APPENDIX B

ENVIRONMENTAL MANAGEMENT PROGRAMME

for the

PROPOSED LOXTON WIND ENERGY FACILITY 2, NEAR LOXTON IN THE NORTHERN CAPE PROVINCE

On behalf of

LOXTON WIND FACILITY 2 (PTY) LTD

DFFE REFERENCE: 14/12/16/3/3/2/2237

JUNE 2023

Prepared by:

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QUALITY MANAGEMENT SYSTEM

Issue/Revision	**First Issue**	**Revision 1**	**Revision 2**
Version Number	Version 1-0		
Date	17 March 2023		
Arcus Review and Approval	Ashlin Bodasing		
Signature			
ERM Review and Approval	Dieter Rodewald		
Signature	-		

Glossary of Terms

Construction Phase: The activities pertaining to the preparation for and the physical construction of the proposed development

Contractor: Persons/organisations contracted by the Developer to carry out parts of the work for the proposed project

Engineer / Project Director (PD): Person/organisation appointed by the Developer to oversee the work of all consultants, sub-developers, contractors, residents and visitors.

Environment: The environment is defined as the surroundings within which humans exist and that are made up of – the land, water and atmosphere of the earth; micro-organisms, plant and animal life; any part or combination of (i) and (ii) and the interrelationships among and between them; and the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental and Social Manager (ESM) also known as the Environmental Control Officer (ECO): Person/organisation appointed by the Developer who will provide direction to the Principal Agent concerning the activities within the Construction site. The ECO will also be responsible to liaise with the independent auditor who will conduct an environmental audit during the construction phase of the project according to the provisions of the Environmental Management Programme.

Independent Auditor: The person or entity who will conduct an environmental audit during the construction phase of the project according to the provisions of the Environmental Management Programme and Environmental Authorisation.

Environmental Management Programme (EMPr): The EMPr is a detailed plan for the implementation of the mitigation measures to minimise negative environmental impacts during the life-cycle of a project. The EMPr contributes to the preparation of the contract documentation by developing clauses to which the contractor must adhere for the protection of the environment. The EMPr specifies how the construction of the project is to be carried out and includes the actions required for the Post-Construction Phase to ensure that all the environmental impacts are managed for the duration of the project's life-cycle.

Therefore the EMPr will be a working document, which will be reviewed when necessary, or if required by the authorities. A revision will be done once the detailed design of the proposed development has been completed.

Operational Phase (Post Construction): The period following the Construction Phase, during which the proposed development will be operational.

Pre-Construction Phase: The period prior to commencement of the Construction Phase, during which various activities associated with the preparation for the Construction Phase: detailed final designs, micro siting, etc. will be undertaken.

Rehabilitation: Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (where possible) which it was before disruption. Rehabilitation for the purposes of this specification is aimed at post-reinstatement revegetation of a disturbed area and the insurance of a stable land surface. Revegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment.

Site Manager: The person, representing the Contractor, responsible for all the Contractor's activities on the site including supervision of the construction staff and activities associated with the Construction Phase.

Project Area: This refers to the authorised area for the proposed development to take place. Farm portions numbers are outline in the EMPr.

Local Community: People residing or present in the region and near the construction activities, including the owners and/or managers of land affected by construction, workers on the land, and people in nearby towns and villages.

Public: Any individual or group concerned with or affected by the Project and its consequences, including the local community, local, regional, and national authorities, investors, workforce, customers, consumers, environmental interest groups, and the general public.

Construction Area / Site: The land on which the Project is to be located. It includes the site, construction campsite, access roads and tracks, as well as any other area affected or disturbed by construction activities. The EMPr (particularly the specifications for rehabilitation) is relevant for all areas disturbed during construction.

Access Roads and Tracks: All newly established roads and tracks, and areas cleared or driven over to provide access to/from the construction areas, and for the transportation of the construction workforce, equipment and materials.

Environmental Impact: The effect of an activity on the environment, whether desirable or undesirable. Undesirable or negative environmental impacts will result in damage and/or pollution of, or detriment to the environment, or in danger to the public, whether immediate or delayed.

Environmental Incident: An unexpected or sudden occurrence related to the Project, including major emissions, spills, fires, explosions, floods or erosion leading to serious or potentially serious negative environmental impacts.

Fugitive Dust: Can be defined as natural and/or human-associated dust becoming airborne due to the forces of wind or human activity.

Fauna and Flora / Plants and Animals: Any individual or group of micro-organisms, plants or animals.

General Waste and Construction Rubble It includes waste paper, board, cardboard, benign organic and domestic waste and uncontaminated construction debris such as used bricks, wood, waste concrete, unused subsoil and rubble from excavations or demolished structures.

Heritage Sites and Artefacts: Heritage sites and artefacts can be defined as any object or site of cultural, historical, archaeological or palaeontological significance found in or on the land. Historical objects are objects older than 50 years with architectural, historical, scientific, cultural, social, spiritual, linguistic, technological or aesthetic value. For example: buildings or parts thereof, graves or burial sites, milestones, numismatic objects (i.e. coins and beads), and military objects.

Archaeological objects include material remains resulting from human activity which are older than 100 years and which are in a state of disuse, such as tools, artefacts, human and hominoid remains and artificial features and structures.

Palaeontological objects include any fossilised remains of animals or plants.

Hazardous Substances: Substances which are potentially dangerous and may affect human and/or environmental health. This would be because of the substances' inherent chemical and physical composition, which could be toxic, poisonous, flammable, explosive, carcinogenic or radioactive. Hazardous waste includes, but is not limited to: human excrement, the by-products and wastes associated will the use of hazardous substances (i.e. used fuel, oil, lubricants and solvents), as well as items such as spent batteries, old oil filters, light bulbs, tyres, circuit boards, etc. which requires special collection and handling. When left abandoned, even substances such as scrap metal, wire, tins, broken glass and plastic could be harmful to people, wild and domestic animals. For example: plastic could be ingested by animals; people and animals could be injured by broken glass or metal objects; and animals could get trapped in drums, tins and bottles or get entangled in plastic or metal wiring. Even if buried, such objects may become exposed over time due to wind erosion, scavengers or future human activities. Because of the sensitive nature of the area, these substances are all regarded as 'hazardous waste' for the purposes of this EMPr.

Hydrological Features: Hydrological features include, but are not limited to:

- wetlands;
- open water;
- vegetated drainage channels;
- subterranean water;
- marine environments;
- estuarine environments.

Life Support Systems: Life support systems include, but are not limited to: an ecological system in which its outputs are vital for sustaining specialised habitats; an ecological system in which its outputs are vital for sustaining human life (e.g. water purification).

Mitigation: Environmental management measures designed to avoid, limit or remedy undesirable environmental impacts.

Monitoring: Structured observation, measurement and evaluation of environmental data over a period of time to assess the efficiency of environmental mitigation and rehabilitation measures.

Rehabilitation: Measures implemented to restore a damaged Environment.

Sensitive Sites: Environmentally sensitive sites include, but are not limited to:

- Areas with high conservation value due to the presence of important plant specimens, pristine habitats, high biodiversity, important water resources or heritage features and artefacts;
- Areas particularly prone to erosion once disturbed (i.e. steep slopes);

- Vulnerable areas with low potential for rehabilitation / slow rate of recovery (i.e. rock outcrops, steep slopes); and
- Areas in close proximity of sensitive receptors, such as farm homesteads, viewpoints or tourist stopovers.

Specialised habitats: Specialised habitats include, but are not limited to, areas which are:

- Priority breeding habitats;
- Refuge areas;
- Vital for species survival (important for, part, or all of its life cycle);
- Essential for species performance;
- Cryptic habitats, etc.

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1 INTRODUCTION

Loxton Wind Facility 2 (Pty) Ltd ('the Project Applicant') is applying for environmental authorisation to construct and operate the up to 480 MW Loxton Wind Energy Facility (WEF) 2 and its associated on-site substation and battery energy storage system. Hereafter the proposed Loxton WEF 2 and its associated infrastructure will be referred to as the 'proposed development'.

The proposed development is located approximately 17 km north of the town of Loxton within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus' – an ERM group company) have been appointed by the Project Applicant to compile and submit the Environmental Management Programme (EMPr) to the Department of Forestry, Fisheries and the Environment (DFFE) as part of the Environmental Impact Assessment (EIA) process for the proposed development.

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

Details of the Developer (Applicant)	
Project Applicant	Loxton Wind Facility 2 (Pty) Ltd
Company Registration	2021/485195/07
Contact Person	Unai Urtasun
Postal Address	PO Box 1730, Welgemoed, Cape Town, Western Cape
Telephone	-
Email	unai.bravo.urtasun@acciona.com
Environmental Assessment Practitioner	
EAP	Ashlin Bodasing
Organisation	Arcus Consultancy Services South Africa (Pty) Ltd (an ERM group company)
Qualifications	Bachelor of Social Science (Geography and Environmental Management) Registered EAP (EAPASA 2020/780)
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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.

This EMPr will be updated to include inputs from interested and affected parties (I&APs) during the public review and comment period. Moreover, 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.

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 3
(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 - 27
(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-* *(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;*	Section 4 - 27
(g)	*the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);*	Section 4 - 27
(h)	*the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);*	Section 4 - 27
(i)	*an indication of the persons who will be responsible for the implementation of the impact management actions;*	Section 4 - 27
(j)	*the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;*	Section 4 - 27
(k)	*the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);*	Section 4 - 27
(l)	*a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;*	Section 4 - 27
(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 - 27

Appendix 4 Requirements NEMA, 1998 (Act No. 107 of 1998)		EMPr Reference
(n)	*any specific information that be required by the competent authority.*	Section 4 - 27

2 THE PROPOSED LOXTON WEF 2 DEVELOPMENT

The proposed Loxton WEF 2 is located approximately 17 km north east of Loxton within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

The proposed development will consist of:

- Up to 61 wind turbines with a maximum hub height of up to 160 m and a rotor diameter of up to 200 m;
- A transformer at the base of each turbine;
- Concrete turbine foundations with a permanent footprint of approximately 9.1 ha;
- Each turbine will have a crane hardstand of 70 m x 45 m. The permanent footprint for turbine hardstands will be up to approximately 20 ha.
- Each turbine will have a temporary blade hardstand of 80 m x 45 m. The temporary footprint for blade hardstands will be up to approximately 23 ha.
- Temporary laydown areas (with a combined footprint of up to approximately 38 ha) which will accommodate the boom erection, storage and assembly area;
- Battery Energy Storage System (with a footprint of up to 5ha);
- One construction period laydown areas (temporary) up to 6 ha each;
- Medium voltage (33 kV) cables/powerlines running from wind turbines to the facility substations. The routing will follow existing/proposed access roads and will be buried where possible.
- One on-site substations up to 4 ha in extent to facilitate the connection between the wind farm and the electricity grid;
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 15 m road corridor may be temporarily impacted upon during construction and rehabilitated to 8 m wide after construction. The WEF will have a total road network of up to 100 km.
- A temporary site camp establishment and concrete batching plant (with a combined footprint of up to 2 ha); and
- Operation and Maintenance buildings (each with a combined footprint of up to 2 ha) including a gate house, security building, control centre, offices, warehouses, parking bays, storage facility and a workshop.
- Total permanent development footprint of up to 110 ha.

2.1 Loxton WEF 2 Components

The WEF will comprise components described below. It should be noted that as the design of the proposed development is not yet finalised, all dimensions are maximums 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 Wind Turbine Generators and Hardstand Areas

The proposed WEF will comprise of up to 61 turbines.

At this stage, it is envisaged that the turbines will each have a capacity to generate up to 8 MW of power. The turbines will be three-bladed horizontal-axis design with a hub height of up to 160 m, a rotor diameter of up to 200 m and a blade length of up to 100 m. The exact turbine model has not yet been selected and will be identified based on the wind resource distribution, technical, commercial and site-specific considerations.

The turbine rotor speed will vary according to the energy available in the wind, the wind speed. The turbines will generate power in wind speeds between approximately 3 metres per second (m/s) and 28 m/s (depending on the model of turbine) with maximum power output usually achieved at wind speeds of around 10 - 12 m/s. On average, wind speeds greater than approximately 25 m/s the turbines will automatically turn the angle of the blade to reduce energy capture (this is known as 'feathering') and stop turning to prevent damage.

Each turbine will require a transformer that will be located at the base of the turbine.

Each turbine will have a circular foundation with a diameter of up to 32 m and this will be placed alongside the 45 m wide hardstand resulting in an area of about 32 m x 45 m that will be permanently disturbed for the turbine foundation. The combined permanent footprint for the turbine foundations will be approximately 9.1 ha.

Each turbine will have a crane hardstand of 70 m x 45 m. The permanent footprint for turbine hardstands will be approximately 20 ha.

Each turbine will have a blade hardstand of 80 m x 45 m. The temporary footprint for turbine hardstands will be approximately 23 ha.

The precise location of the turbines within the WEF site has not yet been finalised and will be confirmed during the EIA process, following the assessment of technical and environmental constraints.

2.1.2 Electrical Cabling and On-site Substation

Medium-voltage (MV) power lines internal to the WEF will be entrenched and will mostly be located adjacent to the access roads and /or within the footprint of the internal roads to an on-site substation. The 132 kV high-voltage (HV) powerline that transmits power from the Eskom Switching Station on site to the proposed Loxton WEF Cluster Collector Substation (assessed as part of a separate S&EIR) will be strung overhead, supported either on monopole or lattice tower structures. The 400 kV high-voltage (HV) powerline that transmits power from the Loxton WEF Cluster Collector Substation to the Gamma MTS (assessed as part of an application process) will be strung overhead, supported either on lattice tower or cross-rope suspension structures.

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 System

The substation area will also house the battery energy storage system (BESS). The function of the BESS will be to store peak kinetic energy produced by the Loxton WEF 2 for use in the following ways:

- To power the operation of the proposed development when the national grid is strained by high (or peak) demand, often resulting in load-shedding.
- To provide excess generation to the national grid which will assist with stabilizing electricity supply during peaks and troughs of demand.
- To reduce the impact caused by the variability and limited predictability of wind generation.

The preferred battery technology being considered would be Solid-State, Lithium Ion (Li-Ion) batteries, which consists of multiple battery cells that are assembled together to form module. Each cell contains a positive electrode, a negative electrode and an electrolyte. A module may consist of thousands of cells working in conjunction. Modules are normally

packaged inside containers (similar to shipping containers) and these containers are delivered pre-assembled to the project site.

The containers will have approximate dimension ranges of: height 2 m - 5 m, width 1.5 m - 3 m, length 7 m - 20 m. The containers are raised slightly off the ground and are bunded to prevent possible environmental damage resulting from any equipment malfunction. The proposed development is considering the option of stacking these containers vertically to a maximum of two container layers or a height of 8 m.

The BESS storage capacity will be up to 1000 (MWh) with up to four hours of storage, and will be placed on a concrete footprint of up to 5 ha. The BESS will be located in close proximity to the on-site substation, 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 the substation.

2.1.4 Laydown Areas and Site Offices

Individual turbine temporary laydown areas including crane boom laydown areas, blade laydown areas and other potential temporary areas will be up to a maximum of 6000 m^2. A total footprint of approximately 38 ha.

The construction laydown area will be up to 6 ha.

2.1.5 Internal Site Access Roads

Permanent roads will be 8m wide and may require side drains on one or both sides. All roads may have underground cables running next to them. A 15 m wide road corridor may be temporarily impacted during construction and rehabilitated to 8 m wide after construction. The WEF will have a total road network of about 100 km (approximately 38 ha). Additional space may be required for cut and fill, side drains, stormwater control measures, turning areas and vertical and horizontal turning radii to ensure safe delivery of the turbine components. The specialists have assessed all proposed internal service roads during the EIA Phase.

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.

Loxton Wind Facility 2 (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 borehole 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.

High water use is only anticipated during the first six-twelve months of the construction phase mainly for purposes of the turbine foundations, roads and dust suppression. Thereafter the water usage will decrease drastically. The anticipated water usage for the proposed development 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 WEF infrastructure, i.e., turbines and substation, etc.

The water use requirement during the operational phase will be primarily for human consumption and sanitation purposes.

2.2.3 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 waste water will be handled in accordance with the *Guidelines for the Utilisation and Disposal of Wastewater Sludge Volumes 1 to 6 (Herselmann & Snyman, 2006)*.

2.2.4 Waste

During the construction phase, it is estimated that the Wind Energy Facility 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 Wind Energy Facility 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.

2.2.5 Sewage

The Wind Energy Facility 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.

2.2.6 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

WEF Technical Details

WEF Technical Details Components	Description/Dimensions
Maximum Generation Capacity	Up to 480 MW
Type of technology	Onshore Wind
Number of Turbines	Up to 61
WTG Hub Height from ground level	Up to 160 m
Blade Length	Up to 100 m
Rotor Diameter	Up to 200 m
Structure height (Tip Height)	Maximum of 260 m tip height
Structure orientation	Vertical towers with 3 blades attached
Area occupied by both permanent and construction laydown areas	• Concrete turbine foundations with a permanent footprint 9.1 ha; • Each turbine will have a crane hardstand of 70 m x 45 m. The permanent footprint for turbine hardstands will be up to 20 ha. • Each turbine will have a temporary blade hardstand of 80 m x 45 m. The temporary footprint for blade hardstands will be up to 23 ha. • Temporary laydown areas (with a combined footprint of up to 38 ha) which will accommodate the boom erection, storage and assembly area; and • A temporary site camp establishment and concrete batching plants (with a combined footprint of up to 2 ha).
Operations and maintenance buildings (O&M building) with parking area	Up to 2 ha including a gate house, security building, control centre, offices, warehouses, a workshop and visitor's centre.

WEF Technical Details Components	Description/Dimensions
Site Access	Access roads to the site and between project components inclusive of stormwater infrastructure. A 15 m road corridor may be temporarily impacted upon during construction and rehabilitated to 8 m wide after construction. The WEF will have a total road network of up to 100 km.
Area occupied by inverter transformer stations/substations	Up to 2 ha
Capacity of on-site substation	132 / 400 kV
Battery Energy Storage System footprint	Footprint of up to 5 ha
Length of internal roads	Up to 100 km
Width of internal roads	8 - 12 m including road reserve.
Proximity to grid connection	100 km, depending on the preferred alternative route (separate application process is being followed for the grid connection).
Internal Cabling	Up to 33kv medium voltage electrical cabling between the turbines, to be laid underground where practical
Height of fencing	Up to 5 m
Type of fencing	Palisade fencing or similar

Proposed Loxton WEF 2 Site Boundary			
Reference Point	**Aspect**	**Latitude**	**Longitude**
03	North West Corner	31°16’52.51”S	22°18’50.13”E
05	South West Corner	31°18’53.53”S	22°21’28.65”E
09	South East Corner	31°17’19.56”S	22°25’53.07”E
12	North East Corner	31°14’16.99”S	22°27’18.18”E
Proposed Loxton WEF 2 Preferred Supporting Infrastructure Centre point			
A	Construction Laydown Area	31°17'1.68"S	22°22'42.00"E
B	O&M Building	31°17'8.64"S	22°22'44.09"E
C	On-site Substation	31°17'6.45"S	22°22'53.42"E
D	BESS	31°17'5.95"S	22°22'56.19"E
E	Parking Bays	31°17'0.45"S	22°22'50.86"E
F	Site Camp	31°16'59.13"S	22°22'49.76"E

G	Storage Area	31°16'56.32"S	22°22'42.81"E
H	Batching Plant	31°16'58.57"S	22°22'37.61"E

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 1998, EIA Regulations 2014, as amended, Listed Activities in relation to the Loxton WEF 2 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 proposed Loxton WEF 2 will entail the construction of a 33 kV / 132 kV on-site substation hub incorporating the facility substation, switchyard and collector infrastructure with a footprint of up to 2ha. All internal cables have a capacity of 33kV. The proposed Loxton WEF 2 will be constructed across various farm portions located approximately 17 km north east of Loxton within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.
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 proposed Loxton WEF 2 will entail the construction of built infrastructure and structures (such as wind turbines, hardstands, offices, Operations and Maintenance (O&M) buildings, 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 (i) a watercourse;*	The proposed Loxton WEF 2 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. As a result, the proposed Loxton WEF 2 could potentially entail the infilling of more than 10 m^3 of material into the nearby watercourses. Details of the infilling of and excavations from the affected watercourses/drainage features will be confirmed during the detailed engineering design phase.

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 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*	A temporary road corridor of up to 12 m will be impacted during the construction phase. This will be rehabilitated after the completion of construction activities to allow for a permanent 8 m wide road surface, with side drains on one or both sides where necessary.
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 developed is bigger than 1 hectare.*	The proposed Loxton WEF 2 will take place outside of an urban area and across several adjoining farm portions, and is considered as a commercial / industrial development, which will have an estimated total development footprint of more than 20 ha. The proposed Loxton WEF 2 will also entail the construction of an onsite substation, as well as a battery energy storage system, and various associated structures and infrastructure of more than 1 ha in total extent.
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 proposed Loxton WEF 2 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 farm access roads will be widened or lengthened. These roads would currently have no road reserve and will be wider than 8 meters in some areas during construction phase of the development.
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 proposed Loxton WEF 2 will comprise a maximum generation capacity of up to 480 MW (i.e., facility 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 proposed development will require clearance of more than 20 hectares of indigenous vegetation.

Listing Notices 1, 2 and 3 **07 April 2017**	**Listed Activity**	**Description of project activity that triggers listed activity**
		The total project development footprint is up to 65 ha.
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* *(g) Northern Cape* *(i) Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical Biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	A 12 m road corridor will be temporarily impacted upon during construction and rehabilitated to 8 m wide after construction. The Loxton WEF 2 will have a total road network of up to 50 km. The site falls outside of an urban area and parts of the site fall within a NPAESF area and Critical Biodiversity Area (CBA) 1 and CBA 2 in the Northern Cape.
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 undertaken in accordance with a maintenance management plan.* *(g) Northern Cape* *(ii) Within critical biodiversity areas identified in bioregional plans;*	The proposed development will require the clearance of natural vegetation in excess of 300 m2 in areas of natural vegetation. A portion of the WEF is located within a CBA 1 and 2 in the Northern Cape. As there are no specific features of very high biodiversity value within the affected polygons and the site actually lies largely within a gap within the NPAES network of the area, the loss of these areas from the NPAES is considered to have low significance.
Listing Notice 3 **GN R 324** Activity 14	*The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback;* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.* *(g) Northern Cape* *(ii) Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted*	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 32m 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 Critical Biodiversity Areas (CBAs) located outside of urban areas. As there are no specific features of very high biodiversity value within the affected polygons and the site actually lies largely within a gap within the NPAES network of the area, the loss of these areas from the NPAES is considered to have low significance.

Listing Notices 1, 2 and 3 07 April 2017	Listed Activity	Description of project activity that triggers listed activity
	by the competent authority or in bioregional plans;	
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.* *(g) Northern Cape* *(ii) Outside urban areas* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Internal access roads will be required to access the wind turbines as well as the respective substation. 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 Northern Cape Province, outside urban areas. The respective proposed development sites contain indigenous vegetation. In addition, the widening of the roads will occur within CBAs and or within 100 m from the edge of a watercourse or wetland.
Listing Notice 3 **GN R 324** **Activity 23**	*The expansion of—* *(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;* *where such expansion occurs—* *(a) within a watercourse;* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *(g) Northern Cape* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	The respective proposed development will entail the development and expansion of roads by $10m^2$ or more within a surface water feature / watercourse or within 32m from the edge of a surface water feature / watercourse. Although the layout of the proposed development 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 proposed developments occur within CBAs, and are 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 Loxton WEF 2.

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.

- 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.
- 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.

- 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.
- Ensuring that the ESO maintains an Incidents Register and Complaints Register on site.

During *operation*, the Environmental Control Officer 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.
- Ensuring that the ESO maintains an Incidents Register and Complaints Register on site.

During *decommissioning*, the Environmental Control Officer will be responsible for:

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

Environmental Site Officer – Nominated Contractor Representative

The ECO must appoint a nominated representative of the contractor as the Environmental Site Officer (ESO). The independent 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.
- Report on any incidents of non-compliance to the ECO and ensure mitigation measures are implemented as soon as practical.

Contractor

An independent 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.
- 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 three 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.
- 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, Environmental Affairs, Rural Development and Land Reform (DAERL), 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 three 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.

- 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.
- 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 this authorisation or any other public authority shall not be held responsible for any damages or losses suffered by the holder of the authorisation or 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 authorisation.

4.7 EMPr Amendments and Instructions

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 MITIGATION MEASURES

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.
- 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.
- No construction camps are allowed on site. 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 storm water 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 draft 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

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

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.
- 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.).
- 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.

- 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 take into account 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 draft 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).
- These 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[2].
- 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.

[2] https://www.nfast.co.za/gallery/fire%20extinguisher%20regulations.pdf

- If fuel is dispensed from 200 litre 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 minimised.
- 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 storm water 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.
- 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.
- 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.

5.4 Final Site Assessment by Specialists

Prior to the submission of the final layout plan to the DFFE for approval, the following specialists must visit the site to assist with micro-siting the final development layout:

- Aquatic specialist;
- Terrestrial Biodiversity specialist;
- Avifaunal specialist;
- Bat specialist; and
- Archaeological specialist.

Following the selection of turbine to be used for the project, the Developer must update the layout plan / site development plan, this together with the final management plans included in this EMPr must be submitted to the DFFE for approval.

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

5.5 Permit Requirements

Activities undertaken during site preparation, construction and operation may require additional permits, over and above the EA. Loxton WEF 2 (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.

5.5.1 Borrow Pits

A borrow pit refers to an open pit where material (soil, sand or gravel rock) is removed for use at another location. Loxton WEF 2 (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. Licenced 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.

5.5.2 Water Use License

The construction of the WEF and roads may result in water crossings. The developer must ensure that Water Use Licences 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.

5.5.3 Heritage, Archaeology and Palaeontology

Should any heritage resources, including evidence of graves and human burials, archaeological material and paleontological material be discovered during the execution of the activities above, all works must be stopped immediately and heritage authorities must be notified without delay.

5.5.4 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.

5.5.5 South African Radio Astronomy Observatory

Although the project poses a low to medium risk of interference to the SKA radio telescope, the applicant is requested to develop an EMI control plan to ensure emissions are reduced by at least 5dB for a hub-height of 200m based on a facility of 55 turbines. No mitigation measures are required for a hub-height of 120m. A permit will not be required if a hub-height of 120m is used provided that the radiated emissions comply with CISPR 11 limits and fall within SARAS compliance margins.

5.6 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.
- Hazardous materials management.

5.7 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.
- 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 turbine 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.
- 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:

- No poaching of any animals or harvesting of any flora;
- No construction camp, for workforce accommodation is allowed on site; contractors are to ensure suitable housing for staff outside of the proposed development footprint.
- No cooking or fires allowed on site; and
- No alcohol or drugs are allowed on site.

Table 6.1 below presents a summary of the potential impacts as assessed by specialists for the construction phase of the WEF.

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	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Freshwater & Wetlands (Aquatics)							
Spread of Alien Vegetation	Local	Long term	Irreversible	Negative	Medium	Probable	Moderate
With Mitigation	*Site*	*Short term*	*Partly reversible*	*Negative*	***Low***	*Possible*	*Low*
Loss of habitat/vegetation	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Loss of Critical Biodiversity Areas (CBAs)	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Loss of riparian habitat	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Changes to the hydrological regime and increase potential for erosion	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Changes to surface water quality	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Bats							
Modification & disturbance of Habitats	Site	Short term	Recoverable	Negative	Low	Probable	Moderate
With Mitigation	*Site*	*Short term*	*Recoverable*	*Negative*	***Low***	*Low Probability*	*Low*
Avifauna							
Destruction of habitat	Site	Long term	Recoverable	Negative	Medium	Highly Probable	Moderate

Construction Phase	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
With Mitigation	*Site*	*Long term*	*Recoverable*	*Negative*	***Medium***	*Highly Probable*	*Moderate*
Disturbance of birds	Local	Short term	Reversible	Negative	Low	Probable	Low
With Mitigation	*Local*	*Short term*	*Reversible*	*Negative*	***Low***	*Probable*	*Low*
Terrestrial Biodiversity							
Disturbance to CBAs and ESAs and habitat loss	Local	Long term	Recoverable	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Long term*	*Recoverable*	*Negative*	***Low***	*Low Probability*	*Low*
Impacts to the value of affected NPAES Focus Areas	Local	Long term	Recoverable	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Long term*	*Recoverable*	*Negative*	***Low***	*Low Probability*	*Low*
Impacts on ecological integrity and Water provision of FEPA catchments	Local	Long term	Recoverable	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Long term*	*Recoverable*	*Negative*	***Low***	*Low Probability*	*Low*
Karoo Dwarf Tortoise							
Habitat loss and degradation	Local	Short-term	Recoverable	Negative	High	Probable	High
With Mitigation	*Local*	*Short-term*	*Recoverable*	*Negative*	***Low***	*Conceivable*	*Moderate*
Tortoise mortalities due to earthworks and roadkill	Local	Long term	Irreversible	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Long term*	*Irreversible*	*Negative*	***Low***	*Conceivable*	*Moderate*
Noise							
Construction of Access Roads	Local	Temporary	High	Negative	Low	Possible	Very High
With Mitigation	*Local*	*Temporary*	*High*	*Negative*	***Low***	*Possible*	*Very High*

Construction Phase	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Traffic Noises	Local	Short-term	High	Negative	Low	Improbable	Very High
With Mitigation	*Local*	*Short-term*	*High*	*Negative*	***Low***	*Improbable*	*Very High*
Daytime WTG construction	Local	Short-term	High	Negative	Low	Improbable	Very High
With Mitigation	*Local*	*Short-term*	*High*	*Negative*	***Low***	*Improbable*	*Very High*
Night-time WTG construction	Regional	Short-term	High	Negative	High	Likely	Very High
With Mitigation	*Regional*	*Short-term*	*High*	*Negative*	***Low***	*Improbable*	*Very High*
Heritage, Archaeology & Palaeontology							
Visual intrusion to the cultural landscape	Regional	Short term	Recoverable	Negative	Medium	Definite	High
With Mitigation	*Regional*	*Short term*	*Recoverable*	*Negative*	***Medium***	*Definite*	*Moderate*
Damage or destruction of archaeological resources	Site	Permanent	Irreversible	Negative	Low	Definite	Low
With Mitigation	*Site*	*Permanent*	*Irreversible*	*Negative*	***Low***	*Low Probability*	*Very Low*
Visual							
Visual effects of construction activities on scenic resources	Local	Short term	Recoverable	Negative	Medium	Definite	Moderate
With Mitigation	*Local*	*Short term*	*Recoverable*	*Negative*	***Medium***	*Highly probable*	*Moderate*
Social							
Creation of employment and business opportunities	Local	Short term	N/A	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Short term*	*N/A*	*Negative*	***Medium***	*Highly probable*	*Moderate*
Presence of construction workers and potential impacts on family structures and social networks	Local	Short term	Recoverable	Negative	Low	Probable	Moderate

Construction Phase	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
With Mitigation	*Local*	*Short term*	*Recoverable*	*Negative*	***Low***	*Probable*	*Low*
Influx of job seekers	Local	Short term	Recoverable	Negative	Low	Probable	Low
With Mitigation	*Local*	*Short term*	*Recoverable*	*Negative*	***Low***	*Probable*	*Low*
Safety risk, stock theft and damage to farm infrastructure associated with presence of construction workers	Local	Short term	Reversible	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Short term*	*Reversible*	*Negative*	***Low***	*Probable*	*Low*
Increased risk of grass fires	Local	Short term	Reversible	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Short term*	*Reversible*	*Negative*	***Low***	*Low Probability*	*Low*
Impact of heavy vehicles and construction activities	Local	Short term	Reversible	Negative	Medium	Probable	Low
With Mitigation	*Local*	*Short term*	*Reversible*	*Negative*	***Low***	*Low Probability*	*Low*
Loss of farmland	Local	Short term	Reversible	Negative	Medium	Highly probable	Moderate
With Mitigation	*Local*	*Short term*	*Reversible*	*Negative*	***Low***	*Probable*	*Low*
Traffic							
Increased Road incidents	Regional	Short term	Irreversible	Negative	Medium	Highly probable	High
With Mitigation	*Regional*	*Short term*	*Irreversible*	*Negative*	***Medium***	*Probable*	*High*
Road Degradation	Regional	Short term	Recoverable	Negative	Medium	Highly probable	Moderate
With Mitigation	*Regional*	*Short term*	*Recoverable*	*Negative*	***Medium***	*Probable*	*Moderate*
Dust	Regional	Short term	Reversible	Negative	Medium	Probable	Moderate
With Mitigation	*Regional*	*Short term*	*Reversible*	*Negative*	***Low***	*Probable*	*Moderate*

Construction Phase	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Intersection Safety	Regional	Short term	Irreversible	Negative	Medium	Highly probable	High
With Mitigation	*Regional*	*Short term*	*Irreversible*	*Negative*	***Medium***	*Probable*	*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 storm water 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 should 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 should 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		
• A pre-construction walkthrough with an aquatic specialist is recommended. Furthermore, the aquatic specialist should assist with the development of the stormwater management plan and the Aquatic Rehabilitation and Monitoring plan, which should inform the micro-siting of the final layout. This of particular importance where the proposed alignments have deviated from existing tracks or roads. • Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. • Suitable stormwater management systems must be installed along roads and other areas, and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). • The aquatic systems have been mapped to a finer scale and have taken cognizance of any potential CBAs, as well as NFEPA river systems.	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
• Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Any unnecessary intrusion into these areas must be prohibited. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences. • Removal of vegetation must only be undertaken if it is essential for the continuation of the project. Disturbance to the adjoining natural vegetation cover or soils should be kept to a minimum. • All pipe culverts should be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that headcut erosion does not develop because of the gradient change from the natural ground level to the invert level of the culvert. • The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown. • Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities. • Any fauna (frogs, snakes, etc.) that are found within the construction area should be relocated to the closest point of similar habitat type outside of the areas to be impacted. • All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas. • Locate access roads further than 15m from verified Noise Sensitive Receptors (NSR) and further than 60m from NSR if the roads are used during the night-time period during the construction phase to reduce effects on surrounding ambient levels. • Construction activities for daytime activities should only be permitted.	Site Engineer ECO / ESO Specialist	Design Phase Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Notify verified NSR when activities take place within 100m from residential dwellings.		
Spread of alien invasion species due to Construction 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. • The revegetation of any temporary sites as well as any previously degraded areas must begin from the onset of the project, with the involvement of a botanist to assist with the revegetation specifications. • Regeneration of alien vegetation must be monitored once all areas have been cleared, forming part of a long-term alien vegetation management plan.	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 discharged may be directed to delineated aquatic zones or the associated buffers. • A detailed stormwater management plan must be compiled prior to construction once the final site layout has been completed. The SWMP should include the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems. • Effective stormwater management must include measures to slow, spread and deplete the energy of concentrated flows thorough effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas	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 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 refuelled or serviced within 100 m of a river channel or wetland. • All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 100 m from any demarcated water courses.	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Littering and contamination associated with construction activity must be avoided through effective construction camp management. • No stockpiling should 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 WEF		
• 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 EO to ensure that any protected plant within the development footprint area are translocated to safety where necessary. • Annual monitoring of erosion and runoff from the roads and hard stands into the adjacent veld to ensure that the hardened surfaces and roads are not generating a lot of runoff that is impacting adjacent natural areas. There should be follow-up erosion control and alien vegetation clearing where required.	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 within the CBAs, ESAs and NPAES Focus Areas should be minimized as far as possible. • Should access roads, internal cables and overhead lines traverse drainage lines and riparian areas mapped as CBAs these should be micro-sited by a suitably qualified ecological and aquatic specialist before construction in that area starts to ensure any potential impacts are minimised. • Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in low sensitivity or previously disturbed areas. • Avoid impact to restricted and specialised habitats such as pans, wetlands and rock pavements. The final development footprint to be authorised should be checked for such sensitive features in the field, such that there is a high degree of confidence that the final layout avoids such features so that significant changes to turbines or roads are not required at the preconstruction phase.	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.
Impacts on NFEPA Catchments during the construction phase		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Disturbance within or near the drainage lines should be kept to a minimum and any disturbance in these areas should be rehabilitated as quickly as possible. • An erosion monitoring programme should be put in place for at least 3 years after construction. Any problems observed should be rectified as soon as possible using the appropriate revegetation and erosion control works.	Site Engineer ECO / ESO Specialist	Throughout Construction and After Construction
Impacts to Karoo Dwarf Tortoise during the construction of the WEF		
• The development must avoid areas identified as prime Karoo Dwarf Tortoise habitat. • Access to areas outside of the construction footprint during construction must be limited to minimise additional habitat degradation • Limit construction activities to within the defined development footprints to minimise the chances of killing tortoise inadvertently. The site ECO would have to make sure that the contractors and vehicles stay away from sensitive areas, i.e., that they will stay on roads and demarcated construction sites. • Incorporate special design features in consultation with the ecologist or herpetologist, to on-site roads to provide safer options for tortoises to minimise the potential of roadkill mortalities, where appropriate. • All vehicles must adhere to a low-speed limit, i.e. 40 km/h on site and in areas where Karoo Dwarf Tortoises are likely to be present, both within the wind farm as well as on the public roads to the site.	Site Engineer ECO / ESO	Throughout Construction Phase
Modification to habitats and disturbance to bats during the construction phase		
• Limit potential for bats to roost in project infrastructure (e.g., buildings, turbines, road culverts) by ensuring they are properly sealed such that bats cannot gain access. • No construction activities at night. • No placement of permanent infrastructure (except roads and MV Cabling) in no-go areas. • Avoid blasting where it would destroy rocky outcrops and minimise clearing of vegetation • Minimise disturbance and destruction of rocky outcrops, trees and buildings, and where it is required, the features should be examined for roosting bats by a qualified bat ecologist. • Apply good construction abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during construction.	Site Engineer ECO / ESO Specialist	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Rehabilitate all areas disturbed during construction (including aquatic habitat).		
Impacts of construction traffic noises on Noise-Sensitive Receptors		
• Locate access roads further than 15 m from verified NSR, unless permission is obtained from the occupant of the specific NSR and further than 60m from NSR if the roads may be used during the night-time period; and • Permit construction activities only during the daytime period if the roads are closer than 60 m from NSR.	Site Engineer ECO / ESO	Throughout Construction Phase
Impacts of WTG construction activities on Noise-Sensitive Receptors		
• The significance of the noise impact is low for daytime construction activities and no additional mitigation is required or recommended. • Minimize night-time activities when working within 2,000m from any structure used for residential purposes. Work should only take place at one WTG location to minimize potential night-time cumulative noises (when working at night within 2,000m from NSR used for residential purposes). • The applicant must notify the NSR when night-time activities will be taking place within 1,000m from the NSR. • The applicant must plan the completion of noisiest activities (such a pile driving, rock breaking and excavation) during the daytime period (even though it is expected that it is highly unlikely that this may take place at night).	Site Engineer ECO / ESO Developer	Throughout Construction Phase
Potential impacts to stormwater during the construction phase		
• Existing flood lines / wetlands / stormwater attenuation areas should 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.	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• All-natural and unlined channels should be inspected for adequate soil binding by sustainable ground cover. Stone pitching should be used to reinforce channel inverts on steep slopes.		
Impacts on Archaeological and Palaeontological resources during the construction phase		
• Avoid the ruin at waypoint 1238 or conduct archaeological excavation and documentation of the site. • Conduct pre-construction survey of the full layout, including all ancillary infrastructure. The survey will make specific recommendations for any further mitigation (avoidance or sampling) that might be required. • Once alerted to fossil occurrence: alert site foreman, stop work in area immediately, safeguard site with security tape. ECO to record accurate geographic location, describe position of fossils and photograph fossils in situ. • If feasible to leave fossils in situ: ◦ Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation ◦ Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume • If not feasible to leave fossils in situ: ◦ Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock) ◦ Photograph fossils against a plain, level background, with scale ◦ Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags ◦ Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist ◦ Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation • If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer. • A qualified palaeontologist responsible for mitigation work must apply for a Fossil Collection Permit for the Northern Cape SAHRA.	Site Engineer ECO / ESO Developer Specialist	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency • 38(4)a – The SAHRA Development Applications Unit (DAU) has no objections to the proposed development; • 38(4)b- The recommendations of the specialists are supported and must be adhered to. Further additional specific conditions are provided for the development as follows: • A no-go buffer of 5 m must be maintained around site 1238; • A report detailing the results of the pre-construction survey must be submitted to SAHRA for review and comment prior to the construction phase. No construction may occur without comments from SAHRA in this regard; • 38(4)c(i) – If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA DAU (Natasha Higgitt 021 202 8660) must be alerted as per section 35(3) of the NHRA. Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule; • 38(4)c(ii) – If unmarked human burials are uncovered, the SAHRA DAU (Natasha Higgitt 021 202 8660) must be alerted immediately as per section 36(6) of the NHRA. Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule; • 38(4)d – See section 51(1) of the NHRA regarding offences; • 38(4)e – The following conditions apply with regards to the appointment of specialists; • i) If heritage resources are uncovered during the course of development, a professional archaeologist or palaeontologist, depending on the nature of the finds, must be contacted as soon as possible to inspect the heritage resource. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to the permits issued by SAHRA.		
Impacts to the cultural landscape during the construction phase		
• Keep construction period as short as possible. • Minimise landscape scarring by minimizing cut and fill and ensuring rehabilitation of all areas not required during operation. • Use low contrast materials for road surfacing where required.	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Place ancillary infrastructure (substations, offices, etc) in low visibility areas		
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. • Recycling and refuse bins to be provided to eliminate litter from the site.	Site Engineer ECO / ESO	Throughout Construction Phase
Impacts of dust and road traffic incidents during construction activities		
• Post relevant road signage along affected routes; • Create local WhatsApp Group, notifying other road users of expected deliveries and associated routes. • Transport Management Plan (TMP) is to be compiled once the contractor has been appointed and all the relevant details of the construction process must be disclosed. Th following must be included in the TMP: ◦ clearly defined route/s to the site for specific vehicles needed to transport equipment and materials ◦ scheduled deliveries to avoid local congestion; • Ensure all vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator. • Reduce travel speed for construction vehicles on the gravel road to reduce dust • Dust suppression measures must be implemented on un-surfaced roads, such as wetting on a regular basis and ensuring that vehicles used to transport building materials are fitted with tarpaulins or covers. • Regular preventative maintenance of roads within the immediate vicinity of the site should be conducted over weekends to minimise the impact on the average construction period.	Site Engineer ECO / ESO	Throughout Construction Phase
Road degradation due to construction activities		
• Create a local WhatsApp Group for the local community and post notices of road conditions and proposed alternatives. Project Developer to contribute to the	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
maintenance of the public roads in the area during the construction phase of the development/s. • A photographic record of the road condition should be maintained throughout the various phases of the development/s. This provides an objective assessment and mitigates any subjective views from road users. • Upgrade unpaved roads to a suitable condition for proposed construction vehicles; • Ensure that the roads are left in the same or better condition, post-construction. • The proponent should implement a Grievance Mechanism that provides local farmers and other road users with an effective and efficient mechanism to address issues related to construction related impacts, including damage to local gravel farm roads. • Implementation of a road maintenance programme throughout the construction phase to ensure that the affected roads maintained in a good condition and repaired once the construction phase is completed. • Repair of all affected road portions at the end of construction period where required.		
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 licenced 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		
• No wind turbines or overhead power lines should be placed within the identified No-Go areas. The High sensitivity areas should be avoided as far as possible with new infrastructure, in particular turbines • A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise before the construction phase by an avifaunal specialist. This can be done in any season, although May to October would be raptor breeding season and should be prioritised if possible. • Existing roads and tracks should be used as far as possible.	Site Engineer ECO / ESO Specialist	Before and during construction

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Movement of all staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted. • Care should be taken not to introduce or propagate alien plant species/weeds during construction. • Any underground cabling should follow roads at all times to reduce the impact on the habitat by grouping these linear infrastructures.		
Creation of employment opportunities for the local community		
• Preparation and implementation of Stakeholder Engagement Plan (SEP) prior to and during the construction phase. • Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. • Efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. • An established skills database of community members should be shared with contractors appointed for the construction phase if such database is available. • Local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals. • Training and skills development programmes for locals should be initiated prior to the initiation of the construction phase if feasible. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. • The proponent should liaise with the MM with regards to the establishment of a database of local companies, specifically BBBEE 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 service providers. These companies should be notified of the tender process and invited to bid for project-related work.	Applicant Contractors (Construction companies)	Before Construction begins
Presence of Construction workers in local community		
• Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase.	Applicant Contractors (Construction companies)	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• The SEP and CHSSP should include a Grievance Mechanism that enables stakeholders to report resolve incidents. • The proponent and contractor should develop a Code of Conduct (CoC) for construction workers. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be subject to appropriate disciplinary action and/or dismissed. All dismissals must comply with the South African labour legislation. The CoC should be signed by the proponent and the contractors before the contractors move onto site. The CoC should form part of the CHSSP. • The proponent and the contractor should implement an HIV/AIDS, COVID-19 and Tuberculosis (TB) awareness programme for all construction workers at the outset of the construction phase. The programmes should form part of the CHSSP. • The contractor should provide transport for workers to and from the site daily. This will enable the contactor to effectively manage and monitor the movement of construction workers on and off the site. • The contractor must ensure that all construction workers from outside the area are transported back to their place of residence within 2 days for their contract coming to an end. • No construction workers, except for security personnel, should be permitted to stay over-night on the site.		
Influx of job seekers due to construction related activities		
• The proponent, in consultation with the LM, should investigate the option of establishing a MC to monitor and identify potential problems that may arise due to the influx of job seekers to the area. The MC should also include the other proponents of solar energy projects in the area. • The proponent should implement a "locals first" policy, specifically regarding unskilled and low skilled opportunities. • The proponent should implement a policy that no employment will be available at the gate.	Applicant MC Contractors	Before and During the Construction phase
Risk to Safety, Livestock and damage to farm infrastructure during construction		
• Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. • The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be	Applicant Contractors	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
compensated for. The agreement should be signed before the construction phase commences. • All farm gates must be closed after passing through. • Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site. • The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities. • The proponent should implement a Grievance Mechanism that provides local farmers with an effective and efficient mechanism to address issues related to damage to farm infrastructure, stock theft and poaching etc. • Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained in the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. • Contractors appointed by the proponent must ensure that construction workers who are found guilty of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the CoC. All dismissals must be in accordance with South African labour legislation.		
Increased risk of grass fires associated with construction activities		
• Cooking or heating on open fires on site should be restricted to designated areas and enforced by the hired contractor. • Smoking on site should be confined to designated areas. • Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high-risk dry, windy summer months. • Contractor should provide adequate fire-fighting equipment on-site, including a fire fighting vehicle. • Contractor should provide fire-fighting training to selected construction staff. • No construction staff, with the exception of security staff, to be accommodated on site overnight.	Contractors ECO	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• 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 should also compensate the fire-fighting costs borne by farmers and local authorities.		
Potential impact on productive farmland due to construction related activities and movement of traffic on the site		
• Affected landowners should be consulted about the timing of construction related activities in advance. • The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised. • An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase. • All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. • The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up by the Environmental Consultants appointed to manage the EIA. • The implementation of the Rehabilitation Programme should be monitored by the ECO.	ECO Site Engineer EAP	Before and During the Construction phase

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 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.
- 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 waste water 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.
- 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.
- 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.
- 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 WEF is complete, the project becomes operational. During the operation and maintenance of the WEF (including the normal operation of the turbine itself) a certain amount of disturbance results. An operational WEF will normally have various day to day activities occurring on site, such as (but not limited to) security control, routine maintenance, road clearing/cleaning, grass/bush cutting and clearing.

The objectives of the operation phase 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 WEF is implemented and conducted appropriately.
- To ensure that the recommended monitoring programmes are implemented accordingly.

The main impacts associated with the operation phase of the WEF relate to birds and bats. A bird and bat specialist must be appointed to undertake the operational phase monitoring as per the EA and according to the applicable bird and bat guidelines at the time of commercial operations.

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 WEF, 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	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Freshwater & Wetlands (Aquatics)							
Spread of Alien Vegetation	Local	Long term	Irreversible	Negative	Medium	Probable	Moderate
With Mitigation	*Site*	*Short term*	*Partly reversible*	*Negative*	***Low***	*Possible*	*Low*
Bats							
Bat Fatality	Local	Long term	Recoverable	Negative	Medium	Highly probable	High
With Mitigation	*Local*	*Long term*	*Recoverable*	*Negative*	***Medium***	*Probable*	*Moderate*
Light Pollution	Local	Long term	Recoverable	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Long term*	*Recoverable*	*Negative*	***Low***	*Low Probability*	*Moderate*
Avifauna							
Disturbance to birds	Local	Long term	Reversible	Negative	Low	Probable	Low
With Mitigation	*Local*	*Long term*	*Reversible*	*Negative*	***Low***	*Probable*	*Low*
Displacement of birds	Local	Long term	Reversible	Negative	Low	Probable	Low
With Mitigation	*Local*	*Long term*	*Reversible*	*Negative*	***Low***	*Probable*	*Low*
Bird collision with turbine blades	National	Long term	Irreversible	Negative	High	Highly Probable	High
With Mitigation	*National*	*Long term*	*Irreversible*	*Negative*	***Medium***	*Probable*	*Moderate*
Bird collision with overhead power lines	National	Long term	Irreversible	Negative	High	Highly Probable	High
With Mitigation	*National*	*Long term*	*Irreversible*	*Negative*	***Medium***	*Probable*	*Moderate*
Bird electrocution on overhead lines	National	Long term	Irreversible	Negative	High	Highly Probable	High
With Mitigation	*National*	*Long term*	*Irreversible*	*Negative*	***Low***	*Improbable*	*Moderate*

Operational Phase	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Terrestrial Biodiversity							
Disturbance, specifically wind turbine noise, to CBAs and ESAs	Local	Long term	Reversible	Negative	Low	Probable	Low
With Mitigation	*Local*	*Long term*	*Reversible*	*Negative*	***Low***	*Low Probability*	*Low*
Connectivity, dispersal and affected movements of fauna about the landscape	Local	Long term	Recoverable	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Long term*	*Reversible*	*Negative*	***Low***	*Low Probability*	*Low*
Karoo Dwarf Tortoise							
Tortoise mortalities due to traffic on new roads	Local	Long term	Irreversible	Negative	High	Probable	High
With Mitigation	*Local*	*Long term*	*Irreversible*	*Negative*	***Low***	*Conceivable*	*Moderate*
Heritage, Archaeology & Palaeontology							
Impacts to the cultural landscape	Regional	Long Term	Recoverable	Negative	High	Definite	Moderate
With Mitigation	*Regional*	*Long Term*	*Recoverable*	*Negative*	***Medium***	*Definite*	*Moderate*
Visual							
Visual effect of wind turbines on the rural landscape	Regional	Long Term	Recoverable	Negative	High	Definite	High
With Mitigation	*Regional*	*Long Term*	*Recoverable*	*Negative*	***High***	*Definite*	*High*
Visual effect of substation and BESS on the rural landscape	Local	Long Term	Recoverable	Negative	Medium	Definite	Moderate
With Mitigation	*Local*	*Long Term*	*Recoverable*	*Negative*	***Medium***	*Highly Probable*	*Moderate*
Visual effect of access roads on the rural landscape	Local	Long Term	Recoverable	Negative	Medium	Probable	Low

Operational Phase	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
With Mitigation	*Local*	*Long Term*	*Recoverable*	*Negative*	***Low***	*Low Probability*	*Low*
Visual intrusion of lighting at night	Local	Long Term	Recoverable	Negative	Medium	Definite	Moderate
With Mitigation	*Local*	*Long Term*	*Recoverable*	*Negative*	***Medium***	*Highly Probable*	*Moderate*
Traffic							
Intersection Safety	Regional	Short term	Irreversible	Negative	Medium	Probable	Low
With Mitigation	*Regional*	*Short term*	*Irreversible*	*Negative*	***Medium***	*Probable*	*Low*
Noise							
Daytime operation of WTG (worst-case SPL)	Local	Long-term	High	Negative	Low	Improbable	Low
With Mitigation	*Local*	*Long-term*	*High*	*Negative*	***Low***	*Improbable*	*Low*
Night-time operation of WTG (worst-case SPL)	Regional	Long-term	High	Negative	Low	Possible	Low
With Mitigation	*Regional*	*Long-term*	*High*	*Negative*	***Low***	*Possible*	*Low*
Social							
Establish infrastructure to generate renewable energy	National	Long term	N/A	Negative	Medium	Highly Probable	High
With Mitigation	*National*	*Long term*	*N/A*	*Negative*	***Low***	*Definite*	*High*
Creation of employment and business opportunities during maintenance	Regional	Long term	N/A	**Positive**	Low	Low Probability	Low
With Mitigation	*Regional*	*Long term*	*N/A*	***Positive***	***Low***	*Highly Probable*	*Moderate*
Benefits associated with the local economic development initiatives	Regional	Long term	N/A	**Positive**	Low	Highly Probable	Moderate

Operational Phase	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
With Mitigation	*Regional*	*Long term*	*N/A*	***Positive***	***Low***	*Definite*	*Moderate*
Benefits for landowners	Regional	Long term	N/A	**Positive**	Low	Probable	Low
With Mitigation	*Regional*	*Long term*	*N/A*	***Positive***	***Low***	*Definite*	*Moderate*
Visual impact and impact on sense of place	Regional	Long term	Reversible	Negative	Medium	Highly Probable	Moderate
With Mitigation	*Regional*	*Long term*	*Reversible*	*Negative*	***Medium***	*Highly Probable*	*Moderate*
Impact on property values	Local	Long term	N/A	Negative	Low	Low Probability	Low
With Mitigation	*Local*	*Long term*	*N/A*	*Negative*	***Low***	*Low Probability*	*Low*
Impact on tourism	Local	Long term	N/A	Negative	Low	Low Probability	Low
With Mitigation	*Local*	*Long term*	*N/A*	*Negative*	***Low***	*Low Probability*	*Low*

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 Construction 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. • Regeneration of alien vegetation must be monitored once all areas have been cleared, forming part of a long-term alien vegetation management plan.	Site Engineer ECO Specialist	Following clearing of vegetation Throughout Operation Phase
Fatalities to Bats due to the operation of the development		
• Avoid placing turbines within no-go areas specified by the specialist during the design and construction phase of the project. • Maintain minimum blade sweep of 30 m to avoid impacts to lower flying bats such as clutter-edge species (e.g., Cape serotine). • Minimise the rotor diameter. • Feather blades for all turbines to prevent free-wheeling below the turbine cut-in speed from start of operation. • Implement post-construction fatality monitoring and apply curtailment or deterrents if fatality thresholds are exceeded. Fatality results should be reviewed quarterly. • Bat carcass searching to be implemented with an appropriate search schedule for a minimum of two years during the operation of the wind farm and must be conducted by appropriate specialist.	Site Engineer ECO / ESO Developer Specialist	Throughout operation phase according to the Bat Management Plan (Section 23).
Effects of Light Pollution on Bats' ecological dynamics		
• Avoid excessive lighting by not placing substations as well as operational and maintenance buildings in no-go areas. • Minimise the use of motion-sensor lighting, avoid sky-glow by using hoods, increase spacing between lighting units, and use low pressure sodium lights.	Site Engineer ECO / ESO	Throughout Operation Phase
Reduction of Noise Impacts to Noise Sensitive Receptors during the operation of the WEF		
• Environmental noise monitoring must be repeated at locations NSR05, NSR06 and NSR07 at least once prior to construction. • To ensure that noise does not become an issue for future residents, landowners or the local communities, it is recommended that the applicant get written agreement from	Developer Specialist	Before Operational Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
current landowners/community leaders that no new residential dwellings will be developed within areas enveloped by the 42 dBA noise level contour. • Structures located within the 45 dBA noise level contour should not be used for residential use		
Operational impacts on CBA's and ESA's		
• Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. • A log should be kept detailing and fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. These should be reviewed annually and used to inform operational management and mitigation measures. • Ensure that maintenance staff remain within the operational footprint of the facility. • Ensure that vehicles remain within speed limits of 40km/h within the site. • Reduce night driving within the site as much as possible and ensure that only essential activities and driving within the site occur at night. • All night-lighting at the site should be of environmentally friendly types such as HPS and other bulb types that attract fewer insects. • All fauna such as snakes that are encountered or enter operational areas, are removed to safety by a suitably qualified person or allowed to move off naturally without persecution or disturbance. • An erosion monitoring programme should be put in place for at least 3 years after construction. Any problems observed should be rectified as soon as possible using the appropriate revegetation and erosion control works	Maintenance Staff Site Engineer ECO / ESO Specialist	Throughout Operation Phase
Impacts to Karoo Dwarf Tortoise during the operation of the WEF		
Tortoise mortalities due to roadkill: • The development must avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase. • Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. • Keep a log of tortoise on-site roadkill mortalities. This log must be reviewed annually to inform operational management and mitigation measures. • Adhere to on-site speed limits and exercise vigilance of tortoises crossing the roads.	Site Engineer ECO / ESO	Throughout Operation Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Operational impacts to the cultural landscape		
• Ensure that all maintenance operations remain within designated areas. • Ensure that visual recommendations with regards to lighting are followed. • Make use of an early warning system that can switch on navigation lights only when they are needed (if such a system is available and approved at the time of construction)	Maintenance Staff Site Engineer ECO / ESO	Throughout Operation Phase
Visual effects of operational wind turbines, substation, BESS and O&M buildings on the rural landscape		
• Avoidance of high visual sensitivity areas and receptors in siting of turbines. • Substations, BESS and O&M Buildings have been located in unobtrusive low-lying area away from the R319 and district roads, as per recommended visual buffers, as currently indicated. • Substations, BESS and O&M Buildings have been located in unobtrusive low-lying area away from the R319 and district roads, as per recommended visual buffers, as currently indicated. • On-site signage to be discrete, and billboards prohibited. Signage to be fixed against a backdrop to avoid intrusion on the skyline. • Overhead powerlines, if applicable, to follow valleys and avoid peaks/ridges where possible. • Security and other outdoor lighting to be fitted with reflectors to conceal light source and prevent light spillage.	Site Engineer ECO / ESO	Throughout Operation Phase
Visual effect of internal access roads on the rural landscape		
• Road verges and cut/fill slopes to be rehabilitated as soon as possible after construction.	Site Engineer ECO / ESO	Throughout Operation Phase
Visual intrusion of lighting at night during operation phase		
• Use of available technology to minimise the visual effect of navigation lights, conforming with CAA requirements. • Use of reflectors on general area and security lighting to conceal light sources.	Site Engineer ECO / ESO	Throughout Operation Phase
Intersection safety on roads during operation		
• Compile a TMP.	Site Engineer	Throughout Operation Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• 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 licenced operator. • Provide drivers with advanced driver training.	ECO / ESO	
Disturbance and Displacement of birds during the operation of the WEF		
• A post-construction inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled and that road and hard stand verges do not provide additional substrate for raptor prey species. It is essential that the new wind farm does not create favourable conditions for mammals in high-risk areas. • It is recommended that within the first year of operations, a full assessment of this aspect be made by the ornithologist contracted for post-construction monitoring. If such conditions have been created, case-specific solutions will need to be developed and implemented by the wind farm. • It is strongly recommended that rodenticides not be used at the newly established Operation and Maintenance (O&M) buildings or around auxiliary infrastructure on the project site. Rodenticides are toxic and pose a significant secondary poisoning risk to predatory avifauna, especially owls.	Site Engineer ECO / ESO Specialist	Throughout Operation Phase
Bird collision and electrocution with WTG infrastructure during the operation of the WEF		
• No wind turbines or overhead power lines should be placed within the identified No-Go areas. The High sensitivity areas should be avoided as far as possible. • The pole design of any overhead power line should be approved by an ornithologist in terms of the electrocution risk it may pose to large birds such as eagles. • A fatality monitoring program must be conducted for the operational wind farm and implemented by a competent body. • All fatalities of avifauna must be extensively documented and should be reported on quarterly to the wind farm operator. These reports must be submitted to the Department of Foresty, Fisheries and the Environment and BirdLife South Africa. The reports should include a comparison of actual measured fatality rates with those predicted by this study.	Wind farm operator ECO / ESO Specialist	Throughout Operation Phase
Social enhancement for the local community (creation of employment, skills development)		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Implement a skills development and training programme aimed at maximizing the number of employment opportunities for local community members. • Maximise opportunities for local content, procurement, and community shareholding • Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. • Efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. • An established skills database of community members should be shared with contractors appointed if such database is available. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.	Applicant Contractors	Throughout Operation Phase
Enhancement of economic development for the local community		
• The ULM should liaise with the proponents of other renewable energy projects in the area to investigate economic development opportunities for the local community. • Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximizing the benefits for the community as a whole and not individuals within the community. • Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the local economic development.	ULM Applicant	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 Loxton WEF 2, 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:

1. The actual risks associated with the delivery, connection, operation, maintenance, disconnection and disposal of the batteries.
2. The likelihood of these actual risks occurring.
3. The significance of the impacts should these risks take place.
4. 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. - Material Safety Data Sheets (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	- Maintenance. - Latest BESS technologies to be used as far as possible. - Appropriate battery design and venting control.

Possible Risk	Likelihood of occurrence	Resultant Impact	Management / Mitigation
- Short circuiting		- Potential spillage of electrolytes or refrigerant - Downstream effects on the current terrestrial ecosystem.	- Source from reputable manufacturers. - 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	- 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
		- Downstream effects on the current terrestrial ecosystem.	- 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	- The recycling of batteries and their potential use as e-waste. - Disposal at a licensed hazardous waste site. - Prior to construction of the WEF, 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.

Possible Risk	Likelihood of occurrence	Resultant Impact	Management / Mitigation
		Africa and recycling of batteries and e-waste has been identified as a sure way of improving the lifespans of such sites.	

9 CUMULATIVE PHASE

The cumulative impact assessment considers the combined impact of the remaining and other renewable projects within a 35 km radius, that are also in the development phase and the associated grid lines on the aquatic resources. The combination of the Loxton WEFs 1, 2 and 3, as well as other similar renewable energy projects, either existing or proposed, was considered to assess cumulative visual impacts within a 35 km radius of the proposed project. There are 12 wind energy applications in the broader area to the south of the Loxton project. Not all of these are within 35 km, but were considered as they are part of the same landscape. Developments considered during the assessment are named below:

- Hoogeland North WEF 1
- Hoogeland North WEF 2
- Hoogeland South WEF 3
- Hoogeland South WEF 4
- Nuweveld North WEF
- Nuweveld East WEF
- Nuweveld West WEF
- Taaibos North WEF
- Taaibos South WEF
- Soutrivier North WEF
- Soutrivier Central WEF
- Soutrivier South WEF

9.1 Soil, Land Use and Agriculture Potential

The cumulative impact assessment has considered all renewable energy projects within a 30 km radius. In quantifying the cumulative impact, the area of land taken out of agricultural use by the initiated projects will amount to a total of approximately 216 hectares. A proportion of the total area within a 30 km radius (approximately 282,700 ha) amounts to only 0.08% of the surface area. 0.08% is well within an acceptable limit in terms of loss of low potential agricultural land, which is only suitable for grazing, and of which there is no scarcity in the country. All the projects contributing to cumulative impact for this assessment have the same agricultural impacts in an almost identical agricultural environment, and therefore the same mitigation measures apply to all. Due to the considerations discussed, the cumulative impact of loss of future agricultural production potential is assessed as low. Loxton WEF 2 will not have an unacceptable negative impact on the agricultural production capability of the area and it is therefore recommended that the development be approved.

9.2 Freshwater and Wetlands

Overall cumulative impact during the construction and operational phases mitigation measures is to reduce residual risk or enhance opportunities by improving the current stormwater and energy dissipation features not currently found along the tracks and roads within the region and installing properly sized culverts with erosion protection measures at the present road / track crossings.

The cumulative assessment considers that the Loxton WEF 2 will be built at the same time as the proposed Loxton WEF 1 and Loxton WEF 3 developments (being applied for in separate S&EIA application processes). The significance rating will be low based on the premise that important or sensitive features will be avoided by the development, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.

9.2.1 Mitigation Measures

All proposed mitigation measures for Construction, Operational and Decommissioning Impact Phases of the Loxton WEF 2 should be implemented, including:

- The Loxton WEF (1 – 3) Cluster should share roads and infrastructure where possible to reduce the overall footprint and reduce stormwater and erosion and sedimentation related impacts
- The Loxton WEF (1 – 3) Cluster should collaborate with provincial roads authority to upgrade the main access routes and improve the crossings and stormwater controls.

9.3 Terrestrial Biodiversity

With regard to cumulative impacts within 30km of the Loxton WEF 2, the only WEFs are the planned Loxton WEFs 1 & 3 with an estimated direct footprint of 175 ha and the Hoogland wind farm projects with an estimated combined footprint of approximately 200 ha. Cumulative impacts on the Riverine Rabbit and Karoo Dwarf Tortoise would be a potential concern. However, the contribution of the Loxton 2 WEF to the cumulative impact on these two species would be low. Loxton WEF 2's total footprint within the associated habitats is low and is not likely to impact the viability of local populations of these species as neither species was observed within the site. As the broader area is still largely intact, and most direct impacts are associated with the construction phase, cumulative impacts associated with the current project are considered low and acceptable. There do not appear to be any ecological processes or corridors that would be specifically disrupted by the Loxton WEF 2. In addition, should all the planned projects be built, the extent of habitat loss would not be significant relative to the overall extent of the affected vegetation types. As such, the contribution of the Loxton WEF 2 to habitat loss would not change the overall threat status of any vegetation and the level of cumulative impact in the area is considered acceptable.

9.4 Dwarf Karoo Tortoise

At the scale of Loxton WEF 2, the layout design avoids development in areas of very high sensitivity and development in high and medium zones are curtailed. The overall potential impact of Loxton WEF 2 on local tortoise populations will be minimised by restricting the development mostly to areas of low sensitivity.

At a local scale, including all proposed or initiated WEFs within 35km, there will be cumulative contributions to habitat loss and degradation during the construction phase and potential tortoise mortalities during all phases of the project over time. The significant impacts on habitat loss and degradation during construction is of moderate significance and low after mitigation. Cumulative impacts of mortalities due to earthworks and roadkill are moderate significance before mitigation and low significance after mitigation.

9.5 Plant

From a plant and vegetative perspective, Loxton WEF 2 would have a very low impact on plant SCC. The Eastern Upper Karoo and Upper Karoo Hardeveld vegetation types have had minimal impacts associated with renewable energy developments to date. The contribution of Loxton Wind Energy Facility 2 towards cumulative impact on plant SCC and vegetation is deemed acceptable.

9.6 Avifauna

The cumulative impacts of wind energy on avifauna in the Loxton area have been carefully assessed according to the guidance in the DEA (DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria); and the IFC guidelines (Good Practice

Handbook - Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets".

The 12 wind energy applications in the broader area to the south of the Loxton project present similar risks to avifauna. The projects' combined could result in up to 508 wind turbines in addition to those planned at the Loxton Wind Farm Cluster (142 - Loxton WEF 1 up to 42 turbines, Loxton WEF 2 up to 61 turbines, Loxton WEF 3 up to 39 turbines). This could bring the total number of turbines in this area to 650.

Cumulative impacts on avifauna are displacement of priority species due to construction activities at the wind development area; direct mortality of priority species due to collisions with the turbines at the wind development area; and displacement of priority species due to dismantling activities at the wind development area.

The significance rating will be moderate as the fatality impact can be mitigated at each wind farm, however the habitat destruction impact cannot be enhanced as it is inevitable. Although the current farming land use on these properties appears not to impact on biodiversity, this is not always the case. Grazing regimes, veld management, pesticide use, problem animal control, fencing, water management and other practices all take their toll on biodiversity.

There is an opportunity to enhance the natural habitat on projects through input into these management practices, perhaps through a biodiversity stewardship approach.

The mitigation measures to reduce residual risk or enhance opportunities is to ensure that all the proposed mitigation measures for the Loxton WEF 2 detailed in this EMPr must be implemented.

9.7 Bats

Cumulative impacts are defined as the total impacts resulting from the successive, incremental, and / or combined effects of a project when added to other existing, planned and / or reasonably anticipated future projects, as well as background pressures (IFC 2013). The goal of the assessment is to evaluate the potential resulting impact to the vulnerability and / or risk to the sustainability of the bat species affected (IFC 2013). The mitigation measures proposed (buffering key habitats used by bats, use of appropriate lighting technology, blade feathering, and using curtailment and/or acoustic deterrents) should be applied to all future projects so that there is a collective management responsibility (IFC 2013). Through the application of fatality thresholds across all projects in the cumulative impact area, residual impacts should be minimized and the significance rating will be moderate. Curtailment and deterrents can successfully reduce bat fatality (Arnett 2011, Arnett et al. 2016, Weaver et al. 2020), but not completely.

9.8 Noise

There is a very low risk of cumulative noises during the construction phase, because it is unlikely that construction activities will take place simultaneously at the different proposed Loxton WEF (1 – 3) Cluster.

NSR05 is located between the turbines of the Loxton WEF 1 and Loxton WEF 2, and only this receptor may be subject to cumulative noises (if the WTG from these two WEFs are operating simultaneously). Noises from other WEFs within 35 km will have an insignificant influence on the noise levels at the NSR.

9.9 Heritage and Archaeology

In relation to an activity, cumulative impact means "the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant

when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities" (NEMA EIA Reg GN R982 of 2014).

To enhance the significance rating to minimize cumulative impacts which relate largely to the landscape, since specific heritage sites are almost entirely avoided, all relevant mitigation measures as recommended for each Loxton WEF (1 – 3) Cluster should be applied and the undertaking of pre-construction surveys are an important component of this.

9.10 Palaeontology

Despite the substantial project footprints as well as the known occurrence of important vertebrate and other fossil sites elsewhere in the wider region between Loxton and Victoria West, the impact significance of the proposed renewable energy developments on local palaeontological heritage is anticipated to be low. This is based on the inferred Low Palaeo-sensitivity of the project area overall based on desktop and field-based data. These impacts, including cumulative impacts considering other renewable energy projects in the broader region, are expected to fall within acceptable limits.

9.11 Visual / Landscape

The combined visual effects of all three proposed Loxton WEFs and other similar projects within a 35 km radius of the site have a Moderate significance on scenic resources and sensitive receptors. After mitigation, significance will remain moderate. Little can be done to visually screen turbines except through avoidance.

9.12 Social

Visual impacts associated with the establishment of more than one WEF in the area and the potential impact on the area's rural sense of place has a moderate significant cumulative impact. There is limited potential to minimize the impact significance. The presence of several renewable energy facilities in the area has the potential to place pressure on local services, namely medical, education and accommodation services. Cumulative impact significance is low for local services, with and without mitigations in place. The creation of local employment, skills development and business development will have a positive effect on the local community with a moderately positive significance on the potential cumulative impacts of the project and other projects.

9.13 Traffic and Transportation

During peak construction of the three proposed Loxton WEFs, cumulative impacts have been identified as increased road incidents, road degradation, dust and intersection safety. Before mitigations, all three impacts have moderate significance ratings. Dust during the construction phase can be enhanced and reduced to low significance. All other impacts identified will remain moderate despite enhancement.

Intersection safety was identified as a cumulative impact during the operation of the three WEFs with a moderate significance rating before and after mitigations.

9.14 Wake Effect Analysis

In March 2023, a wake effect impact analysis was compiled to calculate the impact that the Loxton WEF (1 – 3) would have the on the selected Taaibos North, Soutrivier North and Hoogeland North Wind Farms, using the N163/5.X (5.9) TC120 wind turbine model.

The results of external wake efficiency produced by the operation of the Loxton WEF (1 – 3) over the Taaibos North, Soutrivier North and Hoogeland North Wind Farms are shown in Table 9.1. The wake losses are considered to be insignificant as these are based on a

worst-case theoretical analysis and negligible for the Hoogeland North Wind Farm, as the analysed wake impact has no influence over the wind farm.

Table 9-1: Summary of the wake effect results

External Wake Efficiency	Energy Loss (%)
Loxton WEF (1-3) effect on the Taaibos North WEF	
0,984	1,6 %
Loxton WEF (1-3) effect on the Soutrivier North WEF	
0,996	0,4 %
Loxton WEF (1-3) effect on the Hoogland North WEF	
1,000	0,0 %

10 DECOMMISSIONING PHASE

The objectives of the decommission 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 WEF is implemented and conducted appropriately.
- To ensure that the recommended management plans are implemented accordingly.

Prior to the decommissioning of the WEF, a decommissioning plan must be produced by the ECO. The plan must include details on the decommissioning and dismantling of the WEF, 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 WEF 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 wind turbine infrastructure and includes the restoration of the site as closely as possible to its original state.

10.1 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 Wind Farm has ceased operating.

According to the *Scottish Natural Heritage Commissioned Report: Research and Guidance on restoration and decommissioning of onshore wind farms*, a logical sequence for decommissioning planning and execution of construction activities were reviewed and some of what are suggested below:

- 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 turbines.
- 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 turbine internals and removal of transformer;
    - Controlled dismantling of turbines (blades, nacelle, tower);
    - Removal of turbine 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.

10.1.1Soil Conservation and Management:

Completely removing wind turbine infrastructure is likely to require a rock-based backfill into the voids left behind. Decommissioning plans have proposed options that involve the removal of turbine materials to a depth of approximately 1 m below ground level followed by surface restoration of topsoil. This approach needs to be considered carefully as it may not always be ecologically feasible. Using large quantities of off-site rock or soil for backfill could have detrimental impacts especially if the backfill's chemical composition is significantly different from that found in the natural, baseline (receiving) soil environment of the site. A recommendation would be to avoid using large quantities of backfill that do not match the receiving environment's baseline soil profile.

Other 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.

10.1.2Vegetation 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.

10.1.3 Options for End-of-life Infrastructure

Generally, the turbine would be dismantled at ground level and transported away from the site for recycling, reuse, or disposal. The decommissioning of the turbine structure should have a minimal environmental impact. Costs are driven by haulage and craneage charges.

Installed wind turbines consist of four sections: the rotor, nacelle, tower, and foundation. It is important to know what materials were used in the construction of the turbines as this will provide insight into best practices for appropriate disposal methods.

Materials commonly used in the construction of turbines are:

- Rotor – Blades, Blade hub, Nose cone, Resin, fiberglass, cast iron.
- Nacelle – Bed frame, Main shaft, Transformer, Generator, Gearbox, Nacelle cover, Steel, Silica, copper, steel, fiberglass, resin.
- Tower - Steel, Concrete (very uncommon).
- Foundation – Footing, Ferrule, Concrete, iron, steel.

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.
- Crane Pads can be retained, regraded and then covered. Original soils must be managed to be reused for restoration. Costs involved are Low to Medium. Recycling options would be to use on-site as backfilling voids.
- 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.
- Substations can be removed from site and materials can be separated and reused. Cables made from copper material can be recycled offsite.

Turbine foundations consist of reinforced concrete gravity structures or reinforced concrete bases supported on piles. The removal of a base will involve breaking apart the reinforced concrete. The concrete is recommended to be broken into smaller sections with steel cutting equipment, hydraulic breakers, excavators, and dump trucks for their removal. It is suggested that the removal of a concrete base could take a week if only the top layer of 1 meter is removed. Should reinforced concrete be processed on-site to remove steel (for recycling purposes) and create a granular or rubble concrete material, it can be used for further construction (tracks, hardstandings) if appropriate to the site. Processed or unprocessed reinforced concrete can be removed from site and be reused or recycled.

Alternatively, 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.

Turbine bases supported on concrete piles are more difficult to remove. Leaving such piles *in situ* should not create an environmental hazard but it may be prone to oxidizing and staining or contamination. This is due to the depth of cover between concrete and reinforcement in the piles may be less than in gravity bases.

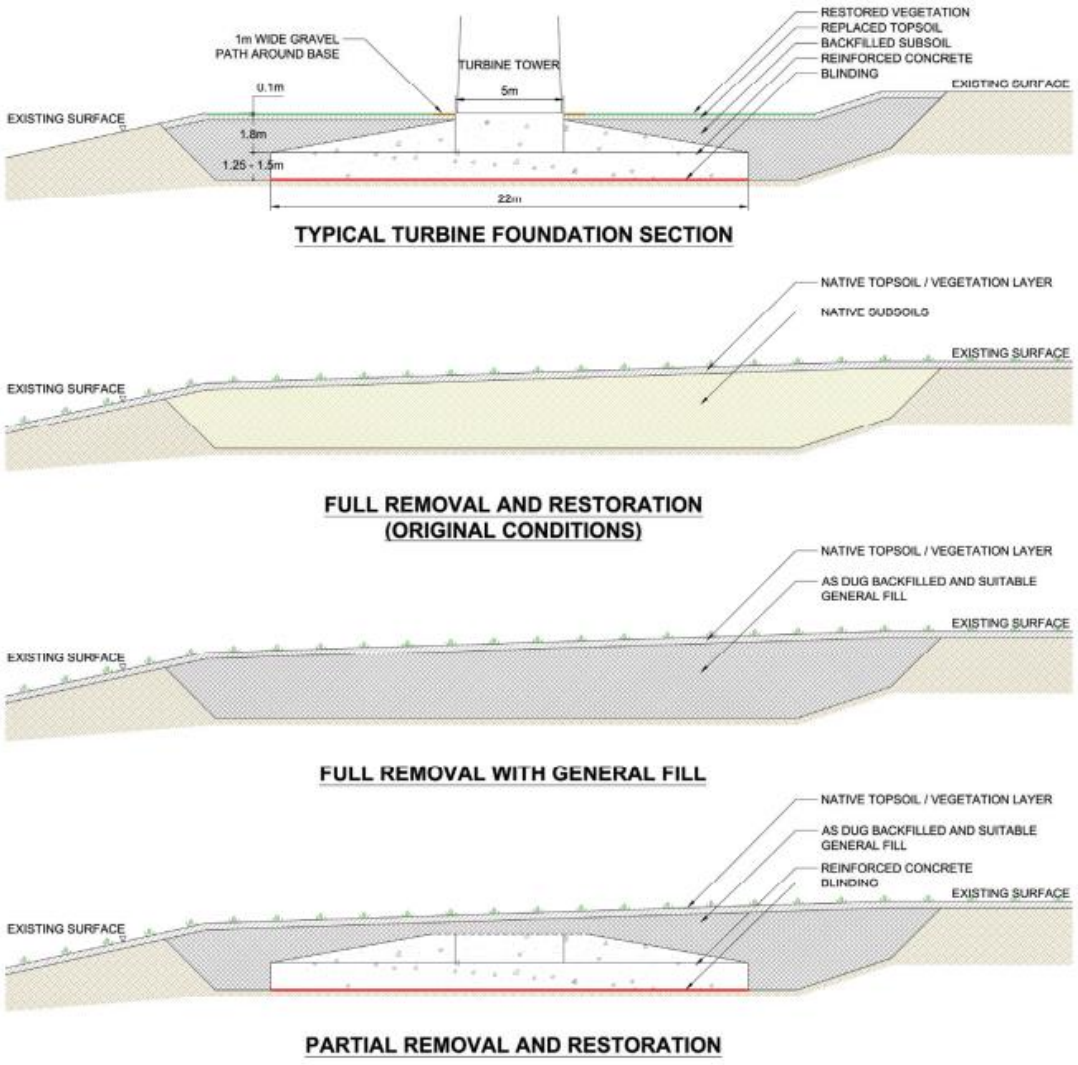

Plate 10-1: Turbine foundation decommissioning alternatives

10.1.4Reuse of Turbines

Ideally, sending off material to a landfill should be avoided or used as a last resort. There is the option of reusing wind turbine infrastructure where feasibly possible. For developing countries, buying second-hand wind turbines serve as an opportunity to gain experience with renewable energy and allow for profit from technology transfer with low capital expenditure. Wind turbines could be sold, or their materials (mainly comprised of steel, copper, and electronics) can be recycled or reused where possible.

Turbine blades are slightly more difficult to recycle as they're made primarily from fiberglass, a composite material. Cutting the blades into smaller, manageable sizes on site is achievable, but transporting the materials off-site is costly. There are limited recycling options for composite materials. Most recycling activities for composite materials are limited to down cycling (converting waste into products of lesser quality or reduced functionality.

10.2 Potential Decommissioning Phase Impacts

Table 10.1 below provides a summary of the potential impacts of the decommissioning of the WEF, 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 10-1: Summary of Decommissioning Phase Impacts

Decommissioning Phase	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Freshwater & Wetlands (Aquatics)							
Loss of habitat/vegetation	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Loss of Critical Biodiversity Areas (CBAs)	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Loss of riparian habitat	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Changes to the hydrological regime and increase potential for erosion	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Changes to surface water quality	Local	Long term	Irreversible	Negative	Medium	Probable	Medium
With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	***Low***	*Possible*	*Low*
Bats							
Disturbance of Bats	Site	Short term	Recoverable	Negative	Low	Probable	Moderate
With Mitigation	*Site*	*Short term*	*Recoverable*	*Negative*	***Low***	*Low Probability*	*Low*
Avifauna							
Disturbance of Birds	Local	Short term	Reversible	Negative	Low	Probable	Low
With Mitigation	*Local*	*Short term*	*Reversible*	*Negative*	***Low***	*Probable*	*Low*
Karoo Dwarf Tortoise							

Decommissioning Phase	Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Tortoise mortalities due to roadkill	Local	Short term	Irreversible	Negative	Medium	Probable	Moderate
With Mitigation	*Local*	*Short term*	*Irreversible*	*Negative*	***Low***	*Conceivable*	*Moderate*
Heritage, Archaeology & Palaeontology							
Impacts to the cultural landscape	Regional	Short term	Recoverable	Negative	Low	Definite	High
With Mitigation	*Regional*	*Short term*	*Recoverable*	*Negative*	***Low***	*Definite*	*Low*
Visual							
Visual intrusion of activities to remove infrastructure	Local	Short term	Recoverable	Negative	Low	Definite	Moderate
With Mitigation	*Local*	*Short term*	*Recoverable*	*Negative*	***Low***	*Highly Probable*	*Moderate*
Social							
Loss of jobs and associated income	Local	Short term	Recoverable	Negative	Low	Probable	Low
With Mitigation	*Local*	*Short term*	*Recoverable*	*Negative*	***Low***	*Probable*	*Moderate*

Table 10-2: Decommissioning Phase Impact Management

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Impacts on Freshwater and Wetlands due to Construction of the Development		
• Where large cut and fill areas are required, these must be stabilised and rehabilitated during the decommissioning process, to minimise erosion and sedimentation. • Suitable stormwater management systems must be installed along roads and other areas, and monitored during the first few months of use. Any erosion/sedimentation must be resolved through additional interventions (i.e., extension, energy dissipaters, spreaders, etc). • The aquatic systems have been mapped to a finer scale and have taken cognizance of any potential CBAs, as well as NFEPA river systems. • If High / No-Go buffers are avoided by the major infrastructure, then impact on the aquatic zones associated within the CBAs is predicted to be low.	Site Engineer ECO / ESO	Throughout Decommission Phase
Impacts associated with the decommissioning of Development Access Roads		
• Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Any unnecessary intrusion into these areas is prohibited. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any decommission commences. • Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • All pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that headcut erosion does not develop due to the gradient change from the natural ground level to the invert level of the culvert. • Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the decommission at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from decommission activities. • Any fauna (frogs, snakes, etc.) that are found within the decommission area must be moved to the closest point of similar habitat type outside of the areas to be impacted.	Site Engineer ECO / ESO	Throughout Decommission Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• All disturbed areas beyond the decommission site that are intentionally or accidentally disturbed during the decommission phase must be rehabilitated. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.		
Changes to the hydrological regime and increase potential for erosion due to Construction of the Development		
• No stormwater discharged may be directed to delineated aquatic zones or the associated buffers. • A stormwater management plan must be finalised post EA, detailing the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems. • Effective stormwater management must include measures to slow, spread and deplete the energy of concentrated flows thorough effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas	Site Engineer ECO / ESO	Throughout Decommission 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 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 refuelled or serviced within 100 m of a river channel or wetland. • All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 100 m from any demarcated water courses. • Littering and contamination associated with construction activity must be avoided through effective construction camp management. • No stockpiling should take place within or near a water course.	Site Engineer ECO / ESO	Throughout Decommission Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable.		
Disturbance to Bats during the decommissioning of the wind facility		
• Avoid decommissioning activities at night. • Apply good abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during decommissioning activities. • Rehabilitate all areas disturbed during construction (including aquatic habitat).	Site Engineer ECO / ESO	Throughout Decommission Phase
Impacts to the cultural landscape		
• Keep decommissioning period as short as possible. • Ensure effective rehabilitation of all areas following advice of the relevant specialist.	Site Engineer ECO / ESO	Throughout and after Decommission Phase
Visual intrusion of activities to remove infrastructure		
• Disturbed areas to be rehabilitated / revegetated as soon as possible after the decommissioning phase. • Wind turbines and building structures removed at the end of the life of the project. • Hardstands and access roads no longer required to be ripped and regraded. • Exposed or disturbed areas to be revegetated and returned to grazing pasture or natural veld to blend with the surroundings.	Site Engineer ECO / ESO	Throughout Decommission Phase
Karoo Dwarf Tortoise mortalities due to roadkill		
• Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. • Keep a log of on-site tortoise roadkill mortalities. • Adhere to on-site speed limits of 40 km and exercise vigilance of tortoises crossing the roads.	Site Engineer ECO / ESO	Throughout Decommission Phase
Disturbance to Birds during the decommissioning of the wind facility		
• Movement of all staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted. • Existing roads and tracks should be used as far as possible	Site Engineer ECO / ESO	Throughout Decommission Phase

11 ALIEN INVASIVE MANAGEMENT PLAN

11.1 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 and operation of the Loxton WEF 2. 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.
- Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

11.2 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.

- 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 licence as these plants consume large quantities of water.
- 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.

11.3 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.
- Construction camps and lay-down areas which are cleared or are active for an extended period.

11.3.1 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. Although there are no turbines within such areas, numerous road crossings will be required. The disturbance footprint within such areas must be minimized and these areas must be checked for alien species more than the surrounding landscape.

11.3.2 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.

11.3.3 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.

11.4 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 won't 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.
- All clearing actions must be monitored and documented to keep track of which areas are due for follow-up clearing.

11.5 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/.

11.6 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.
- 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.

11.7 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
Clearing of vegetation is not allowed within 32 m of any wetland, 80 m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas	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

Construction Phase Action	Frequency
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

11.7.1 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

11.8 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

11.8.1 Monitoring Actions - 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

11.9 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

11.9.1 Monitoring Actions - 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

12 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.

12.1 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 are 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.

12.2 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.
- Steps are taken where necessary to aid the initial establishment of vegetation, including occasional watering.

12.3 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.
- 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.

12.4 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.

13 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.
- 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 storm water 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.
- 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.

13.1 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
- 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 storm water- 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
- 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.

13.2 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
- Storm water 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.

13.3 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.
- Removal of all invasive vegetation – 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.

13.4 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.

13.5 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. 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.

13.6 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 recommended 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.

13.7 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
- 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.

14 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, Plant Rescue and Protection and Re-vegetation and Habitat Management Plans 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;
- 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.

14.1 Grazing Management

The development of the wind energy facility will not prevent the site from being used for its current landuse, however it may reduce the grazing on site as the development footprint will be rezoned from agriculture to mixed-use development land. Parts of the farm are used for cultivation of planted pasture and small grain grazing – all used only for grazing. There is no small grain harvested on the farm. Grazing is compatible with biodiversity maintenance provided that it is implemented according to the basic principles of sustainable grazing management. While the majority of these are beyond the scope of the current plan, the following basic principles are recommended for implementation:

- A grazing management plan for the development footprint should be developed in cooperation with Agricultural Extension services.
- The stocking rate applied should be within the recommended limits as identified by the Department of Agriculture.
- Livestock should be rotated through the different paddocks at the site in a manner which allows for the growth and recovery of the vegetation between grazing events.
- Precautions must be taken to ensure that the development of the site does not increase the risk of stock theft within the facility. These include access control as previously described, as well as security patrols.

15 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, except where a major WEF component (i.e. replace damaged turbine blade) could be required.

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 recommended 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 recommended to allow the community to be informed before the start of site activities.
- A comprehensive assessment of the entire route is recommended on award of the project.
- Prohibit WEF 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 mini bus 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 40 km/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.

16 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, turbines, 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;
- 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

17 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 practise in waste management, the Waste hierarchy (Plate 17.1 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.

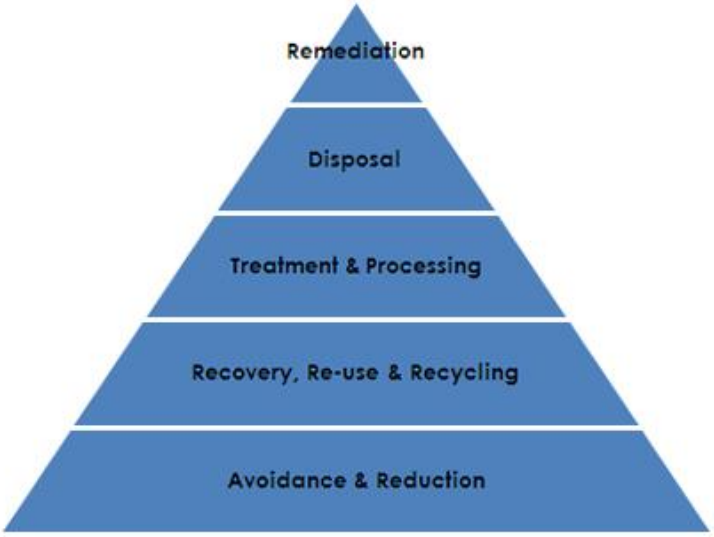

Plate 17-1: Waste Hierarchy- National Waste Management Strategy 2010 (Source: https://www.dffe.gov.za/projectsprogrammes/workingonwaste)

17.1 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 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.
- 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 recommended a procurement policy be implemented that takes into account 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 practises 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 120% 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 so as 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 must 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 in order to maintain a sufficient storage capacity in the event of a breach.
- 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.

17.2 Operation 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.
- 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;
- 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.

18 STORMWATER MANAGEMENT PLAN

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

The Erosion Management Plan (see below) must therefore be seen in conjunction with the SWMP. Actions are listed that will ensure that storm water is channelled in a controlled manner from roads and substations towards natural drainage lines, without impeded natural surface flows.

- Develop and implement a site-specific storm water 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;
- Enforce 32 m construction buffers of all rivers, streams and waterbodies;
- 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 storm water 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.

19 EROSION MANAGEMENT PLAN

19.1 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.

19.2 Scope and Limitations

This 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.

19.3 Background

19.3.1 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.

19.3.2Promoting 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.

19.3.3Erosion 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:

1. Integrate project design with site constraints.
2. Plan and integrate erosion and sediment control with construction activities.
3. Minimise the extent and duration of disturbance.
4. Control stormwater flows onto, through and from the site in stable drainage structures.
5. Use erosion controls to prevent on-site damage.
6. Use sediment controls to prevent off-site damage.
7. Control erosion and sediment at the source.
8. Stabilise disturbed areas promptly.
9. Inspect and maintain control measures.

19.3.4On-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.
- 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.

19.4 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.
- 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.

19.5 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.

19.5.1 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.
- 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.

19.6 Monitoring Requirements

19.6.1 Construction Phase

The following monitoring actions 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

19.6.2 Operational Phase

The following monitoring actions 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

20 FUEL STORAGE MEASURES

20.1 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.

20.2 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 storm water 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.

Filling Operations

- Isolate the area by cones and a rope;
- Prohibit refuelling operations during tank filling operations;
- Avoiding having people who are not involved in the operation within a 10 metre radius;
- Prohibit smoking and the use of mobile telephones or any other ignition sources during tank filling operations or vehicle refuelling, within a 3 metre 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 refuelling;
- Prevent overflowing and spilling situations when the storage tanks are being filled (verify filling sensors and be aware of overflow alarms).

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;
- Prepare a procedure to suitably dispose of wastes recovered from the batches of fuel mixture.

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.
- An accurate drawing of the local drainage system shall be posted next to the spill kit.

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.

Environmental Aspect	Action or Measure
Prevent accidental spills from entering the stormwater drainage system	Provide cleaning equipment conceived specifically to deal with minor spills as may occur at the station. Place a clearly-identified spill kit in a visible location for each fuelling line.
	Develop a step-by-step guide to use of the spill kit.
	Develop an evacuation plan and/or response procedures for emergencies involving large fuel spills.
	Train the whole team in the emergency response procedures. Make sure that all staff knows where the emergency equipment is to be found and is acquainted with its maintenance.
	Label all of the stormwater drains on site in the proximity of the facilities as "Clean Water Only".

Environmental Aspect	Action or Measure
	Inspect the fuel distribution area in order to confirm that rainwater drained or emptied from the roof doesn't enter the areas marked out.
	Check whether the embankment around the fuel distribution area is in good condition and has the capacity to contain a fuel leak in the event of an emergency.
Minimise the risks of environmental contamination and from issues of workers' health and safety	Provide training to the staff regarding the disposal of material contaminated with fuel, such as absorbent material from the spill kit, soaked in fuel.
	Ensure that the product safety cards for all fuels and oils are up-to-date and accessible at all times.
	Should any contamination be found on-site during the decommissioning phase of the existing / proposed facility, the Western Cape Province Pollution and Chemicals Management Directorate must be informed of such contamination, as required in terms of Part 8 of the National Environmental Management Waste Act, 2008 (Act No. 59 of 2008) ("NEM: WA").
	Should more than 100m^3 of general waste and/or or more than 80m^3 of hazardous waste be stored at the proposed WEF for a period exceeding 90 days, the applicant will need to register in terms of, and adhere to, the NEM: WA National Norms and Standards for the Storage of Waste promulgated in GN No. 926 of 29 November 2013.
Minimise the risks of fuel leaks as may result in pollution of the sub-soil and groundwater	Check if there is fuel, from a possible leak, in the spill containment sumps installed at the tank's discharge nozzle.
	Check if there is fuel, from a possible leak, in the all tanks containment sumps, installed on the manhole to the storage tanks. In the event of suspected leakage, report it immediately.
	Check if there is fuel or lube, from a possible leak in the containment sumps installed under the tanks.
Minimise the risks of fuel leaks as this may result in pollution of the sub-soil and groundwater	Check if there is fuel, from a possible leak, in the chambers of the containment sumps installed under the pumps
Minimise the risks of harmful emissions to the atmosphere and the loss of fuel	Check that lids, flanges and connections are closed.
	Confirm that the ventilation conduits are not blocked.
	Supervise the fuel deliveries.
Minimise the risks of water pollution	Carry out an Oil-Water Separator inspection to ensure effective treatment.
Integrity control	Adequate maintenance and calibration of the monitoring equipment

21 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 WEFs' 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.
- 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.

21.1.1 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 recommended 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.

22 AVIFAUNA MANAGEMENT AND MONITORING PLAN

It is recommended that the Avifauna Management and Monitoring programme be implemented by the wind farm if constructed. The findings from operational phase monitoring should inform an adaptive management programme to mitigate any impacts on avifauna to acceptable levels. In particular, any Verreaux's Eagle fatalities should be reported to Dr Megan Murgatroyd in order to close the feedback loop back to the VERA modelling performed for this site.

During construction monitoring

Construction phase bird monitoring must be conducted in line with the current best practise guidelines and applicable species-specific guidelines. Construction phase bird monitoring must be conducted throughout the entire construction phase of the WEF. It will be necessary to monitor the breeding status and productivity of the nesting raptors during all breeding seasons. This can be done by a minimum of 3 specialist visits to the nest site per breeding season. Detailed requirements as follows:

- Independent avifaunal specialist to make 3 visits to nest site in each breeding season (May to October) during construction.
- Breeding status & productivity to be determined.
- Any disturbance to eagles during the construction phase needs to be documented.
- An avifaunal specialist must confirm the reporting requirements, but these must be in line with guideline requirements and reports must be submitted to relevant stakeholders in line with applicable guidelines.

Operational phase monitoring

The intention with operational phase bird monitoring is to repeat as closely as possible the methods and activities used to collect data pre-construction. This work will allow the assessment of the impacts of the proposed facility and the development of active and passive mitigation measures that can be implemented in the future where necessary. One very important additional component needs to be added, namely mortality estimates through carcass searches under turbines. The following programme has therefore been developed to meet these needs, and should start as soon as possible after the operation of the first phase of turbines (not later than 3 months):

Live bird monitoring

- The 18 walked transects of 1km each that have been done during pre-construction monitoring on the site should be continued.
- The 6 vehicle-based road count routes on the site should be continued, and conducted once on each Site Visit.
- The Focal Sites on the site should be monitored. If any sensitive species are found breeding on site in future these nest sites should be defined as focal sites.
- All other incidental sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) within the broader study area should be carefully plotted and documented.
- The Vantage Points already established on the overall site should be used to continue data collection post-construction. The exact positioning of these may need to be refined based on the presence of new turbines and roads. A total of 72 hours direct observation per Vantage Point should be conducted per year.
- The activities at the Control Site should be continued, i.e. 2 Vantage Points, 3 Walked Tran-sects, 1 Vehicle Based transect, and Focal Sites.

Live bird monitoring must mirror the pre-construction monitoring surveys conducted for the Loxton WEF 3 and be in line with the applicable South African post-construction monitoring guidelines and be conducted for the first three years of operations. The need for further fatality monitoring should then be reviewed, but at a minimum it must happen in year 5, 10, 15, 20, 25 etc. (i.e. every 5 years), in line with the applicable South African monitoring guidelines.

Bird Fatality estimates

It is important that in addition to searching for carcasses under turbines, an estimate of the detection (the success rate that monitors achieve in finding carcasses) and scavenging rates (the rate at which carcasses are removed and hence not available for detection) is also obtained (Jenkins et al. 2015).

Fatality searches should be conducted as follows:

- The area surrounding the base of turbines should be searched (up to a radius equal to 75% of the maximum height of turbine) for collision victims.
- All turbines on the wind farm should be searched at least once a week (Monday to Friday).
- Any suspected collision casualty should be comprehensively documented.
- A team of carcass searchers will need to be employed and these carcass searchers will work on site every day searching the turbines for mortalities.
- It is also important that associated infrastructure such as power lines and wind masts be searched for collision victims according to similar methods.

Bird fatality searches must be done for the first three years of operations. The need for further fatality monitoring (i.e. carcass searching) should then be reviewed, but at a

minimum it must happen in year 5, 10, 15, 20, 25 etc. (i.e. every 5 years), in line with the applicable South African monitoring guidelines.

The above programme should be reported on, quarterly, to the wind farm operator, who should submit these reports to the Department of Foresty, Fisheries and the Environment and BirdLife South Africa. These reports should include a comparison of actual measured fatality rates with those predicted by this study.

23 BAT MANAGEMENT AND MONITORING PLAN

The following Management Plan was recommended by the specialist for implementation to minimise the potential negative affects the development can impose:

Objective	**Avoid and minimise modification and disturbance of bat habitats**		
Project component/s	All project infrastructure		
Potential Impact	Vegetation clearing for project infrastructure, as well as noise, dust and pollution generated during construction activities, will impact bats by removing habitat used for foraging and commuting, through disturbance, and displacement. Construction of WEF infrastructure could result in destruction and/or disturbance to bat roosts, and inadvertently provide new roosting spaces for some bat species in risky locations.		
Activity/risk source	All construction activities and associated activities (e.g., driving)		
Mitigation: Target/Objective	• Avoid potential for bats to roost in project infrastructure (e.g., buildings, turbines, road culverts) • Avoid disturbance to bats • Minimise disturbance to bats • Minimise habitat loss • Restore disturbed habitats		
Mitigation: Action/control		**Responsibility**	**Timeframe**
• Ensure all project infrastructure (e.g., buildings, turbines, road culverts) is properly sealed such that bats cannot gain access. • No blasting where this would destroy rocky outcrops. • No placement of infrastructure (except roads and MV Cabling) in No-Go areas. • Minimise clearing of vegetation, minimise disturbance and destruction of farm buildings and rocky crevices, minimise removal of trees. Apply good construction abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste). • Rehabilitate all areas disturbed during construction, (including aquatic habitat).		EPC Contractor/Operator	During design and planning phase and throughout construction phase
Performance Indicator	• No bat roosts are destroyed • No bats colonise new project infrastructure for roosting • No permanent infrastructure in No-Go areas (except roads and MV Cabling) • All areas disturbed during construction are rehabilitated		
Monitoring	• An appointed ECO must inspect all new project infrastructure, in conjunction with or via training from a bat ecologist, to ensure bats cannot gain access.		

	• ECO to ensure compliance with good construction abatement control practices. • ECO must ensure no infrastructure is placed in No-Go areas. • If a bat roost is encountered during construction, the ECO must consult a bat ecologist to determine appropriate actions. • ECO to ensure all disturbed areas are rehabilitated.

Objective	**Avoid and minimise bat fatality**		
Project component/s	Wind Turbines		
Potential Impact	Bat mortality through collisions with wind turbine blades.		
Activity/risk source	Operating Wind Turbines		
Mitigation: Target/Objective	• Avoid bat fatalities through turbine layout design • Minimise bat fatalities through turbine design, and by using blade feathering, curtailment, and deterrents		
Mitigation: Action/control		**Responsibility**	**Timeframe**
• No placement of turbines within No-Go areas to reduce spatial overlap between bats and wind turbines. • Maintain a minimum blade sweep of 30 m to minimize impacts to lower flying bats such as clutter-edge species (e.g., Cape serotine\). • Minimise the rotor swept areas to reduce impacts to high-flying species (e.g., Egyptian free-tailed bat). • All turbine blades must be feathered, or a similar technique should be used, to prevent free-wheeling below the turbine cut-in speed. • Implement fatality monitoring throughout the operational phase and apply curtailment or deterrents if fatality thresholds are exceeded. Annual fatality threshold per Least Concern species = 57 individuals.		EPC Contractor/Operator	BMP developed prior to operation. BMP active throughout operation phase.
Performance Indicator	≤ 57 individuals per Least Concern species killed annually		
Monitoring	• ECO must ensure no turbines are placed in No-Go areas, including the blade tips. • ECO must ensure the dimensions of the final selected turbine adhere to requirements (A minimum blade sweep of 30m). • ECO must ensure blade feathering is implemented. • A Biodiversity Management Plan (BMP) for bats must be developed by a bat ecologist before operation which includes the design of a post-construction fatality monitoring program (PCFM) for bats, and an adaptive management response plan that provides an action plan for mitigation should fatality thresholds be exceeded. • ECO to ensure adherence to BMP and any mitigation measures implemented. • Operational acoustic monitoring and carcass searches (inclusive of scavenger removal and searcher efficiency bias trials) for bats must be performed, based on best practice available at the time (i.e. two years initially) to monitor bat mortality and bat activity. Thereafter, monitoring must take place in year 5, and every 5 years thereafter. Acoustic monitoring must include monitoring at height (i.e., such as on a turbine or met mast) and at ground		

	level (on a met mast and/or short mast(s). The number of sampling locations required must be determined by the size of the area and habitats available at the operational facility. This is to be determined by an appropriate bat specialist at the time of appointment for the operational monitoring campaign. • Carcass searching must be undertaken daily in all seasons for the first two years as per current best practise. Beyond the initial two years, monitoring of impacts must then continue throughout the lifespan of the facility. The scope of this monitoring must be informed by the findings of the initial two years of operational monitoring. However, as a minimum, following the initial two-year period, monitoring of impacts (together with seasonal scavenger removal and bias trials) must be repeated again for an entire year in year five, and again every five years thereafter. The search interval must be twice a week initially, to be updated using carcass removal rates by scavengers for the specific study area.

Objective	**Avoid and minimise light pollution**		
Project component/s	Project Lighting		
Potential Impact	Light pollution can alter ecological dynamics		
Activity/risk source	Emission of light from project lighting		
Mitigation: Target/Objective	• Avoid light pollution through spatial planning of the facility • Minimise light pollution by using appropriate lighting technology		
Mitigation: Action/control		**Responsibility**	**Timeframe**
• No placement of substations and operational and maintenance buildings in No-Go areas. • Use as little lighting as possible, maximise use of motion-sensor lighting, avoid sky-glow by using hoods, increase spacing between lighting units, and using low intensity lights.		EPC Contractor/Operator	During design and planning phase and throughout operation phase
Performance Indicator	• No buildings in No-Go areas • Use of appropriate lighting technology		
Monitoring	• ECO must ensure no buildings are in No-Go areas (see Figure 6). • ECO must ensure lighting technology meets requirements.		

24 NOISE MANAGEMENT AND MONITORING PLAN

Is it recommended that the project applicant:

- Re-evaluate the noise impact should the layout be revised where:
  - any WTG, located within 1,500 m from a confirmed NSR, are moved closer to the NSR;
  - the number of WTG within 2,000m from an NSR are increased.
- re-evaluate the noise impact once the final make and model of WTG was selected (if the project proceeds, considering the latest WTG layout as well as the specific characteristics of the selected WTG);
- design and implement a noise monitoring program, measuring ambient sound levels before construction activities start, as well as during the operational phase;
- ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine

bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised;
- include a component covering environmental noise in the Health and Safety Induction to sensitize all employees and contractors about the potential impact from noise, especially those employees and contractors that have to travel past receptors at night, or might be required to do work close (within 1,500m) to NSR at night. This should include issues such as minimising the use of vehicle horns;
- investigate any reasonable and valid noise complaint if registered by a receptor staying within 2,000 m from the location where construction activities are taking place, or where night-time construction activities are required, or where an operational WTG are located. A complaint register, keeping a full record of the complaint, must be kept by the applicant;
- with regard to unavoidable noisy night-time construction activities in the vicinity of NSR (closer than 1,500 m from any identified NSR), the contractor and Environmental Control Officer (ECO) must liaise with local NSR on how best to minimise impact and the NSR must be kept informed of the nature and duration of intended activities; and
- where practicable, mobile equipment should be fitted with broadband (white-noise generators/alarms), rather than tonal reverse alarms.

Environmental Noise Monitoring can be divided into two distinct categories, namely, Passive monitoring (registering of valid and reasonable complaints) and Active monitoring (measuring noise levels at identified locations).

Active noise monitoring is recommended because the projected noise levels are more than 42 dBA (more than 7 dBA of the night-time rating level of a rural noise district) for the layout and WTG as assessed in this report. Noise levels may be higher than 42 dBA at certain NSR for a WTG with an SPL exceeding 106.5 dBA (re 1 pW).

Should a reasonable and valid noise complaint be registered, the Applicant should investigate the noise complaint as per the guidelines. Once-off noise measurements must be conducted at the location of the person that registered the complaint. The measurement location should consider the direct surroundings to ensure that other sound sources cannot influence the reading. The guidelines should be used as a rough guideline as site-specific conditions may require that the monitoring locations, frequency or procedure be adapted.

The applicant must develop and implement an environmental noise monitoring programme before the construction phase start, conducting active night-time noise measurements at selected NSR05, NSR6 and NSR07 before the construction activities start.

Environmental noise monitoring during the operational phase (once the WEF is fully operational) must be repeated at the same locations at least once. Ambient sound levels must be measured at the NSR before the development of the WEF, with the measurements repeated after the first year of operation. Should any of the locations not be used for residential purposes, measurements would not be required. The noise specialist employed to do the noise monitoring must recommend and motivate the need (or not) for continued noise monitoring.

Potential environmental management objectives would be:

- The development of the WEF project should not result in noise levels exceeding 55 dBA during the day.
- The WEF project should not result in noise levels exceeding 42 dBA at night during the construction phase; and
- The WEF project should not result in noise levels exceeding 45 dBA at night during the operational phase.

As noise levels will not exceed 55 dBA during both the construction and operational phases, Environmental Management is mainly focusing on the night-time period as summarized in:

Environmental Management for Planning Phase

Objective: Future project activities not to result in disturbing noises			
Project Components:	Future construction activities and operation of WTG		
Potential Impact:	No noise impact during the planning phase		
Activity/Risk source	Future construction activities and operation of WTG		
Mitigation: Target	Night-time noise levels less than 42 dBA (construction phase) and 45 dBA (operational phase) at locations used for residential purposes		
Mitigation: Action / Control		**Responsibility**	**Timeframe**
Applicant to re-evaluate the noise impact should the layout be revised where any new WTG are introduced within 1,500 m from an NSR		Applicant	Planning phase, before development of WEF
Applicant to re-evaluate the noise impact should the layout be revised where the number of WTG within 2,000 m from an NSR are increased		Applicant	Planning phase, before development of WEF
Applicant to design access roads further than 15 m (if only daytime construction activities will take place), or 60m from verified NSR (if the roads may be used during the night-time period)		Applicant	Planning phase, before development of WEF
Applicant to re-evaluate the noise impact once the WTG layout and WTG specifications was finalised		Applicant	Planning phase, before development of WEF
Design and implementation of a noise monitoring programme to define current ambient sound levels at selected NSR before the construction phase start.		ECO	Before the construction phase start
Performance Indicator	Calculated noise levels should be 45 dBA at structures used residential purposes		
Monitoring	No monitoring required during planning phase		

Environmental Management for night-time construction activities

Objective: Project activities not to result in noise levels exceeding night-time noise levels of 42 dBA			
Project Components:	Construction activities and construction equipment generating disturbing and nuisance noises		
Potential Impact:	Night-time noise levels impacting on the quality of living of people living at NSR		
Activity/Risk source	Construction activities		
Mitigation: Target	Night-time noise levels less than 42 dBA at locations used for residential purposes		
Mitigation: Action / Control		**Responsibility**	**Timeframe**
ECO to ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures;		ECO	Ongoing during construction phase
ECO to include a component covering environmental noise in the Health and Safety Induction to sensitize all employees and contractors about the potential impact from noise;		ECO	Ongoing during construction phase
ECO to notify NSR before night-time construction activities are to take place within 1,000 m from this NSR (if the structures are used for residential activities during the proposed construction period).		ECO	Construction activities within 1,500 m from NSR, if NSR is used for residential purposes
Performance Indicator	Night-time noise levels less than 42 dBA		
Monitoring	Noise level monitoring before the construction phase start at NSR03 and NSR04. Inspection of equipment by ECO.		

Environmental Management for night-time operational period

Objective: Project activities not to result in noise levels exceeding 45 dBA			
Project Components:	Operation of WTG within 2,000 m from structures used for residential purposes		
Potential Impact:	Noise levels impacting on the quality of living of people living at NSR		
Activity/Risk source	Operation of WTG		
Mitigation: Target	Night-time noise levels less than 45 dBA at locations used for residential purposes		
Mitigation: Action / Control		**Responsibility**	**Timeframe**
ECO to conduct noise monitoring when a reasonable and valid noise complaint are received from an NSR living within 2,000m from a WTG of the project.		ECO	Within 2 months after a noise complaint is registered
Noise monitoring to confirm that noise levels associated with operating WTG are less than 45 dBA at all NSR		ECO	During the first year once the project is operational. Noise specialist to confirm need for future measurements.
Performance Indicator	Night-time noise levels less than 45 dBA		

25 VISUAL MANAGEMENT AND MONITORING PLAN

During the **construction phase**, ensure that visual management measures are included and monitored by an Environmental Control Officer (ECO). This includes siting of any construction camps, stockpiles, temporary laydown areas and batching plants outside of identified no-go areas unless otherwise approved by the visual specialist. Dust suppression and litter control measures should be implemented as well. Rehabilitation efforts must commence immediately after construction activities are completed.

Responsibility: ECO / Contractor.

Timeframe: Preparation of the EMPr during the planning phase and monitoring during the construction phase.

For the **operation phase**, visual mitigation measures must be monitored by management on an on-going basis, including the maintenance of rehabilitated areas, as well as control of any signage, lighting and wastes at the proposed wind farm. Interim inspections must be conducted by the environmental officer based on site to ensure all of the above.

Responsibility: Wind Farm Operator and ECO.

Timeframe: During the operational life of the project.

Throughout the **decommissioning phase**, ensure that procedures for the removal of wind turbines and building structures are implemented. This includes recycling of materials and rehabilitation of the site to a visually acceptable standard, and signed off by the delegated authority. It is assumed that some access roads and concrete pads would remain. Those that are not required should be ripped and vegetation or cropland reinstated to match the surroundings. The revegetation measures are not described as they would fall under the auspices of the appropriate specialist.

Responsibility: ECO / Contractor / qualified rehabilitation ecologist or horticulturist.

Timeframe: During the decommissioning contract phase, as well as a prescribed maintenance period thereafter (usually one year).

26 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 Loxton WEF 2. 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: EMPR FIGURE

FIGURE

EAP CURRICULUM VITAE

APPENDIX 1: METHOD STATEMENTS

To be prepared by the contractor prior to commencement of the activity. The method statements are **not required** to be submitted to the CA.

CURRICULUM VITAE

Ashlin Bodasing

Technical Director and Environmental Assessment Practitioner

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Specialisms

- Environmental Impact Assessments
- Environmental Management Plans and Programmes
- Environmental Feasibility Studies
- Environmental Due Diligence and Compliance
- Client Relationship Management

Summary of Experience

Ashlin Bodasing is a Director at Arcus Consultancy Services South Africa (Pty) Ltd (Arcus is an ERM Group Company). She manages the Arcus South African office and the team based in Cape Town. Ashlin is a Registered EAP with the EAPASA Governing Body.

Having obtained her Bachelor of Social Science Degree (Geography and Environmental Management) from the University of Kwa-Zulu Natal; she has over seventeen years' experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment, green and brown field coal mines, as well as renewable energy facilities, both wind and solar and hydrogen. Ashlin has excellent Project Management experience and has gained major project experience in the development of Environmental Impact Assessments, Environmental Management Programmes and the monitoring of construction activities. Her areas of expertise include project management, environmental scoping and impact assessments, environmental management programmes, environmental compliance monitoring and environmental feasibility studies. Having spent over two year working at Glencore's Coal Mine in Mpumalanga, she has excellent knowledge of EMPr implementation and reporting on EMPr compliance in the construction phase. Experience also includes International Finance Corporation Performance Standards and World Bank Environmental Guidelines environmental due diligence reviews. She has worked in Mozambique, Namibia, Botswana, Lesotho and Zimbabwe.

Professional History

2017 – Present	-	Technical Director, Arcus Consultancy Services SA (Pty) Ltd
2015 – 2017	-	Team Leader, Arcus Consultancy Services SA (Pty) Ltd
2012 – 2015	-	Lead Environmental Officer, Tweefontein Optimisation Project, Glencore / Xstrata Coal Mine, Witbank, Mpumalanga, South Africa (*Secondment*)
2007 – 2015	-	Senior Environmental Assessment Practitioner, Parsons Brinckerhoff Africa
2005 – 2007	-	Environmental Consultant, WSP Environment and Energy

Qualifications and Professional Interests

- **University of Kwa-Zulu Natal, 2004**
  Bachelor of Social Science (Geography and Environmental Management)
- **Environmental Assessment Practitioners Association of South Africa, 2020**
  Registered Environmental Assessment Practitioner: Number 2020/780.
- Member of IAIA International and South Africa.

Project Experience (Selected)

<u>Environmental Impact Assessments</u>

- **De Aar 2 South Wind Farm Transmission Corridor and Road, 2022-present.** Project Director (client liaison) and Lead EAP.
- **De Aar 2 South Wind Farm Grid Connection and Battery Energy Systems, 2019-2022.** Project Director (client liaison) and Lead EAP.

- **Darling Wind Farm, 2020-2022.** Project Director and Lead EAP.
- **Elands Bay Housing Development, 2017-2018.** Project Director, Project Manager and Lead EAP.
- **Highlands North, South and Central Wind Energy Facilities, 2018-2020**. Project Director (client liaison) and Lead EAP.
- **Paulputs Wind Energy Facility, 2018-present.** Project Director (client liaison) and Lead EAP.
- **San Kraal Wind Energy Facility, 2016- 2018**. Project Director (client liaison) and Lead EAP.
- **Phezukomoya Wind Energy Facility, 2016 – 2018**. Project Director (client liaison) and Lead EAP.
- **Kolkies and Karee Wind Energy Facilities, 2016-2016**. Project Director (Client liaison) and Lead EAP.
- **Komsberg East and West Wind Energy Facilities 2015-2016**. Project Director (Client Liaison) and EAP.
- **Umsinde Emoyeni Wind Energy Facilities, 2015-2018.** Project Director (Client Liaison) and EAP.

Amendment Applications

- **Paulputs Wind Energy Facility, 2020 –2021.** Project Director (client liaison) and Lead EAP.
- **San Kraal and Phezukomoya Wind Energy Facilities, 2019.** Project Director (client liaison) and Lead EAP.
- **Banna ba Phifu Wind Farm, 2019-present.** Project Director (client liaison) and Lead EAP.
- **Juno WEF Amendment 2021-2022.** Project Director (client liaison) and Lead EAP.

Ecological Impact Assessments and Monitoring

- **Nuweveld Wind Farms, 2018-2021.** Coordination and management of bat specialists, review of technical reports and input into impact assessments.
- **Confidential Wind Farm, Mozambique, 2021-present.** Coordination and management of bat specialists, review of technical reports and input into impact assessments.
- **Kurland Housing Development, Western Cape, 2022.** Coordination and management of ecological specialist, review of technical reports and input into impact assessments.
- **Confidential Wind Farm, Zambia, 2019-2021.** Coordination and management of bat specialists, review of technical reports and input into impact assessments.
- **Confidential Wind Farm, 2017-2018, Northern Cape Province**. Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Paulputs Wind Energy Facility 2017-present, Northern Cape Province.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Highlands Wind Energy Facilities 2017 – 2018, Northern Cape Province.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Komsberg Wind Farms, 2015-2016.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Kolkies and Karee Wind Energy Facilities 2015-2016.** Project Director (Client Liaison), coordination and management of bird and bat specialists and review of technical and impact assessment reports.

- **Umsinde Wind Energy Facilities, Additional Bird Monitoring**. Project Director. Coordination and management of bird specialists and review of technical reports.
- **Kap Vley Wind Energy Facility, Bird and Bat Pre-Construction Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Highlands Wind Energy Facility, Bird and Bat Pre-Construction Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Hopefield Wind Farm –Operational Monitoring.** Project Manager. Coordination and management of bird and bat specialists, review of technical reports.
- **Gouda Wind Farm – Operational Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **West Coast 1 Wind Farm – Operational Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Oyster Bay Wind Farm – Operational Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Nxuba Wind Farm – Operational Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.

Feasibility Studies and Due Diligence Reviews

- **Ecological Feasibility Studies for Three Potential Wind Farm Sites for EDF.** Project Director and Reviewer.
- **Lenders Technical Advisor – Environmental Professional – ABSA, Standard Bank and Nedbank, Wind Farm and Solar PV Due Diligence (six projects).** Project Director and Client Liaison. Technical review of Solar projects for REIPPPP Financial Close.
- **Total Energies South Africa Solar PV Due Diligence.** Project Director and Client Liaison. Technical review of Solar projects for REIPPPP.
- **Environmental Feasibility for confidential wind farm, Western Cape Province, 2020.** Project Director and Client Liaison. Technical review of specialist reports and feasibility study.
- **Ecological due diligence for IFC PS6 – Wind Energy Developments:** Project Manager. Review and reporting on bird and bat specialist reports to IFC/World Bank Standards – Various sites across South Africa.
- **Power Plant – Ghana**. Project Manager Compilation of environmental due diligence for refinancing, IFC and World Bank Standards, on behalf of Botswana Development Corporation.
- **Ecological Feasibility Study.** Project Director. Review of the feasibility of a site for a wind energy facility in relation to bats.
- **Environmental Feasibility Study.** Project Director and EAP. Review of a proposed site for the development of industrial facility.

Previous Project Experience

Environmental Scoping and Impact Assessments and Project Management for:

- eThekwini Municipality
- Moreland Developments
- RBCH – Bulk Materials and Handling Facility
- SAPREF
- Mittal Steel Permit Amendment
- Transnet Projects
- ArcelorMittal South Africa
- MCA-Lesotho
- Talbot Group Holdings (Australian Mining Company)
- Ncondezi Energy – Mozambique

CURRICULUM VITAE

Environmental Management Plans and Compliance Monitoring

- Nongoma Road Monitoring – Compliance Monitoring
- eThekwini Municipality - Taxi Holding Areas: Canberra Road and Umgeni Road Compilation of the EMP; and Bi-monthly compliance monitoring (site visits) and reporting.
- EMP for Kwezi V3 - Kwamashu Fuel Tank Exemption
- eThekwini Municipality - Ridgeview Road – Compliance Monitoring
- eThekwini Municipality and Merz and Mclellen - Phoenix Overhead Transmission Lines – Compliance Monitoring
- eThekwini Municipality and Merz and Mclellen - E8546 E8699 Compliance Monitoring
- eThekwini Municipality and Merz and Mclellen - Environmental Assessment and EMP
- EMP for eThekwini Municipality - Parlock Switching Station

Training and Auditing

- Petronet Alien Plant Training - Compilation of the training material for alien plant identification and removal methods.
- eThekwini Municipality - Taxi Holding Areas – Canberra and Umgeni Road - Contactor and workforce training.
- eThekwini Municipality - Kingsway Road Taxi Rank - Contactor and workforce training.

Environmental Reviews / Terms of Reference

- Biotherm Energy - Environmental Project Manager: Independent review of environmental impact assessment reports and management plans compiled for 3 wind farms in the Western Cape and 2 PV Solar Plants in the Northern Cape, to ensure compliance to IFC and World Bank Standards.
- Government of Zimbabwe – Hwange Power Station - Environmental Project Manager: Compilation of the Terms of Reference for Environmental Management Plan and Environmental and Social Audit of the Hwange Power Plant in Zimbabwe.

Pre-Feasibility Studies

- Pre-feasibility studies for eThekwini Municipality, Investec, Sekoko Coal Resources, Mulilo, Sekoko Mining and MCA-Lesotho for renewable energy, coal mines and power plants.