
North East corner	25° 27’ 49.65”	26° 59’ 45.11”
South East corner	25° 28’ 31.56”	26° 0’ 9.48”
South West corner	25° 29’ 12.11”	26° 59’ 15.22”

3. LEGAL FRAMEWORK

Any EA obtained from the DFFE, or any other competent authority, only applies to those specific listed activities for which the application was made. The applicable Listed Activities are presented in Table 3.1 below. This section of the EMPr will need to be updated to include the recommendations and requirements that are outlined in the EA, should this project be authorised by the DFFE.

TABLE 3-1 NEMA LISTED ACTIVITIES APPLICABLE TO THE BOSHOEK SOLAR 1 DEVELOPMENT

Listing Notices 1, 2 and 3 07 April 2017	**Listed Activity**	**Description of project activity that triggers listed activity**
Listing Notice 1 GN R 327 Activity 11	*The development of facilities or infrastructure for the transmission and distribution of electricity— (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.*	The facility will entail the construction of an on-site up to 132kV substation and overhead transmission powerline to facilitate the connection between the solar farm and the national grid collector switching station.
Listing Notice 1 GN R 327 Activity 12	*The development of- (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs (a) within a watercourse; (c) if no development setback exists within 32 m of a watercourse, measured from the edge of a watercourse.*	The facility will entail the construction of built infrastructure and structures (such as panel mounting structure, panel foundations, offices, workshops, Operations and Maintenance (O&M) buildings, BESS, ablution facilities, onsite substations, laydown areas and security enclosures etc.). The infrastructure and structures are expected to exceed a footprint of 100 m^2 and could occur within small drainage features and 32 m of the watercourses.
Listing Notice 1 GN R 327 Activity 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;*	The facility will entail the excavation, removal and moving of more than 10 m^3 of soil, sand, pebbles, or rock from nearby watercourses on site, mainly for the purpose of constructing access roads. Details of the infilling of and excavations from the affected watercourses / drainage features will be confirmed during the detailed engineering design phase.
Listing Notice 1 GN R 327 Activity 24	*The development of a road- (ii) with a reserve wider than 13.5 meters, or where no reserve exists where the road is wider than 8 meters*	Roads with a reserve wider than 13.5 meters are proposed for the facility.
Listing Notice 1 GN R 327 Activity 28	*Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be*	The facility will take place outside of an urban area, and is considered as a commercial / industrial development, which will have an estimated total development footprint of more than 20 ha. The facility will entail the construction of solar facility, including on-site substations, a BESS, and various associated structures and infrastructure. This will constitute

Listing Notices 1, 2 and 3 07 April 2017	Listed Activity	Description of project activity that triggers listed activity
	developed is bigger than 1 hectare.	infrastructure with a total physical footprint of more than 1 ha.
Listing Notice 1 GN R 327 Activity 48	*The expansion of- Infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion occurs- (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*	The facility will require the upgrading of existing roads within the development area, as well as watercourse crossing upgrades, where such upgrades may take place within watercourses and within 32 m from the edge of these watercourses. The total footprint of the upgrades to be undertaken on the existing roads would be in excess of 100 m^2 within a watercourse, or within 32 m of a watercourse.
Listing Notice 1 GN R 327 Activity 56	*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13.5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.*	Existing roads will be widened by more than 6 m and will require lengthening by more than 1 km, to accommodate the movement of heavy vehicles and cable trenching activities associated with the facility.
Listing Notice 2 GN R 325 Activity 1	*The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more.*	The facility will comprise a maximum generation capacity of more than 20 MW (i.e., for the generation of electricity from a renewable resource).
Listing Notice 2 GN R 325 Activity 15	*The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity*	The construction of the facility will require clearance of more than 20 hectares of indigenous vegetation.
Listing Notice 3 GN R 324 Activity 4	*The development of a road wider than 4 metres with a reserve less than 13,5 metres (h) North West (iv) Critical Biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority;*	The facility will require the development of roads wider than 4 m within areas which contain indigenous vegetation.
Listing Notice 3 GN R 324 Activity 12	*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes*	The facility will require the clearance of natural vegetation in excess of 300 m^2 in areas of natural vegetation. Portions of the respective facility are located within Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs).

Listing Notices 1, 2 and 3 07 April 2017	Listed Activity	Description of project activity that triggers listed activity
	undertaken in accordance with a maintenance management plan. *(h) North West* *(iv) Critical biodiversity areas identified in systematic bioregional plans adopted by the competent authority;*	
Listing Notice 3 GN R 324 Activity 14	*The development of—* *(ii) channels exceeding 10 square metres in size;* *(h) North West* *(iv) Critical biodiversity areas identified in systematic bioregional plans adopted by the competent authority;*	The proposed development will entail the development of infrastructure with physical footprints of 10m^2 or more within a watercourse / surface water feature or within 32 m from the edge of a watercourse / surface water feature. Although the layout of the proposed development will be designed to avoid the identified surface water features / watercourse as far as possible, some of the infrastructure / structures will likely need to traverse the identified surface water features / watercourses. The construction of the infrastructure for the development will occur within CBAs and Ecological Support Areas (ESAs) located outside of urban areas.
Listing Notice 3 GN R 324 Activity 18	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *(h) North West* *(v) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority*	Internal access roads will be required to access the facility as well as the respective substations. Existing roads will be used wherever possible. Internal access roads will thus likely be widened by more than 4 m or lengthened by more than 1 km. These roads will occur within the North West Province, outside urban areas. The respective proposed development sites contain indigenous vegetation.
Listing Notice 3 GN R 324 Activity 23	*The expansion of—* *channels where the channel is expanded by 10 square metres or more;* *(i) North West* *(iv) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority.*	The facility will likely entail the development and expansion of roads by 10m^2 or more within a surface water feature / watercourse or within 32 m from the edge of a surface water feature / watercourse. Although the layout will be designed to avoid the identified surface water features / watercourses as far as possible, some of the existing internal and access roads may likely need to traverse some of the identified surface water features / watercourses. The facility will occur within a CBA, and is located outside urban areas.

4. ENVIRONMENTAL MANAGEMENT PROGRAMME

This section forms the core of the EMPr and outlines the specific mitigation measures for those key impacts identified for the development of the Boshoek Solar 1.

4.1 ENVIRONMENTAL AWARENESS AND COMPLIANCE

The philosophy that has been used for the compilation of this management programme is derived from the principles of the NEMA, 1998 (Act No. 107 of 1998), which states that development must be socially, economically and environmentally sustainable. Sustainable development requires that:

- The disturbance of ecosystems and loss of biodiversity are avoided (minimised or remedied);
- Pollution and degradation of the environment are avoided or minimised and remedied;
- Waste is avoided or minimised and re-used or re-cycled where possible and otherwise disposed of in a responsible manner;
- A risk averse and cautious approach is applied; and
- Negative impacts on the environment and on people's environmental rights be anticipated, and, prevented and where they cannot altogether be prevented, are minimised and remedied.

The Act makes provision that anyone who causes pollution or degradation of the environment is responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment.

4.1.1 LEGALLY BINDING DOCUMENTS

Should favourable decision be received for the proposed development, a copy of the EA, the audit and compliance monitoring reports, and the approved EMPr, must be made available for inspection and copying during all phases of the development -

- At the site of the authorised activity;
- To anyone on request; and
- Where the holder of the EA has a website, on such publicly accessible website.

4.2 ROLES AND RESPONSIBILITIES FOR GOOD ENVIRONMENTAL MANAGEMENT

The developer, together with the appointed contractor, will be responsible for environmental management on site during all phases of the development. Specific roles and responsibilities are highlighted below.

ENVIRONMENTAL MANAGER - DEVELOPER REPRESENTATIVE

- Review and approve final EMPr prior to authorisation by the DFFE;
- Review and approve any EMPr updates or amendments post approval of the EMPr;
- Ensure environmental requirements are integrated into the project plans, method statements and tender processes;
- Support the site environmental control officer (ECO) during the construction phase, to ensure implementation of the EMPr;
- Follow up and close out all environmental incidents and non-conformances; and

- Appoint a suitably qualified independent ECO during the construction phase.

ENVIRONMENTAL CONTROL OFFICER - PRINCIPAL CONTRACTOR REPRESENTATIVE

An independent ECO will work along-side the Environmental Site Officer (ESO) to conduct the required inspections of the construction activities and EMPr implementation throughout the construction phase. After each monthly inspection, the ECO will produce a monitoring report that will be submitted to Developer / Applicant, the DFFE, and any other person(s) if required. Relevant sections of the minutes of customary (monthly) site meetings will be attached to the monitoring report.

The ECO will be responsible for overseeing the implementation of the EMPr during the construction and operations phases, and for monitoring, reviewing and verifying compliance of the ESO and contractor with the EMPr, record-keeping and updating of the EMPr as and when necessary.

The ECO will:

- Be fully knowledgeable with the contents of the EMPr;
- Be fully knowledgeable with the contents of all relevant environmental legislation and ensure compliance with them;
- Ensure that the contents of the EMPr are communicated to the contractor, all site staff, and the contractor and /or site manager are made aware of the contents of the EMPr, through presentations and discussions;
- Ensure that compliance to the EMPr is monitored by regular and comprehensive inspection of the site and surrounding areas; and
- Report on any incidents of non-compliance and ensure mitigation measure are implemented as soon as practical.

DURING *CONSTRUCTION*, THE ECO WILL BE RESPONSIBLE FOR THE FOLLOWING:

- Meeting on site with the Construction Manager and ESO prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Ensuring that daily / weekly (depending on the extent of construction activities, at any given time) monitoring of site activities take place by the ESO to ensure adherence to the specifications contained in the EMPr. The ESO should use a monitoring checklist that is to be prepared by an independent environmental assessment practitioner (EAP) at the start of the construction phase;
- Preparation of the monitoring report based on the site visits and feedback by the ESO;
- Conducting an environmental inspection on completion of the construction period and signing off the construction process with the Construction Manager and ESO; and
- Ensuring that the ESO maintains an Incidents Register and Complaints Register on site.

ENVIRONMENTAL MANAGEMENT PROGRAMME

DURING *OPERATION*, THE ECO WILL BE RESPONSIBLE FOR:

- Overseeing the ESO during the implementation of the EMPr for the operation phase;
- Ensure that the necessary environmental monitoring takes place as specified in the EMPr;
- Update the EMPr and ensure that records are kept of all monitoring activities and results; and
- Ensuring that the ESO maintains an Incidents Register a Complaints Register on site.

DURING DECOMMISSIONING, THE ECO WILL BE RESPONSIBLE FOR:

- Overseeing the ESO during the implementation of the EMPr for the decommissioning phase; and
- Conducting an environmental inspection on completion of decommissioning and "signing off" the site rehabilitation process.

ESO – NOMINATED CONTRACTOR REPRESENTATIVE

The ECO must appoint a nominated representative of the contractor as the ESO. The ESO is required to be on site at all times and will conduct the required inspections of the construction activities and ensure implementation of the EMPr throughout the construction phase. After each inspection, the ESO is required to submit a completed monitoring checklist to the ECO.

The ESO will be responsible for ensuring the implementation of the EMPr during the construction and operations phases by the contractor and providing feedback to the ECO regarding the compliance of the contractor with the EMPr and any updates required to the EMPr as and when necessary.

The ESO will:

- Be fully knowledgeable with the contents of the EMPr;
- Be fully knowledgeable with the contents of all relevant environmental legislation and ensure compliance with them;
- Ensure that the contents of the EMPr are implemented by the contractor, all site staff;
- Ensure that compliance to the EMPr is monitored by regular and comprehensive inspection of the site and surrounding areas; and
- Report on any incidents of non-compliance to the ECO and ensure mitigation measures are implemented as soon as practical.

CONTRACTOR

A contractor who will be responsible for the implementation of the EMPr in accordance with the requirements of the EA.

The Contractor will:

- Be fully knowledgeable with the contents of the EMPr;
- Ensure that the contents of the EMPr are understood by all site staff; and
- Report on any incidents of non-compliance to the ESO and ensure mitigation measures are implemented as soon as practical.

ENVIRONMENTAL AUDITOR

The Developer must appoint an Independent Environmental Auditor. The independent Auditor is required to undertake routine site visits (at least every six months) to conduct the required inspections of the compliance with the EA and EMPr during the construction and post construction phase of the activities. After each inspection, the auditor is required to submit an environmental audit report to the DFFE.

The Auditor will:

- Be fully knowledgeable with the contents of the EMPr;
- Be fully knowledgeable with the contents of all relevant environmental legislation and monitoring compliance with them; and
- Submit reports to the DFFE.

4.2.1 FREQUENCY FOR AUDITING OF COMPLIANCE AND SUBMISSION OF REPORTS

The Auditor will arrange for inspections of the activities and EMPr implementation throughout the construction and post construction phase. After each inspection, the auditor will produce an environmental audit report that will be submitted to the client, DFFE, Department of Agriculture, Land Reform and Rural Development, and any other stakeholder as required. The monitoring reports, recommended to be produced by the ECO must be appended to the audit reports for submission.

The frequency of auditing and submission of the environmental audit reports must be at least every six months, or what is deemed necessary in consultation with the ECO during times of heavy earth works and vegetation clearing, and ensuring compliance with all aspects of the EA and EMPr.

4.3 TRAINING AND INDUCTION OF EMPLOYEES

The ECO has a responsibility to ensure that all personnel involved in the project are aware of and are familiar with the environmental requirements for the project. The EMPr shall be part of the terms of reference (ToR) for all contractors, sub-contractors and suppliers. All Contractors have to give some assurance that they understand the EMPr and that they will undertake to comply with the conditions therein. All senior and supervisory staff members shall familiarise themselves with the full contents of the EMPr. They shall know and understand the specifications of the EMPr and be able to assist other staff members in matters relating to the EMPr.

The ECO and / or ESO must ensure that all staff working on site have an environmental induction. The presentation can include the following topics:

- What is meant by “Environment”?;
- Why the environment needs to be protected and conserved;
- How construction activities can impact on the environment;
- What can be done to militate against such impacts?;
- Awareness of emergency and spills response provisions; and
- Social responsibility during construction e.g. being considerate to local residents.

A detailed environmental management and training program must be developed. The purpose of this is to ensure that all staff and workers understand what is required of them. The main components of the program can incorporate the following:

- Concept of sustainability and the reasons for good environmental management and practice;
- Potential environmental impacts;
- Mitigation measures;
- Establishing a chain of responsibility and decision making;
- Specific training requirements of certain staff, and the potential hazardous associated with the job;
- Methodologies to be used for field sampling;
- Training in the use of field equipment;
- Training in identification of non-compliance situations and procedures to be followed in such instances;
- Reporting requirements;
- Healthy and Safety;
- Fire management; and
- HIV/AIDS.

4.4 COMPLAINTS REGISTER AND ENVIRONMENTAL INCIDENTS BOOK

Any complaints received from the community must be brought to the attention of the ECO / ESO, who will respond accordingly.

The following information will be recorded:

- Time, date and nature of the complaint;
- Response and investigation undertaken; and
- Actions taken and by whom.

All complaints received will be investigated and a response (even if pending further investigation) will be given to the complainant within 7 days.

All environmental incidents occurring on the site will be recorded. The following information will be provided:

- Time, date, location and nature of the incident; and
- Actions taken and by who.

4.5 CONSTRUCTION ENVIRONMENTAL MONITORING

In order to facilitate communication between the Environmental Manager, the ECO (and the ESO), it is vital that a suitable chain of command is structured that will ensure that the ECO's recommendations have the full backing of the project team before being conveyed to the Contractor. In this way, penalties as a result of non-compliances with the EMPr may be justified as failure to comply with instruction from the highest authority.

4.6 DEALING WITH NON-COMPLIANCE WITH THE EMPR

There may be difficulties encountered with carrying out the mitigation measures within the EMPr, this may result in non-compliance with the EMPr. It may be possible that the contractor and or the developer put in place procedures to motivate staff members to comply with the EMPr and to deal with non-compliance. The developer must make this known to the contractor at the earliest stage possible, even during the tender phase. When dealing with non-compliance, the following process is recommended to take place:

- A notice of transgression should be issued to the transgressor;
- It must be documented in a designated register; and
- It must be reported in a monthly report and made available to I&APs and DFFE upon request.

National government, provincial government, local authorities or committees appointed in terms of the conditions of the authorisation or any other public authority shall not be held responsible for any damages or losses suffered by the holder of the authorization. Additionally, his/her successor in title in any instance where construction or operation subsequent to construction be temporarily or permanently stopped for reasons of non-compliance by the holder of the authorisation with the conditions of authorisation as set out in this document or any other subsequent document emanating from these conditions of authorization.

4.7 EMPR AMENDMENTS AND INSTRUCTION

No EMPr amendments shall be allowed without the approval of the DFFE. Amendments may be possible, following discussions with the relevant ECO, who may propose EMPr amendments on behalf of the developer or issue EMPr instructions, corrective actions, remediation or rehabilitation. These correction actions must be completed within the specified timeframes.

5. DESIGN PHASE/PRE-CONSTRUCTION PHASE AND MITIGATION MEASURE

The objectives of the pre-construction phase are:

- To promote environmental awareness;
- To define roles and responsibilities for environmental management;
- To ensure suitable environmental training and induction to all contractors, sub-contractors and labourers;
- To ensure that all legal obligations and contractual conditions have been met prior to commencing of construction;
- To ensure that the facility design responds to the identified environmental constraints and opportunities; and
- To implement effective communication methods and practices.

5.1 MITIGATION MEASURES FOR LEGAL COMPLIANCE

- Appoint an independent ECO;
- Appoint an internal ESO to oversee day to day environmental activities.
- Staff should be educated as to the need to refrain from indiscriminate waste disposal and/or pollution of local soil and water resources and receive the necessary safety training;
- The contractor must ensure conditions described in the EA are adhered to;
- Confirm with ESO / ECO, suitable sites for the construction camps (equipment and batching etc.) and storage areas for materials. All construction equipment must be stored within this construction camp and all associated oil changes etc. (no servicing) must take place within this camp;
- Unskilled labourers should be drawn from the local market where possible;
- Environmental awareness training for site personnel, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both surface and groundwater), air pollution and litter control and identification of archaeological artefacts;
- The Contractor, together with the ESO shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks. Training developed by the Contractor and ESO must be approved by the ECO;
- Site personnel operating light, and heavy-duty equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks;
- No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the Contractor and certified competent by the Project Manager;
- Before construction begins, all areas to be developed must be clearly demarcated with fencing, by a qualified surveyor;
- Apart from security personnel, no workers are allowed to stay overnight in the construction area;
- The developer is to compile and implement a grievance mechanism procedure for the public.

- The contractor to develop a Construction Site Traffic Management Plan – this will be in the form of a site layout, showing the flow of traffic during the construction phase taking into consideration existing land users;
- Once the final layout plan has been approved the appointed responsible engineers must produce an updated *stormwater* management plan (SWMP) for the site, during the construction and operational phases of the project. An effective SWMP will include bunds and ditches, where it is required - that is at all points of disturbance where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces, and it must prevent any potential down slope erosion;
- A health and safety plan must be drawn up to ensure worker safety;
- Develop a Project Layout and Access Plan to show the intended use of the area. The plan shall clearly indicate and/or describe the location and details of the final:
  - Servitudes.
  - Areas and routes to be cleared – including the size / width of the cleared areas.
  - The construction campsite and rest areas to be used during construction.
  - Waste disposal sites to be used during construction.
  - Sources of construction materials.
  - Power supply during construction.
  - Existing roads and tracks to be used as transportation routes, and routes to gain access to construction areas.
  - New tracks deemed necessary to provide access to construction activities.
  - Any informal residential structures found within the property.
  - Affected land use, 1:50 year floodlines.
  - Sensitive areas.

5.2 SITE ESTABLISHMENT

The object of site establishment is to ensure that an appropriate site is selected for the construction camp/site office and that the site office is managed in an environmentally responsible manner with minimal impact on the environment.

The optimised site layout (including the location of construction camps and laydown areas) must be finalised through a micro-siting process, which will include a detailed site assessment of the final site layout by various specialists as stipulated in the EA and this final EMPr.

5.2.1 MITIGATION MEASURES

Before establishing the construction office areas, carefully plan the layout and develop a Construction Site Office Plan[1]. The Construction Site Office Plan shall provide a description of the site and shall show, on a reasonably scaled map, the intended use of the site. Indicate and/or describe the location, size / quantity / capacity and design of:

- Access routes;
- Ablution facilities (including details on the handling of sewage and wastewater);
- On-site waste management facilities (waste containers, etc.);
- Design of bunds and other structures for containment of hazardous substances;
- Fencing;
- Water storage and supply;

[1] To form part of the Project Layout and Access Plan.

- Power supply (for cooking, space heating, lighting, etc.);
- Fire extinguishers, first aid kit and any other relevant safety equipment;
- Other structures and buildings (offices, storerooms, workshops, etc.);
- Other storage areas and stockpiles (i.e. topsoil, construction materials, equipment, etc.); and
- Location of areas to be rehabilitated upon completion of the construction period, providing measures to be used for rehabilitation.

THE FOLLOWING MUST ALSO BE UNDERTAKEN:

- An area within the site must be demarcated for a construction site office, which will include storage area. This area must be fenced off;
- Site establishment shall take place in an orderly manner and all required amenities shall be installed at the lay down area before the main workforce move onto site;
- The construction camp shall have the necessary ablution facilities with chemical toilets at commencement of construction;
- During the pre-construction phase, the temporary construction camps and laydown areas must be located outside of the water courses (including the 45 m buffer);
- The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate sanitary activities be allowed other than in supplied facilities;
- The Contractor shall supply waste collection bins and all solid waste collected shall be disposed of at a registered landfill;
- Potable water for use by on site workers must be made available on a daily basis at the site office and the working areas on site;
- A certificate of disposal shall be obtained by the Contractor and kept on file. Where a registered waste site is not available close to the construction site, the Contractor shall provide a method statement with regard to waste management;
- The disposal of waste shall be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site;
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc;
- Apply for all relevant permits for abnormal loads and route clearances with the relevant authorities prior to construction;
- Appoint a qualified specialist to conduct a detailed site-specific Transport Risk Assessment during the detailed design phase and prior to construction;
- Determine the pre-construction condition of the road immediately prior to construction by carrying out a condition assessment or from recent pavement management system condition assessments if available from the Provincial Authorities;
- Public notices regarding any planned abnormal load transports must be placed at the construction site to inform affected parties;
- Abnormal loads must conform with legal maximum dimensions, and vehicles carrying abnormal loads must display sufficient signage; and

- Any roads damaged during the transportation of components, or from other construction vehicles must be rehabilitated and returned to pre-construction conditions.

5.3 SITING, ESTABLISHING AND MANAGEMENT MATERIALS

- Choice of location for storage areas must consider prevailing winds, distances to water bodies, general onsite topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary;
- Mitigation measures as provided in this final EMPr must be adhered to during site establishment;
- Storage areas must be designated, demarcated and fenced;
- Storage areas must be secure so as to minimize the risk of crime. They must also be safe from access by children / animals etc;
- Fire prevention facilities must be present at all storage facilities;
- Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s).
- Pollution prevention measures for storage must include a bund wall high enough to contain at least 110% of any stored volume, and this must be sited away from drainage lines on site with the approval of the Engineer;
- Any water that collects in the bund must not be allowed to stand and must be removed immediately and the hydrocarbon digestion agent within must be replenished;
- All legal compliance requirements with respect to fuel storage and dispensing must be met.
- All fuel storage tanks (temporary or permanent), and associated facilities must be designed and installed in accordance with the relevant oil industry standards, SANS codes and other relevant requirements;
- Areas for storage of fuels and other flammable materials must comply with standard fire safety regulations;
- Flammable fuel and gas must be separated from all welding workshops, assembly plants and loading bays where ignition of gas by an accidental spark may cause an explosion or fire.
- The tank must be erected at a safe distance from buildings, boundaries, welding sites and workshops and any other combustible or flammable materials;
- Symbolic safety signs depicting “No Smoking”, “No Naked Flames” and “Danger” are to be prominently displayed in and around the fuel storage area;
- The capacity of the tank must be clearly displayed and the product contained within the tank clearly identified;
- There must be adequate fire-fighting equipment at the fuel storage and dispensing area or areas;
- The storage tank must be removed on completion of the construction phase of the project;
- All such tanks to be designed and constructed in accordance with the national standard for storage tanks, i.e., ISO 16961:2015 and a recognised international standard code if required;
- The rated capacity of tanks must provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage;

- Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks must be sealed and stored in an area where the ground has been protected;
- Any electrical or petrol-driven pump must be equipped and positioned so as not to cause any danger of ignition of the product;
- If fuel is dispensed from 200 liter drums, the proper dispensing equipment must be used;
- The drum must not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage tank must be stored in a waterproof container when not in use;
- All waste fuel and chemical impregnated rags must be stored in leak-proof containers and disposed of at an approved hazardous waste site;
- The amounts of fuel and chemicals stored on site must be minimized;
- Storage sites must be provided with bunds to contain any spilled liquids and materials;
- These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of *stormwater* from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources;
- Clear signage must be placed at all storage areas containing hazardous substances / materials;
- Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances to be used on site. Where possible, the available MSDSs must additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes;
- Storage areas containing hazardous substances / materials must be clearly signed;
- Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures;
- Any hazardous waste handling on site must be undertaken by experienced staff. No mixing of hazardous and general waste should be permitted;
- A suitable Waste Disposal Contractor must be employed to remove waste oil. These wastes must only be disposed of at licensed landfill sites designed to handle hazardous wastes;
- The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training;
- All excess cement and concrete mixes are to be contained on the construction site prior to disposal off site; and
- Any spillage, which may occur, shall be investigated and immediate action must be taken.

5.3.1 SITE CLEARANCE

- Vegetation clearance must preferably be phased as required to work in certain areas, rather than clearing of the entire site initially. If this is not practical and the entire site is cleared at the start of the contract, it is to be stabilized immediately to control dust. Wherever possible, vegetation shall be trimmed rather than cleared;
- Cleared vegetative material is not to be dumped anywhere other than an approved waste disposal site or an area as agreed to with the ECO;

- Wherever possible and where the material is suitable, the material must be chipped for later use as mulch in landscaped areas or for stabilization purposes or it must be dumped at a green waste recycling depot for compost production;
- Invasive alien plant species, which are removed from the site, are not to be chipped for mulch if they are in a seed-bearing state. Such material is to be disposed of at a suitable waste disposal site. Wherever possible, suitable larger stumps must be made available to the local community as firewood;
- Plant material removed from the site is not to be burnt for disposal on site unless a burning permit has been obtained from the local authority;
- Sensitive ecosystems in the vicinity of the areas of construction must be demarcated (e.g. using danger tape or droppers) prior to any construction activities, so that these can be avoided;
- Removal of vegetation must be kept to a minimum, and cleared areas must be re-vegetated after clean-up. A detailed planting plan must be developed, in consultation with a landscaper and ecologist;
- Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development;
- Demarcate all areas to be cleared with construction tape or similar material. However, caution must be exercised to avoid using material that might entangle fauna;
- An alien control and monitoring program must be adhered to, to ensure that the site is cleared of alien plants (as listed under the Conservation of Agricultural Resources Act 43 of 1983 - as amended/updated) and kept free from alien plants for the duration of the construction phase; and
- A low cover of vegetation must be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.

5.3.2 TOPSOIL

Topsoil / top material shall be removed from all areas cleared of vegetation and retained for future landscaping use, where feasible. Top material must exclude litter, building rubble, alien plant material or any other waste.

All topsoil, and specifically any topsoil from areas which are likely to contain bulbs, must be stripped and stockpiled for re-use in rehabilitation. This will constitute at least a 300 mm layer.

Topsoil shall be stored in areas demarcated by the ECO and Engineer and in piles not higher than 2 m, and may not be removed from site, or used for any purpose other than in the rehabilitation of the site post-construction. The stockpiles shall not be compacted or disturbed and shall be domed at the top to promote runoff. The period between the stockpiling of topsoil and its utilization shall be as short as possible, and ideally the topsoil must be transferred to its intended site of use immediately following site clearance and stockpiling. This would also avoid double handling.

Stockpiles that are to be stored for less than three months must be covered with shade-cloth or Geotech fabrics or similarly suitable material to prevent erosion. If stockpiles are to be stored

for more than 3 months a protective vegetation layer must be established to cover topsoil stockpiles in order to protect them against erosion and desiccation. If possible, the stockpile must be kept moist in order to maintain the vitality of the vegetation. Vegetation may not consist of weeds, but must comprise of grass or ground covers.

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Should any telephone communication lines require moving this will have to be facilitated and approved by Telkom.

5.4 PERMIT REQUIREMENTS

Activities undertaken during site preparation, construction and operation may require additional permits, over and above the EA. Boshoek Solar 1 (Pty) Ltd is responsible for ensuring that they hold the necessary permits in order to comply with national and local regulations.

Additional permit requirements which may be required are described below.

5.4.1 BORROW PITS

A borrow pit refers to an open pit where material (soil, sand or gravel rock) is removed for use at another location. Boshoek Solar 1 (Pty) Ltd or their contractors may want to use borrow pits for certain earthworks operations, such as the construction of roads, embankments, bunds, berms, and other structures. Licensed borrow pits will be used to source material.

The establishment of borrow pits is regarded as a mining activity and is legislated in terms of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA). A mining permit must be obtained from the Department of Mineral Resources and Energy (DMRE) prior to the establishment of borrow pits on the site.

5.4.2 WATER USE LICENCE

The construction of the SEF and roads may result in water crossings. The developer must ensure that Water Use Licenses are applied for and approved, prior to the start of construction, if required.

There are licensing procedures that need to be followed for particular "water uses" under the National Water Act, 1998 (Act No. 36 of 1998). Water uses that may be of relevance to the development and associated road construction include the following:

- Taking of water from a water resource, including a water course, surface water, estuary or aquifer (i.e. borehole);
- Altering the bed, banks, course or characteristics of a water course; and/or
- Impeding or diverting of a flow in a water course.

5.4.3 HERITAGE, ARCHAEOLOGY AND PALAEONTOLOGY

It must be kept in mind that mitigation and monitoring of heritage resources discovered during construction activity will require permitting for collection or excavation of heritage resources and lead times must be worked into the construction time frames. Table 5-1 gives guidelines for lead times on permitting.

TABLE 5-1 GUIDELINES FOR LEAD TIMES ON PERMITTING

Action	Responsibility	Timeframe
Preparation for field monitoring and finalisation of contracts	The contractor and service provider	1 month
Application for permits to do necessary mitigation work	Service provider – Archaeologist and SAHRA	3 months
Documentation, excavation and archaeological report on the relevant site	Service provider – Archaeologist	3 months
Handling of chance finds – Graves/Human Remains	Service provider – Archaeologist and SAHRA	2 weeks
Relocation of burial grounds or graves in the way of the development	Service provider – Archaeologist, SAHRA, local government and provincial government	6 months

5.4.4 VEGETATION SEARCH AND RESCUE

Under the National Forests Act, 1998 (Act No. 84 of 1998) (NFA), a license must be applied for from the DFFE for the removal or disturbance of any protected trees on the site, in terms of the List of Protected Tree Species promulgated under the NFA.

5.5 METHOD STATEMENTS

Prior to construction the developer must ensure that the contractor supply the following method statements:

- Vegetation clearing;
- Cement mixing;
- Hazardous waste management;
- Emergency preparedness and response;
- Hazardous spills clean up;
- Topsoil stockpiling management;
- Laydown area management; and
- Hazardous materials management.

5.6 POLICIES AND PLANS TO BE PRODUCED PRIOR TO CONSTRUCTION COMMENCING FOR IFC REQUIREMENTS

The requirements below are not specifically required for the approval of this EMPr, this is required for the developer should the project require funding. The project developer will need to develop these policies.

- Project Environmental and Social Management System Framework;
- Project Environmental, Health and Safety and Social Policy;
- Project Labour Policy;
- Project Drug and Alcohol Policy;
- Project Smoking Policy;

- Project Code of Conduct;
- Project Security Policy;
- Project Grievance Mechanism for Workforce, and Stakeholders and Communities;
- Project Labour and Working Conditions Policy; and
- Project Stakeholder Engagement Plan.

6. CONSTRUCTION PHASE MITIGATION MEASURES

The following sections form the core of the EMPr during the construction phase of the development. The major sources of potential impacts include, the Solar PV Panel footprint construction, the construction of infrastructure, the construction of roads and bridges, and vehicle operation, and spillages.

THE OBJECTIVES OF THE CONSTRUCTION PHASE ARE:

- To promote environmental awareness;
- To define roles and responsibilities for environmental management; and
- To ensure that the contractor complies with all mitigation measures during the construction period.

6.1 POTENTIAL CONSTRUCTION PHASE IMPACTS

The following impacts are likely to occur during the construction of the development. Specific mitigation measures for each impact are presented below.

- The accidental, negligent, or deliberate spillage or inappropriate disposal of hazardous substances could result in air, soil and water pollution and may affect the health and well-being of people, plants and animals;
- Excessive noise could be made by the construction activity which would affect neighbouring communities;
- Potential damage to the soil structure, soil compaction and loss of soil fertility;
- Loss of the vegetation cover and increased erosion risks;
- Dust related problems;
- Safety hazards to the public, workers and animals in the area;
- Disturbance to local hydrology from construction activities;
- Pollution of surface water bodies;
- Dust can be a nuisance to the construction workforce and to the public and can negatively affect the growth and recovery rate of plants. Potential sources of fugitive dust include, but are not limited to:
  - Demolition of concrete foundations and existing buildings;
  - Grading / movement of soil;
  - Transportation and unloading of construction materials;
  - Vehicular movement over unsurfaced roads and tracks; and
  - Wind erosion of stockpiles.
- Construction activities will result in the exposure of the soil to erosive factors, i;e;, wind and water, and the compaction of the soil in other areas;
- Illegal poaching and collection of animals and plant material;
- Loss of established indigenous and exotic habitat;
- Unnecessary trampling of vegetation and harm to animals;
- Degradation of the scenic quality due to the major earthworks and any unsightly structures;
- Damage or loss of important cultural, historical or pre-historical sites and artefacts;
- Damage to existing roads and tracks, power lines, pipelines, etc;

- Dangerous conditions near road;
- Trespassing and illegal access onto land;

The following is not allowed on site:

- Poaching of any animals or harvesting of any flora;
- Construction camp, for workforce accommodation is not allowed on site; contractors are to ensure suitable housing for staff outside of the proposed development footprint;
- Cooking or fires; and
- Alcohol or drugs.

Table 6-1 below presents a summary of the potential impacts as assessed by specialists for the construction phase of the SEF.

Recommended persons as provided in Table 6-2 below should take responsibility for the implementation and monitoring to ensure that all operational mitigation measures outlined in this document, and all revisions thereof, are complied with.

TABLE 6-1 SUMMARY OF CONSTRUCTION PHASE POTENTIAL IMPACTS AND SIGNIFICANCE RATING

Construction Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Freshwater and Wetlands								
Impact on freshwater resource systems through the increase in surface runoff on form and function	Without Mitigation	Medium	Medium	Medium	Negative	High	Medium	High
	With Mitigation	Low	Medium	Low	Neutral	Medium	Medium	High
Increase in sedimentation and erosion	Without Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	High
	With Mitigation	Low	Low	Low	Negative	Low	Low	High
Potential impact on localised surface water quality	Without Mitigation	Medium	Medium	Low	Negative	Low	Low	High
	With Mitigation	Low	Low	Low	Negative	Low	Low	High
Loss of freshwater resource features during the construction	Without Mitigation	High	Medium	Medium	Negative	High	Medium	High
	With Mitigation	Low	Medium	Low	Negative	Low	Low	High
Terrestrial Biodiversity								
Potential impacts on plant biodiversity and habitats	Without Mitigation	Medium	Low	High	Negative	High	Medium	High
	With Mitigation	Medium	Low	Medium	Negative	Medium	Medium	High

Construction Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Impact on Faunal Diversity	Without Mitigation	Low	Low	Medium	Negative	High	Medium	High
	With Mitigation	Low	Low	Medium	Negative	Medium	Medium	High
Potential impacts on Animal Species of Conservation Concern (SoCC)	Without Mitigation	High	Low	High	Negative	Low	Medium	High
	With Mitigation	High	Low	Medium	Negative	Low	Low	High
Soil erosion and associated degradation of ecosystems	Without Mitigation	Medium	Medium	High	Negative	Medium	High	High
	With Mitigation	Low	Low	Low	Negative	Medium	Medium	High
Avifauna								
Displacement of avifaunal community due to habitat loss, direct mortalities and disturbance	Without Mitigation	Medium	Medium	Medium	Negative	Medium	High	Medium
	With Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	Medium
Spread and/or establishment of alien and/or invasive species	Without Mitigation	Medium	Medium	Medium	Negative	Medium	High	Medium
	With Mitigation	Low	Low	Low	Negative	Low	Low	Low
	Without Mitigation	Medium	Medium	Medium	Negative	Medium	High	Medium

Construction Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Destruction, further loss and fragmentation of the habitats, ecosystems and vegetation community, including protected species	*With Mitigation*	Medium	Medium	Medium	Negative	Medium	Medium	Medium
Dust generation from construction activities	Without Mitigation	Low	Medium	Medium	Negative	Low	Low	Medium
	With Mitigation	Low	Low	Low	Negative	Low	Low	Low
Heritage and Paleontology								
Damage/destruction to archaeological heritage	Without Mitigation	Low	Low	Low	Neutral	Low	Low	High
	With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Impact on Fossil Heritage	Without Mitigation	Medium	Low	High	Negative	High	Low	High
	With Mitigation	Medium	Low	High	Neutral	Low	Low	High
Damage/destruction to archaeological heritage	Without Mitigation	Low	Low	Low	Neutral	Low	Low	High
	With Mitigation	Low	Low	Low	Neutral	Low	Low	High

Construction Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Visual/Landscape								
Change of the landscape characteristics and key views i.e. visual intrusion	Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
	With Mitigation	Medium	Medium	Low	Negative	Medium	Medim	Medium
Socio-economic								
Employment opportunities and skills development	Without Mitigation	Low	Medium	Low	Positive	Medium	Low	Medium
	With Mitigation	Medium	Medium	Low	Positive	Medium	Medium	Medium
Multiplier effects on the local economy	Without Mitigation	Low	Medium	Low	Positive	Medium	Low	Medium
	With Mitigation	Medium	Medium	Low	Positive	Medium	Medium	Medium
Influx of Jobseekers and change of population	Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
	With Mitigation	Low	Medium	Low	Negative	Medium	Low	Medium
Safety and security	Without Mitigation	Medium	Medium	Low	Negative	Medium	Low	Medium
	With Mitigation	Low	Low	Low	Negative	Low	Low	Medium
Increased pressure on local services/resources	Without Mitigation	Medium	Medium	Low	Negative	Medium	Low	Medium
	With Mitigation	Low	Low	Low	Negative	Low	Low	Medium

Construction Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Disruption of daily living and movement patterns	Without Mitigation	Medium	Medium	Low	Negative	High	Low	Medium
	With Mitigation	Low	Low	Low	Negative	Medium	Low	High
Nuisance impacts (noise & dust)	Without Mitigation	Medium	Medium	Low	Negative	High	Low	Medium
	With Mitigation	Low	Low	Low	Negative	Medium	Low	High
Impacts associated with the loss of agricultural land	Without Mitigation	Medium	Medium	Low	Negative	High	Low	Medium
	With Mitigation	Low	Low	Low	Negative	Medium	Low	High
Traffic and Transportation								
Traffic congestion	Without Mitigation	Medium	Medium	Low	Negative	High	Medium	Medium
	With Mitigation	Low	Medium	Low	Negative	Medium	Medium	Medium
Road safety at DR114/R565 intersection	Without Mitigation	High	Medium	Low	Negative	High	Medium	High
	With Mitigation	High	Medium	Low	Positive	Low	Low	High
Road safety at DR114/Site access road intersection	Without Mitigation	High	Medium	Low	Negative	Medium	Medium	Medium
	With Mitigation	High	Medium	Low	Negative	Low	Low	Medium
Road safety at site access	Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
	With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium

Construction Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Degradation of gravel site access road	Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	High
	With Mitigation	Medium	Medium	Low	Negative	Low	Low	High
Dust on gravel site access road	Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	High
	With Mitigation	Medium	Medium	Low	Negative	Low	Low	High
Pedestrian safety on-site	Without Mitigation	High	Low	Low	Negative	High	Medium	Medium
	With Mitigation	High	Low	Low	Negative	Low	Low	High

TABLE 6-2 DESIGN AND CONSTRUCTION PHASE IMPACT MANAGEMENT

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Soil Degradation due to Construction of the Development		
• A system of *stormwater* management, which will prevent erosion, will be an inherent part of the road engineering on site. • Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended to prevent further erosion from occurring there. • Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 30 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it is at the surface. Topsoil will only be stripped in areas that are excavated. Across the majority of the site, including construction lay down areas, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil will be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface.	Site Engineer ECO / ESO	Design Phase Throughout Construction Phase
Impacts on Freshwater and Wetlands due to Construction of the Development		
• Implement appropriate measures to ensure strict use and management of all hazardous materials used on site. • Implement appropriate measures to ensure strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.). • Any erosion problems observed to be associated with the project infrastructure will be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. • No *stormwater* runoff must be allowed to discharge directly into any wetland feature, and flows from these substations will be allowed to dissipate over a broad area covered by natural vegetation. • Silt traps will be used where there is a danger of topsoil eroding and entering streams and other sensitive areas. • Construction of gabions and other stabilisation features to prevent erosion, if deemed necessary.	Site Engineer ECO / ESO Specialist	Design Phase Throughout Construction Phase
Impacts associated with the construction of Access Roads		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Increased traffic/construction traffic at the site access could lead to vehicle crashes, and advance warning "truck crossing" signage will be erected on the gravel site access road approaches to the site access. • Increased traffic/construction traffic at the D114/site access road intersection could lead to vehicle crashes, and advance warning "truck crossing" signage will be erected on the D114 approaches. • Increased vehicles / construction vehicles on the gravel site access road could lead to deterioration of the road pavement, and this requires monitoring and regular road maintenance. • Increased traffic on the site access road could lead to increased dust, with reduced forward visibility and higher risk of vehicle crashes, and construction vehicles travel speeds will be reduced to 50km/h reduce dust.	Site Engineer ECO / ESO Specialist	Design Phase Throughout Construction Phase
Spread of alien invasion species due to Construction of the Development		
• An Invasive Alien Plant Management Plan must be compiled and implemented. This will regularly be updated to reflect the annual changes in IAP composition. • The footprint area of the construction will be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. Footprints of the roads must be kept to prescribed widths. • Only existing access routes and walking paths may be made use of.	Site Engineer ECO / ESO	Design Phase Following clearing of vegetation Throughout Construction Phase
Changes to the hydrological regime and increase potential for erosion due to Construction of the Development		
• No *stormwater* runoff must be allowed to discharge directly into any wetland feature, and flows from the SEF will be allowed to dissipate over a broad area covered by natural vegetation. • *Stormwater* run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any *stormwater* leaving the switching station sites. • Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.	Site Engineer ECO / ESO	Throughout Construction Phase
Changes to the surface water quality characteristics due to Construction of the Development		
• All liquid chemicals including fuels and oil, including for the BESS, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely. • Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment). • Mechanical plant and bowsers must not be refueled or serviced within 100 m of a river channel or wetland. • Littering and contamination associated with construction activity must be avoided through effective construction camp management. • No stockpiling will take place within or near a water course. • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable.		
Impacts to botany during the construction of the SEF		
• Ensure that all vegetation-related preconstruction permits, surveys and walk-throughs have been conducted prior to the commencement of construction activity. • Monitoring of vegetation clearing during construction by the ECO to ensure that any protected plant within the development footprint area are translocated to safety where necessary. • ECO and/or Contractor's EO to provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially at the initiation of the project, when the majority of vegetation clearing is taking place. • Ensure that laydown areas, construction camps and other temporary use areas are located in areas of low sensitivity and are properly fenced or demarcated as appropriate and practically possible.	Site Engineer ECO / ESO	Throughout Construction Phase
Impacts to CBA's, ESA's and NPAES Focus Areas due to the construction phase		
• The development footprint will be kept to a minimum and natural vegetation will be encouraged to return to disturbed areas. • Limited vegetation removal around the pylons, as well as the removal of trees underneath the power line (trim only and/or avoid large tree specimens where possible).	Site Engineer ECO / ESO Specialist	Micro-siting should be done before construction in a specific area. All other mitigations should be carried out throughout the construction phase.

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Using existing roads, farm tracks, watercourse crossings and fire breaks as far as possible for access with new access roads being small twin tracks, and only deviating from the existing roads to the pylon locations (shortest distance). • Apart from using existing watercourse crossings and spanning of powerline, no other infrastructure may take place within the freshwater resource features as well as their buffer areas (as delineated and recommended within the separate Freshwater Resource Assessment). • The implementation of best management practices (BMPs) for erosion/sediment control and abatement of pollutant loading will minimizing secondary impacts to adjoining communities and habitats. • All disturbed areas that are not used, such as excess road widths, will be rehabilitated with locally occurring plant species after construction to reduce the overall footprint of the development.		
Potential impacts to *stormwater* during the construction phase		
• Existing flood lines / wetlands / *stormwater* attenuation areas will be protected from encroachment by the development. • On-site *stormwater* control systems, such as swales, berms, and attenuation ponds, must be constructed before any other construction commences. These systems must be monitored and adjusted as construction progresses to ensure complete *stormwater*, erosion and pollution control. • All formed embankments must be adequately stabilised. • Silt, trash and oil traps must be strategically provided to ensure water quality is not compromised and prevent drainage system blockages. • All-natural and unlined channels will be inspected for adequate soil binding by sustainable ground cover. Stone pitching will be used to reinforce channel inverts on steep slopes.	Site Engineer ECO / ESO	Throughout Construction Phase
Impacts on Archaeological and Palaeontological resources during the construction phase		
• A heritage practitioner / archaeologist will be appointed to develop a heritage induction program and conduct training for the ECO as well as team leaders in the identification of heritage resources and artefacts during the implementation of the EMPr. • An appropriately qualified heritage practitioner / archaeologist must be identified to be called upon in the event that any possible heritage resources or artefacts are identified.	Site Engineer ECO / ESO Developer Specialist	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Should an archaeological site or cultural material be discovered during construction (or operation), the area will be demarcated, and construction activities halted. • The qualified heritage practitioner / archaeologist will then need to come out to the site and evaluate the extent and importance of the heritage resources and make the necessary recommendations for mitigating the find and the impact on the heritage resource. • The contractor therefore will have some sort of contingency plan so that operations could move elsewhere temporarily while the materials and data are recovered. • Construction can commence as soon as the site has been cleared and signed off by the heritage practitioner / archaeologist.		
Impacts to the cultural landscape during the construction phase		
• Where possible, avoid vegetation stripping in straight lines but rather non-geometric shapes that blend with the landscape. Maintain a 10m vegetative buffer (of existing and/or established indigenous trees) outside the project footprint and along the adjacent public roads to restrict visibility and to shield against potential glare to motorists. • Keep construction period as short as possible. • Paint all other project infrastructure elements such as operational buildings a dark colour to blend with the general environment. • Minimise landscape scarring by minimizing cut and fill and ensuring rehabilitation of all areas not required during operation. • Locate construction camps and all related facilities such as stockpiles, lay-down areas, batching plants in areas already impacted such as existing farmyards or in unobtrusive locations away from the main visual receptors.	Site Engineer ECO / ESO	Throughout Construction Phase
Visual impact of construction activities on scenic resources and sensitive receptors		
• Disturbed areas to be rehabilitated / revegetated as soon as possible during the construction phase. • Temporary laydown areas and batching plants to be located away from arterial or district roads. • Stockpiles to be located within approved construction footprints. • Limit need for security lighting and ensure it is aimed away from sensitive receptor areas.	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Impacts of dust and road traffic incidents during construction activities		
• Increased traffic on the site access road could lead in increased dust, with reduced forward visibility and higher risk of vehicle crashes, and construction vehicles travel speeds will be reduced to 50km/h reduce dust. • A short Traffic Management Plan will set out practical steps / means to implement the recommendations of the Traffic Impact Assessments.	Site Engineer ECO / ESO	Throughout Construction Phase
Road degradation due to construction activities		
• The site access is via a gravel site access road section between D114 and the site access. Extensive use of the gravel site access road by heavy vehicles will lead to deterioration of the road structure that could result in vehicle crashes. This can be mitigated by regular maintenance of the gravel site access road section used by development traffic.	Site Engineer ECO / ESO	Throughout Construction Phase
Intersection safety on roads during construction activities		
• Compile a TMP. • Reduce speed at intersections and use appropriate traffic warning signs. • Identify alternative routes where possible. • Request the assistance of local law enforcement. • Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licensed operator. • Provide drivers with advanced driver training.	Site Engineer ECO / ESO Developer	Throughout Construction Phase
Destruction of avifaunal habitats and disturbance to birds during the construction phase		
• All areas to be developed must be walked through prior to any activity to ensure no SCC nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken. • The duration of the construction must be kept to a minimum to avoid disturbing avifauna. • Infrastructure must be consolidated where possible in order to minimise the amount of ground and air space used. • Fencing mitigations: ◦ Top 2 strands must be smooth wire;	Site Engineer ECO / ESO Specialist	Before and during construction

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
◦ Routinely retention loose wires; ◦ Minimum 300 mm between wires; and ◦ Place markers on fences.		
Creation of employment opportunities for the local community		
• It is a must that the local employment policy be adopted where possible to maximise the opportunities made available to the local labour force. The project will make it a requirement for contractors to implement a 'locals first' policy, especially for semi and low skilled job categories., if this is not possible, then the broader focus areas will be considered for sourcing workers. • Employment opportunities will be for the immediate local area Rustenburg and Kgetlengrivier LM, if this is not possible, then the broader focus areas will be considered for sourcing employees. • During the recruitment selection process, consideration must be given to women. • It is a must that realistic local recruitment targets be set for the construction phase. • Training and skills development programmes will be initiated prior to the commencement of the construction phase.	Applicant Contractors (Construction companies)	Before Construction begins
Presence of Construction workers in local community		
• It is a must that the developer adopts a local procurement policy to maximise the benefit to the local economy, where feasible (Rustenburg and Kgetlengrivier LM). • Boshoek Solar 1 (Pty) Ltd will develop a database of local companies, specifically Historically Disadvantaged (HD) companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies will be notified of the tender process and invited to bid for project-related work, where applicable. • It is a requirement to source as many goods and services as possible from the local area. • Engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods, and products from local suppliers, where feasible.	Applicant Contractors (Construction companies)	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Influx of job seekers due to construction related activities		
• Access in and out of the construction area will be strictly controlled by a security company. • The appointed Engineering, Procurement and Construction (EPC) contractor must appoint a security company and appropriate security procedures are to be implemented. • Advertisement for employment opportunities will be targeted and preferably focused on local LMs. • With the preference and focus on hiring locally, it will reduce the amount of people coming to look for work from further afield. • A ECO will be appointed, and an appropriate grievance mechanism implemented. A method of communication will be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.	Applicant MC Contractors	Before and During the Construction phase
Risk to Safety and Security during construction		
• The contractor must ensure that open fires on the site for heating, smoking, or cooking are not allowed except in designated areas. • Contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff. • A comprehensive employee induction programme which covers land access protocols, fire management and road safety will be prepared. • A ECO will be appointed, and an appropriate grievance mechanism implemented. A method of communication will be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.	Applicant Contractors	Before and During the Construction phase
Increased risk of grass fires associated with construction activities		
• Cooking or heating on open fires on site will be restricted to designated areas and enforced by the hired contractor. • Smoking on site will be confined to designated areas. • Contractor will 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	Contractors ECO	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
greater. In this regard special care will be taken during the high-risk dry, windy summer months. • Contractor will provide adequate fire-fighting equipment on-site, including a fire fighting vehicle. • Contractor will 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 advent of a fire onsite, an investigation in terms of the Veld Fire Management Act must be undertaken by an independent veld fire inspector to identify the source of the fire, if the results of the investigation indicate the fire was caused by construction workers or construction related activities the, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor will also compensate the fire-fighting costs borne by farmers and local authorities.		

6.2 POST CONSTRUCTION

- Once construction has been completed on site and all excess material has been removed, the storage area shall be rehabilitated, if it will no longer be required. If the area was badly damaged, re-seeding shall be done and fencing in of the area shall be considered if livestock/faunal species specific to the area may subsequently have access to such an area;
- Such areas shall be rehabilitated to their natural state; Any spilled concrete shall be removed and soil compacted during construction shall be ripped, levelled and re-vegetated;
- 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;
- Only designated areas must be used for storage of construction materials, soil stockpiles, machinery and other equipment;
- Specific areas must be designated for cement/concrete mixing/ batching plants; Sufficient drainage for these plants must be in place to ensure that soils do not become contaminated;
- The construction camp must be kept clear of litter at all times;
- Spillages within the construction camp need to be cleaned up immediately and disposed of in the hazardous skip bin for correct disposal;
- All remaining material including building rubble and waste are to be removed from the site;
- All areas disturbed must be managed to ensure efficient drainage; and
- The area designated for the deposition of spoil material is to be levelled and shaped to ensure the efficient drainage of the site; Under no circumstances is general or hazardous waste to be disposed of at this site.

6.2.1 INFRASTRUCTURE

- Disassemble all temporary infrastructure units and remove components from the working areas and contractors' camp; This will include storage structures and containers, water storage container, power supply, workers accommodation, sewage systems;
- Drain all potable chemical toilets, being careful not to spill the contents; Transfer the waste to an appropriate disposal site;
- Drain all wastewater and sewage associated with temporary ablution facilities and transfer the waste to an appropriate disposal site to be identified by the contractor;
- Disassemble all fencing around the camp and either sell, suction or donate to the local community or transfer the waste components to a disposal site or the contractor's base; and
- Do not leave any components, waste or infrastructure units within the working area and camp unless specifically required for the operation and maintenance phases and as agreed by the ECO.

6.2.2 CONTAMINATED SUBSTRATE AND POLLUTION CONTROL STRUCTURES

- Excavate all areas of contaminated substrate, transfer the contaminated substrate to an appropriate disposal site and treat the affected areas;
- Remove all plastic linings used for pollution control and transfer to an appropriate disposal site; and
- Break up all concrete structures that have been created and remove concrete waste to an appropriate disposal site.

6.2.3 WASTE

- Remove all remaining construction materials from the camp and working areas and either sell, auction, donate to the local community or transfer the waste components to a disposal site or the contractor’s base;
- Remove all construction debris, litter and domestic waste from the camp and working areas and transfer to an appropriate disposal site; and
- Remove all waste receptacles from the camp and working areas and either sell, auction, donate to the local community or transfer the waste components to a disposal site or the contractor’s base.

7. OPERATION PHASE MITIGATION MEASURES

Once the commissioning and construction of the SEF is complete, the project becomes operational. During the operation and maintenance of the SEF a certain amount of disturbance results. An operational SEF will normally have various day to day activities occurring on site, such as (but not limited to) security control, routine maintenance, cleaning of panels, road clearing/cleaning, grass/bush cutting and clearing.

The objectives of the operation phase mitigation measures are:

- To promote environmental awareness;
- To define roles and responsibilities for environmental management;
- To ensure that the mitigation measures proposed for the operational phase of the SEF is implemented and conducted appropriately; and
- To ensure that the recommended monitoring programmes are implemented accordingly.

If the destruction of natural vegetation is unavoidable, a habitat rehabilitation programme should be established before operation and following decommissioning. The programme must address the rehabilitation of the existing habitats as well as the rehabilitation of areas disturbed during construction and investigate the potential of rehabilitating previously transformed or degraded areas. This rehabilitation programme must be approved by the relevant government departments and the relevant permits must be obtained for the handling/transport/propagation of protected species.

7.1 POTENTIAL OPERATION PHASE IMPACTS

Table 7-1 below provides a summary of the potential impacts of the operation of the SEF, as assessed by specialists.

Recommended persons as provided in Table 7-2 below should take responsibility for the implementation and monitoring to ensure that all operational mitigation measures outlined in this document, and all revisions thereof, are complied with.

TABLE 7-1 SUMMARY OF OPERATION PHASE POTENTIAL IMPACTS AND SIGNIFICANCE RATING

Operational Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Freshwater and Wetlands								
Impact on freshwater resource systems through the increase in surface runoff on form and function	Without Mitigation	Medium	Medium	Medium	Negative	High	Medium	High
	With Mitigation	Low	Medium	Low	Neutral	Medium	Medium	High
Increase in sedimentation and erosion	Without Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	High
	With Mitigation	Low	Low	Low	Negative	Low	Low	High
Terrestrial Biodiversity								
Alien Plant Invasion	Without Mitigation	Medium	Medium	High	Negative	Medium	High	High
	With Mitigation	Low	Low	Low	Negative	Medium	Medium	High
Direct Faunal Impacts	Without Mitigation	Low	Low	Medium	Negative	Medium	Medium	High
	With Mitigation	Low	Low	Low	Negative	Low	Low	High
Soil erosion and associated degradation of ecosystems	Without Mitigation	Medium	Medium	High	Negative	Medium	High	High
	With Mitigation	Low	Low	Low	Negative	Low	Low	High
Alien Plant Invasion	Without Mitigation	Medium	Medium	High	Negative	Medium	High	High
	With Mitigation	Low	Low	Low	Negative	Low	Low	High
Avifauna								
Ongoing displacement and	Without Mitigation	High	Medium	Medium	Negative	Medium	Medium	Medium

Operational Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
direct mortalities of faunal community (including SCC) due to disturbance	*With Mitigation*	Medium	Low	Low	Negative	Low	Low	Low
Continued fragmentation and degradation of habitats and ecosystems	Without Mitigation	Medium	Medium	Medium	Negative	Medium	High	Medium
	With Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	Medium
Spread of alien and/or invasive species	Without Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	Medium
	With Mitigation	Low	Low	Low	Negative	Low	Low	Low
Heritage and Paleontology								
Damage/destruction to archaeological heritage	Without Mitigation	Low	Low	Low	Neutral	Low	Low	High
	With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Impact on Fossil Heritage	Without Mitigation	Medium	Low	High	Negative	High	Low	High
	With Mitigation	Medium	Low	High	Neutral	Low	Low	High
Damage/destruction to archaeological heritage	Without Mitigation	Low	Low	Low	Neutral	Low	Low	High
	With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Visual/Landscape								
Visual Impact	Without Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	Medium
	With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium
Socio-economic								

Operational Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Direct Employment and skills development during operation	Without Mitigation	Low	Medium	High	Positive	Medium	Low	Medium
	With Mitigation	Medium	Medium	High	Positive	High	Low	High
Development of clean, renewable energy infrastructure	Without Mitigation	Medium	Medium	High	Positive	High	Low	High
	With Mitigation	Medium	Medium	High	Positive	High	Low	High
Visual impacts and impacts on sense of place	Without Mitigation	Medium	Medium	High	Negative	High	Medium	Medium
	With Mitigation	Low	Low	High	Negative	Medium	Low	High
Benefits associated with socio-economic contributions	Without Mitigation	Medium	Medium	High	Positive	High	Low	High
	With Mitigation	Medium	Medium	High	Positive	High	Low	High
Impacts associated with the loss of agricultural land	Without Mitigation	Medium	Medium	High	Negative	High	Low	Medium
	With Mitigation	Low	Low	High	Negative	Medium	Low	High
Traffic and Transportation								
Road safety at site access	Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
	With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium

TABLE 7-2 OPERATION PHASE IMPACT MANAGEMENT

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Spread of alien invasion species due to Operational of the Development		

• Alien vegetation management must be initiated at the beginning of the construction period and must extend into any remaining areas into the operation phase on the facility.	Site Engineer ECO Specialist	Following clearing of vegetation Throughout Operation Phase
Operational impacts on CBA's and ESA's		
• An open space management plan will be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland. • Outside lighting must be designed and limited to minimize impacts on fauna. All outside lighting will be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting will be avoided, and sodium vapor (red/green) lights will be used wherever possible. • Vehicles movement must be limited to a minimal footprint on site (no movement outside of the earmarked footprint). • Any fauna directly threatened by the associated activities will be removed to a safe location by a suitably qualified person.	Maintenance Staff Site Engineer ECO / ESO Specialist	Throughout Operation Phase
Operational impacts to the cultural landscape		
• Suppress dust during operation by maintaining access roads, substations and office/admin areas with appropriate dust suppressants. • If required, ensure effect maintenance of the tree screens around the property. • Limit need for security lighting and ensure it is aimed away from sensitive receptor areas. • Use non-reflective materials, where possible. • Paint all other project infrastructure elements such as operational buildings a dark colour to blend with the general environment, where possible.	Maintenance Staff Site Engineer ECO / ESO	Throughout Operation Phase
Visual intrusion of lighting at night during operation phase		
• Limit need for security lighting and ensure it is aimed away from sensitive receptor areas. • Use non-reflective materials, where possible.	Site Engineer ECO / ESO	Throughout Operation Phase
Intersection safety on roads during operation		
• Compile a TMP. • Reduce speed at intersections and use appropriate traffic warning signs. • Identify alternative routes where possible. • Request the assistance of local law enforcement.	Site Engineer ECO / ESO	Throughout Operation Phase

• Ensure that all vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licensed operator. • Provide drivers with advanced driver training.		
Disturbance and Displacement of birds during the operation of the SEF		

• Post-construction monitoring will follow the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017). If monitoring results indicate excessive bird fatalities, then adaptive mitigations will be implemented. Before implementation, these will be discussed with the avifaunal specialist and ECO and could include the retrofitting/incorporation of additional visual cues/diverters to existing PV panels/infrastructure.
• All personnel will undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species, and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.
• Fencing mitigations:
  ° Top 2 strands must be smooth wire;
  ° Routinely retention loose wires;
  ° Minimum 300 mm between wires; and
  ° Place markers on fences.
• All maintenance motor vehicle operators will undergo an environmental induction that includes instruction on the need to comply with speed limit (50 km/h), to respect all forms of wildlife. Speed limits must be enforced to ensure that road killings and erosion is limited.
	Site Engineer
	ECO / ESO
	Specialist
		Throughout Operation Phase

Social enhancement for the local community (creation of employment, skills development)		
• A local employment policy will be adopted by the developer to maximise the project opportunities being made available to the local community. • Enhance employment opportunities for the immediate local area, Rustenburg, and Kgetlengrivier LM. If this is not possible, then the broader focus areas will be considered for sourcing employees. • The recruitment selection process will seek to promote gender equality and the employment of women wherever possible. • The developer will establish vocational training programs for the local employees to promote the development of skills.	Applicant Contractors	Throughout Operation Phase

8. BESS RISK ASSESSMENT AND MANAGEMENT PLAN

8.1 HIGH-LEVEL BESS RISK ASSESSMENT

The risks associated with Solid-State, Lithium Ion (Li-Ion) batteries, are typically well researched and documented. The main concerns relating to a BESS are fire hazards (from toxic and flammable gasses) and the potential for a condition known as 'thermal runaway'. Thermal runaway occurs in situations where an increase in temperature changes the conditions in a way that causes a further increase in temperature, often leading to a destructive result. As far as general environmental risks, the main concerns are surrounding the disposal of the batteries at end of their life.

This section will attempt to address the risks associated with the on-site use of a BESS for the Boshoek Solar 1, and the resultant Risk Assessment is presented in Table 8-1 below. To do this, the EAP looked at several potential situations which could result in a possible detrimental environmental hazard. These are:

- The actual risks associated with the delivery, connection, operation, maintenance, disconnection and disposal of the batteries;
- The likelihood of these actual risks occurring;
- The significance of the impacts should these risks take place; and
- Appropriate and practical mitigation measures and/or management actions to reduce likelihood of the risk occurring and/or the impact.

A comprehensive operations and maintenance programme is necessary to ensure that all management and mitigation measured are included in the EMPr and adopted and implemented as well as to ensure that all monitoring and protective devices are in good working order.

Regular inspections should be undertaken to ensure the battery systems are not overheating or showing signs of malfunction. Annual thermographic scanning can help ensure the BESS is operating within normal parameters.

Where a BESS does not meet its performance requirements, and where repairs do not solve a problem which exists, and where change in the BESS does not lead to a profitable alternative business solution, the BESS is said to have reached its End-of-Life (EoL). Following an EoL shutdown procedure a BESS would be de-installed, disassembled, removed from the site and transported. Further, its components would be reused and/or recycled.

For decommissioning the energy storage system, the appropriate technical guidelines from the manufacturer should be consulted. Before the actual decommissioning, the BESS system needs to be checked for hazardous substances and a risk assessment should be performed considering safety and/or environmental risks which might occur during the decommissioning activities (e.g., fire hazards, electric shocks and poisonous effects on the environment). Depending on the safety and/or environmental risks identified and on the type of BESS equipment, local authorities should be consulted or informed about the decommissioning activities.

For recycling, it is advised to consult a specialized organization in waste treatment to the extent that all materials, also non-hazardous are disposed of correctly and preferably recycled. Several materials which commonly are found in modern batteries or redox flow batteries are environmentally hazardous and regulated and thus should be disposed of according to regional

government requirements, such as directive 2006/66/EC of the European parliament and of the council, also known as the Batteries Directive.

This high-level risk assessment must be replaced with a detailed technology specific risk assessment once the final equipment suppliers have been identified during the detailed design and procurement stage. The technology specific risk assessment should be undertaken or provided by the battery supplier once identified.

TABLE 8-1 HIGH-LEVEL BESS RISK ASSESSMENT

Possible Risk	Likelihood of occurrence	Resultant Impact	Management / Mitigation
General leakage: • Leakage of Coolant • Leakage of Electrolyte	Low	• On site fires. • Electrical failure. • Potential spillage of electrolytes or refrigerant • Soil contamination • Groundwater contamination	Latest BESS technologies to be used as far as possible. BESS installation is to adhere to the appropriate international standards and South African National Standard (SANS) requirements. Training of all staff and employees on how to handle spillages, fires and electrocutions. Records kept for well managed operations and maintenance. Bunding of containers and batteries to be placed on an impermeable barrier/layer (e.g., concrete surface with acid lining). In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree of contamination, excavation and removal to a hazardous waste disposal site might be necessary. If the spillage is widespread, a specialist will need to be immediately appointed to deal with the issue, the DFFE must be notified, and the notification process stipulated in the National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (GN 331, 2 May 2014) should be followed. Implementation of spill handling and management in line with the EMPr. Demarcate all no-go and sensitive areas. Avoid the placement of batteries near watercourses and sensitive features. MSDS Records to be kept, as well as incidents reporting register. Source batteries from reputable suppliers, and batteries to arrive on site pre-assembled in suitable containers. Battery inspection prior to installation.
Mishandling: • Batteries incorrectly connected • Batteries left disconnected • Short circuits • Forced discharged • Venting of Electrolyte • Punctured/Crushed or damaged modules and battery casing	Low	• On site fires. • Electrical failure • Electrocution • Potential spillage of electrolytes or refrigerant • Vented gasses • Staff and personal injury • Contaminated Runoff • Soil and microbe contamination • Groundwater seepage • Downstream effects on the current terrestrial ecosystem.	
Thermal Runaway: • Thermal and/or Mechanical failure in one or more battery cells • Overheating	Low	• On site fires. • Electrical failure • Potential spillage of electrolytes or refrigerant	Maintenance. Latest BESS technologies to be used as far as possible. Appropriate battery design and venting control. Source from reputable manufacturers.

Possible Risk	Likelihood of occurrence	Resultant Impact	Management / Mitigation
• Short circuiting		• Downstream effects on the current terrestrial ecosystem.	Safe and appropriate storage in line with the above and the EMPr. Safe handling which must include battery inspection prior to installation. Should electrolyte solutions be stored on site, these should be stored away from incompatible materials such as all peroxides, such as hydrogen peroxide; chemicals that react with acid to generate a gaseous product, such as carbonate and bicarbonates, sulfites and bisulfites; strong reducing agents, such as alkaline metals (Li, Na, K) and alkaline earth metals (Be Mg Ca, Sr, Ba); reactive metals such as aluminum and zinc, all hydrides (such as LiAlH4, $NaBH_4$), and some carbides (such as CaC_2). Development and implementation of Thermal Management Plan prior to installation/construction.
Limited Employee Training and Experience: • Device Monitoring Failure (SCADA) • Poor incidents reporting • Poor first responders training • Distance to nearest fire station and response time.	Low	• Time lag for first respondent • Inability to contain spillage • Fire • Electrocution • Damage to exiting/surrounding infrastructure	During the construction phase the proposed project, first responders from the nearest major center (such as fire fighters and paramedics) must be given appropriate training on dealing with any emergency situation that may occur as a result of the operation of BESS. Such training must be provided by the technology suppliers or an appointed service provider.
• Inappropriate Storage • Hydrocarbon Spill • Leaked battery pack coolant • Leaked refrigerant • Leaked cell electrolyte • Rapid heating of individual cells • Fires	Low	• On site fires. • Electrical failure • Electrocution • Potential spillage of electrolytes or refrigerant • Vented gasses • Staff and personal injury • Contaminated Runoff • Soil and microbe contamination • Groundwater seepage • Downstream effects on the current terrestrial ecosystem.	Solid State Li-Ion technologies to be preferred where possible. Training of all staff and employees on how to handle spillages, fires and electrocutions. In terms of appropriate design measures, the holder of the EA must identify a secondary containment facility, which is to be constructed with a capacity of at least 110% of the largest storage tank's capacity and the off-loading point must be located in the bunded area to ensure that any potential spill during the off-loading of the electrolyte solutions is contained. Records kept for well managed operations and maintenance. Bunding of containers.

Possible Risk	Likelihood of occurrence	Resultant Impact	Management / Mitigation
			Implementation of spill handling and management in line with the EMPr which ensures that run-off and dirty water does not mix with electrolyte spill. Containment areas to be sloped towards a sump. All drains to be covered. Demarcate all no-go and sensitive areas. Avoid the placement of batteries near watercourses and sensitive features. MSDS Records to be kept, as well as incidents reporting register. The batteries should be placed in a well-ventilated area, include vents (where necessary and applicable) and appropriate PPE (appropriate gloves, safety glasses/face shield, appropriate clothing) should be worn when handling the electrolyte solutions. Source batteries from reputable suppliers. The transport vehicle should be identified with symbols. Transport schedule and map must be implemented and kept on each drivers person, with a copy kept in the admin offices on site. Battery inspection prior to installation.
• Inappropriate disposal at the end of life • Landfill Disposal • Heavy Metal Pollution	Medium	Potential scenario of fluids from the batteries leaking into environment. The release of such chemicals through leaching, spills or air emissions can harm communities, ecosystems and food production. The potentially toxic materials contained in batteries means that they are classified as hazardous materials in terms of NEM:WA. There are only a few licensed hazardous waste sites in South Africa and recycling of batteries and e-waste has been identified as a sure way of improving the lifespans of such sites.	The recycling of batteries and their potential use as e-waste. Disposal at a licensed hazardous waste site. Prior to construction of the SEF, and BESS, the holder of the EA is to develop a dedicated Battery Recycling Programme to be adopted on-site. Records of disposal at a licensed facility must be kept.

9. DECOMMISSIONING PHASE

The objectives of the decommissioning phase are:

- To promote environmental awareness;
- To define roles and responsibilities for environmental management;
- To ensure that the mitigation measures proposed for the decommissioning phase of the SEF is implemented and conducted appropriately; and
- To ensure that the recommended management plans are implemented accordingly.

Prior to the decommissioning of the SEF, a decommissioning plan must be produced by the ECO. The plan must include details on the decommissioning and dismantling of the SEF, taking in consideration the potential environmental impact associated with it. Environmental monitoring plans must be produced to ensure no pollution occurs during this phase. The plan must include the steps that will be taken to rehabilitate the area after the SEF is dismantled, as well as recycling options of the equipment and structures. Recommendations for consideration for the decommissioning plan is provided below.

Decommissioning ultimately requires the removal of all associated solar infrastructure and includes the restoration of the site as closely as possible to its original state.

9.1 DECOMMISSIONING AND RESTORATION PLAN RECOMMENDATIONS

A Decommissioning and Restoration Plan (DRP) should be considered to ensure that habitat and ecosystem restoration is achievable once the Solar Farm has ceased operating.

- De-energising the site, usually involves initially high voltage (HV) disconnection in the event of re-energizing of the site followed by low voltage (LV) disconnection of the affected panels;
- Handing over the site responsibility to an experienced Contractor and management of Operator access and site setup;
- Decommissioning of structures, likely to be the reverse of the installation procedure, such as:
    - Stripping out of PV Panels and removal of transformer;
    - Removal of Solar base and backfilling void;
    - Removal of cables (whole or partial) and making good trenches (throughout);
    - Removal of crane pads (whole or partial) and backfilling/landscaping;
    - Removal of Sub-station and associated buildings (when applicable);
    - Removal of access tracks (whole or partial) and associated water crossings, passing areas etc. Working from end point towards exit point;
    - Reinstating watercourses and /or removing watercourse crossings;
    - Final landscaping (seeding) and making good remaining borrow pits etc;
    - Make good public road junctions, if required;
    - Providing ‘as-built’ documentation including residual risks to Landowner and Planning Authority; and
    - Monitoring and maintaining the site to achieve the end-use requirement.

9.1.1 SOIL CONSERVATION AND MANAGEMENT:

There are direct and indirect impacts on soil properties that may occur during construction and decommissioning phases that should be avoided include:

- Sealing soil by covering it with impermeable materials that may alter the soil's chemical and biological properties and could have adverse impacts on drainage characteristics;
- Contaminating soil through accidental spillage / use of chemicals;
- Compacting soil with heavy machinery;
- Mixing topsoil with subsoil, resulting in reduced soil quality; and
- Indirect effects on water quality – increase in dissolved organic carbon and presence of suspended soils.

Before any decommissioning and restorative design work takes place, an in-depth assessment of the available soil on site, along with soil-forming resources from the restorative layers should be carried out. It is important to understand a site's soil characteristics and their influence on habitats so that communities that are re-established are likely to sustain themselves in the long run.

Agricultural restoration would need at least a thin layer of topsoil, while semi-natural environments often require low nutrient substrates and woodland restorative planting needs a minimum depth of 1 m of suitable material.

Imported soils should match the chemical and nutrient composition of the receiving soil profile and should be free of invasive and undesired seedlings / propagules. Using imported peat or soils may result in the need for resowing if the material does not contain a viable seed bank of local provenance. Reseeding techniques will inevitably be needed as materials that were side-casted during the initial construction phase will not contain enough viable seeds to regenerate the whole restoration area. Other soil-forming materials can be used in the absence of sufficient topsoil, peat, and appropriate seed bank levels as long as soils and/or soil substitutes are aligned with the site's target ecosystem.

9.1.2 VEGETATION RESTORATION

The objective of habitat restoration is to minimize degradation of the ecological resource and promote the re-establishment of a functional ecosystem. Decommissioning plans that involve significant disturbance of habitats (complete removal of infrastructure) require a longer recovery period in environments less resilient to disturbance (peatlands or species-rich grasslands). Habitat restoration techniques must consider the ease that different habitats can be restored and the likely success of this restoration.

9.1.3 OPTIONS FOR END-OF-LIFE INFRASTRUCTURE

Installed solar PV panels consist of these sections: the panels, mounting structures and foundation. It is important to know what materials were used in the construction of the panels as this will provide insight into best practices for appropriate disposal methods.

Materials commonly used in the construction of solar panels are:

- Aluminum frame;
- Tempered glass;
- O&M Buildings;
- BESS;

- Encapsulant material e.g. Ethylene vinyl acetate (EVA) film;
- Silicon cells; and
- Back sheet.

Other material to be decommissioned are discussed below.

- Transformer - There are limited recycling options and is therefore recommended to be removed from site for disposal or be used by others; It would be a low cost to the decommissioning plan;
- Tracks and roads can be left in situ if suitable and if not hindering on any other risks such as visual, hydrology; For reinstatement, original topsoil and appropriate seed layer must be used; and
- Substations can be removed from site and materials can be separated and reused; Cables made from copper material can be recycled offsite.

The reinforced concrete can under normal circumstances remain *in situ* as an inert material. Concrete is inherently durable unless attacked by soils containing sulphates or low pH and other aggressive agents. The risk of rebar corrosion is low in buried concrete due to the low risk of carbonation and low levels of oxygen. Where ground conditions pose a chemical risk, it is likely that the concrete would have been designed to be resistant to acidic or alkaline conditions. Site-specific risks should be assessed in the DRP as the base has been *in situ* for 15 years.

Retaining the base *in situ* can be considered as there is a relatively low environmental risk associated with reinforced concrete. The noise, ground disturbance, and costs of excavating, processing, and transporting along with associated carbon emissions may create a larger environmental impact than leaving the base *in situ*.

Removing the concrete base without backfilling would leave a sizeable void that could pose a health and safety hazard or an unwanted feature in the visual landscape. The void would need to be filled with appropriate material as discussed in the soil conservation section.

9.2 POTENTIAL DECOMMISSIONING PHASE IMPACTS

Table 9-1 below provides a summary of the potential impacts of the decommissioning of the SEF, as assessed by specialists.

Recommended persons as provided in Table 10.2 below should take responsibility for the implementation and monitoring to ensure that all decommissioning mitigation measures outlined in this document, and all revisions thereof, are complied with.

TABLE 9-1 SUMMARY OF DECOMMISSIONING PHASE IMPACTS

Decommissioning Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Freshwater and Wetlands								
Compromise ecological processes as well as ecological functioning of important freshwater resource habitats	Without Mitigation	Medium	Medium	High	Negative	High	High	High
	With Mitigation	Low	Medium	Medium	Negative	Low	Low	High
Heritage and Paleontology								
Damage/destruction to archaeological heritage	Without Mitigation	Low	Low	Low	Neutral	Low	Low	High
	With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Impact on Fossil Heritage	Without Mitigation	Medium	Low	High	Negative	High	Low	High
	With Mitigation	Medium	Low	High	Neutral	Low	Low	High
Damage/destruction to archaeological heritage	Without Mitigation	Low	Low	Low	Neutral	Low	Low	High
	With Mitigation	Low	Low	Low	Neutral	Low	Low	High
Visual/Landscape								
Visual Impact	Without Mitigation	Low	Medium	Low	Negative	Low	Medium	Medium
	With Mitigation	Low	Medium	Low	Negative	Low	Medim	Medium
Traffic and Transportation								

Decommissioning Phase		Severity	Extent	Duration	Status	Probability	Significance	Confidence
Road safety at site access	Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
	With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium
Degradation of gravel site access road	Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
	With Mitigation	Medium	Medium	Low	Negative	Low	Low	Medium
Dust on gravel site access road	Without Mitigation	High	Low	Low	Negative	Medium	Medium	Medium
	With Mitigation	Low	Low	Low	Negative	Low	Low	Medium
Pedestrian safety on site	Without Mitigation	High	Low	Low	Negative	Medium	Medium	Medium
	With Mitigation	Medium	Low	Low	Negative	Low	Low	Medium

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Impacts on Freshwater and Wetlands due to Decommissioning of the Development		
• Implement appropriate measures to ensure strict use and management of all hazardous materials used on site. • Implement appropriate measures to ensure strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.). • Any erosion problems observed to be associated with the project infrastructure will be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.	Site Engineer ECO / ESO	Throughout Decommission Phase

• No *stormwater* runoff must be allowed to discharge directly into any wetland feature, and flows from these substations should be allowed to dissipate over a broad area covered by natural vegetation. • Silt traps will be used where there is a danger of topsoil eroding and entering streams and other sensitive areas. • Construction of gabions and other stabilisation features to prevent erosion, if deemed necessary.			
Impacts associated with the decommissioning of Development Access Roads			
• During the decommissioning phase increased number of heavy vehicles on the gravel site access road could lead to deterioration of the pavement, which increases risk of crashes. The condition of the site access road will be monitored and maintained to a good standard. • Increased traffic on the site access road increases dust which creates forward visibility issues for motorists and increases risk of crashes. This can be mitigated by implementing a 50 km/h speed restriction for heavy vehicles on the gravel site access road, with possible dust suppressant if really needed. • Increased traffic/decommissioning traffic at the D114/site access road intersection could lead to vehicle crashes, and advance warning "truck crossing" signage should be erected on the D114 approaches the site access road.	Site Engineer ECO / ESO	Throughout Phase	Decommission
Changes to the hydrological regime and increase potential for erosion due to Decommissioning of the Development			
No *stormwater* runoff must be allowed to discharge directly into any wetland feature, and flows from the substations will be allowed to dissipate over a broad area covered by natural vegetation. *Stormwater* run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any *stormwater* leaving the switching station sites. Any *stormwater* within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.	Site Engineer ECO / ESO	Throughout Phase	Decommission
Changes to the surface water quality characteristics due to Decommissioning of the Development			
• All liquid chemicals including fuels and oil, including for the BESS, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely.	Site Engineer ECO / ESO	Throughout Phase	Decommission

• Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment). • Mechanical plant and bowsers must not be refueled or serviced within 100 m of a river channel or wetland. • Littering and contamination associated with decommissioning activity must be avoided through effective construction camp management. • No stockpiling will take place within or near a water course. • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable. • There will be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures.		
Impacts to the cultural landscape		
• Remove all project components from site. • Rip all compacted hard surfaces such as platforms, words areas, access and service roads etc. and reshape to blend with the surrounding landscape. • Rehabilitate/revegetate all disturbed areas to visually the original state by shaping and planting.	Site Engineer ECO / ESO	Throughout and after Decommission Phase

10. ALIEN INVASIVE MANAGEMENT PLAN

10.1 PURPOSE OF THE ALIEN INVASIVE MANAGEMENT PLAN

The purpose of the Alien Invasive Management Plan is to provide a framework for the management of alien and invasive plant species during the construction, operation and decommissioning of the Boshoek Solar 1. The broad objectives of the plan include the following:

- Ensure alien plants do not become dominant in parts or the whole site through the control and management of alien and invasive species presence, dispersal & encroachment;
- Initiate and implement a monitoring and eradication programme for alien and invasive species; and
- Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

10.2 PROBLEM OUTLINE

Alien plants replace indigenous vegetation leading to severe loss of biodiversity and change in landscape function. Potential consequences include loss of biodiversity, loss of grazing resources, increased fire risk, increased erosion, loss of wetland function, impacts on drainage lines, increased water use etc.

In addition, the Conservation of Agricultural Resources Act (Act 43 of 1983), as amended in 2001, requires that land users clear *Declared Weeds* from their properties and prevent the spread of *Declared Invader Plants* on their properties.

Table 3 of CARA (the Conservation of Agricultural Resources Act) lists all declared weeds and invader plants. Alien plants are divided into 3 categories based on their risk as an invader as follows:

- Category 1 - These plants must be removed and controlled by all land users; They may no longer be planted or propagated and all trade in these species is prohibited;
- Category 2 – These plants pose a threat to the environment but nevertheless have commercial value; These species are only allowed to occur in demarcated areas and a land user must obtain a water use license as these plants consume large quantities of water; and
- Category 3 – These plants have the potential of becoming invasive but are considered to have ornamental value; Existing plants do not have to be removed but no new plantings may occur and the plants may not be sold.

The following guide is a useful starting point for the identification of alien species: Bromilow, C. 2010. *Problem Plants and Alien Weeds of South Africa*. Briza, Pretoria.

10.3 VULNERABLE ECOSYSTEMS AND HABITATS

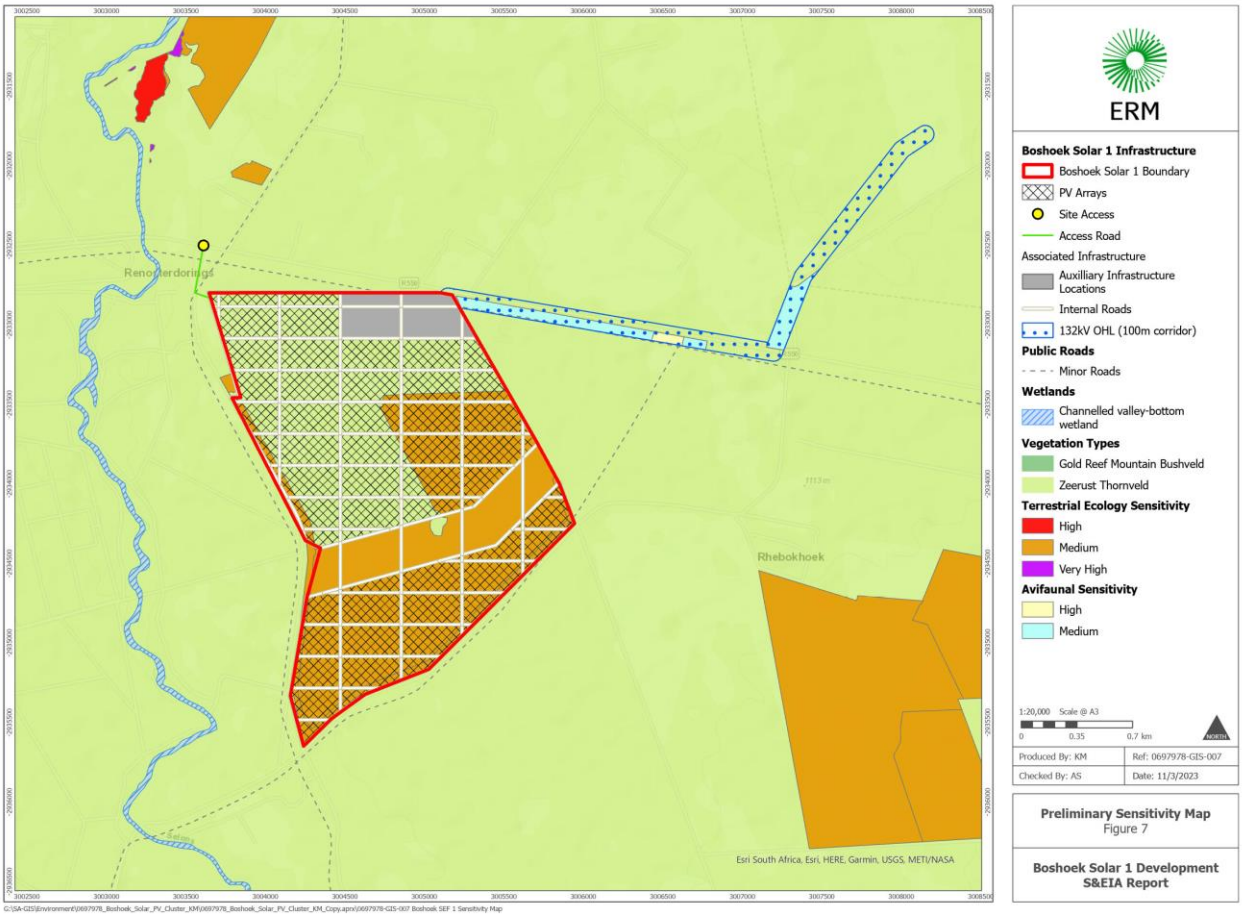
Certain habitats and environments are more vulnerable to alien plant invasion and are likely to bear the brunt of alien plant invasion problems at the site. In addition, construction activities and changes in water distribution at the site following construction are also likely to increase and alter the vulnerability of the site to alien plant invasion.

Areas at the site which are likely to require specific attention include the following:

- Wetlands, drainage lines and other mesic areas;

- Cleared and disturbed areas such as road verges, crane pads and construction footprints etc; and
- Construction camps and lay-down areas which are cleared or are active for an extended period.

FIGURE 10-1 BOSHOEK SOLAR 1 SEF ENVIRONMENTAL SENSITIVITY MAP



10.3.1 WETLANDS, DRAINAGE LINES AND OTHER MESIC AREAS

There are a relatively large number of drainage lines at the site, as well as a number of artificial wetlands. Disturbance within these areas often results in alien plant invasion on account of the greater water and nutrient availability in this habitat. The disturbance footprint within such areas must be minimized and these areas must be checked for alien species more than the surrounding landscape.

10.3.2 CLEARED AND DISTURBED AREAS

Cleared and disturbed areas are clearly vulnerable to invasion on account of the lack of existing plant cover to resist invasion, as well as the disturbance created during construction, which promoted the germination and establishment of alien plant species.

10.3.3 CONSTRUCTION CAMPS AND LAYDOWN AREAS

Construction camps and lay down areas are either cleared of vegetation or prolonged activities in these areas result in negative impact on indigenous vegetation. In addition, repeated vehicle

and human activity in these areas usually results in the import of alien plant seed on clothes, dirty vehicles or with construction machinery and materials.

10.4 GENERAL CLEARING AND GUIDANCE PRINCIPLES

Alien control programs are long-term management projects and must include a clearing plan, which includes follow up actions for rehabilitation of the cleared area. Alien problems at the site must be identified during pre-construction surveys of the development footprint. This may occur simultaneously to other required reaches and surveys. The clearing plan must then form part of the pre-construction reporting requirements for the site.

The plan must include a map showing the alien density & indicating dominant alien species in each area.

- Lighter infested areas must be cleared first to prevent the build-up of seed banks;
- Pre-existing dense mature stands ideally must be left for last, as they probably will not increase in density or pose a greater threat than they are currently;
- Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of aliens are easily dispersed across boundaries by wind or water courses; and
- All clearing actions must be monitored and documented to keep track of which areas are due for follow-up clearing.

10.5 CLEARING METHODS

Different species require different clearing methods such as manual, chemical or biological methods or a combination of both. However, care must be taken that the clearing methods used do not encourage further invasion. As such, regardless of the methods used, disturbance to the soil must be kept to a minimum. Fire is not a natural phenomenon in the area and fire must not be used for alien control or vegetation management at the site.

The best-practice clearing method for each species identified must be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water Website. http://www.dwaf.gov.za/wfw/Control/.

10.6 USE OF HERBICIDE FOR ALIEN CONTROL

Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance, which stimulates alien invasion and may also be ineffective for many woody species which re-sprout. Where herbicides are to be used, the impact of the operation on the natural environment must be minimised by observing the following:

- Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control;
- All care must be taken to prevent contamination of any water bodies; This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures;
- Equipment must be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site;
- To avoid damage to indigenous or other desirable vegetation, products must be selected that will have the least effect on non-target vegetation;

- Coarse droplet nozzles must be fitted to avoid drift onto neighbouring vegetation; and
- The appropriate health and safety procedures must also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the following guidelines must be followed:

Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.

10.7 CONSTRUCTION PHASE ACTIVITIES

The following management actions are aimed at reducing soil disturbance during the construction phase of the development, as well as reducing the likelihood that alien species will be brought onto site or otherwise encouraged.

Construction Phase Action	Frequency
The ECO is to provide permission prior to any vegetation being cleared for development.	Daily
Clearing of vegetation must be undertaken as the work front progresses – mass clearing must not occur unless the cleared areas are to be surfaced or prepared immediately afterwards.	Weekly
Where cleared areas will be exposed for some time, these areas must be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides must not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose must be brought onto site. Brush from cleared areas must be used as much as possible. The use of manure or other soil amendments is likely to encourage invasion.	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment.) Stockpiles must be checked regularly and any weeds emerging from material stockpiles must be removed.	Weekly
Alien vegetation regrowth on areas disturbed by construction must be controlled throughout the entire site during the construction period.	Monthly
The alien plant removal and control method guidelines must adhere to best-practice for the species involved. Such information can be obtained from the DWAF Working for Water website.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into demarcated No Go areas.	Daily
Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only.	Monthly
Wetlands and other sensitive areas must remain demarcated with appropriate fencing or hazard tape. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities.	Daily

10.7.1 MONITORING ACTIONS – CONSTRUCTION PHASE

The following monitoring actions must be implemented during the construction phase of the development.

Monitoring Action	Indicator	Timeframe
Document alien species present at the site	List of alien species	Pre-construction
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannually

10.8 OPERATIONAL PHASE ACTIVITIES

The following management actions are aimed at reducing the abundance of alien species within the site and maintaining non-invaded areas clear of aliens.

Operational Phase Action	Frequency
Surveys for alien species must be conducted regularly. Every 6 months for the first two years after construction and annually thereafter. All aliens identified must be cleared.	Every 6 months for 2 years and annually thereafter
Where areas of natural vegetation have been disturbed by construction activities, revegetation with indigenous, locally occurring species must take place where the natural vegetation is slow to recover or where repeated invasion has taken place following disturbance.	Biannually, but revegetation must take place at the start of the rainy season
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, must be controlled using methods that leave the soil protected, such as using a weed-eater to mow above the soil level.	When necessary
No alien species must be cultivated on-site. If vegetation is required for esthetic purposes, then non-invasive, water-wise locally occurring species must be used.	When necessary

10.8.1 MONITORING ACTION – OPERATIONAL PHASE

The following monitoring actions must be implemented during the operation phase of the development.

Monitoring Action	Indicator	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually

Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Quarterly
Document rehabilitation measures implemented, and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

10.9 DECOMMISSIONING PHASE ACTIVITIES

The following management actions are aimed at preventing the invasion, by alien plant species, of the re-vegetated areas created during the decommissioning phase. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to operation.

Decommissioning Phase Action	Frequency
All damaged areas shall be rehabilitated if the infrastructure is removed, and the facility is decommissioned.	Once off
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.	Once off, with annual follow up re-vegetation where required
Maintain alien plant monitoring and removal programme for 3 years after rehabilitation.	Biannually

10.9.1 MONITORING ACTION – DECOMMISSIONING PHASE

The following monitoring and evaluation actions must take place during the decommissioning phase of the development.

Monitoring Action	Indicator	Timeframe
Monitor newly disturbed areas where infrastructure has been removed to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation	Alien plant surveys and distribution map	Biannually until such time as the natural vegetation has recovered sufficiently to resist invasion.
Monitor re-vegetated areas to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation	Alien plant surveys and distribution map	Biannually for 3 years
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Annually for 3 years

11. PLANT RESCUE AND PROTECTION PLAN

The purpose of the plant rescue and protection plan is to implement avoidance and mitigation measures to reduce the impact of the development on listed and protected plant species and their habitats.

The objective of reusing plants on the project area is to prevent the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.

Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.

11.1 EFFECT OF REMOVING INDIVIDUAL SPECIES OF CONSERVATION CONCERN

Species of conservation concern are declining either due to overexploitation or because their range of occupancy is limited and further infringed on by development. Most plant populations require a certain minimum number of individuals within a population or metapopulation to allow for sufficient genetic transfer between individuals. This prevents genetic erosion and hence weakening of the ability of individuals to persist in their environments. Similarly, where the distance between metapopulations is significantly increased due to fragmentation and the resultant loss of some populations, populations may suffer genetic decline due to restricted movement of pollen. Pollinators or other species that depend on a particular plant species for a specific microhabitat or food source may be equally affected because of the reduction of available resources. Therefore, the aim of plant rescue actions is always to maintain as many individuals of a plant population in as close proximity to the original habitat as possible to minimise loss of individuals and fragmentation of populations to prevent the creation of future extinction debts of the development.

11.2 PLANT RESCUE AND PROTECTION

Successful plant rescue can only be achieved if:

- Species can be removed from their original habitat with minimal damage to the plant, especially the roots;
- All plants removed are safely stored and treated according to their specific requirements prior to being transplanted again;
- They are relocated into a suitable habitat and protected from further damage and all disturbances to aid their re-establishment;
- Timing of planting activities is planned with the onset of the growing season; and
- Steps are taken where necessary to aid the initial establishment of vegetation, including occasional watering.

11.3 TIME OF PLANTING

- All planting shall be carried out as far as is practicable during the period most likely to produce beneficial results (i.e. during the peak growing season), but as soon as possible after completion of a section of earthworks; and

- Drainage line rehabilitation preparation must be done during autumn, and planting of appropriate species in these areas must commence during early spring after the first rains.

11.4 PLANT SEARCH AND RESCUE

Prior to construction, once all the areas where topsoil will be removed or areas will be transformed have been demarcated, the ECO and contractor will be responsible to remove all bulbous species from the topsoil, as well as succulents and small indigenous shrubs that can be transplanted. These are to be kept in a raised, protected position in a designated area until they can be replanted again as part of the rehabilitation process. Further details are listed in the Re-vegetation and Habitat rehabilitation Plan.

12. RE-VEGETATION AND HABITAT REHABILITATION PLAN

The Revegetation and Habitat Rehabilitation Plan addresses the need to mitigate all impacts leading to disturbed vegetation, loss of species and/or agricultural potential, disturbed soil surfaces, and generally bare soils prone to erosion and further degradation on the proposed development site. The plan overlaps to some degree with the Erosion Management Plan, and for successful rehabilitation, it is imperative that this plan is at all times used in conjunction with other EMPrs mentioned.

The objective of the plan is therefore to provide:

- Protocols for the removal, temporary storage and replanting of plant species of conservation concern Protocols for the rehabilitation of vegetative cover across the project area;
- Tools for planning the rehabilitation work and responding to unforeseen events Guidelines on implementation and post-implementation tasks Criteria for evaluating rehabilitation success; and
- A summary of items to be included in the rehabilitation budget to ensure that there is sufficient allocation of resources on the project budget so that the scale of EMPr-related activities is consistent with the significance of project impacts.

The objective of rehabilitation and revegetation of the development area is:

- Preventing the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern;
- Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist;
- Preserving or re-creating the structural integrity of natural plant communities. Actively aid the improvement of indigenous biodiversity according to a desirable end state according to a previously recorded reference state. This reference state, if healthy, will be dynamic and able to recover after occasional disturbances without returning to a degraded state;
- Improving the ecosystem function of natural landscapes and their associated vegetation; and
- Successful rehabilitation can only be achieved with: »A long-term commitment »Practical, adaptive management »Viable goals of desired outcomes.

Prior to vegetation rehabilitation, all stakeholders involved must be consulted to determine:

- What the rehabilitation is ultimately aiming for– rehabilitation of cropping/grazing lands or rehabilitation of indigenous vegetation, after soil erosion and *stormwater* management is in place and IAPs have been cleared?
- A clear definition of incompatible and compatible vegetation on and in the immediate surroundings of the development must be defined and maintained as such. No tree or shrubs shall be allowed to grow to a height in excess of the horizontal distance of that tree or shrub from the nearest newly developed structure or to grow in such a manner as to endanger the development or its operation;
- Who will take long-term ownership and hence responsibility for the rehabilitation and its subsequent monitoring and management? Continued monitoring of vegetation establishment and composition, as well as erosion detection will have to be coupled with continued follow-

up maintenance of rehabilitation and erosion control from commencement of activity up to the decommissioning phase; and

- The ultimate objective for rehabilitation must focus on the stabilisation of soil erosion, retaining agricultural potential of transformed areas and /or the establishment of a dense and protective plant cover and the maintenance of habitats to enable vegetation to persist and flourish on rehabilitated areas indefinitely, ultimately relying only on environmental resources.

12.1 MAP AND CREATE MANAGEMENT AREAS

The entire project area must be mapped and divided into management areas indicating:

- Current land cover;
- Roads and residential;
- Areas with IAPs, subdivided further in sparse or dense infestations where applicable;
- Transformed areas; and
- Untransformed indigenous vegetation

For every one of the management areas, the project proponent, in consultation with the land users, will have to decide what intervention will be necessary, desirable, and feasible to enable the development of the project and long-term sustainable maintenance of infrastructure. Thus, for every management area there must be an operational outline on:

- What will happen there;
- What needs to be mitigated – including *stormwater*- and erosion management;
- Which management units need priority intervention/mitigation;
- How will this mitigation / intervention be done (method statements) including schedule of work;
- Realistic and desirable end states including list of species that must be established to initiate rehabilitation after initial revegetation;
- Approximate timeframes;
- Monitoring protocol to evaluate success or failures of interventions; and
- Establish permanently marked transects and monitor with fixed-point photography who will be responsible for doing what how will different actions be integrated to achieve and maintain or improve the desirable end state of the environment of that management unit.

Special attention will have to be given to drainage zones, as these not only have very active morphodynamics, but are also distributers of seeds – both indigenous and of IAPs. Thus, clearing a downstream invasion of aliens to enable maintenance of the development will be futile if the upstream IAPs are not cleared or at least aggressively controlled.

12.2 SETTING REALISTIC REHABILITATION GOALS

Rehabilitation efforts typically aim at improving ecosystem function that consists of a series of processes, which can in the end be evaluated against a desired outcome or reference state of the vegetation and environment.

Attainable goals of rehabilitation on the project area must be possible and viable for at least the following:

- Stabilisation of soils;

- Stabilisation of riparian areas;
- *Stormwater* reduction through management and wetland integrity;
- Clearing of IAPs:
  - The degree to which IAPs can be cleared from the project area needs to be determined according to desirability, available project funding, personnel and project requirements.
- Restoring and/or rehabilitating vegetative cover on non-transformed areas to obtain an acceptable vegetation cover that can be maintained or persists on its own indefinitely.

12.3 REMOVE OR AMELIORATE THE CAUSE OF DEGRADATION

This will include:

- Physical rehabilitation of topsoil where it has been removed;
- Topsoil on areas that have not been cultivated are considered as the upper 20 - 30 cm only. These contain the most important nutrients, micro flora and –fauna essential for nutrient cycling processes. Topsoils are also an important source of seeds;
- Subsoils and overburden substrata lack the above elements and will first have to be used for physical rehabilitation of landscapes as and where necessary, and then overlain with topsoils;
- Stabilisation of topsoils and prevention of erosion – refer to the Erosion management plan; and
- Removal of all invasive vegetation within the disturbed footprint – refer to the Alien Invasive Management Plan.

Where it is desirable to use brush or logs of the cleared vegetation for soil stabilisation, such material must be free of regenerative material – e.g. seeds or root suckers.

12.4 INITIAL REVEGETATION

Immediately after clearing of vegetation, the soil surface must be inspected for signs of erosion and stabilised as soon as possible. After completion of construction, such erosion stabilisation must preferably be with a cover of vegetation. A dense initial grass or other perennial cover will be desirable. The appropriate seed mix must be determined in consultation with an ecologist familiar with the area. The aim of the first vegetation cover is to form a protective, relatively dense indigenous layer to slow runoff, increase moisture infiltration into the soil, and gradually change the soil nutrient status in order for it to be more favourable for other desirable indigenous vegetation to become established.

12.5 NATURAL SEED BANKS AND IMPROVEMENT OF PLANT STRUCTURAL AND COMPOSITIONAL DIVERSITY

It is expected that soil seed banks of indigenous vegetation will be present to initiate initial vegetation cover, but may not be sufficient to establish an acceptable cover of desirable species. If necessary, after deciding which indigenous species must be re-introduced, seed must be ideally collected from site or an environmentally-matched site nearby.

Seed collection may be done throughout the year as seed ripens, but can also be restricted to summer, when a large amount of the perennial seed should have ripened. Seeds must be stored in paper or canvas bags dusted with insecticide and sown at the onset of the rainy season.

Alternatively, slower-growing perennials may be raised from seed or cuttings in a nursery and then transplanted once established. It will be beneficial to investigate if community members

would be able to create and maintain such a nursery, or if there are nurseries in the area, that raise indigenous flora from the area.

The final vegetation cover must resemble the original (non-encroached) vegetation composition and structure as far as practicable possible or permissible within each management unit.

For drainage areas:

- First restore drainage line morphology following the guidelines of the Erosion Management Plan – without that ecological recovery cannot be initiated;
- Determine if natural seed sources may be present further upstream;
- If such upstream seed sources are still present, rehabilitation of riparian vegetation after soil erosion management will most likely occur naturally, PROVIDED that follow-up monitoring of the establishment of vegetation is carried out, and all invasive species eradicated as they emerge. This can only be achieved with a long-term commitment (> 5 years minimum); and
- Should no upstream seed resources be available, suitable species (as determined in consultation with an ecologist) must be sown or planted.

12.6 MONITORING AND FOLLOW-UP ACTION

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of ecosystems affected by the development, and remedy these as soon as detected.

During the construction phase, the ECO and contractor will be responsible for initiating and maintaining a suitable monitoring system. Once the development is operational, the project proponent will have to identify a suitable entity that will be able to take over and maintain the monitoring cycle and initiate adaptive management as soon as it is required. Monitoring personnel must be adequately trained.

The following are the minimum criteria that must be monitored:

- Composition and density of replanted vegetation, distinguishing between species introduced for initial revegetation only and species that are part of the pre-determined desirable end state;
- Associated nature and stability of surface soils;
    - It is a must that permanent transects are marked and surveyed annually according to the LFA technique (Tongway and Hindley 2004), adapted to integrate both surface soil characteristics and the vegetation to be monitored.
- Re-emergence of IAPs;
    - If noted, remedial action must be taken immediately according to Working for Water specifications
- Nature and dynamics of riparian zones;
    - Stability of riparian vegetation;
    - Any form of bank erosion, slumping or undercutting; and
    - Stability of channel form and width of streams – if this increases, it shows that vegetation on plains and/or riparian areas and upper drainage lines are not yet in a stable enough state to be fully functional in reducing excess runoff and the ecosystem overall is losing valuable resources.

12.7 TIMEFRAMES AND DURATION

- Rehabilitation will occur during construction, as areas for the re-application of topsoil and revegetation become available or where revegetation can be initiated after clearing of invasives or to stabilise erosion;
- The initial revegetation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs;
- The rehabilitation phase (including post seeding maintenance) must be at least 12 months (depending on time of seeding and rainfall) to ensure establishment of an acceptable plant cover is achieved (excluding invasive plant species or weeds);
- If the plants have not established and the acceptable plant cover is not achieved within the specified maintenance period, maintenance of these areas shall continue until at acceptable plant cover is achieved (excluding alien plant species or weeds);
- Additional seeding or planting may be necessary to achieve acceptable plant cover. Hydroseeding may have to be considered as an option in this case;
- Any plants that die, during the maintenance period, shall be replaced by the Horticultural Landscape Contractor (at the Horticultural Landscape Contractor's cost if it was due to insufficient maintenance);
- Succession of natural plant species must be encouraged; and
- Monitoring of rehabilitation success and follow-up adaptive management, together with clearing of emerging invasives shall be carried on until the decommissioning phase has been completed.

13. OPEN SPACE MANAGEMENT PLAN

The objective of open space management is to restore, enhance and rehabilitate open spaces, improve climate change adaptations through the minimisation of biodiversity loss, and mitigate against environmental degradation. Management actions consider open spaces and natural areas as well as community perceptions of these.

In the context of the proposed grid connections and substations the primary purpose of the open plan management plan is therefore to:

- Minimise visual impact on the character of the area; and
- Maintain biodiversity within the area to ensure that no long-term negative impacts occur on the local environment.

In order to maintain biodiversity, the Alien Invasive Management Plan, Plant Rescue and Protection and Re-vegetation and Habitat Rehabilitation Plan must be adhered to.

In addition, the following actions must be implemented by the Contractor and Project Company:

- Promote environmental awareness in all employees and sub-contractors and create an understanding of the environmental sensitivities of the project site;
- No waste, including organic matter may be disposed of anywhere on site, except in provided bins placed at convenient locations, especially during the construction period. Disciplinary actions must be taken against littering;
- Open spaces are to be kept free of alien plants and weeds;
- Indigenous plants may not be collected or removed from the site;
- Access to the facility must be strictly controlled;
- All visitors and contractors must be required to sign-in; and
- Signage at the entrance must indicate that disturbance to fauna and flora is strictly prohibited.

The following activities must not be permitted by anyone except the landowner or his representatives:

- No fires within the site;
- No hunting, collecting or disturbance of fauna and flora, except where required for the safe operation of the facility and only by the Environmental Officer on duty and with the appropriate permits and landowner permission;
- No driving off of demarcated road; and
- No interfering with livestock.

14. TRAFFIC MANAGEMENT PLAN

The objective of the traffic management plan is the prevention of incidents from the use of vehicles and disturbance of local traffic on public roads during the construction, operation and decommissioning phases of the development. Traffic volumes are most likely to increase during the construction phase. Operations, maintenance and decommissioning phase traffic is expected to be insignificant.

The development must be accessible to passenger cars, buses, trucks and abnormal multi-vehicle combinations which will be delivering WT components. Access to the site needs to be safe and practical to minimise the risk of pedestrian and vehicle accidents through:

- The provision of adequate traffic control; and
- Clear visibility by ensuring sufficient stopping sight distances and sufficient markings and warnings signs.

The traffic management plan to be implemented during construction and decommissioning should consist of the following mandatory mitigation measures:

- The arrival and departure of construction vehicles should be staggered during off- peak periods to have a distributed effect over low volume traffic periods;
- All vehicles with abnormal loads should have exemption permits as required by the National Road Traffic Act 93 of 1996;
- The Contractor and Site Safety Officer / ESO, during construction and decommissioning should ensure correct signage and safety precautions are in place for vehicles and pedestrians on-site and at the site access. These may include warning signs, construction vehicle signage and flagmen;
- Unpaved roads must be watered to lesson dust generation and routine maintenance on road surface to maintain condition;
- Vehicles transporting materials that can be blown away and cause dust must be securely covered and adhere to speed limits;
- Community participation/stakeholder involvement at every stage of the project is a must to allow the community to be informed before the start of site activities;
- A comprehensive assessment of the entire route is required on award of the project; and
- Prohibit SEF equipment and materials transportation at night, during the school December holiday period, on public holidays, during festivals or other special events;

Actions to be implemented by the Contractor and the Developer:

- Limit use of private cars by arranging minibus transport service for workers;
- Monitor for overloading of vehicles;
- Use only well trained, suitably qualified and experienced drivers in possession of an appropriate and valid driver’s license;
- All vehicles must be roadworthy and serviced regularly;
- Clear and visible signage must be placed on and around site, clearly demarcating safe entry and exit points;
- Require all drivers to abide by standard road and safety procedures on site;
- When travelling on public roads all speed limits and rules of the road must be adhered to; and
- Limit dust generation by applying dust suppressants and postponing dust generating activities during period of strong winds and enforcing a strict speed limit of 50km/h on unpaved roads.

Monitoring actions to be conducted by the ECO / ESO:

- Maintain incidents/complaints register for community complaints;
- Monitor dust generation and implementation of management actions detailed above.

The Traffic Management Plan is aimed at managing the access and on-site worker drop and collection area in this instance and it is part of the detail design before construction. .

15. TRANSPORTATION MANAGEMENT PLAN

The Transportation Management Plan aims to ensure the safe transportation of all components required for the construction of the development to the construction site. This includes the PV Panels, substation transformers, BESS, electrical cables and pylon structures.

The following actions must be implemented by the developer and Contractor:

- Apply for all relevant permits for abnormal loads and route clearances with the relevant authorities prior to construction;
- Appoint a qualified specialist to conduct a detailed site-specific Transport Risk Assessment during the detailed design phase and prior to construction;
- Determine the pre-construction condition of the road immediately prior to construction by carrying out a condition assessment or from recent pavement management system condition assessments if available from the Provincial Authorities;
- Public notices regarding any planned abnormal load transports must be placed at the construction site to inform affected parties;
- Abnormal loads must conform with legal maximum dimensions, and vehicles carrying abnormal loads must display sufficient signage; and
- Any roads damaged during the transportation of components, or from other construction vehicles must be rehabilitated and returned to pre-construction conditions.

The following monitoring activities must be carried out by the ECO / ESO:

- Conduct site audits and report non-compliance with the above-mentioned conditions.

16. WASTE MANAGEMENT PLAN

A waste management plan (WMP) is important to ensure a safe and healthy environment and that sustainable waste management, and procedures are followed throughout the lifecycle of the project. The DFFE promulgated the National Environmental Management: Waste Act 59 of 2008 (Waste Act) and in 2010 developed the National Waste Management Strategy (NWMS). The WMP provides recommended measures for the collection, temporary storage and safe disposal of the various waste streams associated with the project and includes recommendations for the recovery, re-use and recycling of waste. The purpose of this plan is therefore to ensure that effective procedures are implemented for the handling, storage, transportation and disposal of waste generated from the project activities on site.

The introduction of an internationally best-known practice in waste management, the Waste hierarchy (Figure 16-1 below) is one of the best mechanisms that came into effect with the promulgation of the waste act. The waste act promotes the exercising of the duty of care and the implementation of the waste hierarchy while protecting the environment.

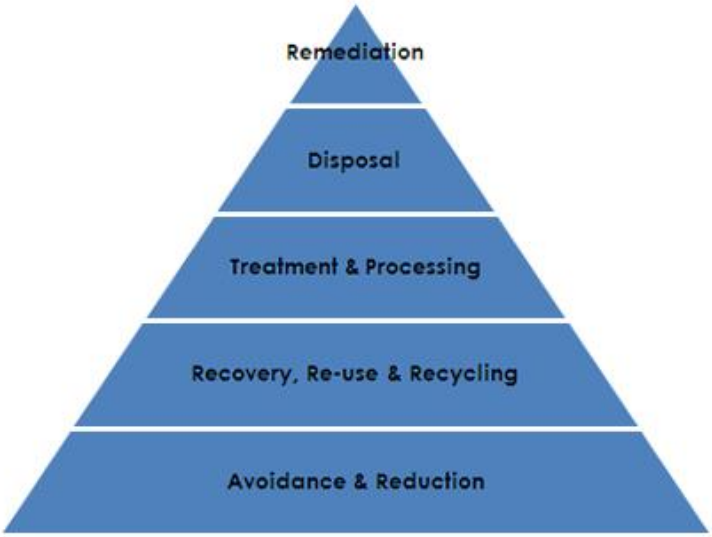


FIGURE 16-1 WASTE HIERARCHY- NATIONAL WASTE MANAGEMENT STRATEGY 2010 (SOURCE: HTTPS://WWW.DFFE.GOV.ZA/PROJECTSPROGRAMMES/WORKINGONWASTE)

16.1 CONSTRUCTION PHASE WASTE MANAGEMENT

A method statement to detail the specific (hazardous) waste management practices should be prepared by the Contractor prior to the commencement of activities.

GENERAL AND HAZARDOUS WASTE MANAGEMENT

- Construction methods and materials should be carefully considered and implemented in view of waste reduction, re-use, and recycling opportunities;
- The ESO / ECO must conduct waste classification and rating in terms of SANS 10288 and Government Notice 634 published under the NEM: WA;
- The ESO / ECO must develop, implement and maintain a waste inventory reflecting all waste generated during construction for both general and hazardous waste;

- A dedicated waste area must be established on site for the storage of all waste streams before removal from site. The storage period must not trigger listed waste activities as per the NEMWA, GN 921 of November 2013;
- Waste collection bins and hazardous waste containers must be provided by the contractor and placed at strategic locations around the site for the storage of organic, recyclable and hazardous waste;
- Hazardous waste must be stored separate from other forms of waste to avoid contamination. The following items are hazardous: Batteries, Light bulbs (fluorescent, LED, Halide), Electronic waste, used oils, chemicals and chemical containers;
- The location of all temporary waste storage areas must aim to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control, while being reasonably placed in terms of centrality and accessibility on site. Where required, an additional temporary waste storage area may be designated, provided identical controls are exercised for these locations;
- Waste storage shall be in accordance with all Regulations and best-practice guidelines and under no circumstances may waste be burnt on site;
- All waste removed from site must be done by a registered / licensed subcontractor, who must supply information regarding how waste recycling / disposal will be achieved. The registered subcontractor must provide waste manifests for all removals at least once a month or for every disposal made, records of which must be kept on file at the site camp for the duration of the construction period;
- Waste must be stored in designated containers and not on the ground;
- Hazardous waste must be stored in a lockable container on an impermeable surface and bunded, should the need arise;
- Waste generated on site must be removed on a regular basis. This frequency may change during construction depending on waste volumes generated at different stages of the construction process, however removal must occur prior to the storage capacity being reached to avoid overflow of containers and poor waste storage;
- Waste should not be dumped, buried or burned on site;
- Reduce waste transportation and disposal costs by ensuring full loads of waste are transported instead of half loads; and
- Setting up a reverse logistics system (products move from supplier to customer and vice-versa) would minimise waste and reduce disposal costs, i.e, suppliers deliver batteries and collect used batteries.

WASTE MANAGEMENT PRACTICES

- To achieve sustainable waste management, it is a must that a procurement policy be implemented that considers the waste that will be generated at the end of the construction phase. Sourcing local goods would reduce costs of transportation and carbon emissions. Purchasing and using environmentally safe cleaning and building materials as well as considering reusable/recyclable goods will help to achieve reduced waste;
- Once a waste inventory has been established, targets for the recovery of waste (minimisation, re-use, recycling) should be set;
- Recyclable materials must be identified as part of the site's waste management monitoring records;

- Waste manifests and waste acceptance approvals (i.e. receipts) from designated waste facilities must be kept on file at the site office, in order to record and prove continual compliance for future auditing;
- It is the responsibility of the ESO / ECO to ensure that each subcontractor implements their own waste recycling system, i.e. separate bins for food waste, plastics, paper, wood, glass cardboard, metals, etc. Such practices must be made contractually binding upon appointment of the subcontractors. Signage / colour coding must be used to differentiate disposal areas for the various waste streams (i.e. paper, cardboard, metals, food waste, glass etc.);
- Septic tanks and portable toilets must be maintained regularly and monitored by the ESO / ECO. Below ground storage of septic tanks must withstand the external forces of the surrounding environment. The area above the tank must be demarcated to prevent any vehicles or heavy machinery from moving around in the surrounding area;
- Hazardous waste must be stored within a bunded area constructed according to SABS requirements and must ensure complete containment of the spilled material in the event of a breach. As such, appropriate bunding material, design, capacity and type must be utilised to ensure that no contamination of the surrounding environment will occur despite a containment breach. The net capacity of a bunded compound in a storage facility should be at least 110% of the net capacity of the largest tank and should also take into consideration the capacity displaced by other tanks within the same bunded area and any foundations;
- Interconnected tanks should be treated as a single tank of equivalent total volume for the purposes of the bund design criteria;
- Inspections and maintenance of bunds must be undertaken regularly. Bunds must be inspected for leaks or cracks in the foundation and walls. If any leaks occur in the bund, these must be removed immediately;
- The position of all waste storage areas must be located to ensure minimal degradation to the environment. The main waste storage area must have a suitable *stormwater* system separating clean and contaminated *stormwater*;
- Bund systems, preferably be designed to avoid dewatering of contaminated water, but to rather separate oil and hydrocarbons from water prior to dewatering;
- It is assumed that any rainwater collected inside the bund is contaminated and must be treated by oil / water separation (or similar method) prior to dewatering, or removed and stored as hazardous waste, and not released into the environment;
- Following rainfall event bunds must always be dewatered to maintain a sufficient storage capacity in the event of a breach; and
- No mixing of hazardous and general waste is allowed.

The success of the Waste Management Plan is determined by measuring criteria such as waste volumes, cost recovery from recycling and cost of disposal. Recorded data can indicate the effect of training and education, or the need for education. It will provide trends and benchmarks for setting goals and standards and provide clear evidence of the success or otherwise of the plan.

- Documentation (waste manifest, certificate of issue or safe disposal) must be kept detailing the quantity, nature, and fate of any regulated waste for audit purposes;
- Waste management must form part of the monthly reporting requirements in terms of volumes generated, types, storage and final disposal.

Training and awareness regarding waste management shall be provided to all employees and contractors.

16.2 OPERATIONAL PHASE WASTE MANAGEMENT

Operation phase activities will result in the production of limited amounts of general waste consisting mostly of cardboard, paper, plastic, tins, metals and a variety of synthetic compounds. Hazardous wastes (including grease, oils) will also be generated. All waste generated will be required to be temporarily stored at the facility in appropriate sealed containers prior to disposal at a permitted landfill site or other facilities.

WASTE MANAGEMENT PRACTICES

- The Operational Manager must develop, implement and maintain a waste inventory reflecting all waste generated during operation for both general and hazardous waste streams;
- Adequate waste collection bins at site must be supplied. Separate bins should be provided for general and hazardous waste;
- Recyclable waste must be removed from the waste stream and stored separately;
- All waste must be stored in appropriate temporary storage containers (separated between different operation wastes, and contaminated or wet waste);
- Waste storage shall be in accordance with all best-practice guidelines and under no circumstances may waste be burnt on site;
- Waste generated on site must be removed on a regular basis throughout the operation phase; and
- Waste must be removed by a suitably qualified contractor and disposed at an appropriately licensed landfill site. Proof of appropriate disposal must be provided by the contractor and kept on site.

WASTE MANAGEMENT PRACTICES

Records must be kept of the volumes / mass of the different waste streams that are collected from the site throughout the life of the project. The appointed waste contractor is to provide monthly reports to the operator containing the following information:

- Monthly volumes / mass of the different waste streams collected;
- Monthly volumes / mass of the waste that is disposed of at a landfill site;
- Monthly volumes / mass of the waste that is recycled; and
- Data illustrating progress compared to previous months.

This report will aid in monitoring the progress and relevance of the waste management procedures that are in place. If it is found that the implemented procedures are not as effective as required, this WMP is to be reviewed and amended accordingly. This report must from part of the ESO’s reports to the ECO on a monthly basis.

17. STORMWATER MANAGEMENT PLAN

The objective of the stormwater management plan (SWMP) is to prevent increased soil erosion, to contain any contaminated run-off and to avoid water logging and pollution.

The On-site Erosion Management Plan must therefore be seen in conjunction with the SWMP. Actions are listed that will ensure that stormwater is channeled in a controlled manner from roads and substations towards natural drainage lines, without impeded natural surface flows.

- Develop and implement a site-specific *stormwater* management plan during the detailed design phase of the projects and prior to construction;
- In the detailed design phase of the project minimise any water crossings and utilise existing roads wherever possible;
- Should new roads be required to cross any banks or channels these must be secured with erosion protection (i.e. gabions etc.);
- Monitor for erosion during the clearing of vegetation;
- Avoid hard-engineered surfaces (i.e., construct gravel roads and not asphalt roads wherever possible);
- Roads in steep areas must be equipped with side drainages and culverts that channel the run-off to natural drainage lines without gaining velocity and causing erosion;
- Construction camps and temporary ablution facilities must be located beyond the 1:100 year floodline;
- Stockpiles must be located on flat areas and protected from erosion;
- The substation site design must include side water outlets and an adequate slope to allow *stormwater* run-off from the paved areas;
- Any run-off from the BESS area must be controlled and managed before entering any stormwater channel; and
- Prevent surface run-off from areas of potential contamination.

GUIDELINES AND *STORMWATER* MANAGEMENT

Where buildings/ infrastructure occur on-site, the developer should ensure that all *stormwater* flow paths are protected against erosion. All inlets to piped systems must be fitted with a screen/grating to prevent debris and refuse from entering the *stormwater* system. Screens/ grating must be installed immediately after the installation of piped infrastructure. Buildings, earthworks, or any other infrastructure may obstruct or encroach on a watercourse inside or outside the site without approved plans. The approved plans must not compromise the SWMP or any other required Authority approvals.

Designs must ensure that rainfall run-off from roofing, not subjected to increases in pollution, can be captured for re-use for on-site irrigation and non-potable water uses. Where storage for re-use and ground conditions permit, rainwater run-off should connect to detention areas to maximise groundwater recharge. Detention areas must be designed to attenuate run-off.

Parking or paved areas should be structured to reduce stormwater runoff by allowing ponding or infiltration. Stormwater from these areas should be discharged and controlled as overland sheet flow or attenuation facilities.

Designed roads must avoid concentration of flow along and off the road. Where flow concentration is unavoidable, incorporating the road into the major *stormwater* system must be considered.

Subsurface disposal must be designed to ensure that slope instability, concentrated saturation or inundation does not occur.

Channels may be constructed to convey *stormwater* directly to a natural watercourse where deemed necessary and unavoidable. The channels must be suitably lined to prevent erosion and provide maximum possible energy dissipation of the flow.

Open trenches should not be unprotected for extended periods and should be progressively backfilled as construction proceeds. Excavated material to be used as a backfill must be placed close to the trench on the upstream side to avoid loose material from washing away.

Materials to be stockpiled away from drainage paths and loose material such as stone, sand or gravel must be covered or kept damp to minimise dust. The *stormwater* systems should be free from materials that could harm the water systems' fauna, flora, and aquatic life.

18. EROSION MANAGEMENT PLAN

18.1 PURPOSE

The purpose of the erosion management plan is to implement avoidance and mitigation measures to reduce the erosion potential and the likely impact of erosion associated with the construction and operational phases of the proposed facility. As part of the management plan, measures to protect hydrological features from erosion damage are included.

18.2 SCOPE AND LIMITATIONS

The erosion management plan is intended at introducing measures aimed at reducing the negative impacts of erosion on biodiversity as well as reducing the vulnerability of the site to erosion problems during the construction and operational phases of the development. The focus is on managing runoff and reducing the construction phase impact on ecologically sensitive areas. The plan does not cover engineering-side issues, which are of relevance to soil management and erosion. Therefore, issues such as the potential presence of heaving clays, compressible soils, perched water tables, dispersive soils and corrosive groundwater at the site are beyond the general scope of this study and are not directly dealt with. These issues would need to be addressed and their relevance assessed during detailed geotechnical investigation of the site.

18.3 BACKGROUND

18.3.1 TYPES OF EROSION

Erosion comes in several forms, some of which are not immediately obvious. The major types of erosion are briefly described below:

RAINDROP IMPACT

This is the erosion that occurs due to the “bomb blast” effect of raindrop impact. Soil particles can be blasted more than a meter into the air. Apart from loosening soil particles, the effect can also break soil aggregates apart and form a clay seal on the surface which resists infiltration and results in increased levels of runoff. This effect is most important when large areas of exposed soils are present. If the site is cleared, then this effect will play an important role as it results in the soil surface becoming sealed which reduces infiltration and increases runoff, leading to erosion.

SHEET EROSION

This is the removal of a shallow and uniform layer of soil from the surface. It is caused initially by raindrop splash and then by runoff. Sheet erosion is often difficult to see as no perceptible channels are formed. Accumulated sediment at the bottom of the slope is often the only indicator. This is likely to be an important erosion type at the site given the gently sloping nature of the site and the susceptible soils.

RILL EROSION

This is the removal of soil from the surface whereby small channels or rills up to 300 mm are formed. It is caused by runoff concentrating into depressions, wheel tracks etc.

GULLY EROSION

This is the removal of soil from the surface and sub-surface caused by concentrated runoff eroding channels greater than 300mm deep. Gully erosion often begins as rill erosion.

WIND EROSION

Wind erosion results from soil particles being picked up, bounced or moved by the wind. Wind erosion is primarily a problem in arid areas and may affect sands soils as well as fine-textured soils. Vegetation cover is usually an effective barrier to wind erosion, but large soils losses or degradation can occur in disturbed areas or on croplands.

18.3.2 PROMOTING FACTORS

RAINFALL CHARACTERISTICS

High-intensity, short-duration storm events have much greater erosion potential than low intensity, longer duration storm events with the same runoff volume. Intense storms produce larger raindrops, and are more likely to break up the soil and dislodge particles.

SOIL ERODIBILITY

Soil erodibility is determined by the soils ability to resist detachment and transport due to rainfall, runoff and infiltration capacity. Well-structured soils with a high clay content are generally least erodible. Some clays are dispersible meaning that they break down when wet and become highly erodible. Silts and fine sands are highly erodible.

LENGTH AND STEEPNESS OF SLOPE

Steeper slopes cause runoff velocities to increase, resulting in increased erosion. As the slope length increases the opportunity for runoff to concentrate and achieve an erosive velocity increases.

SOIL SURFACE COVER

Soil surface cover such as vegetation and mulch protect the soil surface from raindrop impact, reduce flow velocity, disperse flow, and promote infiltration and the deposition of sediment. This is a basic principle underlying many erosion control approaches which aim to modify the surface characteristics in order to reduce the flow velocity and reduce the potential for erosion. In this regard it is important to note that many of the practices which are used to enhance rehabilitation potential are also useful in reducing erosion potential.

18.3.3 EROSION AND SEDIMENT CONTROL PRINCIPLES

The goals of erosion and sediment control during and after construction at the site must be to:

- Protect the land surface from erosion.
- Intercept and safely direct run-on water from undisturbed upslope areas through the site without allowing it to cause erosion within the site or become contaminated with sediment.
- Progressively revegetate or stabilise disturbed areas.
- Prevent damage to hydrological features such as drainage lines or wetlands, either within or adjacent to the site.

These goals can be achieved by applying the following principles:

- Integrate project design with site constraints

- Plan and integrate erosion and sediment control with construction activities;
- Minimise the extent and duration of disturbance;
- Control *stormwater* flows onto, through and from the site in stable drainage structures;
- Use erosion controls to prevent on-site damage;
- Use sediment controls to prevent off-site damage;
- Control erosion and sediment at the source;
- Stabilise disturbed areas promptly; and
- Inspect and maintain control measures.

18.3.4 ON-SITE EROSION MANAGEMENT

Exposed and unprotected soils are the main cause of erosion in most situations. Therefore, the erosion management plan and the revegetation and rehabilitation plan should be closely linked to one another and must not operate independently, but must rather be seen as complementary activities within the broader environmental management of the site and must therefore be managed together.

General factors to consider regarding erosion risk at the site includes the following:

- Soil loss will be greater during wet periods than dry periods. Intense rainfall events outside of the wet season, such as occasional unseasonal showers can also however cause significant soil loss. Therefore, precautions to prevent erosion must be present throughout the year;
- Soil loss is related to the length of time that soils are exposed prior to rehabilitation or stabilization. Therefore, the gap between construction activities and rehabilitation must be minimized. Allied to this the fact that topsoil does not store well and must preferably be used within a month or at most within 3 months to aid in the revegetation and rehabilitation of disturbed areas;
- Phased construction and progressive rehabilitation are important elements of the erosion control strategy; and
- The extent of disturbance will influence the risk and consequences of erosion. Therefore, large areas must not be cleared at a time, especially in areas such as slopes where the risk of erosion is higher.

18.4 CONCENTRATION OF FLOWS INTO DOWNSTREAM AREAS

Road crossings over drainage lines, streams and wetlands can impact downstream wetland ecosystems. Crossings that result in narrowing of the downstream system can result in concentration of flows and channelisation downstream. This may result in a loss of wetland function, and result in the drying out and shrinkage of the wetland area. Erosion and increased vulnerability to invasion of drier banks by alien vegetation may occur.

- Culverts must be adequately spaced such that they do not result in shrinkage of downstream wetlands. Where roads cross minor drainage channels, a single culvert may be adequate, aligned with the downstream drainage line. Where more substantial wetland systems are intercepted by a road, sufficient culverts must be provided such that downstream shrinkage of wetland width does not occur. Moreover, culverts must be aligned, as far impossible, with existing, natural channels; and

- All crossings of drainage systems must ensure that both surface and shallow subsurface flows can be accommodated where appropriate and that unnatural channelisation does not occur downstream.

18.5 RUNOFF CONCENTRATION

The increase in hardened surfaces associated with roads, and other infrastructure will lead to a significant increase in volume and velocity of flow generated from these areas during large rainfall events.

Runoff from road surfaces is usually channelled off of the road surface towards the downslope side of the road. On steep slopes, the volumes and velocity of runoff generated may result in erosion of the surrounding areas. Therefore, specific measures to curb the speed of runoff water is usually required in such areas, such as rock beds or even gabions. In addition, these areas must be monitored for at least a year after construction to ensure that erosion is not being initiated in the receiving areas. Once erosion on steep slopes has been initiated, it can be very difficult to arrest.

18.5.1 DIVERSION OF FLOWS

Diversion of flows from natural drainage channels may occur when roads interrupt natural drainage lines, and water is forced to run in channels along the manipulated road edge to formalized crossing points. Even slight diversion from the natural drainage line can result in excessive downstream erosion, as the new channel cuts across the slope to reach the valley bottom. Should the access road to the site traverse any major drainage lines, the following principles must apply.

- Adequate culverts must be provided along the length of all roads to prevent diversion of flow from natural drainage lines;
- Culverts must be carefully located, such that outlet areas do in fact align with drainage lines.
- The downstream velocity of runoff must be managed, such that it does not result in downstream erosion – on steep slopes, where roads have been constructed on cut areas, allowance must be made for culverts to daylight sufficiently far down the slope that their velocities are managed and erosion does not occur;
- Where necessary, anti-erosion structures must be installed downstream of road drains – these may comprise appropriate planting, simple riprap or more formal gabion or other structures; and
- Roads and their drainage system must be subject to regular monitoring and inspection, particularly during the wet season, so that areas where head cut erosion is observed can be addressed at an early stage.

18.6 MONITORING REQUIREMENTS

18.6.1 CONSTRUCTION PHASE

The following monitoring actions for erosion management must be implemented during the construction phase of the development:

Monitoring Action	Indicator	Timeframe

Identify all river and drainage line crossings affected by the development	Map of sites of potential concern	Preconstruction
Monitor cleared areas for erosion problems	Record of monitoring site, problems encountered and remedial actions implemented	Monthly during the rainy season and following significant rainfall events otherwise
Monitor vegetation clearing activities near sensitive areas such as wetlands or drainage lines	Activity log of monitoring actions and any mitigation and avoidance measures implemented	Monthly during the rainy season and following significant rainfall events otherwise
Monitor revegetated and stabilised areas	Record of monitoring site, problems encountered and remedial actions implemented	Monthly during the rainy season and following significant rainfall events otherwise

18.6.2 OPERATIONAL PHASE

The following monitoring actions for erosion management must be implemented during the operational phase of the development:

Monitoring Action	**Indicator**	**Timeframe**
Monitor for the development of new erosion problems across the site, with a focus on areas where water has been diverted or collected from upslope onto downslope areas	Map of erosion problem areas	Quarterly
Document erosion control measures implemented	Records of control measures and their success rate.	Quarterly
Document the extent of erosion at the site and the remedial actions implemented	Decline in erosion and vulnerable bare areas over time	Biannually

19. FUEL STORAGE MEASURES

19.1 STORAGE TANKS

The storage tanks will be within contained areas to prevent spills contaminating soil and water, and with a design to capture and contain a volume of spill of at least 110% of the volume of stored fuel. These containers can be built in concrete and painted with anti-corrosive paint. The floor of the container must be inclined to permit the collection of the spilled liquids.

The storage tanks must also have a cover protection on top, prepared for drainage and collection of runoff.

19.2 GENERAL PROCEDURES

- Transport routes for the transport of fuel will be clearly indicated;
- Pollution control equipment (spill and leak cleaning kits) must be readily available;
- Ensure personnel training, including: measures to prevent fuel spills, to treat/clean fuel spills, how to react on spill of flammable liquids on clothing and in the inhalation of vapours, leaks simulations; fuel vapour recovery processes, etc. Keep records of all training;
- Maintain the premises and equipment in a clean and tidy state;
- Regularly clean outdoor areas with a broom;
- Wastewater from outside areas must be directed to the contaminated water drainage system, and not enter the *stormwater* system;
- Used oils (waste oil) will be collected, re-used, stored and disposed of in line with disposal procedures for hazardous wastes;
- Ensure the proper management of other hazardous wastes (contaminated soils, used spilling kits, waste lube, etc.); and
- All hazardous waste should be collected by a licensed service provider and transported to a licensed disposal facility.

19.3 FILLING OPERATIONS

- Isolate the area by cones and a rope;
- Prohibit refueling operations during tank filling operations;
- Avoiding having people who are not involved in the operation within a 10 meter radius;
- Prohibit smoking and the use of mobile telephones or any other ignition sources during tank filling operations or vehicle refueling, within a 3 meter radius;
- Use a tight-fill cap to completely seal off the connections between the tubing and the truck’s and station’s tanks;
- Engines must be turned off during refueling; and
- Prevent overflowing and spilling situations when the storage tanks are being filled (verify filling sensors and be aware of overflow alarms).

19.4 PREVENTING ACCIDENTS WITH FUEL MIXTURES

Establish a procedure to deal with the potential occurrence of these situations, such as:

- The chemicals and reaction mechanisms associated with the substances mixed or blended must be well understood and documented;
- Chemical and process hazards must be understood and addressed and the facilities must ensure that process equipment, controls, and procedures are designed, installed and maintained to safely operate the process;
- All employees must understand the chemical and process hazards.
- Facilities must establish a system for Standard Operating Procedures and ensure that they are understood and followed;
- Display clear and informative messages for users of the station, as to how to deal with this situation; and
- Prepare a procedure to suitably dispose of wastes recovered from the batches of fuel mixture.

19.5 SPILL KITS

- Emergency spill kits of absorbent material (e.g. sand) must be provided and stored next to the higher risk sites, and must be easily-accessible, ideally outside, in order to allow an immediate response when a spill occurs. This will be clearly labelled and ready for use;
- Drums for the storage of contaminated material must be provided; and
- An accurate drawing of the local drainage system shall be posted next to the spill kit.

19.6 CLOSURE PHASE

- During the closure phase, there may be loss of product into the soil, as a result of a deliberate or accidental release during closure and removal of tanks and tubing. In addition, this risk may arise outside of the facility site, if the tanks and/or tubing are not properly disposed of;
- In the closure phase, it is important to remove all tanks and pipes. A risk may arise if the tanks are left on site with residual products. As the integrity of the equipment will no longer be ensured or monitored;
- During closure, it must be ensured that facilities do not present a risk to the environment, health or safety. Measures must be taken to ensure that the closure does not result in an unacceptable risk, including:
    - Any and all waste products will be removed from the tanks. Care will be taken to ensure that no product is lost into the soil. Tank closure must be carried out safely, with the removal of explosive vapours, for example by filling the tanks with water or inert gases. All tanks will be safe prior to their removal from the ground. Similar methods will be employed prior to the removal of the pipes.
    - Water used in this process will be contaminated with residual product, and thus a water contamination risk may arise if the contaminated water is not disposed of in a way which is appropriate for hydrocarbon contamination. This would normally imply the removal to a suitable waste handling facility.
    - According to best environmental practices, the tanks, tubing and distributors will be disposed of. However, if the tanks remain in situ, it will be ensured that the procedure is

safe. After making the tanks inert and safe, they will be filled in with sand, concrete, inert mud or hydrophobic foam.

- The tanks and associated tubing which are no longer considered appropriate or safe for fuel storage will not be used for storage of other hydrocarbons, without first ensuring their integrity.
- The oil/water separators will be removed for disposal, off the facility site. Otherwise, they will be filled in a similar way to the tanks. Regardless of the fate of the oil/water separator, all liquid and mud waste will be removed (off the facility site) and all the inlets and outlets will be sealed.
- Whatever drainage system left behind will be modified to ensure that it does not serve as a path for pollutants to reach groundwater or other waters.
- If the deactivation is temporary, product can be left in the tanks. In this case, all monitoring procedures will be carried out as if the facility were in operation. If for any reason the monitoring cannot carry on, the tanks will be emptied and made inert.
- Personnel involved in the closure of a filling and fuel station will be aware and respect obligations with regards to waste disposal, in line with the best practices described above.

20. FIRE MANAGEMENT PLAN

The National Veld and Forest Fires Act (Act 101 of 1998) states that it is the landowner' and / or relevant contractors in the context of the SEFs' responsibility to ensure that the appropriate equipment as well as trained personnel are available to combat fires.

Although fires are not a regular occurrence at the site, fires may occasionally occur under the right circumstances. Ignition risk sources in the area include the following:

- Lightning strikes;
- Personnel within the facility; and
- Infrastructure such as transmission lines.

A fire management plan in compliance with Veld Fire Management Act should be compiled by the main contractor prior to the commencement of construction.

20.1 FIREBREAKS

Extensive firebreaks are not recommended as a fire risk management strategy at the site. The site is very large compared to the extent of the infrastructure and the maintenance of firebreaks would impose a large management burden on the operation of the facility. In addition, the risk of fires is not distributed equally across the site and within many of the lowlands of the site, there is not sufficient biomass to carry fires and the risk of fires within these areas is very low. Rather targeted risk management must be implemented around vulnerable or sensitive elements of the facility, such as substations or other high-risk components. Within such areas, the extent over which management action needs to be applied is relatively limited and it is necessary that firebreaks are created by mowing and that burning to create firebreaks is not used as this in itself poses a risk of runaway fires. Where such firebreaks need to be built such as around substations, a strip of vegetation 5 - 10 m wide can be cleared manually and maintained relatively free of vegetation through manual clearing on an annual basis. However, if alien species colonise these areas, more regular clearing must be implemented.

21. AVIFAUNA MANAGEMENT AND MONITORING PLAN

It is a must that a Avifauna Management and Monitoring programme be implemented. The findings from operational phase monitoring should inform an adaptive management programme to mitigate any impacts on avifauna to acceptable levels. Table 21-1 presents the required mitigation measures and the respective timeframes, targets and performance indicators for the avifauna study.

The focus of mitigation measures is to reduce the significance of potential impacts associated with the development and thereby to:

- Prevent the further loss and fragmentation of vegetation communities and the CBA areas in the vicinity of the project area;
- As far as possible, reduce the negative fragmentation effects of the development and enable safe movement of avifaunal species;
- Prevent the direct and indirect loss and disturbance of avifaunal species and community (including potentially occurring species of conservation concern); and
- Follow the guidelines for interpreting Site Ecological Importance (SEI).

TABLE 21-1 SUMMARY OF MANAGEMENT OUTCOMES PERTAINING TO IMPACTS TO AVIFAUNA AND THEIR HABITATS

Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	**Responsible Party**	**Aspect**	**Frequency**
Management outcome: Avifauna				
Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	**Responsible Party**	**Aspect**	**Frequency**
• All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting avifauna species, and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.	Life of operation	Environmental Officer	Evidence of trapping etc	Ongoing
• The duration of the construction must be kept to a minimum to avoid disturbing avifauna.	Construction/Operational Phase	Project Manager Environmental Officer	Construction/Closure Phase	Ongoing
• Outside lighting must be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (red/green) lights should be used wherever possible.	Construction/Operational Phase	Project Manager Environmental Officer Design Engineer	Light pollution and period of light.	Ongoing
• All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (50 km/h), to respect all forms of wildlife. Speed limits must be	Life of Operation	Health and Safety Officer	Compliance to the training.	Ongoing

Impact Management Actions	Implementation		Monitoring	
	Phase	**Responsible Party**	**Aspect**	**Frequency**
enforced to ensure that road killings and erosion is limited.				
• All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region.	Construction/Operational Phase	Project Manager Environmental Officer	Noise	Ongoing
• All areas to be developed must be walked through prior to any activity to ensure no SCC nests or avifauna species are found in the area. Should any SSC be found and not move out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.	Construction	Environmental Officer	Presence of avifauna species and nests	During Phase
• Infrastructure must be consolidated where possible in order to minimise the amount of ground and air space used.	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of bird collisions	During phase
• All infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution	Planning and Construction	Environmental Officer Contractor Engineer	Presence of electrocuted birds	During phase
• Use environmentally friendly cleaning and dust suppressant products	Construction and Operation	Environmental Officer Contractor Engineer	Chemicals used	During phase
• Fencing mitigations: - Top 2 strands must be smooth wire; - Routinely retention loose wires; - Minimum 300 mm between wires; and - Place markers on fences.	Life of Operation	Project Manager Environmental Officer Contractor Design Engineer	Presence of birds stuck /dead in fences Monitor fences for slack wires	During phase

Impact Management Actions	Implementation		Monitoring	
	Phase	**Responsible Party**	**Aspect**	**Frequency**
• As far as possible power cables within the PAOI should be thoroughly insulated and preferably buried.	Construction and Operation	Project Manager Environmental Officer Design Engineer	Exposed cables	During phase
• Any exposed parts must be covered (insulated) to reduce electrocution risk	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
• The BESS must be enclosed in a structure with a non-reflective surface	Construction and Operation	Project Manager Environmental Officer Design Engineer	Reflective surfaces on BESS	During phase
• Post-construction monitoring should follow the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017). If monitoring results indicate excessive bird fatalities, then adaptive mitigations should be implemented. Before implementation, these should be discussed with the avifaunal specialist and ECO and could include the retrofitting/incorporation of additional visual cues/diverters to existing PV panels/infrastructure.	Operational	Project Manager Environmental Officer Design Engineer	Presence of dead birds in the project site. Monitoring must be undertaken in accordance with the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017). The precise location of any dead birds found should be recorded and mapped (using GPS). All carcasses should be photographed as found then placed in a plastic bag, labelled as to the location and date, and preserved (refrigerated or frozen) until identified. Feather spots	During phase. The monitoring frequency is based on the collision rate.

Impact Management Actions	Implementation		Monitoring	
	Phase	**Responsible Party**	**Aspect**	**Frequency**
			(e.g., a group of feathers attached to skin) and body parts should also be collected.	
• Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of bird collisions	During phase
• All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution	Planning and Construction	Environmental Officer Contractor Engineer	Presence of electrocuted birds	During phase
• Any exposed parts must be covered (insulated) to reduce electrocution risk	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
• Overhead cables/lines must be fitted with bird diverters or flappers.	Operational	Project Manager Environmental Officer Design Engineer	Collisions. Monitoring must be undertaken in accordance with the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017).	During phase. The monitoring frequency is based on the collision rate.
• All infrastructure including powerlines must be removed if the facility is decommissioned	Closure/Rehabilitation	Project Manager Environmental Officer	Infrastructure removal	During Process

22. HERITAGE MANAGEMENT AND MONITORING PLAN

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camp areas and small-scale infrastructure development associated with the project. During the construction phase, it is important to recognize any significant material being unearthed, making the correct judgment on which actions should be taken.

Table 22-1 presents the required mitigation measures and the respective timeframes, targets, and performance indicators pertaining to the Heritage component.

TABLE 22-1 HERITAGE MANAGEMENT PLAN FOR EMPR IMPLEMENTATION

Area and site no.	Mitigation measures	Phase	Timeframe	The responsible party for implementation	Monitoring Party (frequency)	Target	Performance indicators (monitoring tool)
General project area	Implement a chance to find procedures in case where possible heritage finds are uncovered.	Construction	During construction	Applicant ECO Heritage Specialist	ECO (monthly / as or when required)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 34-36 and 38 of NHRA	ECO Monthly Checklist/Report
Palaeontological resources	Implement a chance to find protocol. If fossil remains or trace fossils are discovered during any phase of construction, either on the surface or exposed by excavations the Environmental Control Officer (ECO) in charge of these developments must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021	Construction	During Construction	Applicant Environmental Control Officer (ECO)	Monthly	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 36 and 38 of NHRA	ECO Monthly Checklist/Report

Area and site no.	Mitigation measures	Phase	Timeframe	The responsible party for implementation	Monitoring Party (frequency)	Target	Performance indicators (monitoring tool)
	462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation can be carry out by a palaeontologist						

23. VISUAL MANAGEMENT AND MONITORING PLAN

The following visual measures are suggested for the Project:

PLANNING AND SITE DEVELOPMENT

- With the preparation of the land within the full extent of the site and servitude onto which activities will take place, the minimum amount of existing vegetation and topsoil should be removed.
- Specifications with regards to the placement of construction camps (if required), as well as a site plan of the construction camp, indicating waste areas, storage areas and placement of ablution facilities, should be included in the EMPr. These areas should either be screened or positioned in areas where they would be less visible from the public road north of the Project site.
- Construction activities should be limited to between 08:00 and 17:00 or in conjunction with the ECO.
- Adopt responsible construction practices that strictly contain the construction/establishment activities to demarcated areas.
- Building or waste material discarded should be undertaken at an authorised location, which should not be within any sensitive areas.

EARTHWORKS AND VEGETATION

- Earthworks should be executed so that only the footprint and a small 'construction buffer zone' around the proposed activities are exposed. In all other areas, the naturally occurring vegetation should be retained, especially along the periphery of the site(s) where they are adjacent to public roads.
- Disturbed soil must be exposed for the minimum time possible once cleared of vegetation to avoid prolonged exposure to wind and water erosion and to minimise dust generation.
- Maintain a 10m vegetative buffer (of existing and/or established indigenous trees) outside the project footprint and along the adjacent public roads to restrict visibility and to shield against potential glare to motorists.

LANDSCAPING AND ECOLOGICAL APPROACH

- Where new vegetation is proposed to be introduced to the site, an ecological approach to rehabilitation, as opposed to a horticultural approach should be adopted. For example, communities of indigenous plants will enhance biodiversity, a desirable outcome for the area. This approach can significantly reduce long-term costs as less maintenance would be required over conventional landscaping methods as well as the introduced landscape being more sustainable.
- Progressive rehabilitation of all construction areas should be conducted immediately after they have been established.
- Undertake planting of screening vegetation along the boundaries of the Project site where required i.e. where there are open views from the adjacent public roads to the arrays or an adjacent sensitive receptor. Retain and maintain all existing vegetation outside the project footprint.

MOUNTING STRUCTURES AND ASSOCIATED INFRASTRUCTURE

- Where required, paint the outer rows, which face sensitive viewing sites/public roads, of the mounting structures with a dark colour that reflects and compliments the colours of the surrounding landscape.
- Ensure the perimeter fence is of a 'see through' variety and that its colour blends with the environment.

GOOD HOUSEKEEPING

- "Housekeeping" procedures should be developed for the Project to ensure that the Project site and lands adjacent to the Project site are kept clean of debris, garbage, graffiti, fugitive trash, or waste generated onsite; procedures should extend to control of "track out" of dirt on vehicles leaving the active construction site and controlling sediment in *stormwater* runoff and the proposed wetlands.
- During construction, temporary fences surrounding the material storage yards and laydown areas should be covered with 'shade' cloth (khaki coloured).
- Operating facilities should be actively maintained during operation.

LIGHTING

Light pollution is largely the result of bad lighting design, which allows artificial light to shine outward and upward into the sky, where it is not wanted, instead of focusing the light downward, where it is needed. Ill-designed lighting washes out the darkness of the night sky and radically alters the light levels in rural areas where light sources shine as 'beacons' against the dark sky and are generally not wanted.

Of all the pollutions faced, light pollution is perhaps the most easily remedied. Simple changes in lighting design and installation yield immediate changes in the amount of light spilled into the atmosphere. The following are measures that must be considered in the lighting design of the Project, particularly at the management and service platforms:

- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the site i.e. lights (specifically spotlights) are to be aimed away from the nearby farmsteads (north west and south of the site), the east-west arterial road and the local feeder farm roads.
- Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the site.
- Minimise the number of light fixtures to the bare minimum, including security lighting.

24. CONCLUSION

In terms of the National Environmental Management Act 107 of 1998, as amended, everyone is required to take reasonable measures to ensure that they do not pollute the environment. Reasonable measures include informing and educating employees about the environmental risks of their work and training them to operate in an environmentally acceptable manner.

Although all foreseeable actions and potential mitigation measures and management actions are contained in this document, the EMPr should be seen as a day-to-day management document. The EMPr thus sets out the environmental and social standards, which would be required to minimise the negative impacts and maximise the positive benefits of the Boshoek Solar 1. The EMPr could thus change daily, and if managed correctly lead to successful construction and operational phases of the development.

Furthermore, in terms of the 'Act', the cost to repair any environmental damage shall be borne by the person responsible for the damage. It is therefore imperative that the management plan is successfully implemented, as a failure to comply could have legal implications. The environmental impacts on the site will not be significant if the construction management is well implemented, and a set of operational guidelines are developed by the long-term site management body.

APPENDIX A GENERIC EMPR FOR SUBSTATION INFRASTRUCTURE

APPENDIX B GENERIC EMPR FOR OVERHEADPOWERLINE STRUCTURE

APPENDIX C EMPR FIGURES

FIGURE 24-1 BOSHOEK 1 SEF ENVIRONMENTAL SENSITIVITY MAP

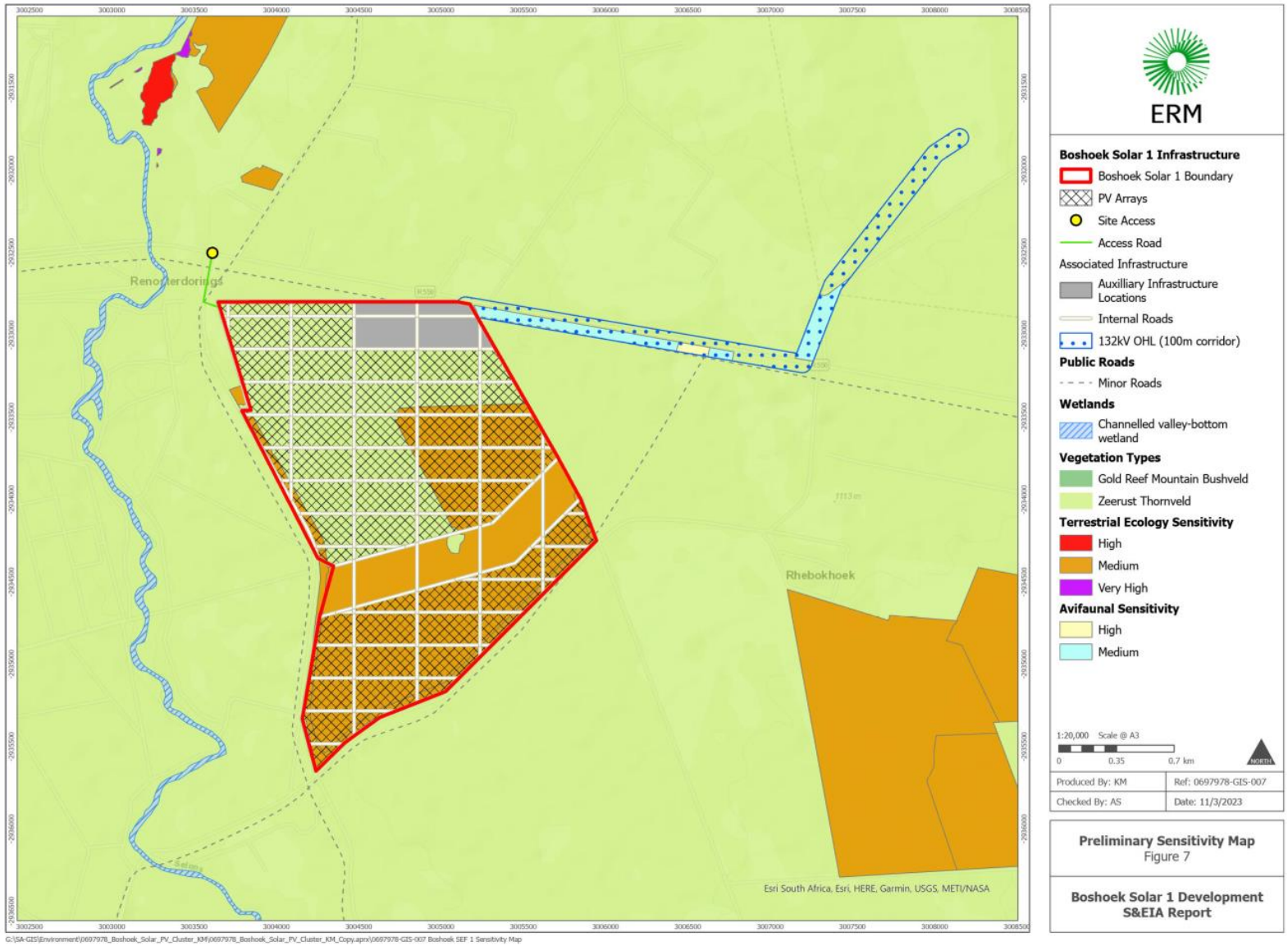
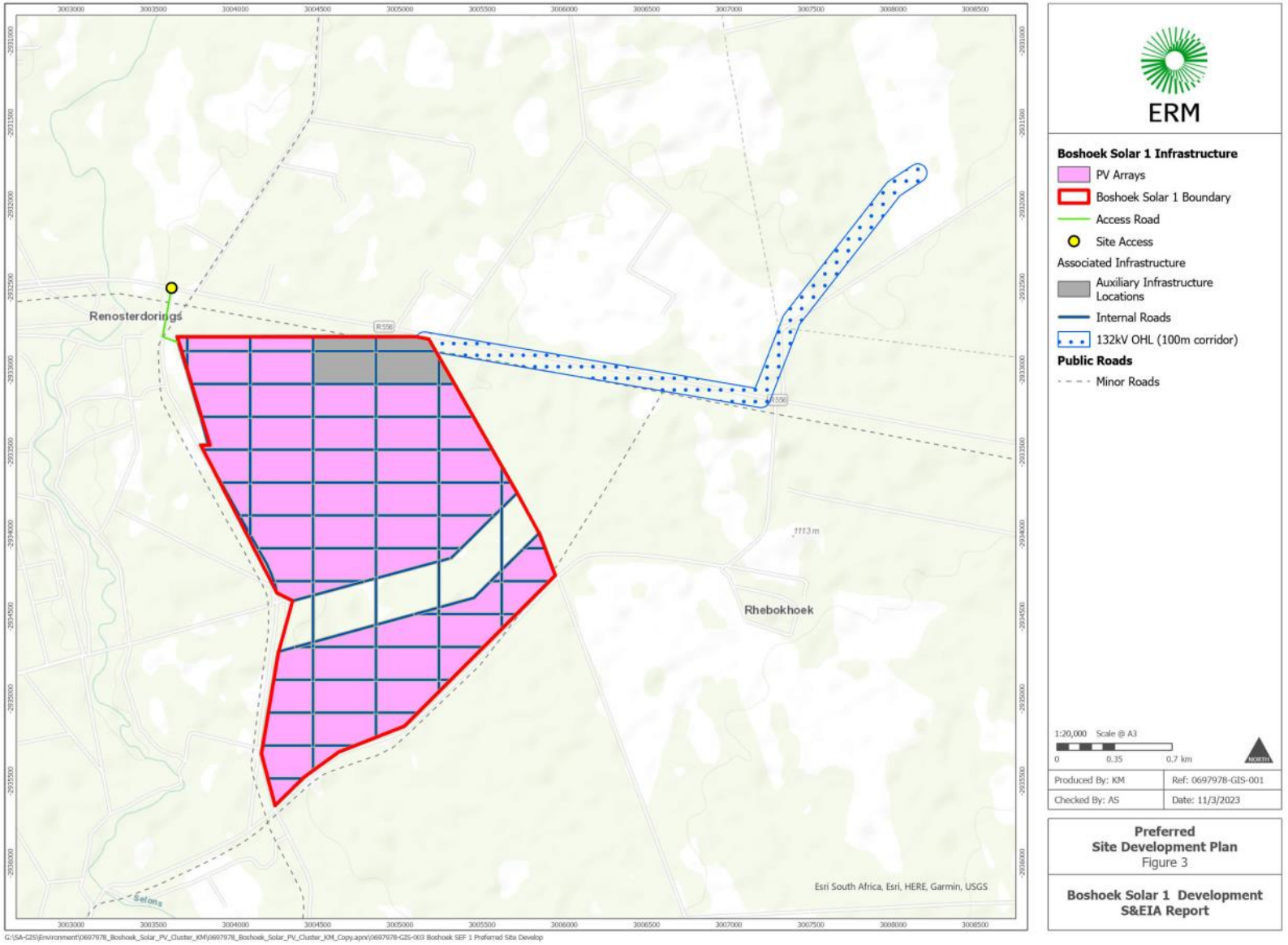


FIGURE 24-2 BOSHOEK 1 SEF FINAL SITE LAYOUT



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