Environmental Management Programme

Proposed Khoe Wind Energy Facility and associated Infrastructure, Western Cape Province.

PREPARED FOR

FE Hugo & Khoe (Pty) Ltd

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Environmental Management Programme

Proposed Khoe Wind Energy Facility and associated Infrastructure, Western Cape Province.

0695823

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Stephanie Gopaul
Partner and Registered EAP

Dieter Rodewald
Partner

ERM Southern Africa (Pty) Ltd.
1st Floor
Great Westerford
240 Main Road, Rondebosch
Cape Town, 7700
South Africa
T +27 21 681 5400

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
ABC	Activity Based Costing
BARESG	Bird and Renewable Energy Specialist Group

Acronyms	Description
BBBEE	Broad-Based Black Economic Empowerment
BESS	Battery Energy Storage System
CARA	Conservation of Agricultural Resources Act
CBAs	Critical Biodiversity Areas
CEC	Community Engagement Committee
CHSSP	Community Health, Safety, and Security Plan
CoC	Code of Conduct
CRM	Conservation Risk Management
CSI	Community Social Investment
CSR	Corporate Social Responsibility
DAERL	Department of Agriculture, Environmental Affairs, Rural Development, and Land Reform
DBA	A-weighted Decibels
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry, Fisheries, and the Environment
DMRE	Department of Mineral Resources and Energy
DRP	Decommissioning and Restoration Plan
DWAF	Department of Water Affairs and Forestry
EA	Environmental Authorization
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme

Acronyms	Description
EoL	End-of-Life
ERM	Environmental Resource Management
ESAP	Environmental and Social Action Plan
ESM	Environmental and Social Manager
ESO	Environmental Site Officer
GN	Government Notice
H&S	Health and Safety
Ha	Hectares
HV	High Voltage
I&APs	Interested and Affected Parties
IAPs	Invasive Alien Plants
IFC	International Finance Corporation
IPWIS	Integrated Pollutant and Waste Information System
Li-Ion	Lithium Ion
LV	Low Voltage
MC	Monitoring Committee
MPRDA	Mineral and Petroleum Resources Development Act
MSDS	Material Safety Data Sheets
MW	Megawatts
MWe	Megawatts electrical
NEMWA	National Environmental Management: Waste Act
NEMA	National Environmental Management Act
NFA	National Forests Act

Acronyms	Description
NSR	Noise Sensitive Receptor
NWMS	National Waste Management Strategy
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
OHSA	Occupational Health and Safety Act
PD	Project Director
PIA	Paleontological Impact Assessment
PV	Photovoltaic
S&EIA	Scoping and Environmental Impact Assessment
SABAA	South African Bat Assessment Association
SABS	South African Bureau of Standards
SANS	South African National Standards
SCADA	Supervisory Control and Data Acquisition
SCC	Species of Conservation Concern
SDOD	Shut Down on Demand
SEA	Strategic Environmental Assessment
SED	Socio-Economic Development
SEP	Stakeholder Engagement Plan
SWMP	Storm Water Management Plan
TMP	Traffic Management Plan
ToR	Terms of Reference
ULM	Urban Land Management
WEF	Wind Energy Facility

Acronyms	Description
WTG	Wind Turbine Generator

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.

EXECUTIVE SUMMARY

FE Hugo and Khoe (Pty) Ltd is applying for an Environmental Authorisation to construct and operate the Khoe Wind Energy Facility (WEF) with a capacity of up to 232 MW. Additional ancillary infrastructure to the WEF would include underground and above-ground cabling between project components, onsite substation/s, Battery Energy Storage Systems (BESS), foundations to support turbine towers, internal/ access roads linking the wind turbines and other infrastructure on the site, and permanent workshop area and office for control, maintenance and storage. As far as possible, existing roads will be utilised and upgraded (where needed). The proposed development is located near the De Doorns town in the Western Cape Province. Hereafter, the proposed Khoe WEF as well as its associate infrastructure will be referred to as the "proposed development".

One additional WEF, namely Hugo is concurrently being considered in the surrounding properties and is assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment (EIA) Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended).

It is important to note that the grid connection will not form part of this S&EIA process. It will, however, be assessed in a separate application process at a later stage.

SITE LOCATION AND PROPOSED DEVELOPMENT DESCRIPTION

The proposed Khoe WEF is located near De Doorns within the Langeberg Local Municipality in the Western Cape Province.

The Khoe WEF project site is proposed to accommodate infrastructure (as detailed below), which will enable the WEF to supply a contracted capacity of up to 232 MW. The development footprint of the site will be up to 85 ha, dependent on the sensitivities in the area. The proposed development will comprise of the following infrastructure:

- Up to 29 wind turbines with a maximum tip height of up to 250 m and a rotor diameter of up to 200 m.
- Each turbine with have a capacity of up to 8 MW
- A transformer at the base of each turbine.
- Concrete turbine foundations approximately up to 1,000 m^2 per turbine
- Each turbine will have a hardstand area of approximately up to 7,500 m^2 per turbine
- Temporary laydown areas (with a footprint of up to 9 ha) which will accommodate the boom erection, storage and assembly area.
- Battery Energy Storage System (BESS) (with a footprint of up to approximately 5 ha).
- Cabling between the turbines, to be laid underground where practical.
- One on-site substations of up to 2.5 ha in extent to facilitate the connection between the WEF and the electricity grid.
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 13.5 m road corridor may be temporarily impacted upon during construction and rehabilitated to 8m wide after construction.

- A temporary site camp establishment and concrete batching plants (with a combined footprint of up to 1 ha).
- Operation and Maintenance (O&M) buildings (with a combined footprint of up to 1 ha) including a gate house, security building, control centre, offices, warehouses, a workshop and visitor's centre.

The project is expected to have a 20-25-year life span, but with possible refurbishment this could be extended if deemed feasible at the time.

1. INTRODUCTION

The FE Hugo & Khoe (Pty) Ltd ('the Project Applicant') is applying for environmental authorisation to construct and operate the up to 232 MW Khoe Wind Energy Facility (WEF). Additional ancillary infrastructure to the WEF would include underground and above-ground cabling between project components, onsite substation/s, Battery Energy Storage Systems (BESS), foundations to support turbine towers, internal/ access roads linking the wind turbines and other infrastructure on the site, and permanent workshop area and office for control, maintenance and storage. As far as possible, existing roads will be utilised and upgraded (where needed) ('the proposed development').

The proposed development is located approximately 20 km southeast of the De Doorns town within the Langeberg Local Municipality and the Cape Winelands District Municipality of the Western Cape Province.

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	FE Hugo & Khoe (Pty) Ltd
Company Registration	K2022778660
Contact Person	Mr Thomas Condesse
Postal Address	15 Bridgeway Road, Bridgeway Precinct, Century City, Cape Town
Telephone	+33 6 22 66 59 32
Email	Thomas.Condesse@energyteam.co.za/Deon.lottering@energyteam.co.za
Environmental Assessment Practitioner	
EAP	Stephanie Gopaul

Details of the Developer (Applicant)	
Organisation	Environnemental Resource Management (Pty) Ltd
Qualifications	• Masters in Environmental Management, University of the Free State, South Africa, 2012 • BSc. Environmental and Engineering Geology, University of KwaZulu Natal, South Africa, 2005
Physical address	Regus, Floor -3, 18 The Boulevard, Westway Office Park, Westville, Durban
Postal address	As above
Postal code	3629
Telephone	+27 11 798 4300
Email	stephanie.gopaul@erm.com

1.2 PURPOSE AND AIM OF THIS DOCUMENT

An EMPr for the proposed development is required in terms of the Appendix 4 (Table 1.1) 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* *the expertise of the EAP to prepare an EMPr, including a curriculum vitae;*	Section 1.1
(b)	*A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;*	Section 3
(c)	*a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitives of the preferred site, indicating any areas that should be avoided, including buffers;*	Figure 2
(d)	*a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment processed for all phased of the development including-* *(i) planning and design;* *(ii) pre-construction activities;* *(iii) construction activities;* *(iv) rehabilitation of the environment after construction and where applicable post closure; and*	Section 4 - 27

Appendix 4 Requirements NEMA, 1998 (Act No. 107 of 1998)		EMPr Reference
	where relevant, operation activities;	
(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-* *avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;*	Section 4 - 27
	comply with any prescribed environmental management standards or practices;	
	comply with any applicable provisions of the Act regarding closure, where applicable; and	
	comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	
(g)	*the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);*	Section 4 - 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* *risks must be dealt with in order to avoid pollution or the degradation of the environment; and*	Section 4 - 27
(n)	*any specific information that be required by the competent authority.*	Section 4 - 27

2. THE PROPOSED KHOE WEF PROJECT DESCRIPTION

2.1 KHOE WEF COMPONENTS

2.1.1 WIND TURBINE GENERATORS AND HARDSTAND AREAS

The proposed Khoe WEF will comprise up to 29 turbines (each turbine with an approximate capacity of 8 MW) with a maximum combined output capacity of up to 232 MW with an anticipated lifespan of 20-25 years.

The turbines will be three-bladed horizontal-axis design with a Wind Turbine Generator (WTG) hub height from ground level is anticipated to be up to 150 m, with a blade length and rotor diameter of up to 100 m and 200 m respectively. The height of the complete structure is approximately up to 250 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 proposed turbine development footprint and associated facility infrastructure will cover an area of up to 85 ha depending on the final design. The aerial extent of the total area is 4,113 ha ha.

Each turbine will require a transformer that will be located within the turbine tower. Each turbine will have a circular foundation which will be placed alongside the hardstand, resulting in that area being permanently disturbed by the turbine foundation. The dimensions of the turbines provided in this report are preliminary and will be finalized at a later stage of the Project.

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

2.1.2 ELECTRICAL CABLING AND ON-SITE SUBSTATION

It is proposed that an on-site substation with a capacity up to 132 kV with an up to 33 kV overhead / underground powerline will be installed. It is unknown at this stage how long the connection to the grid will be, or what route the cabling will be installed. Due to the complexity related to the routing of the transmission line, it will not form a part of this application. The intention is for the internal project cabling to follow the road network to the on-site facility substation.

The on-site substation is expected to have a footprint of 2.5 ha. It will be used to facilitate the connection to the national grid. The turbines will be connected to the on-site substation using an underground cabling network with a capacity of up to 33kV.

2.1.3 BATTERY ENERGY STORAGE SYSTEM

The battery energy storage system (BESS) is expected to have a total footprint of approximately 5 ha. The function of the BESS will be to store peak kinetic energy produced by the WEF 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 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 (like shipping containers) and these containers are delivered pre-assembled to the project site.

The containers will have approximate dimension ranges of: height 5 m, width 3 m, length 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 up to 10 m.

The BESS storage capacity has not been finalized at this point. The BESS will be placed on a concrete footprint of up to 5 ha. The BESS will be near 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.

The following figures are examples of BESS in other facilities for ease of reference. This proposed development will have similar project components and will be designed in a similar manner.

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 6 ha. The temporary warehouse and site camp establishment, as well as the concrete batching plants will have a footprint of up to 2 ha. As such, the footprint of the construction laydown area will be up to 8 ha in aerial extent.

2.1.5 INTERNAL SITE ACCESS ROADS

Permanent roads will be up to 4.5 m wide, with a servitude of up to 13.5 m, which includes additional space required for cut and fill, side drains and other stormwater control measures. Furthermore, the servitude will be used as turning areas and vertical and horizontal turning radii to ensure safe delivery of the WTG components. Internal roads will provide access to each turbine, the on-site substation hub (which includes substation infrastructure, BESS and Balance of Plant area). All roads may have underground cables running next to them. The 13.5 m wide road servitude will be temporarily impacted during construction and rehabilitated to 4.5 m wide after construction.

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.

FE Hugo & Khoe (Pty) Ltd will institute a Health and Safety (H&S) Plan prior to construction, for all persons working at the proposed development site. The policy will need to evaluate the risks and impacts to the health and safety of the affected community during the design, construction and operation of the proposed development, and establish preventive measures to address them in a manner commensurate with the identified risks and impacts within this assessment. Such

measures need to adhere to the precautionary principle for the prevention or avoidance of risks and impacts over minimization and reduction.

2.2.2 WATER REQUIREMENTS

Water will be sourced from either the Local Municipality, supplied from a contractor and trucked in, from existing boreholes located within the application site or from a new licensed borehole (if feasible) if none of these options are available. Note, however, that should municipal water supply not be confirmed, the Applicant will investigate other water sources considering any necessary and relevant legal requirements.

High water use is only anticipated during the first 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 wastewater will be handled in accordance with the *Guidelines for the Utilisation and Disposal of Wastewater Sludge Volumes 1 to 6 (Herselmann & Snyman, 2006)*.

A project specific stormwater management plan was produced and has been included in the EMPr (Appendix B) for implementation.

2.2.4 WASTE MANAGEMENT

During the construction phase, it is estimated that the Khoe WEF 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 WEF 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.

The development of the wind energy facility will include the construction and operation of facilities and infrastructure for the storage and handling of dangerous goods (combustible and flammable liquids, such as oils, lubricants, solvents associated with the facility, and facility substation) where such storage will occur inside containers with a combined capacity exceeding 80 cubic meters but not exceeding 500 cubic meters.

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.

It must be noted that waste handling is not yet confirmed and is to be confirmed at a later stage through municipal or private channels. Similarly, the volumes of waste to be generated during construction and operation phases cannot be confirmed at this stage. This being said, the Project will adopt the 4R principle for solid waste management, which includes (in order or priority) to:

- Refuse single use plastics as much as possible;
- Reduce the use of non-recyclable products;
- Reuse solid wastes where possible to convert it into other useful products; and
- Recycle all wastes where possible.

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

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 use of conservancy tanks or septic tanks for ablution as part of the operational phase is being considered by the applicant.

2.2.7 ELECTRICITY FOR CONSTRUCTION PHASE

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

2.3 SUMMARY OF PROJECT INFORMATION

WEF Technical Details

WEF Technical Details Components	Description/Dimensions - Khoe
Maximum Generation Capacity	Up to 232MW
Turbine Capacity	Up to 8 MW
Type of technology	Onshore Wind
Number of Turbines	Up to 29
WTG Hub Height from ground level	Up to 150m
Blade Length	Up to 100m
Rotor Diameter	Up to 200m
Structure height (Tip Height)	Up to 250m
Structure orientation	Wind regime dependent
Area occupied by both permanent and construction laydown areas	• Concrete turbine foundations - approximately up to 1000m^2 per turbine • Each turbine will have a hardstand area of approximately up to 7500m^2 per turbine • Temporary laydown areas (with a combined footprint of up to 9 ha) which will accommodate the boom erection, storage and assembly area; • A temporary site camp establishment and concrete batching plants (with a combined footprint of up to 1 ha)
O&M building with parking area	Up to 1 ha
Site Access	Via the R318
Area occupied by inverter transformer stations/substations	Up to 2.5 ha
Capacity of on-site substation	132/33kv
Battery Energy Storage System footprint	Up to 5 ha
BESS type	Lithium-ion technology
Width of internal roads	Access roads to the site and between project components with a width of approximately 4.5 m and a servitude of 13.5 m.
Proximity to grid connection	This has not been determined at this stage of the Project.
Internal Cabling	Cabling between the turbines, to be laid underground where practical.
Height of fencing	Up to 3 metres

WEF Boundary and Associated Infrastructure		
Reference point 1	33° 36′ 19.66″ S	19° 49′ 22.29″ E
Reference point 2	33° 34′ 35.92″ S	19° 51′ 23.21″ E
Reference point 3	33° 34′ 30.62″ S	19° 52′ 10.48″ E
Reference point 4	33° 33′ 41.69″ S	19° 53′ 22.80″ E
Reference point 5	33° 34′ 45.71″ S	19° 53′ 40.74″ E
Reference point 6	33° 35′ 18.16″ S	19° 55′ 42.16″ E
Reference point 7	33° 36′ 42.15″ S	19° 55′ 54.43″ E
Reference point 8	33° 37′ 25.48″ S	19° 50′ 45.01″ E
Reference point 9	33° 37′ 21.30″ S	19° 54′ 6.55″ E
Reference point 10	33° 37′ 25.83″ S	19° 53′ 52.34″ E
Reference point 11	33° 37′ 1.84″ S	19° 52′ 1.55″ E
Reference point 12	33° 37′ 12.56″ S	19° 51′ 57.36″ E
Reference point 13	33° 36′ 56.04″ S	19° 51′ 20.80″ E
Reference point 14	33° 37′ 30.03″ S	19° 54′ 26.22″ E
Preferred Laydown Area		
Northwest Corner	33° 35' 21.49'' S	19° 52' 2.50'' E
Northeast Corner	33° 35' 8.47'' S	19° 52' 12.71'' E
Southeast Corner	33° 35' 13.074'' S	19° 52' 20.12'' E
Southwest Corner	33° 35' 24.60'' S	19° 52' 6.51'' E
Preferred BESS		
Northwest Corner	33° 35' 24.60'' S	19° 52' 6.51'' E
Northeast Corner	33° 35' 18.62'' S	19° 52' 11.20'' E

Southeast Corner	33° 35' 23.37'' S	19° 52' 17.35'' E
Southwest Corner	33° 35' 29.97'' S	19° 52' 12.88'' E
Preferred Substation		
Northwest Corner	33° 35' 15.34'' S	19° 52' 17.09'' E
Northeast Corner	33° 35' 17.97'' S	19° 52' 21.14'' E
Southeast Corner	33° 35' 23.39'' S	19° 52' 17.36'' E
Southwest Corner	33° 35' 20.31'' S	19° 52' 13.38'' E
Preferred OMM		
Northwest Corner	33° 35' 16.00'' S	19° 52' 18.16'' E
Northeast Corner	33° 35' 13.07'' S	19° 52' 20.12'' E
Southeast Corner	33° 35' 14.88'' S	19° 52' 23.19'' E
Southwest Corner	33° 35' 17.95'' S	19° 52' 21.16'' E
Alternative Laydown Area		
Northwest corner	33° 35' 53.10'' S	19° 53' 14.57'' E
Northeast Corner	33° 35' 57.81'' S	19° 53' 31.83'' E
Southeast corner	33° 36' 2.70'' S	19° 53' 31.59'' E
Southwest Corner	33° 36' 1.92'' S	19° 53' 14.82'' E
Alternative OMM		
Northwest Corner	33° 35' 49.61'' S	19° 53' 14.65'' E
Northeast Corner	33° 35' 49.66'' S	19° 53' 18.31'' E
Southeast Corner	33° 35' 53.17'' S	19° 53' 18.16'' E
Southwest Corner	33° 35' 53.10'' S	19° 53' 14.57” E
Alternative BESS		

Northwest Corner	33° 35' 49.73'' S	19° 53' 24.76'' E
Northeast Corner	33° 35' 49.89'' S	19° 53' 32.15'' E
Southeast Corner	33° 35' 57.81'' S	19° 53' 31.83'' E
Southwest Corner	33° 35' 57.49'' S	19° 53' 24.65'' E
Alternative Substation		
Northwest Corner	33° 35' 49.66'' S	19° 53' 18.31" E
Northeast Corner	33° 35' 49.73'' S	19° 53' 24.76'' E
Southeast Corner	33° 35' 54.80'' S	19° 53' 24.69'' E
Southwest Corner	33° 35' 53.17'' S	19° 53' 18.16'' 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 LISTED ACTIVITIES IN RELATION TO THE PROPOSED DEVELOPMENT

Listing Notices 1, 2 and 3 07 April 2017	**Listed Activity**	**Description of project activity that triggers listed activity**
Listing Notice 1 – GNR 327		
Listing Notice 1 GN R 327 Activity 11(i)	*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;*	FE Hugo and Khoe propose to develop an on-site substation at the WEF location with a capacity of 132 kV to facilitate the connection to the national grid. The turbines will be connected to the on-site substation via cabling with a capacity of 33kv or more, the development footprint for the facility substation is located outside of an urban area.
Listing Notice 1 GN R 327 Activity 12(ii)(a)(c)	*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; or (c) within 32 metres of a watercourse*	The WEF will require the establishment of infrastructure (including internal access roads) with a physical footprint exceeding 100m^2 within or within 32m of drainage features, ephemeral washes or streams present within the project site.
Listing Notice 1 GN R 327 Activity 14	*The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic meters or more but not exceeding 500 cubic meters.*	The development of the WEF will include the construction and operation of facilities and infrastructure for the storage and handling of dangerous goods (combustible and flammable liquids, such as oils, lubricants, solvents associated with the facility, and facility substation) where such storage will occur inside containers with a combined capacity exceeding 80 cubic meters but not exceeding 500 cubic meters. The volumes are not known at the time but will have a maximum combined capacity of 490 m3.
Listing Notice 1 GN R 327 Activity 19(i)	*The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand shells, shell grit, pebbles or rock of more than 10 cubic meters from a watercourse.*	Drainage features, ephemeral washes or streams are present within the project sites. During the construction phase, more than 10 cubic metres of rock will be removed from drainage features for the construction of the WEF and associated infrastructure.
Listing Notice 1 GN R 327 Activity 24(ii)	*The development of a road— (ii) with a reserve wider than 13,5 meters, or where no*	The width of the internal access roads between the project components will be approximately 8m but may be up to 10m

Listing Notices 1, 2 and 3 07 April 2017	Listed Activity	Description of project activity that triggers listed activity
	reserve exists where the road is wider than 8metres;	wide where required for the movement of the crane between turbine positions
Listing Notice 1 GN R 327 Activity 28(ii)	*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 total area to be developed for the WEF (including the facilities substation) are greater than 1ha and occurs outside an urban area and is currently used for agricultural purposes, mainly grazing. The WEF is located outside an urban area. The proposed development is approximately 85HA.
Listing Notice 1 GN R 327 Activity 56(i)(ii)	*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.*	Existing farm roads within the project site will be widened to up to 8m and/or lengthened by more than 1km to accommodate the movement of heavy vehicles and cable trenching activities.
Listing Notice 2 – GNR 325		
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 Khoe WEF is anticipated to have an electricity capacity of up to 232 MW.
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 total for the Khoe WEF is ~4,113 ha, with a development footprint of up to 85 ha . The project is proposed on a property where the predominant land use is grazing and comprises of indigenous. vegetation. It is therefore anticipated that over 20 ha of indigenous vegetation will be cleared as a result of the development.
Listing Notice 3 – GNR 324		
Listing Notice 3 GN R 324 Activity 4(i)(ii)(aa)	*The development of a road wider than 4 metres with a reserve less than 13,5 metres* *(i) in the Western Cape,* *(ii) outside urban areas (aa) within areas containing indigenous vegetation*	Existing roads on the affected properties will be used where feasible and practical. The width of the main access roads at the access points will be up to 8 m. The WEF will have internal access roads of up to 4.5 m wide, with a servitude of up to 13.5 m, which will include additional space required for cut and fill, side drains and other stormwater control measures, turning areas and vertical and horizontal turning radii to ensure safe delivery of the WTG components. Internal roads will provide access to each turbine, the on-

Listing Notices 1, 2 and 3 07 April 2017	**Listed Activity**	**Description of project activity that triggers listed activity**
		site substation hub (which includes substation infrastructure, BESS and Balance of Plant area). The project site is located within the Western Cape Province, outside of an urban area on land containing indigenous vegetation.
Listing Notice 3 GN R 324 Activity 18(i)(ii)(aa)	*The widening of a road by more than four (4) meters, or the lengthening of a road by more than one (1) kilometre within (i) the Western Cape, and in (ii) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined; (aa) Areas containing indigenous vegetation.*	Existing farm roads within the project site will be widened to up to 10m. The project site is located in the Western Cape, outside of an urban area, on land containing indigenous vegetation and within 100m of the edge of a watercourse.

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 Khoe WEF.

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 (construction, operation and decommissioning) 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 of the contents of the EMPr.
- Be fully knowledgeable of the contents of all relevant environmental legislation and ensure compliance with them.
- Communicate the contents of the EMPr 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.
- Monitor compliance to the EMPr 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 of the contents of the EMPr.
- Communicate and develop understanding of the contents of the EMPr by all staff on site and other relevant 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 of the contents of the EMPr.
- Be fully knowledgeable of 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. OBJECTIVES AND GENERAL MITIGATION MEASURES-DESIGN PHASE / PRECONSTRUCTION PHASE

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 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 requirements must be complied with:

- 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.

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

- 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.

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

- The capacity of the tank must be clearly displayed and the product contained within the tank clearly identified.
- There must be adequate fire-fighting equipment at the fuel storage and dispensing area or areas.
- The storage tank must be removed on completion of the construction phase of the project.
- All such tanks to be designed and constructed in accordance with the national standard for storage tanks, i.e., ISO 16961:2015 and a recognised international standard code if required.
- The rated capacity of tanks must provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage.
- Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks must be sealed and stored in an area where the ground has been protected.
- Any electrical or petrol-driven pump must be equipped and positioned so as not to cause any danger of ignition of the product.
- If fuel is dispensed from 200 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 separately and outside of the EIA process

5.5 POTENTIAL ADDITIONAL PERMIT REQUIREMENTS

Activities undertaken during site preparation, construction and operation may require additional permits, over and above the EA. FE Hugo & Khoe 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. Hugo & Khoe WEF (Pty) Ltd or their contractors may want to use borrow pits for certain earthworks operations, such as the construction of roads, embankments, bunds, berms, and other structures. Licensed borrow pits will be used to source material.

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

5.5.2 WATER USE LICENSE

The construction of the WEF and roads may result in water crossings. The developer must ensure that any necessary Water Use Licenses (or general authorizations) 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.

5.6 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, 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	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Moderate
	With Mitigation	Site	Short term	Partly reversible	Negative	Low	Possible	Low
Loss of habitat/vegetation	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	Site	Short term	Partly Reversible	Negative	Low	Possible	Low
Loss of Critical Biodiversity Areas (CBAs)	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	Site	Short term	Partly Reversible	Negative	Low	Possible	Low
Loss of riparian habitat	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	Site	Short term	Partly Reversible	Negative	Low	Possible	Low
Changes to the hydrological regime and increase potential for erosion	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	Site	Short term	Partly Reversible	Negative	Low	Possible	Low
Changes to surface water quality	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	Site	Short term	Partly Reversible	Negative	Low	Possible	Low
Terrestrial Biodiversity								
Potential vegetation clearing	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	Medium
	With Mitigation	Site	Short term	Recoverable	Negative	Low	Probable	Low

Potential chemical contamination	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	Site	Short term	Recoverable	Negative	Low	Probable	Medium
Reduced connectivity and restricted movement of fauna	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	Medium
	With Mitigation	Site	Short term	Recoverable	Negative	Low	Probable	Low
Potential altered flow regime	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	Medium
	With Mitigation	Site	Short term	Recoverable	Negative	Low	Probable	Low
Potential disturbance and/or displacement	Without Mitigation	Regional	Medium term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	Local	Short term	Recoverable	Negative	Low	Probable	Moderate
Potential mortality of faunal and flora species	Without Mitigation	Local	Long term	Irreversible	Negative	High	Highly Probable	Very High
	With Mitigation	Site	Medium term	Recoverable	Negative	Moderate	Probable	High
Faunal								
Direct habitat loss	Without Mitigation	Site	Medium term	Recoverable	Negative	Moderate	Highly Probable	Moderate
	With Mitigation	Local	Medium term	Recoverable	Positive	Moderate	Highly Probable	Moderate
Indirect habitat loss	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Probable	Moderate
	With Mitigation	Local	Medium term	Recoverable	Positive	Moderate	Highly Probable	Moderate
Displacement or disturbance	Without Mitigation	Site	Short term	Recoverable	Negative	Moderate	Highly Probable	High

	With Mitigation	Site	Short term	Recoverable	Negative	Low	Low Probability	Moderate
Direct Mortality	Without Mitigation	Site	Short term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	Site	Short term	Recoverable	Negative	Low	Low Probability	High
Indirect Mortality	Without Mitigation	Site	Short term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	Site	Short term	Recoverable	Negative	Low	Low Probability	High
Impacts of all phases of the proposed development on ecological processes of the area	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	Local	Medium term	Recoverable	Positive	Moderate	Probable	High
Avifauna								
Destruction of habitat and	Without Mitigation	Site	Short term	High	Negative	High-Moderate	Highly likely	High
	With Mitigation	Site	Short term	High	Negative	Moderate	Probable	High -Medium
Disturbance of birds	Without Mitigation	Site	Short term	High	Negative	High-Moderate	Highly likely	High
	With Mitigation	Site	Short term	High	Negative	Moderate	Probable	High -Medium
Bats								
Clearing and excavation of natural habitat	Without Mitigation	Local	Short Term	Recoverable	Negative	Moderate	Definite	Moderate
	With Mitigation	Local	Short Term	Recoverable	Negative	Low	Probable	Low
	Without Mitigation	Local	Long Term	Recoverable	Negative	Moderate	Highly probable	Moderate

Creating attractive bat habitat within the development terrain	With Mitigation	Site	Short Term	Reversable	Negative	Moderate	Low probability	Very Low
Construction noise	Without Mitigation	Local	Short term	Reversible	Negative	Moderate	Definite	Low
	With Mitigation	Site	Short Term	Reversable	Negative	Moderate	Definite	Very Low
Archaeology, Paleoontology and Heritage								
Disturbance or destruction of archaeological sites and/or materials	Without Mitigation	Local	Permanent	Irreversible	Negative	Low	Low Probability	Low
	With Mitigation	Local	Permanent	Irreversible	Negative	Low	Low Probability	Very Low
Disturbance or destruction of fossil material	Without Mitigation	Local	Permanent	Irreversible	Negative	Low	Low Probability	Low
	With Mitigation	Local	Permanent	Irreversible	Negative	Low	Low Probability	Very Low
Disruption of the cultural landscape due to the presence of construction equipment and activity	Without Mitigation	Local	Long-term	Irreversible	Negative	High	Definite	High
	With Mitigation	Local	Long-term	Recoverable	Negative	Moderate	Definite	Moderate
Visual								
Visual impact of construction activities on residents of homesteads and visitors to tourist accommodation within 5 km to the proposed WEF	Without Mitigation	Very short distance	Short term	Reversible	Negative	Very High	Highly Probable	Very High
	With Mitigation	Very short distance	Short term	Reversible	Negative	High	Probable	High
Visual impact of construction activities	Without Mitigation	Very short distance	Short term	Reversible	Negative	Moderate	Highly Probable	Very High

on observers travelling along roads within 5 km of the proposed WEF	With Mitigation	Very short distance	Short term	Reversible	Negative	Moderate	Probable	High
Noise								
Construction of Access Roads	Without Mitigation	Local	Temporary	High	Negative	Moderate	Likely	High
	With Mitigation	Local	Temporary	High	Negative	Low	Possible	Moderate
Traffic Noises	Without Mitigation	Local	Short-term	High	Negative	Low	Possible	Low
	With Mitigation	Local	Short-term	High	Negative	Low	Possible	Low
Daytime WTG construction	Without Mitigation	Local	Short-term	High	Negative	Low	Improbable	Low
	With Mitigation	Local	Short-term	High	Negative	Low	Improbable	Low
Night-time WTG construction	Without Mitigation	Regional	Short-term	Very High	Negative	Moderate	Likely	Very High
	With Mitigation	Regional	Short-term	High	Negative	Low	Possible	High
Social								
Creation of employment and business opportunities	Without Mitigation	Local-Regional	Short-term	n/a	Positive	Moderate	Probable	Moderate
	With Mitigation	Local-Regional	Short-term	n/a	Positive	Moderate	Highly Probable	Moderate
Impact of construction workers on local communities	Without Mitigation	Local	Short-term	Irreversible – in case of HIVE and AIDS	Negative	Moderate	Probable	Moderate
	With Mitigation	Local	Short-term	Irreversible – in case of HIVE and AIDS	Negative	Low	Probable	Low

Influx of job seekers	Without Mitigation	Local	Short-term	Irreversible – in case of HIVE and AIDS	Negative	Low	Probable	Low
	With Mitigation	Local	Short-term	Irreversible – in case of HIVE and AIDS	Negative	Low	Probable	Low
Safety risk, stock theft and damage to farm infrastructure associated with presence of construction workers	Without Mitigation	Local	Short-term	Reversible – with compensation	Negative	Moderate	Probable	Medium
	With Mitigation	Local	Short-term	Reversible – with compensation	Negative	Low	Probable	Low
Increased risk of grass fires	Without Mitigation	Local	Short-term	Reversible	Negative	Moderate	Probable	Moderate
	With Mitigation	Local	Short-term	n/a	Negative	Low	Probable	Low
Nuisance impacts associated with construction related activities	Without Mitigation	Local	Short-term	Reversible	Negative	Moderate	Probable	Medium
	With Mitigation	Local	Short-term	n/a	Negative	Low	Probable	Minor
Loss of farmland	Without Mitigation	Local	Long term	Reversible	Negative	Moderate	Probable	Medium
	With Mitigation	Local	Short term	Reversible	Negative	Low	Highly Probable	Minor
Traffic								
Increased Traffic	Without Mitigation	Regional - Local	Short term	Reversible	Negative	Low	Probable	Low
	With Mitigation	Regional - Local	Short term	Reversible	Negative	Very Low	Probable	Low
	Without Mitigation	Regional - Local	Short term	Reversible	Negative	Low	Probable	Low

Additional heavy vehicles/E80's on the external road network-	With Mitigation	Regional - Local	Short term	Reversible	Negative	Low	Probable	Low

TABLE 6.2 DESIGN AND CONSTRUCTION PHASE IMPACT MANAGEMENT

Potential Impact and Management Actions	**Responsibility for Implementation and Monitoring**	**Frequency and timing of Monitoring**
Soil Degradation due to Construction of the Development		
• A system of to manage storm water, and 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 of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout prior to construction. • Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). • 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	Site Engineer Specialist	Design Phase Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
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 High / No-Go have been avoided by the major infrastructure such as turbines and buildings, the aquatic zones associated within the CBA / ESAs have also been avoided. Roads will need to traverse these areas, thus it is important to try and select existing areas with impacts / crossings where possible.		
Impacts associated with the construction of Access Roads		
• Use existing roads or upgrade existing tracks rather than constructing entirely new roads wherever possible and has been included in the proposed layout. • Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. 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 when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • Where required, all pipe culverts must 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 head cut 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, with a preference for low level drifts where possible. • 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 must be moved 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.	Site Engineer ECO / ESO Specialist	Design Phase Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• 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.		
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 refueled or serviced within 100m of a river channel or wetland.	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be beyond any demarcated water courses and their respective buffers. • 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. • ECO monitors the site on a daily basis to ensure plant is in working order (minimise leaks), spills are prevented and if they do occur, are quickly rectified.		
Potential vegetation clearing impacts associated with the construction of the WEF		
• The development footprint must avoid High Sensitivity areas as much as possible • Limit the area of impact as much as possible. • A pre-construction walkthrough during the optimal flowering period (spring) of the finalized development layout must be conducted to ensure that No-Go and High Sensitivity areas are avoided where possible. • Ensure that lay-down and other temporary infrastructure are within Low Sensitivity areas. • Rehabilitate disturbed areas that are not required by the operational phase of the development. • All construction staff on site must attend an environmental induction to ensure that basic environmental principles are adhered to. This includes topics such as avoiding fire hazards, no littering, appropriate handling of pollution and chemical spills, minimizing wildlife interactions, remaining within demarcated construction areas, avoidance of No-Go areas and sensitive habitats etc. • Demarcate sensitive areas near the development footprint as no-go areas with construction tape or similar and clearly marked as No-Go areas. • An environmental management programme (EMPr) must be implemented and must provide a detailed description of how construction activities must be conducted to reduce unnecessary clearing and/or destruction of habitat.	Site Engineer ECO / ESO	Throughout Construction Phase
Potential chemical contamination impacts associated with construction of the WEF		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• The development footprint must avoid High Sensitivity areas as much as possible. • Ensure proper storage and handling of chemicals (fuel, lubricants, cleaning agents) used on-site. Store all chemicals in designated areas equipped with spill containment measures to prevent leaks and spills. • A chemical spill response plan must be developed before construction activities are undertaken. This spill response plan must be implemented by an ECO on site. • Provide appropriate training to construction staff on the safe handling of chemical and hazardous materials. • Implement measures to prevent runoff to nearby waterbodies by installing sediment traps and/or containment pods. This should be addressed in the Stormwater Assessment	Site Engineer ECO / ESO	Throughout Construction Phase
Reduced connectivity and restricted movement of fauna impacts associated with the construction of the WEF		
• Minimization of length and width of road network. • Fencing and road designs to allow for passage of animals (e.g., short, wide culverts in roads and wildlife friendly fencing). • Implement habitat enhancement and restoration measures to offset the loss of connectivity caused by construction and decommissioning activities. This can be achieved by planting native vegetation, installing nesting boxes, or creating artificial shelters to provide alternative habitats for displaced fauna species and enhance connectivity within the landscape.	Site Engineer ECO / ESO	Throughout Construction
Overgrazing impacts associated with the construction phase of the proposed development.		
• Temporary laydown areas, construction yards and site office buildings to be placed in low sensitivity areas. • Developer should work closely with the farmer to identify areas that should be left for livestock grazing. These areas should be of an adequate size and should accommodate all livestock. • Developer to work with livestock farmers to reduce number of stock prior to construction to avoid the displacement of sheep during construction. The loss of income from affected livestock farming should be compensated by the developer. • Modified areas to be rehabilitated as far as possible through a restoration and rehabilitation plan. • Disturbed areas from construction activities should be rehabilitated and treated in conjunction with an Alien Invasive Management Plan to reduce encroachment of invasive species	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
Potential disturbance and/or displacement impacts on local wildlife associated with the construction phase of the proposed development.		
• Temporary laydown areas, construction yards and site office buildings to be placed in low sensitivity or modified areas. • Pre-construction baseline animal monitoring programme must be implemented, with focus on areas identified for the construction footprint during the design phase (e.g., road network). • Avoidance of highly sensitive habitats for construction areas. • Clearly demarcated construction areas and no unauthorized personnel to be permitted beyond demarcated areas. • Adequate noise reduction measures (where possible) on heavy machinery. • Minimize construction activity that occurs between dusk and dawn when animals are most active. • Minimization of lighting used to illuminate construction areas and site buildings.	Site Engineer ECO / ESO	Throughout Construction Phase
Potential mortality of faunal and flora species due to direct and indirect impacts associated with the construction phase of the proposed development		
• No movement of construction vehicles and personnel between dusk and dawn. • Implementation and enforcement of speed limits. • Roadkill monitoring and recording programme. • Induction toolbox talks to personnel to increase awareness about animal SCCs present and roadkill risks. • No unauthorized movement of personnel. • No unauthorized access to the construction site. • No trenches to be left uncovered overnight. • Trenches, excavations and cattle grids to have slopes to allow for animals to escape should they fall in. • No hunting permitted. • No dogs or cats permitted (other than those of the landowner). • Waste management programme to prevent trash buildup attracting species such as crows. • Roadkill to be immediately reported, removed and suitably disposed of to prevent scavenging (e.g., buried).	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
Direct and indirect habitat loss from construction activities		
• The production of an appropriate rehabilitation and restoration plan with the aims of improving and monitoring habitat availability and connectivity, in consultation with specialists and relevant stakeholders (e.g., CapeNature, Endangered Wildlife Trust) prior to construction; • Strategic rehabilitation and restoration of currently modified areas within areas of high sensitivity to be initiated concurrently with the construction phase; • Minimization of development footprint and utilization of existing roads and existing modified areas for temporary laydown areas and site buildings; • Rehabilitate disturbed areas that are not required by the operational phase of the development; • All construction vehicles should adhere to clearly defined and demarcated roads, no off-road driving should be allowed; • An environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as avoiding fire hazards, littering, appropriate handling of pollution and chemical spills, minimizing wildlife interactions, remaining within demarcated construction areas; • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill; • No open fires to be permitted outside of designated areas. • The production of an appropriate rehabilitation and restoration plan with the aims of improving and monitoring habitat availability and connectivity, in consultation with specialists and relevant stakeholders (e.g., CapeNature, Endangered Wildlife Trust) prior to construction; • Strategic rehabilitation and restoration of currently modified areas within areas of high sensitivity to be initiated concurrently with the construction phase; • Fencing and road designs to allow for passage of animals (e.g., appropriately sized culverts in roads and wildlife friendly fencing); • Appropriate water runoff control measures to be constructed on all hard surfaces; • Appropriate erosion control measures to be constructed on all servitudes and access roads in the project area; • Rehabilitate existing servitude and access roads in the project area with sufficient erosion control measures to prevent the loss of soil and the degradation of vegetation.	Site Engineer ECO / ESO	Throughout Construction Phase
Disturbance or displacement of animal SCCs from the vicinity of construction activities		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• Restrict construction activity to daylight hours; • Minimize activity that occurs between dusk and dawn; • Pre-construction baseline animal monitoring programme, with focus on areas identified for the construction footprint during the design phase (e.g., road network); • Avoidance of highly sensitive habitats for laydown areas and temporary site offices • Clearly demarcated construction areas and no unauthorized personnel to be permitted beyond demarcated areas; • Adequate noise reduction measures (where possible) on heavy machinery; • Construction areas and site buildings should be lit with as little light as practically possible, with lights directed downwards where appropriate to reduce the disturbance and foraging activities of nocturnal species; • No dogs or cats other than those of the landowners permitted on site as these animals cause unnecessary disturbance such as chasing fauna.	Site Engineer ECO / ESO	Throughout Construction Phase
Mortality of animal SCCs from direct and indirect impacts of construction activities		
• Waste management programme to prevent trash buildup attracting species such as crows; • Roadkill to be immediately reported to the environmental control officer, removed and suitably disposed of to prevent scavenging (e.g., buried); • Construction activity to be minimized during the night to reduce noise pollution during periods when Riverine Rabbit are most active.	Site Engineer ECO / ESO	Throughout Construction Phase
Impacts on broad-scale ecological processes from construction phase activities		
• In-situ habitat restoration designed to improve connectivity between natural/near-natural patches and facilitate animal SCC movement across the site (to be done by a specialist in consultation with appropriate stakeholders); • Restoration and rehabilitation of currently modified agricultural land; • Partner with the Drylands Conservation Programme of the Endangered Wildlife Trust to enhance the ecosystem processes across the site, e.g. through the Biodiversity Stewardship Programme and/ or the provision of research support;	Site Engineer ECO / ESO Specialist	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• Initiation of formal, long-term research programmes across the site, offering access to the property for the purposes of research on riverine rabbit if/when approached by appropriately recognised academic institutions; and		
Avifauna impact of construction activities on sensitive receptors		
• Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible and should avoid all sensitive areas (e.g., CRM-designated high-risk areas, wetlands). • Measures to control noise and dust should be applied according to current best practice in the industry. • Roads and tracks to avoid all identified sensitive areas wherever possible. • An avifaunal walk-down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the EIA process and the construction phase..	Site Engineer ECO / ESO Specialist	Throughout Construction Phase
Impacts of clearing and excavation of natural habitat on bats		
• Apart from access roads and the management building, construction activities are to be kept out of all high bat-sensitive areas as far as possible. • Rock formations occurring along the ridge lines should be avoided during construction, as these could serve as roosting space for bats. • Destruction of limited trees should be avoided during construction. • Care should be taken if any dense bushes are destroyed, to make sure that there are not bat roosts in the vegetation. If bat roosts are found, a bat specialist should be contacted immediately. • Aardvark holes or any large derelict holes or excavations should not be destroyed before careful examination for bats. • The Environmental Control Officer (ECO) or a responsible appointed person or site manager should contact a bat specialist before construction commences so that they know what to look out for during construction.	Site Engineer ECO / ESO Specialist	Throughout Construction Phase
Creating attractive bat habitat within the development terrain		
• Completely seal off roofs of new buildings e.g., substations and site buildings. Note a small bat species could enter a hole the size of 1 cm^2.	Site Engineer ECO / ESO	Throughout Construction Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• Roofs need to be regularly inspected during the lifetime of the wind farm and any new holes need to be sealed. • Excavation areas, quarries or any other artificial depressions should be filled and rehabilitated to avoid creating new areas of open water sources which could attract bats during rainy spells. • Inspect all existing buildings and infrastructure for possible roosting opportunities regularly, at least on a seasonal basis. If any holes are found, the ECO or operational bat specialist should be contacted to establish whether there are any bats in the roofs. If there is a roost in the roof, a bat specialist should be consulted.	Specialist	
Construction noise impact on bats		
• Noise levels should be prevented as far as possible. • Avoid night-time construction activities as much as possible.	ECO	Throughout Construction Phase
Disruption of the cultural and paleontological landscape due to construction activities		

• A pre-construction archaeological walkdown survey of the final WEF layout is recommended.
• Any archaeological sites or material encountered during construction activities must be reported to the ECO by contractors, and HWC must be notified of HWC of any such discovery by the ECO so that the find can be assessed and arrangements made to mitigate it, if necessary.
• Keep the construction duration as short as possible and as much of the activity as possible out of the public view.
• In particular the infrastructure area(s) should be screened if possible, and noise and light pollution kept to a minimum
• The EAP and ECO must be informed of the very high palaeontological significance of the WEF area;
• The Fossil Chance Find Protocol contained in Volume II (Specialist reports), which is designed to record all unexpected fossils associated with the geological formations on site must:
  ◦ be implemented during the construction WEF, and
  ◦ be included as part of the EMPr for this project.
• If fossils are exposed during construction they should be rescued and a palaeontologist called to assess and collect a representative sample, unless HWC recommends an alternative approach; and
• Recommendations contained in the PIA must be approved by HWC for inclusion in the EMPr for the project.
	Site Engineer
	ECO / ESO
	Specialist
		Before and during construction

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
Visual impact of construction activities		
• Retain and maintain natural vegetation in all areas outside of the development footprint, but within the project site • Ensure that vegetation is not unnecessarily removed during the construction period. • Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) where possible. • Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. • Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed of regularly at licensed waste facilities. • Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). • Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. • Rehabilitate all disturbed areas immediately after the completion of construction works.	Site Engineer ECO / ESO	Before Construction begins
NOISE IMPACT DURING THE CONSTRUCTION PHASE		
• Road construction activities near NSR K-6, K-7, K-8, K-13, K-15 and K-16: The applicant can discuss the potential noise levels with these NSR, highlighting the temporary nature of the noise impact; • Road construction activities near NSR K-6, K-7, K-8, K-13, K-15 and K-16: The applicant can plan for construction activities past these NSR when the dwelling is not used for residential purposes (residents at school or working); • Road traffic passing NSR K-7, K-8 and K-15: The applicant can discuss the potential noise levels with highlighting the projected worst-case noise levels; • Road traffic passing NSR K-7, K-8 and K-15: The applicant can plan for activities past these when the dwellings are not used for residential purposes (residents at school or working); • Road traffic passing NSR K-7, K-8 and K-15: Active noise monitoring during construction activities (noise levels and the opinion of the NSR about the noise level; • Road traffic passing NSR K-7, K-8 and K-15: The potential temporary relocation of NSR if noise monitoring indicates high annoyance levels with the construction traffic noise levels;	Contractor	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• Road traffic passing NSR K-7, K-8 and K-15: The inclusion of noise as an environmental theme as part of the induction training to employees and contractors, highlighting the potential impact on the identified Noise Sensitive Receptor(NSR). • Night-time construction activities within 1,500m from NSR K-6, K-7, K-8, K-9, K-10, K11, K-15 and potentially K-12: Plan construction schedule that simultaneous activities are only required at one WTG location (WTG locations within 1,500m from these NSR). Other simultaneous night-time construction activities can continue, but should take place further than 1,500m from these NSR; • Night-time construction activities within 2,000m from all NSR: Warning NSR of when construction activities may take place at night; • Night-time construction activities within 2,000m from all NSR: Minimise active equipment at night, planning the completion of noisiest activities (such a pile driving, rock breaking and excavation) during the daytime period.		
Creation of employment and business opportunities		
Employment • Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. • Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, most skilled posts are likely to be filled by people from outside the area. • Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. • Before the construction phase commences the proponent should meet with representatives from the Langeberg Municipality to establish the existence of a skills database for the area. If such a database exists, it should be made available to the contractors appointed for the construction phase. • The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project. • Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.	Contractor Developer	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. Business • The proponent should liaise with the local municipality with regards the establishment of a database of local companies, specifically BBBEE companies, which could 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. • Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.		
Potential impacts on family structures and social networks associated with the presence of construction workers		
• The proponent, in consultation with the local municipality should investigate the option of establishing a Monitoring Committee (MC) to monitor and identify potential problems that may arise during the construction phase. • Preparation and implementation of a SEP prior to and during the construction phase. • Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. • The SEP and CHSSP should include a Grievance Mechanism that enables stakeholders to report and resolve incidents. • Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories. • 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 and Tuberculosis (TB) awareness programme for all construction workers at the outset of the construction phase. The programmes should form part of the CHSSP.	Applicant Contractors	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• 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, with the exception of security personnel, should be permitted to stay over-night on the site.		
Potential impacts on family structures, social networks and community services associated with the influx of job seekers.		
• Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. • Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. • The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities. • The proponent should implement a policy that no employment will be available at the gate. • 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.	Site Engineer ECO / ESO Contractor	Before and During the Construction phase
Potential risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the presence of construction workers on site.		
• Where reasonable and practical 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 compensated for. The agreement should be signed before the construction phase commences. • The developer(s) and local farming community should co-ordinate (and if necessary, upgrade) security arrangements, such as establishment of security cameras at strategic locations. • 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 consider the option of establishing a MC (see above) that includes local	Site Engineer ECO / ESO Contractor	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
farmers and develop a Code of Conduct for construction workers. The MC should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before construction activities commence. • 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. This should be contained in the Code of Conduct to be signed between the proponent, the contractors, and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below). • The Environmental Management Programme (EMPr) must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested. • Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained in the 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 Code of Conduct. All dismissals must be in accordance with South African labour legislation. • It is recommended that no construction workers, except for security personnel, should be permitted to stay over-night on the site.		
Potential noise, dust and safety impacts associated with construction related activities.		
• The movement of construction vehicles on the site should be confined to agreed access road/s. • Establishment of 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. • The movement of heavy vehicles associated with the construction phase should be timed to avoid times and days of the week, such as weekends, when the volume of traffic travelling along the access roads may be higher. • Dust suppression measures should be implemented, such as wetting on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. • All vehicles must be road worthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.	Site Engineer ECO / ESO Contractor	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires		
• 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 compensated for. The agreement should be signed before the construction phase commences. • Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas. • Smoking on site should be confined to designated areas. • Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high-risk dry, windy winter 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. • As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors should compensate farmers for damage caused to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities.	Site Engineer ECO / ESO Contractor	Before and During the Construction phase
The activities associated with the construction phase, will damage farmlands and result in a loss of farmlands for grazing.		
• An ECO should be appointed to monitor the implementation of the EMPr during the construction phase. • Existing internal roads should be used where possible. In the event that new roads are required, these roads should be rehabilitated upon completion of the construction phase. • The footprint associated with the construction- related activities (access roads, construction camps, workshop etc.) should be minimized to the approved layout. • All areas disturbed by construction related activities, such as access roads on the site and construction camps etc., should be rehabilitated at the end of the construction phase. • The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be included in the EMPr in Section 13	Site Engineer ECO / ESO Contractor	Before and During the Construction phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency and timing of Monitoring
• The implementation of the Rehabilitation Programme should be monitored by the ECO.		
Increased traffic on the route and access points to site		
• Implementation of Traffic Management Plan(Section 15)	Site Engineer ECO / ESO Contractor	Before and During the Construction phase

6.2 POST CONSTRUCTION

The following are the overarching post construction measures:

- 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

The following are post construction infrastructure mitigation measures:

- 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 a designated area in 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 RATINGH

Operation Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Freshwater & Wetlands (Aquatics)								
Spread of Alien Vegetation	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Moderate
	With Mitigation	*Site*	*Short term*	*Partly reversible*	*Negative*	*Low*	*Possible*	*Low*
Terrestrial Biodiversity								
Potential habitat fragmentation impacts	Without Mitigation	Local	Long term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	*Site*	*Medium term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Medium*
Potential encroachment of alien invasive species resulting in loss of flora	Without Mitigation	Local	Long term	Irreversible	Negative	High	Definite	High
	With Mitigation	*Site*	*Medium term*	*Recoverable*	*Negative*	*Moderate*	*Highly Probable*	*Medium*
Potential light, noise and visual impacts	Without Mitigation	Local	Long term	*Recoverable*	Negative	Moderate	Highly Probable	High
	With Mitigation	*Site*	*Medium term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Medium*
Potential fire	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Highly Probable	High
	With Mitigation	*Site*	*Medium term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Medium*
Potential faunal mortality and loss of SCC	Without Mitigation	Local	Long term	Irreversible	Negative	High	Definite	High
	With Mitigation	*Site*	*Medium term*	*Recoverable*	*Negative*	*Moderate*	*Highly Probable*	*Medium*
Soil erosion	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Highly Probable	High
	With Mitigation	*Site*	*Medium term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Medium*
Faunal								

Operation Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Direct habitat loss	Without Mitigation	Local	Long term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	*Local*	*Long term*	*Recoverable*	*Negative*	*Low*	*Low Probability*	*High*
Indirect habitat loss	Without Mitigation	Local	Long term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	*Local*	*Long term*	*Recoverable*	*Negative*	*Low*	*Low Probability*	*High*
Disturbance/displacement	Without Mitigation	Local	Long term	Reversible	Negative	Moderate	Highly Probable	High
	With Mitigation	*Local*	*Long term*	*Reversible*	*Negative*	*Low*	*Low Probability*	*High*
Direct Mortality	Without Mitigation	Local	Long term	Reversible	Negative	Moderate	Highly Probable	High
	With Mitigation	*Local*	*Long term*	*Reversible*	*Negative*	*Low*	*Low Probability*	*High*
Indirect Mortality	Without Mitigation	Site	Long term	Irreversible	Negative	Moderate	Highly Probable	High
	With Mitigation	*Site*	*Long term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Low*
Avifauna								
Bird collision with turbine blades, habitat alteration and displacement	Without Mitigation	Site	Short term	High	Negative	Moderate - High	Highly Likely	High
	With Mitigation	*Site*	*Short term*	*High*	*Negative*	Moderate-Low	*Probable*	*High-Moderate*
Bird collision with overhead power lines	Without Mitigation	Site	Long term	High	Negative	High	Highly Likely	High
	With Mitigation	*Site*	*Long term*	*High*	*Negative*	*High-Moderate*	*Probable*	*High-Moderate*

Operation Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Bats								
Direct collision or barotrauma	Without Mitigation	Regional	Indefinite	Irreversible	Negative	High Negative	Definite	High
	With Mitigation	Regional	Long term	Recoverable	Negative	High Negative	Definite	Moderate
Fatality of migrating bats	Without Mitigation	National	Long term	Recoverable	Negative	Moderate Negative	Probable	Moderate
	With Mitigation	National	Long term	Recoverable	Negative	Low Negative	Low probability	Low
Loss of bats of conservation value	Without Mitigation	Regional	Long term	Recoverable	Negative	Moderate Negative	Probable	Moderate
	With Mitigation	Regional	Long term	Reversable	Negative	Low Negative	Low probability	Low
Fatality curiosity	Without Mitigation	Local	Long term	Recoverable	Negative	Moderate Negative	Probable	Moderate
	With Mitigation	Local	Long term	Reversable	Negative	Low Negative	Probable	Low
Smaller genetic pool	Without Mitigation	Regional	Long term	Irreversible	Negative	Moderate Negative	Highly probable	Moderate
	With Mitigation	Regional	Long term	Recoverable	Negative	Moderate Negative	Probable	Low
Visual								
Visual impact on residents of homesteads and visitors to tourist accommodation within 5 km to the proposed WEF	Without Mitigation	Very short distance	Long term	Reversible	Negative	Very High	Definite	Very High
	With Mitigation	*Very short distance*	*Long term*	*Reversible*	*Negative*	*Very High*	*Definite*	*Very High*
Visual impact on observers travelling	Without Mitigation	Very short distance	Long term	Reversible	Negative	High	Definite	Very High

Operation Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
along the roads within 5 km to the proposed WEF	*With Mitigation*	Very short distance	*Long term*	*Reversible*	*Negative*	*High*	*Definite*	*Very High*
Visual impact on residents of homesteads and visitors to tourist accommodation within 5-10 km to the proposed WEF	Without Mitigation	Short distance	Long term	Reversible	Negative	Very High	Definite	High
	With Mitigation	Short distance	*Long term*	*Reversible*	*Negative*	*Very High*	*Definite*	*High*
Visual impact on observers travelling along roads within 5-10 km to the proposed WEF	Without Mitigation	Short distance	*Long term*	*Reversible*	*Negative*	*Very High*	*Definite*	*High*
	With Mitigation	Short distance	Long term	*Reversible*	*Negative*	*Very High*	*Definite*	*High*
Visual impact on visitors to formally protected areas within 5-10 km to the proposed WEF	Without Mitigation	Short distance	*Long term*	*Reversible*	*Negative*	*Very High*	*Definite*	*High*
	With Mitigation	*Short distance*	*Long term*	*Reversible*	*Negative*	*Very High*	*Definite*	*High*
Visual impact on residents of homesteads and visitors to tourist accommodation within 10-20 km to the proposed WEF	Without Mitigation	Medium distance	*Long term*	*Reversible*	*Negative*	Moderate	Highly Probable	Moderate
	With Mitigation	*Medium distance*	*Long term*	*Reversible*	*Negative*	*Moderate*	*Highly Probable*	*Moderate*
Visual impact on observers travelling along roads within 10-20 km to the proposed WEF	Without Mitigation	Medium distance	*Long term*	*Reversible*	*Negative*	*High*	Probable	Moderate
	With Mitigation	*Medium distance*	*Long term*	*Reversible*	*Negative*	High	*Probable*	*Moderate*
Visual impact on visitors to formally	Without Mitigation	Medium distance	*Long term*	*Reversible*	*Negative*	Moderate	Highly Probable	Moderate

Operation Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
protected areas and private nature reserves within 10-20 km to the proposed WEF	*With Mitigation*	*Medium distance*	*Long term*	*Reversible*	*Negative*	*Moderate*	*Highly Probable*	*Moderate*
Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF	Without Mitigation	Very short distance	Long term	Reversible	Negative	Moderate	Probable	Moderate
	With Mitigation	Very short distance	*Long term*	*Reversible*	*Negative*	*Moderate*	*Probable*	*Moderate*
Visual impact of lighting at night on residents and visitors to homesteads and tourist accommodation within 10 km from the proposed WEF	Without Mitigation	Short to medium distance	Long term	Reversible	Negative	Very High	Definite	High
	With Mitigation	*Very short distance*	*Long term*	*Reversible*	*Negative*	*High*	*Highly Probable*	*Moderate*
Visual impact of lighting at night on observers travelling along roads within 10 km from the proposed WEF	Without Mitigation	Short to medium distance	Long term	Reversible	Negative	High	Definite	High
	With Mitigation	*Very short distance*	*Long term*	*Reversible*	*Negative*	*Moderate*	*Highly Probable*	*Moderate*
Visual impact of the ancillary infrastructure on observers in close proximity to the structures	Without Mitigation	Very short distance	Long term	Reversible	Negative	High	Highly Probable	High
	With Mitigation	*Very short distance*	*Long term*	*Reversible*	*Negative*	*Moderate*	*Probable*	*Moderate*
Visual impact of the ancillary infrastructure on observers in close proximity to the structures	Without Mitigation	Very short distance	Long term	Reversible	Negative	High	Definite	High
	With Mitigation	*Very short distance*	*Long term*	*Reversible*	*Negative*	*Moderate*	*Highly Probable*	*Moderate*
	Without Mitigation	Long distance	Long term	Reversible	Negative	Very High	Definite	Very High

Operation Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
The potential impact on the sense of place of the region	*With Mitigation*	*Long distance*	*Long term*	*Reversible*	*Negative*	*Very High*	*Definite*	*Very High*
Noise								
Daytime operation of WTG	Without Mitigation	Local	Long-term	High	Negative	Low	Improbable	Low
	With Mitigation	*Local*	*Long-term*	*High*	*Negative*	*Low*	*Improbable*	*Low*
Night-time operation of WTG	Without Mitigation	Regional	Long-term	High	Negative	Low	Possible	Low
	With Mitigation	*Regional*	*Long-term*	*High*	*Negative*	*Low*	*Possible*	*Low*
Social								
Improve energy security and support renewable sector	Without Mitigation	Local, Regional and National	Long term	Reversible	Positive	High	Highly Probable	High
	With Mitigation	*Local, Regional and National*	*Long term*	*n/a*	*Positive*	*High*	*Definite*	*High*
Creation of employment and business opportunities	Without Mitigation	Local and Regional	Long term	n/a	Positive	Low	Highly Probable	Minor
	With Mitigation	*Local and Regional*	*Long term*	*n/a*	*Positive*	*Moderate*	*Highly Probable*	*Low*
Generate income for affected landowners	Without Mitigation	Local	Long term	Reversible	Positive	Low	Probable	Low
	With Mitigation	*Local*	*Long term*	*Reversible*	*Positive*	*High*	*Definite*	*Moderate*
Benefits associated with the socio-economic development contributions	Without Mitigation	Local and Regional	Long term	Reversible	Positive	Moderate	Probable	Low

Operation Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
	With Mitigation	*Local and Regional*	*Long term*	*Reversible*	*Positive*	*High*	*Definite*	*Moderate*
Visual impact and impact on sense of place	Without Mitigation	Long distance	Long term	Reversible	Negative	Very High	Definite	Very High
	With Mitigation	*Long distance*	*Long term*	*Reversible*	*Negative*	*High*	*Definite*	*Very High*
Potential impact on property values	Without Mitigation	Local	Long term	Reversible	Negative	Moderate	Probable	Moderate
	With Mitigation	Local	*Long term*	*Reversible*	*Negative*	*Low*	*Probable*	*Low*
Visual impact associated with the proposed facility and associated infrastructure and the potential impact on the area's rural sense of place	Without Mitigation	Local	Long term	Reversible	Negative	Medium-High	Highly Probable	Moderate-High
	With Mitigation	Local	*Long term*	*Reversible*	*Negative*	*Medium-High*	*Highly Probable*	Moderate-High
Potential impact on tourism	Without Mitigation	Local	Long term	Reversible	Negative	Moderate	Probable	Moderate
	With Mitigation	Local	*Long term*	*Reversible*	*Negative*	*Low*	*Probable*	*Low*

TABLE 7.2 OPERATION PHASE IMPACT MANAGEMENT

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Potential habitat fragmentation impacts associated with the operational phase of the proposed development.		
• The EMPr should include biodiversity monitoring and an adaptive management plan for the operational phase to ensure there are no adverse impacts observed to the fauna community.	Site Engineer ECO Specialist	Following clearing of vegetation Throughout Operation Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Biodiversity monitoring must be implemented for various specialisms to assess the ongoing impacts of the operational wind farm compared to pre-construction baseline data. Specialists would need to be contracted by the Functional Entity and monitoring must come into effect in direct alignment with various specialist Guidelines and Best Practice. • Implement habitat enhancement and restoration measures to offset the loss of connectivity caused by operational activities. This can be achieved by planting native vegetation, installing nesting boxes, or creating artificial shelters to provide alternative habitats for displaced fauna species and enhance connectivity within the landscape. This should be considered in the EMPr. • All recommendations in the Terrestrial Animal Specialist Assessment must be adhered to.		
Potential encroachment of alien invasive species resulting in loss of flora SCC associated with the operational phase of the proposed development		
• Disturbed areas such as road verges, lay-down areas and areas utilised by temporary construction facilities must be regularly monitored to detect the establishment of alien species and those species should be eradicated before they spread. • Regular alien clearing of alien vegetation should be conducted, as needed, using the best-practice methods for the species concerned, the use of herbicides should be avoided as far as possible. • The use of herbicides (if absolutely required) for the control and eradication of alien grasses should be done in accordance with the alien eradication programme in the EMPr to reduce unintended ecological impacts.	Site Engineer ECO / ESO Developer Specialist	Throughout operation phase according to the Bat Management Plan (Section 23).
Potential light, noise and visual pollution impacts associated with the operational phase of the proposed development.		
• Use low-intensity and downward-facing lighting fixtures to reduce the attraction of insects and mitigate the risk of bat collisions. • Employ noise mitigation measures, such as acoustic insulation, to reduce the transmission of noise from wind turbines and associated infrastructure. • Develop and implement operational protocols to minimize noise and vibration disturbances during critical periods for faunal species, such as breeding, nesting, and foraging.	Site Engineer ECO / ESO	Throughout Operation Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Schedule maintenance activities and construction work during off-peak hours to minimize disruption to wildlife behavior and habitat use.		
Potential fire impacts associated with the operational phase of the proposed development.		
• No open fires should be permitted outside of designated areas. • Smoking areas must be defined, and no smoking should be permitted outside of designated areas. • An emergency response plan for uncontrolled fires must be in place prior to operation and implemented for the duration of the WEF's lifespan. • All staff members must have a Fire and Safety induction to increase awareness.	Developer Specialist	Before Operational Phase
Potential faunal mortality and loss of SCC impacts associated with the operational phase of the proposed development		
• Adhere to the open space management plan which makes provision for the favourable management of An environmental induction for all construction staff on site to identify SCC. • Demarcate sensitive areas, where SCC have been confirmed present near the development footprint as No-Go areas. • Site access should be controlled, and no unauthorised persons should be allowed onto the site to limit illegal harvesting. • The collection or harvesting of any plants at the site should be strictly forbidden. • Bird and bat carcass searchers must be deployed at the WEF and all findings to be reported to an appropriate bird and bat specialist. Refer to recommendations in the Avifaunal Specialist Impact Assessment and Bat Specialist Impact Assessment(Volume II of EIA report).. • The WEF must report all fatalities of SCC to a competent or Interested and Affected Party on a quarterly basis. • All vehicles must adhere traffic rules on the site with a maximum speed of 30km to be implemented. Alternatively, consult and enforce all recommendations in the Traffic Impact Assessment. • Limit driving at night on the site, between dusk and dawn, when fauna are most active. • No hunting permitted. • No dogs or cats permitted (other than those of the landowner).	Maintenance Staff Site Engineer ECO / ESO Specialist	Throughout Operation Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Waste management programme to prevent trash buildup attracting species such as crows. • Roadkill to be immediately reported, removed and suitably disposed of to prevent scavenging (e.g., buried).		
Potential soil erosion impacts associated with the operational phase of the proposed development.		
• Utilize existing servitudes and access roads wherever possible, any new roads or the upgrading of roads should be minimized as far as possible and not be larger than required. • All construction vehicles should adhere to clearly defined and demarcated roads, no off-road driving should be allowed. • Ensure that sufficient erosion control measures are constructed on all servitudes and access roads in the project area, including where such crosses waterbodies. • Rehabilitate existing servitude and access roads in the project area with sufficient erosion control measures to prevent the loss of soil and the degradation of vegetation. • Construction activities in or near drainage lines, washes or temporary inundated depressions must only take place during the dry season. • Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan included in the EMPr. • All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate energy in the water stream which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance during the operation of the project.	Site Engineer ECO / ESO	Throughout Operation Phase
Artificially altered fire regimes may reduce habitat suitability/availability by changing vegetative communities and habitat structure		
• Waste management programme to prevent trash buildup attracting species such as crows; • Roadkill to be immediately reported to the environmental control officer, removed and suitably disposed of to prevent scavenging (e.g., buried); • Construction activity to be minimized during the night to reduce noise pollution during periods when Riverine Rabbit are most active.	Maintenance Staff Site Engineer ECO / ESO	Throughout Operation Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Novel infrastructure (e.g., perimeter fencing) may exclude species from portions of suitable habitat by restricting animals' movement across the landscape.		
• Wildlife friendly road and fence crossings to be frequently serviced to facilitate passage of fauna across the site (e.g., road culverts to be cleared of debris); • Livestock grazing pressure must be reduced in natural, near-natural and recovered areas; • Flow and erosion control measures to be continually monitored for efficacy and remedied if pooling, sedimentation or erosion is observed; • Previously disturbed areas such as road verges, lay-down areas and areas utilized by temporary construction facilities must be regularly monitored to detect the establishment of alien species and those species should be eradicated before they spread; • Regular alien clearing should be conducted, as needed, using the best-practice methods for the species concerned, the use of herbicides should be avoided as far as possible	Site Engineer ECO / ESO	Throughout Operation Phase
Operational activities may disturb and/ or displace certain animal SCCs from the vicinity of infrastructure.		
• Minimized lighting; • Minimize activity that occurs between dusk and dawn; • Adequate noise reduction measures (where possible) on machinery; • Wind Turbine Generators should not spin below a certain cut-in speed, i.e., no free-spinning of WTG blades permitted; • Speed limits should be strictly enforced to reduce unnecessary noise; • No dogs or cats other than those of the landowners should be allowed on site as these animals cause unnecessary disturbance such as chasing fauna; • Long-term animal monitoring programme; •	Site Engineer ECO / ESO	Throughout Operation Phase
Increased frequency of vehicle movement associated with operational activity increases the possibility of vehicles colliding with animals, resulting in roadkill fatalities. Animals may become entangled or entrapped in fencing or cattle grids		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Strictly enforced speed limits; • Strictly controlled site access; • Minimized movement of personnel vehicles at night; • Wildlife friendly road crossings (including culverts that allow animal movement below the road surface); • Signage, education and awareness induction training about relevant animal SCCs to personnel; and • Wildlife-friendly fencing and cattle grids.	Site Engineer ECO / ESO	Throughout Operation Phase
Operational activities can attract species such as crows, which depredate on various animals such as tortoises and juvenile rabbits.		
• Compile a Traffic Management Plan • Overhead Transmission Lines to be of a type and design that reduces nesting opportunities (e.g., solid pylon design); • Nest and perch deterrents on transmission line pylons; • Waste management programme to be implemented; • Roadkill to be reported and immediately removed for adequate disposal that prevents scavenging (e.g., buried); • Operational studies on sound and animal populations (e.g., Riverine Rabbit) across the site; and • No spinning wind turbine generators at wind speeds below a certain cut-in speed (i.e. no free-spinning blades).	• Site Engineer • ECO / ESO	• Throughout Operation Phase •
Bird Collision, habitat alteration and displacement		
• Re-position all turbines that fall within the high-risk zones delineated by the CRM to lower risk areas (as also identified by the CRM). • The high-risk No-Go zones delineated by the CRM should be adhered to (as depicted in this report). • A post-construction programme must be conducted by an avifaunal specialist (following the Birds and Renewable Energy Specialist Group guidelines) to: (i) assess turbine-related fatalities; and	Site Engineer ECO / ESO Specialist	Throughout Operation Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
(ii) confirm that all mitigations have been appropriately adhered to and, in particular, that road and hard stand verges do not provide additional substrate for raptor prey species. • A bird fatality threshold and adaptive management policy must be designed by an ornithologist for the site, prior to construction. This policy should form an annexure of the operational EMP for the facility. Most importantly, this policy should identify the number of bird fatalities of Priority species which will trigger a management response, appropriate responses, and timelines for such responses. In general, it is recommended that should one Red Data species or two or more LC species be killed per turbine per year then those turbines will require further mitigation. • Should the identified Priority bird species fatality thresholds be exceeded in Year 1 and 2, either (i) an automated turbine Shutdown on Demand (SDOD) programme must be immediately initiated; or • (ii) appropriate alternative mitigation (e.g. striped blade, human-SDOD) must be implemented on site. The latter programme must consist of a suitably qualified, trained, and resourced team of observers present on site for all daylight hours 365 days of the year. This team must be stationed at vantage points (VPs) with full visible coverage of all turbine locations (typically 1 VP covering four turbines). The observers must detect incoming Priority bird species, track their flights, judge when they enter a turbine proximity threshold, and alert the control room to shut down the relevant turbine until the risk has passed. A full detailed method statement or protocol must be designed by an ornithologist.		
Direct collision or barotrauma		
• All turbines and turbine components, including the rotor-swept zone, should be kept out of all high-sensitivity zones. • Mitigation as proposed in Section 7, should be applied after testing and as soon as turbines start to turn. • No turbines should be placed within 200 m of open water sources. • The lowest sweep of the turbine blade should not be less than 30 m. • A bat specialist should be appointed before the turbines start to turn, and operational bat monitoring should start when all the turbines start to turn, for a minimum of two years, or as described by the latest South African bat guidelines.	Wind farm operator ECO / ESO Specialist	Throughout Operation Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Mitigation should be discussed between the bat specialist and developer during the construction and operational phase. Mitigation measures should be applied, using Table 9, Section 7, as a starting point for discussions. • Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards where possible. Turbine tower lights should be switched off when not in operation, if possible. • Two years of compulsory bat monitoring as per the latest SABAA bat monitoring guidelines is recommended, but this might be extended, depending on the bat specialist.		
Fatality of migrating bats and fatal curiosity		
• Care should be taken during post-construction monitoring to verify the activity of *M. natalensis*, especially within the rotor swept area of the turbine blades. Carcasses should be identified to establish the fatality of this species. • All turbines and turbine components, including the rotor swept zone, should be kept out of all high sensitivity zones. • No turbines should be placed within 200 m of any open water sources. • The lowest sweep of the turbine blade should not be less than 30 m. • A bat specialist should be appointed before the turbines start to turn and operational bat monitoring should start when all the turbines start to turn, for a minimum of two years, or as described by the latest South African bat guidelines. • Mitigation should be discussed between the bat specialist and developer during the construction and operational phase. • Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards where possible. Turbine tower lights should be switched off when not in operation, if possible. • Two years of compulsory bat monitoring as per the latest SABAA bat monitoring guidelines is recommended, but this might be extended, depending on the bat specialist.	Applicant Contractors Specialist	Throughout Operation Phase
Loss of bats of conservation value		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Care should be taken during post-construction monitoring to verify the activity of M. natalensis, especially within the rotor swept area of the turbine blades. Carcasses should be identified to establish the fatality of this species. • All turbines and turbine components, including the rotor swept zone, should be kept out of all high sensitivity zones. • No turbines should be placed within 200 m of any open water sources. • The lowest sweep of the turbine blade should not be less than 30 m. • Mitigation as proposed in Section 7 should be applied as soon as the test period of turbines is completed, and the turbines start turning. • A bat specialist should be appointed before the turbines start to turn and operational bat monitoring should start when all the turbines start to turn, for a minimum of two years, or as described by the latest South African bat guidelines. • Mitigation should be discussed between the bat specialist and developer during the construction and operational phase. Mitigation measures should be applied, using Table 9, Section 7, as a starting point for discussions. • Except for compulsory lighting required in terms of civil aviation, artificial lighting should be minimised, especially bright lights. Lights should rather be turned downwards where possible. Turbine tower lights should be switched off when not in operation, if possible. • Two years of compulsory bat monitoring as per the latest SABAA bat monitoring guidelines is recommended, but this might be extended, depending on the bat specialist.	Applicant ECO Specialist	Throughout Operation Phase
Disruption of the cultural landscape due to the presence of construction equipment and activity		
• Keep the construction duration as short as possible and as much of the activity as possible out of the public view. • In particular the infrastructure area(s) should be screened if possible, and noise and light pollution kept to a minimum.	Applicant Contractors	Throughout Operation Phase
Visual impact from the operational activities		
• Maintain the general appearance of the facility as a whole.	Applicant ECO / ESO	Throughout Operation Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Noise from daytime and nighttime operation activities		
• Significance of potential impact is low, albeit worst case scenario with WTG emitting maximum noise levels were considered. Mitigation is therefore not required. • The potential significance for night-time operational activities is low and additional mitigation are not required or recommended for night-time operational activities. Operational WTG will be clearly audible at NSR H-6 (permanent residential use, located 750 m from closest WTG).	Applicant ECO / ESO	Throughout Operation Phase
Development of infrastructure to improve energy security and support the renewable sector.		
• 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.	Applicant	Throughout Operation Phase
Creation of employment and business opportunities and generation of additional income to landowners associated with the operational phase		
• Where reasonable and practical, the proponent should implement a 'locals first' policy, especially for semi and low-skilled job categories. • Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. • Where feasible, training and skills development programmes for locals should be initiated as part of the operational phase. The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. • Business • The proponent should liaise with the local municipality with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers for the operational phase. • Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the operational phase. • Implement agreements with affected landowners.		Throughout Operation Phase
Benefits associated with support for local community's form SED contributions.		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• The proponents should liaise with the local municipality to identify projects that can be supported by SED contributions. • Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community. • Strict financial management controls, including annual audits, should be instituted to manage the SED contributions		Throughout Operation Phase 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 Khoe WEF , 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	Potential 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 and Western Cape Province Pollution and Chemicals Management Directorate 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) must 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	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	Potential Impact	Management / Mitigation
Overheating 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 must be stored away from incompatible materials such as all peroxides, such as hydrogen peroxide; chemicals that react with acid to generate a gaseous product, such as carbonate and bicarbonates, sulfites and bisulfites; strong reducing agents, such as alkaline metals (Li, Na, K) and alkaline earth metals (Be Mg Ca, Sr, Ba); reactive metals such as aluminum and zinc, all hydrides (such as LiAlH4, $NaBH_4$), and some carbides (such as CaC_2). Development and implementation of Thermal Management Plan prior to installation/construction.
Limited Employee Training and Experience: Device Monitoring Failure (SCADA) Poor incidents reporting Poor first responders training Distance to nearest fire station and response time.	Low	Time lag for first respondent Inability to contain spillage Fire Electrocution Damage to exiting/surrounding infrastructure	During the construction phase the proposed project, first responders from the nearest major center (such as fire fighters and paramedics) must be given appropriate training on dealing with any emergency situation that may occur as a result of the operation of BESS. Such training must be provided by the technology suppliers or an appointed service provider.
Inappropriate Storage Hydrocarbon Spill Leaked battery pack coolant Leaked refrigerant Leaked cell electrolyte Rapid heating of individual cells Fires	Low	On site fires. Electrical failure Electrocution Potential spillage of electrolytes or refrigerant Vented gasses Staff and personal injury Contaminated Runoff Soil and microbe contamination Groundwater seepage Downstream effects on the current terrestrial ecosystem.	Solid State Li-Ion technologies to be preferred where possible. Training of all staff and employees on how to handle spillages, fires and electrocutions. In terms of appropriate design measures, the holder of the EA must identify a secondary containment facility, which is to be constructed with a capacity of at least 110% of the largest storage tank's capacity and the off-loading point must be located in the bunded area to ensure that any potential spill during the off-loading of the electrolyte solutions is contained. Records kept for well managed operations and maintenance. Bunding of containers.

Possible Risk	Likelihood of occurrence	Potential Impact	Management / Mitigation
			Implementation of spill handling and management in line with the EMPr which ensures that run-off and dirty water does not mix with electrolyte spill. Containment areas to be sloped towards a sump. All drains to be covered. Demarcate all no-go and sensitive areas. Avoid the placement of batteries near watercourses and sensitive features. MSDS Records to be kept, as well as incidents reporting register. The batteries must be placed in a well-ventilated area, include vents (where necessary and applicable) and appropriate PPE (appropriate gloves, safety glasses/face shield, appropriate clothing) must be worn when handling the electrolyte solutions. Source batteries from reputable suppliers. The transport vehicle must be identified with symbols. Transport schedule and map must be implemented and kept on each drivers person, with a copy kept in the admin offices on site. Battery inspection prior to installation.
Inappropriate disposal at the end of life Landfill Disposal Heavy Metal Pollution	Medium	Potential scenario of fluids from the batteries leaking into environment. The release of such chemicals through leaching, spills or air emissions can harm communities, ecosystems and food production. The potentially toxic materials contained in batteries means that they are classified as hazardous materials in terms of NEM:WA. There are only a few licensed hazardous waste sites in South Africa and recycling of batteries and e-waste has been identified as	The recycling of batteries and their potential use as e-waste. Disposal at a licensed hazardous waste site. Prior to construction of the D1B 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	Potential Impact	Management / Mitigation
		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 30 km radius, that are also in the development phase and the associated grid lines on the aquatic resources. The combination of the Hugo and Khoe WEF, as well as other similar renewable energy projects, either existing or proposed, was considered to assess cumulative visual impacts within a 30 km radius of the proposed project. Developments considered during the assessment are named below:

- Proposed Touwsrivier Solar Energy Facility;
- The Proposed Sanval 75 Mw Photovoltaic Solar Power Plant On Portion 6 Of The Farm Nuwerus 450 Near Worcester, Western Cape Province;
- Proposed Construction Of The 2.5 MW Photovoltaic (Pv) Solar Facility On Portion 0054 Of The Farm Osplaats 134 Near De Doorns Within The Breede Valley Local Municipality, Western Cape;
- Proposed Construction Of The 2.5 MW Photovoltaic (Pv) Solar Facility On Portion 0054 Of The Farm Osplaats 134 Near De Doorns Within The Breede Valley Local Municipality, Western Cape; and
- 75 MW Montague Road Solar PV Sef on Vredefort No. 34 Near Touws River within the Breede Valley Local Municipality in the Western Cape Province.

9.1 SOIL, LAND USE AND AGRICULTURE POTENTIAL

This cumulative impact assessment determines the quantitative loss of agricultural land if all renewable energy project applications within a 30 km radius become operational. Note that electrical grid infrastructure projects do not contribute to a loss of agricultural land and are not therefore included in this calculation of cumulative land loss. The area of land taken out of agricultural use as a result of all the projects within a 30 km radius (total generation capacity of 761 MW) will amount to a total of approximately 473 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30 km radius (approximately 282,700 ha), this amounts to only 0.17% of the surface area. This is well within an acceptable limit in terms of loss of marginal potential agricultural land.

All the projects contributing to cumulative impact for this assessment have the same agricultural impacts in a very similar agricultural environment, and therefore the same mitigation measures apply to all.

Furthermore, it should be noted that there are few land uses, other than renewable energy, that are competing for agricultural land use in this area. The cumulative impact from developments, other than renewable energy, is therefore likely to be low.

The loss of agricultural potential by soil degradation can effectively be prevented for renewable energy developments by generic mitigation measures that are all inherent in the project engineering and/or are standard, best-practice for construction sites. Soil degradation does not therefore pose a cumulative impact risk.

Due to all the considerations discussed above, the cumulative impact of loss of future agricultural production potential is assessed as low. It will not have an unacceptable negative impact on the

agricultural production capability of the area, and it is therefore recommended, from a cumulative agricultural impact perspective, that the development be approved.

9.2 FRESHWATER AND WETLANDS

The rating below is based on the premise that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.

9.3 TERRESTRIAL BIODIVERSITY

Solar facilities typically involve more invasive vegetation clearing compared to WEFs. Consequently, this can lead to the loss of individual Species of Conservation Concern (SCC) and increased habitat fragmentation. Habitat fragmentation can reduce habitat connectivity and lead to changes in the dispersal of species, population isolation and reduced genetic diversity within landscapes. While the broad-scale impacts on habitat are concerning, it's noteworthy that the Fynbos biome is not listed as critically endangered. However, broad scale clearing of vegetation could lead to cascading effects in flow regimes, nutrient cycling, and energy flow which ultimately results in decreased biodiversity.

9.4 AVIFAUNA

The estimated figure for all avian fatalities is 969 birds (all species) from interactions with the five solar farms within 30 km. None of these are expected to be raptors as they have not been recorded as victims of solar farms (although the data are very thin). This does not include species that may be displaced from these developments and excludes fatalities due to power line collisions.

These are medium-high totals and suggest cumulative totals must be ranked a medium-high and significant. With CRM- based mitigations (at the Hugo WEF) it is likely that these totals will be lower.

The Cumulative Impacts table with avian fatality rates are based on published studies. Data were sourced from post-construction wind energy facility avian assessments, summarised by Birdlife South Africa, from 1-2 years' post-construction monitoring (Perold et al. 2020).

9.5 HERITAGE AND ARCHEOLOGY

Impacts to the cultural landscape are considered to be the main driver of cumulative impacts on heritage resources and could be extensive if many projects are constructed in the vicinity, particularly if these projects are highly visible. These cumulative impacts cannot be fully mitigated but the implementation of the recommendations of visual consultants across all projects would likely reduce impacts from high to medium negative if highly sensitive areas are avoided.

9.6 PALEONTOLOGY

As with palaeontology, cumulative impacts to archaeological sites and/or materials are difficult to assess, again because of the variable distribution of sites and materials across the landscape and because of the differences in the quality of surveys and reporting on different projects. Field observations made in previous assessments in the vicinity of the Hugo WEF indicate that archaeological sites and materials are not common in the area and that, provided

appropriate mitigation measures are implemented, a low (negative) cumulative impact significance can be expected.

9.7 VISUAL/LANDSCAPE

Cumulative Phase

Nature of the impact: The potential cumulative visual impact of wind farms on the visual quality of the landscape.

Description of Impact:
The study area is not located within a REDZ, and as such very limited renewable energy facilities can be found within a 30 km radius. No other wind energy facilities have been authorized within a 30 km radius; however, three (3) solar PV energy facilities have been approved, namely Sanral PV SEF to the north west and Touws River and Montague Road Solar PV SEFs to the north east.

The proposed Khoe WEF addressed in this report is one half of a larger wind energy cluster consisting of another proposed WEF to the north, namely Hugo wind energy facility.

Impact Status: Negative

	Extent	Duration	Reversibility	Magnitude	Probability
Without Mitigation	Medium distance	Long term	Reversible	Very High	Definite
Score	2	4	1	10	5
With Mitigation	Medium distance	Long term	Reversible	Very High	Definite
Score	2	4	1	10	5

Significance Calculation	**Without Mitigation**	**With Mitigation**
S=(E+D+R+M)*P	Very High Negative Impact (85)	Very High Negative Impact (85)
Was public comment received?	No	
Has public comment been included in mitigation measures?	No	

Mitigation: N/A

Residual impact	The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

is not considered to be within acceptable limits.

9.8 NOISE

The potential effect of cumulative noises during the construction phase was considered, evaluating the impact from numerous simultaneous activities taking place at all locations where WTG will be developed. There are no other WEFs within the area of influence and there will not

be a cumulative noise impact during the operational phase. The possible significance of the cumulative noise impact is summarized below.

Impact Phase: Cumulative Phase
Nature of the impact: Numerous WTG operating simultaneously from various WEFs in area
Description of Impact: Wind turbines from the Khoe and Hugo WEFs operating simultaneously, though the WTG of these WEFs is too far apart for potential cumulative noises (worst-case noise level of 47.7 (K-14) to 34.1 dBA (K-17)). The projected noise levels, the potential change in ambient sound levels as well as the potential noise impact is defined per NSR.
Impact Status: Negative

	Extent	Duration	Reversibility	Magnitude	Probability
Without Mitigation	Regional	Long Term	High	Low	Possible
Score	3	4		4	2
With Mitigation	Regional	Long Term	High	Low	Possible
Score	3	4		4	2

Significance Calculation	**Without Mitigation**	**With Mitigation**
S=(E+D+R+M)*P	Low Negative Impact (10)	Low Negative Impact (10)
Was public comment received?	No	
Has public comment been included in mitigation measures?	No	

- The potential significance of a cumulative noise impact is low and additional mitigation are not required or recommended.

Residual impact	None

Impact Phase: Cumulative Phase
Nature of the impact: Numerous WTG operating simultaneously from various WEFs in area
Description of Impact: Wind turbines from the Khoe and Hugo WEFs operating simultaneously, though the WTG of these WEFs is too far apart for potential cumulative noises. The projected noise levels, the potential change in ambient sound levels as well as the potential noise impact is defined per NSR.
Impact Status: Negative

	Extent	Duration	Reversibility	Magnitude	Probability
Without Mitigation	Regional	Long Term	High	Low	Possible

Impact Phase: Cumulative Phase					
Score	3	4		4	2
With Mitigation	Regional	Long Term	High	Low	Possible
Score	3	4		4	2
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Low Negative Impact (22)		Low Negative Impact (22)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				
• The potential significance of a cumulative noise impact is low and additional mitigation are not required or recommended.					
Residual impact	None				

9.9 SOCIO-ECONOMIC

Cumulative Phase					
Nature of the impact: The potential cumulative visual impact of wind farms on the visual quality of the landscape.					
Description of Impact: The proposed Khoe WEF is also one half of a larger wind energy cluster consisting of another proposed WEF to the south, namely the Hugo WEF. The cumulative visual impact of the proposed Khoe WEF, together with the proposed Hugo WEF is expected to be Very High, depending on the observer's sensitivity to wind turbine structures. The VIA notes that owing to the sensitivity of the landscape, the high visual quality and the potential visual impacts on sensitive visual receptors, the cumulative visual impact is not considered to be within acceptable limits.					
Impact Status: Negative					
	Extent	Duration	Reversibility	Magnitude	Probability
Without Mitigation	Medium distance	Long-term	Reversible	Very High	Definite
Score	2	4	1	10	5
With Mitigation	Medium distance	Long-term	Reversible	Very High	Definite
Score	2	4	1	10	5
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Very High Negative Impact (85)		Very High Negative Impact (85)		

Cumulative Phase	
Was public comment received?	No
Has public comment been included in mitigation measures?	No
Mitigation measures to enhance opportunities: N/A	
Residual impact	The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed, and the area rehabilitated. Failing this, the visual impact will remain.

Cumulative Phase					
Nature of the impact: Cumulative Phase local services					
Description of Impact: The establishment of a number of renewable energy facilities and associated projects, such as the proposed WEF, in the BVM and LM has the potential to place pressure on local services, specifically medical, education and accommodation.					
Impact Status: Negative					
	Extent	Duration	Reversibility	Magnitude	Probability
Without Mitigation	Local	Long-term	Reversible	Low	Probable
Score	1	4	n/a	4	3
With Mitigation	Local and regional	Long-term	Reversible	Low	Probable
Score	2	4	n/a	4	3
Significance Calculation	**Without Mitigation**		**With Mitigation**		
S=(E+D+R+M)*P	Low Negative Impact (27)		Moderate Negative Impact (30)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				
Mitigation measures to enhance opportunities: The proponent should liaise with the LM to address potential impacts on accommodation and local services.					

Cumulative Phase
Cumulative Phase

Nature of the impact: Cumulative Phase local Economy

Description of Impact: The establishment of a number of renewable energy facilities and associated projects, such as the proposed WEF, in the BVM and LM has the potential to place pressure on local services, specifically medical, education and accommodation.

Impact Status: Negative

	Extent	Duration	Reversibility	Magnitude	Probability
Without Mitigation	Local	Long term	Reversible	Low	Highly Probable
Score	1	4	N/A	4	4
With Mitigation	Local and regional	Long term	Reversible	High	Highly Probable
Score	3	4	N/A	8	4
Significance Calculation	**Without Mitigation**			**With Mitigation**	
S=(E+D+R+M)*P	Moderate Positive Impact (36)			High Positive Impact (60)	
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				

Mitigation measures to enhance opportunities:

The proposed establishment of suitably sited renewable energy facilities and associated projects, such as the proposed WEF, within the LM should be supported.

9.10 TRAFFIC AND TRANSPORTATION

Cumulative Impact: Increase in general peak hour traffic volumes

Description of Cumulative Impact: Increased traffic on the route and access points to site - Potential to be greater than what the existing road capacity of the local road network can handle in order to operate at an acceptable level of service.

This impact relates to potential disruption of traffic on local, regional and national roads. The severity of the impacts will depend on the order of the road (how many lanes, lanes width, length, turns, etc.), the receiving environment and vicinity of land uses and towns.

Additional traffic on the road network could result in changes to the operations of that road network, intersection capacity, such as increased congestion, delays, and accidents.

Impact Status: Detail of the impact is Positive, Neutral or Negative

	Extent	Duration	Reversibility	Magnitude	Probability
Without Enhancement	Regional	Short Term	Recoverable	Probable	Probable
Score	3	2	3	3	3
With Enhancement	Local	Short Term	Recoverable	Probable	Probable
Score	2	2	3	3	3
Significance Calculation	**Without Enhancement**		**With Enhancement**		
S=(E+D+R+M)*P	Moderate Negative Impact (33)		Low Negative Impact (30)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				

Enhancement:
- Implementation of the Traffic Management Plan and Road Safety Measures
- Limit use of private cars
- Schedule development traffic movements to not coincide with existing peaks where possible Encourage use of public/staff transportation

Residual impact	Negative to Significant

Cumulative Impact: Increase in abnormal traffic volumes

Description of Cumulative Impact: Additional heavy vehicles/E80's/Abnormal vehicles on the external road network- Potential to require additional road rehabilitation.

The impact of abnormal loads on public roads is expected to cause journey time delays and traffic congestion due to low travelling speeds of heavy vehicles transporting abnormal loads. These often occupy two standard traffic lanes and can potentially lead to incidents when travelling on single carriageways with a single lane per direction and without traffic police escorts.

Impact Status: Detail of the impact is Positive, Neutral or Negative

	Extent	Duration	Reversibility	Magnitude	Probability
Without Enhancement	Regional	Short Term	Recoverable	High	Highly Probable
Score	4	2	3	4	4
With Enhancement	Regional	Short Term	Recoverable	Probable	Probable
Score	3	2	3	3	3

Significance Calculation	**Without Enhancement**	**With Enhancement**
S=(E+D+R+M)*P	Moderate Negative Impact (39)	Moderate Negative Impact (33)
Was public comment received?	No	
Has public comment been included in mitigation measures?	No	

Enhancement:
- Implementation of the Traffic Management Plan and Road Safety Measures
- Compliance to permissible heavy vehicle dimensions, permissible axle mass load on vehicles (no overloading)
- Transportation scheduling to consider the time of day when the abnormal loads would be moved
- Other alternative modes of transportation (rail where feasible) should be considered

Residual impact	Negative to Very Significant

Cumulative Impact: Impact of dust along gravel site access roads

Description of Cumulative Impact: Heavy vehicles are expected to cause dust along unpaved access roads to the site. This can affect the air quality and visibility for nearby residents and road users. Larger vehicles generate more dust which can limit the ability of other vehicles to overtake due to poor visibility.

Cumulative Impact: Impact of dust along gravel site access roads

Impact Status: Detail of the impact is Positive, Neutral or Negative

	Extent	Duration	Reversibility	Magnitude	Probability
Without Enhancement	Site	Immediate	Recoverable	Moderate	Probable
Score	1	1	3	3	3
With Enhancement	Site	Immediate	Recoverable	Low	Low Probability
Score	1	1	1	2	2

Significance Calculation	**Without Enhancement**	**With Enhancement**
S=(E+D+R+M)*P	Low Negative Impact (24)	Low Negative Impact (10)
Was public comment received?	No	
Has public comment been included in mitigation measures?	No	

Enhancement:

- Dust control measures such as regular wet grading and wetting for dust suppression to minimize the negative impact

Residual impact	Negligible

Cumulative Impact: Deterioration of surrounding road network

Description of Cumulative Impact: Heavy vehicle traffic during construction of the development is expected to cause additional wear and tear on the surrounding road network. Gravel access roads to the sites are also expected to sustain damage during the construction phase of the project.

Abnormal loads can exert more pressure on road surfaces and infrastructure, leading to increased maintenance costs and reduced road network lifespan.

Impact Status: Detail of the impact is Positive, Neutral or Negative

	Extent	Duration	Reversibility	Magnitude	Probability
Without Enhancement	Regional	Short Term	Recoverable	Moderate	Probable
Score	1	1	3	4	3

Cumulative Impact: Deterioration of surrounding road network					
With Enhancement	Local	Short Term	Recoverable	Low	Probable
Score	1	1	2	3	3
Significance Calculation	**Without Enhancement**		**With Enhancement**		
S=(E+D+R+M)*P	Low Negative Impact (27)		Low Negative Impact (21)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No				

Enhancement:
- Limiting the number and frequency of heavy and overloaded vehicles where possible
- Undertaking regular maintenance, rehabilitation and upgrading substandard pavement conditions

9.11 BATS

The potential cumulative impacts on bats identified at the proposed Khoe WEF:

- Destruction of natural habitat during construction; and
- A reduction in foraging space.

Cumulative Phase					
Nature of the impact: Activities associated with construction of solar farms within 30 km combined with the wind farm					
Description of impact: The destruction of features that could serve as potential roosts, such as rock formations and derelict aardvark holes, and the removal of trees or the fragmentation of woody habitat which includes dense bushes in the surrounding 30 km, together with the construction activities of the wind farm. See Section 8 for a more in dept dis					
Impact Status: Negative					
	Extent	Duration	Reversibility	Magnitude	Probability
Without Mitigation	Local	Medium Term	Recoverable	Moderate	Definite
Score	2	3	3	3	5
With Mitigation	Local	Short Term	Recoverable	Low	Probable
Score	2	2	3	2	3
Significance Calculation	Without Mitigation			With Mitigation	
S=(E+D+R+M)*P	Moderate Negative Impact (55)			Low Negative Impact (27)	

Was public comment received?	No
Has public comment been included in mitigation measures?	No

Mitigation measures to reduce residual risk or enhance opportunities:

- No clearance of vegetation or construction activities should take place if there is a chance of disturbing a possible bat roost. If there is uncertainty about any feature that could comprise a bat roost, a bat specialist should be contacted.
- Apart from access roads and the management building, construction activities are to be kept out of all high bat-sensitive areas as far as possible.
- Rock formations occurring along the ridge lines should be avoided during construction, as these could serve as roosting space for bats.
- Destruction of limited trees should be avoided during construction.
- Care should be taken if any dense bushes are destroyed, to make sure that there are not bat roosts in the vegetation. If bat roosts are found, a bat specialist should be contacted immediately.
- Aardvark holes or any large derelict holes or excavations should not be destroyed before careful examination for bats.
- The ECO or a responsible appointed person or site manager should contact a bat specialist before construction commences so that they know what to look out for during construction.

Residual impact	Yes, natural habitat will be removed, but with rehabilitation a component of this could be replaced.

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.

10.1.1 SOIL 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.

10.1.2 VEGETATION RESTORATION

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

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.

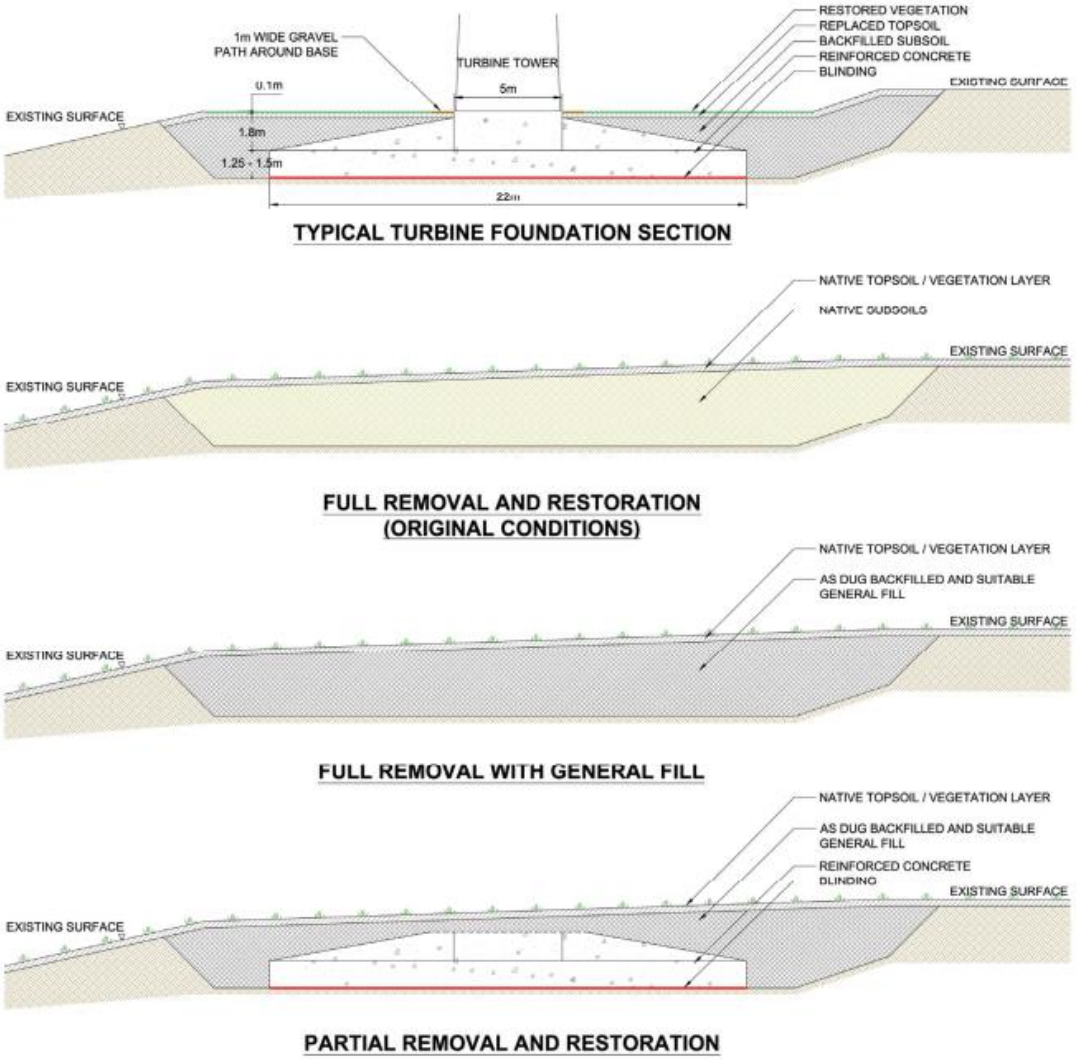
Alternatively, reinforced concrete can under normal circumstances remain *in situ* as an inert material. Concrete is inherently durable unless attacked by soils containing sulphates or low pH and other aggressive agents. The risk of rebar corrosion is low in buried concrete due to the low risk of carbonation 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.

FIGURE 10.1 TURBINE FOUNDATION DECOMMISSIONING ALTERNATIVES



10.1.4 REUSE 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

Decommission Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Freshwater & Wetlands (Aquatics)								
Spread of Alien Vegetation	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Moderate
	With Mitigation	*Site*	*Short term*	*Partly reversible*	*Negative*	*Low*	*Possible*	*Low*
Loss of habitat/vegetation	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	*Low*	*Possible*	*Low*
Loss of Critical Biodiversity Areas (CBAs)	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	*Low*	*Possible*	*Low*
Loss of riparian habitat	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	*Low*	*Possible*	*Low*
Changes to the hydrological regime and increase potential for erosion	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	*Low*	*Possible*	*Low*
Changes to surface water quality	Without Mitigation	Local	Long term	Irreversible	Negative	Moderate	Probable	Medium
	With Mitigation	*Site*	*Short term*	*Partly Reversible*	*Negative*	*Low*	*Possible*	*Low*
Terrestrial Biodiversity								
Potential vegetation clearing	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	Medium
	With Mitigation	*Site*	*Short term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Low*
Potential chemical contamination	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	*Site*	*Short term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Medium*

Decommission Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Reduced connectivity and restricted movement of fauna	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	Medium
	With Mitigation	*Site*	*Short term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Low*
Potential altered flow regime	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	Medium
	With Mitigation	*Site*	*Short term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Low*
Potential disturbance and/or displacement	Without Mitigation	Regional	Medium term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	*Local*	*Short term*	*Recoverable*	*Negative*	*Low*	*Probable*	*Moderate*
Potential mortality of faunal and flora species	Without Mitigation	Local	Long term	Irreversible	Negative	High	Highly Probable	Very High
	With Mitigation	*Site*	*Medium term*	*Recoverable*	*Negative*	Moderate	*Probable*	*High*
Faunal								
Direct habitat loss	Without Mitigation	Site	Medium term	Recoverable	Negative	Moderate	Highly Probable	Moderate
	With Mitigation	*Local*	*Medium term*	*Recoverable*	*Positive*	*Moderate*	*Highly Probable*	Moderate
Indirect habitat loss	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Probable	Moderate
	With Mitigation	*Local*	*Medium term*	*Recoverable*	*Positive*	*Moderate*	*Highly Probable*	Moderate
Displacement or disturbance	Without Mitigation	Site	Short term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	*Site*	*Short term*	*Recoverable*	*Negative*	*Low*	*Low Probability*	*Moderate*

Decommission Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Direct Mortality	Without Mitigation	Site	Short term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	*Site*	*Short term*	*Recoverable*	*Negative*	*Low*	*Low Probability*	*High*
Indirect Mortality	Without Mitigation	Site	Short term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	*Site*	*Short term*	*Recoverable*	*Negative*	*Low*	*Low Probability*	*High*
Impacts of all phases of the proposed development on ecological processes of the area	Without Mitigation	Local	Medium term	Recoverable	Negative	Moderate	Highly Probable	High
	With Mitigation	*Local*	*Medium term*	*Recoverable*	*Positive*	*Moderate*	*Probable*	*High*
Visual								
Visual effects of construction activities on scenic resources	Without Mitigation	Long distance	Long term	Reversible	Negative	**Very high**	Definitive	Very high
	With Mitigation	Long distance	Long term	Reversible	Negative	**Very high**	Definitive	Very high
Noise								
Potential Cumulative Noise Impacts	Without Mitigation	Regional	Long term	High	Negative	Low	Possible	Low
	With Mitigation	*Regional*	*Long term*	*High*	*Negative*	*Low*	*Possible*	*Low*
Social								
Retrenchment including loss of jobs, and source of income.	Without Mitigation	Local	Short term	n/a	Negative	Moderate	Probable	Moderate
	With Mitigation	*Local*	*Short term*	*n/a*	*Negative*	*Low*	*Probable*	*Low*
Traffic								
	Without Mitigation	Regional - Local	Short term	Reversible	Negative	Low	Probable	Low

Decommission Phase		Extent	Duration	Reversibility	Status	Significance	Probability	Magnitude
Additional heavy vehicles/E80's on the external road network-	*With Mitigation*	*Regional - Local*	*Short term*	*Reversible*	*Negative*	*Low*	*Probable*	*Low*
Additional heavy vehicles/E80's on the external road network-	Without Mitigation	Regional - Local	Short term	Reversible	Negative	Low	Probable	Low
	With Mitigation	*Regional - Local*	*Short term*	*Reversible*	*Negative*	*Low*	*Probable*	*Low*

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		
• The development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout prior to construction. • Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). • 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 High / No-Go have been avoided by the major infrastructure such as turbines and buildings, the aquatic zones associated within the CBA / ESAs have also been avoided. Roads will need to traverse these areas, thus it is important to try and select existing areas with impacts / crossings where possible.	Site Engineer ECO / ESO	Throughout Decommission Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Impacts associated with the decommissioning of Development Access Roads		
• Use existing roads or upgrade existing tracks rather than constructing entirely new roads wherever possible and has been included in the proposed layout. • Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. 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 when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • Where required, all pipe culverts must 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 head cut 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, with a preference for low level drifts where possible. • 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 must be moved 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.	Site Engineer ECO / ESO	Throughout Decommission Phase
Changes to the hydrological regime and increase potential for erosion due to decommissioning of the Development		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• 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 Decommission Phase
Changes to the surface water quality characteristics due to decommissioning of the Development		
• All liquid chemicals including fuels and oil, including for the BESS, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely. • Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment). • Mechanical plant and bowsers must not be refueled or serviced within 100m of a river channel or wetland. • All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be beyond any demarcated water courses and their respective buffers. • 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. • ECO monitors the site on a daily basis to ensure plant is in working order (minimise leaks), spills are prevented and if they do occur, are quickly rectified.	Site Engineer ECO / ESO	Throughout Decommission Phase
Potential vegetation clearing impacts associated with the decommissioning phase of the proposed development		

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• The development footprint must avoid No-Go/ High Sensitivity areas as much as possible. • Limit the area of impact as much as possible. • A pre-construction walkthrough during the optimal flowering period (spring) of the finalized development layout must be conducted to ensure that No-Go and High Sensitivity areas are avoided where possible. • Ensure that lay-down and other temporary infrastructure are within Low Sensitivity areas. • Rehabilitate disturbed areas that are not required by the operational phase of the development. • All construction staff on site must attend an environmental induction to ensure that basic environmental principles are adhered to. This includes topics such as avoiding fire hazards, no littering, appropriate handling of pollution and chemical spills, minimizing wildlife interactions, remaining within demarcated construction areas, avoidance of No-Go areas and sensitive habitats etc. • Demarcate sensitive areas near the development footprint as no-go areas with construction tape or similar and clearly marked as No-Go areas. • An environmental management programme (EMPr) must be implemented and must provide a detailed description of how construction activities must be conducted to reduce unnecessary clearing and/or destruction of habitat.	Site Engineer ECO / ESO	Throughout Decommission Phase
Reduced connectivity and restricted movement of fauna impacts associated with the construction and decommissioning phase of the proposed development.		
• Minimization of length and width of road network. • Fencing and road designs to allow for passage of animals (e.g., short, wide culverts in roads and wildlife friendly fencing). • The EMPr should include wildlife monitoring and an adaptive management plan for the operational phase to ensure there are no adverse impacts observed to the fauna community. • Implement habitat enhancement and restoration measures to offset the loss of connectivity caused by construction and decommissioning activities. This can be achieved by planting native vegetation, installing nesting boxes, or creating artificial shelters to provide alternative habitats for displaced fauna species and enhance connectivity within the landscape. This should be considered in the EMPr. • All recommendations in the Terrestrial Animal Specialist Assessment must be adhered to.	Site Engineer ECO / ESO	Throughout and after Decommission Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
Potential disturbance and/or displacement impacts on local wildlife associated with the decommissioning phase of the proposed development		
• 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
Potential mortality of faunal and flora species due to direct and indirect impacts associated with the decommissioning phase of the proposed development.		
• No movement of construction vehicles and personnel between dusk and dawn. • Implementation and enforcement of speed limits. • Roadkill monitoring and recording programme. • Induction toolbox talks to personnel to increase awareness about animal SCCs present and roadkill risks. • No unauthorized movement of personnel. • No unauthorized access to the construction site. • No trenches to be left uncovered overnight. • Trenches, excavations and cattle grids to have slopes to allow for animals to escape should they fall in. • No hunting permitted. • No dogs or cats permitted (other than those of the landowner). • Waste management programme to prevent trash buildup attracting species such as crows. • Roadkill to be immediately reported, removed and suitably disposed of to prevent scavenging (e.g., buried).	Site Engineer ECO / ESO	Throughout Decommission Phase
Disturbance to Birds during the decommissioning of the wind facility		
• Artificial lighting during decommissioning should be minimized as much as possible, especially bright lights or spotlights. Lights should avoid skyward illumination.	Site Engineer ECO / ESO	Throughout Decommission Phase

Potential Impact and Management Actions	Responsibility for Implementation and Monitoring	Frequency of Monitoring
• Night-time decommissioning activities should be avoided as far as possible. Existing roads and tracks should be used as far as possible		
Visual impacts from decommissioning activities		
• Remove infrastructure not required for the post-decommissioning use. • Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Social impacts associated with retrenchment including loss of jobs, and source of income. Decommissioning will also create temporary employment opportunities, which would represent a positive temporary impact.		
• The proponent should ensure that retrenchment packages are provided for all staff retrenched when the plant is decommissioned. • All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning		
Traffic impacts from decommissioning activities		
• Implementation of Traffic Management Plan (Section 15)		

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 Hugo & Khoe. 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	Weekly

Construction Phase Action	Frequency
these are such that break down on contact with the soil. Residual herbicides must not be used.	
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
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

Monitoring Action	Indicator	Timeframe
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	Decline in vulnerable bare areas over time	Biannually

success achieved in problem areas		

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. A Plant Rescue and Rehabilitation Plan must be designed by an ecologist before construction takes place and implemented during all phases of the project lifecycle.

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 to:

- 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

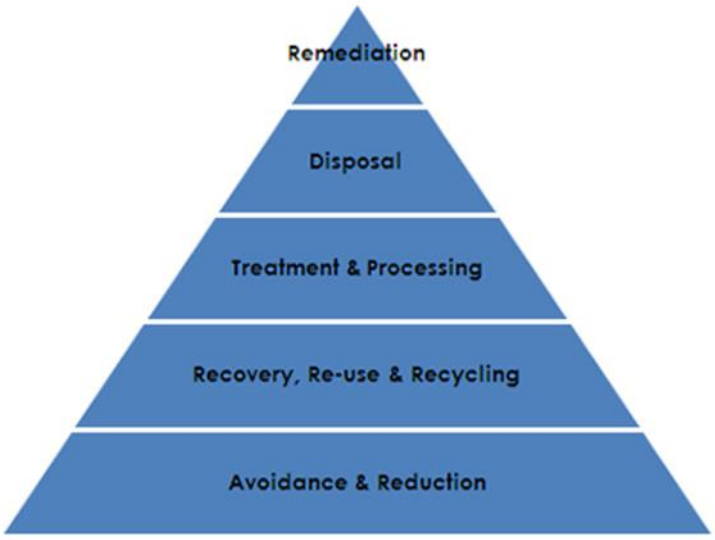
17. WASTE MANAGEMENT PLAN

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 National Waste Information Regulations published in GN No. R. 625 of 13 August 2012 must be adhered to in terms of any hazardous waste generated on the site. The Developer must apply for registration as a "hazardous waste generator" with the Department's Integrated Pollutant and Waste Information System ("IPWIS") (http://ipwis.pgwc.gov.za/ipwis3/public/login) should the need for hazardous waste disposal arise. The application can be completed within 30 days of the commencement of the waste generation activity.

The introduction of an internationally best-known practice in waste management, the Waste hierarchy (Figure 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.

FIGURE 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 practices must be made contractually binding upon appointment of the subcontractors. Signage / colour coding must be used to differentiate disposal areas for the various waste streams (i.e. paper, cardboard, metals, food waste, glass etc.).
- Septic tanks and portable toilets must be maintained regularly and monitored by the ESO / ECO. Below ground storage of septic tanks must withstand the external forces of the surrounding environment. The area above the tank must be demarcated to prevent any vehicles or heavy machinery from moving around in the surrounding area.
- Hazardous waste must be stored within a bunded area constructed according to SABS requirements, and must ensure complete containment of the spilled material in the event of a breach. As such, appropriate bunding material, design, capacity and type must be utilised to ensure that no contamination of the surrounding environment will occur despite a containment breach. The net capacity of a bunded compound in a storage facility should be at least 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.

19.3.2 PROMOTING FACTORS

Rainfall characteristics

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

Soil erodibility

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

Length and Steepness of Slope

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

Soil Surface Cover

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

19.3.3 EROSION AND SEDIMENT CONTROL PRINCIPLES

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

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

These goals can be achieved by applying the following principles:

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.

19.3.4 ON-SITE EROSION MANAGEMENT

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

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

- Soil loss will be greater during wet periods than dry periods. Intense rainfall events outside of the wet season, such as occasional unseasonal showers can also however cause significant soil loss. Therefore, precautions to prevent erosion must be present throughout the year.
- Soil loss is related to the length of time that soils are exposed prior to rehabilitation or stabilization. Therefore, the gap between construction activities and rehabilitation must be minimized. Allied to this the fact that topsoil does not store well and must preferably be used within a month or at most within 3 months to aid in the revegetation and rehabilitation of disturbed areas.
- Phased construction and progressive rehabilitation are important elements of the erosion control strategy.
- 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 overhey 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".
	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	Check if there is fuel, from a possible leak, in the spill containment sumps installed at the tank's discharge nozzle.

result in pollution of the sub-soil and groundwater	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 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

Given the possible impact of the proposed KHOE Wind Farm development, the overall impact on avifaunal species requires systematic monitoring at both the construction-phase and operational-phase of the wind farm. This is a recommendation of the BARESG guidelines (Jenkins et al. 2015).

The guidelines suggest an adaptive and systematic monitoring of bird displacement (comparing avian densities before and after construction, particularly for Priority collision-prone and Red Data species) and particularly the monitoring of all turbine-related fatalities. The latter must take account of biases introduced by scavengers removing carcasses and observers failing to detect bird-remains below the turbines.

The monitoring must include the following (as per BARESG guidelines):

Construction-phase monitoring should begin at the same time as construction begins – bearing in mind that the effects of construction on the environment can be higher than the operational phase. This phase should include monitoring nests and roosts and bustard leks on site to determine any disturbance or habitat loss where it may cause irreparable harm. These are more checks on the most important (threatened) components of the biodiversity on site than systematic surveys covering all species. This should cover a minimum 18-24 months.

Post-construction monitoring can be divided into two categories:

A. quantifying bird numbers and movements (replicating baseline data collection), and
B. estimating bird mortalities.

Carcass monitoring should be undertaken by trained observers, able to cover 4-5 turbines per day in all weather conditions throughout the year at ~40% or more of all turbines, overseen by an ornithologist competent to determine species identification, and a manager to collate and analyse each years' data.

Estimating bird fatality rates includes:

A. estimation of searcher efficiency and scavenger removal rates using carcasses;
B. carcass searches; and
C. data analysis incorporating systematically collected data from (a) and (b); these biases should then inform the fatality rates.

A minimum of 30-40% of the wind farm footprint should be methodically searched for fatalities, throughout the year, with a search interval informed by scavenger removal trials and objective monitoring. Any evidence of mortalities or injuries within the remaining area should be recorded and included in reports as incidental finds.

The search area should be defined and consistently applied throughout monitoring.

The duration and scope of post-construction monitoring should be informed by the outcomes of the previous year's monitoring and reviewed annually.

Post-construction monitoring of bird abundance and movements, and fatality surveys, should span 2-3 years to take inter-annual variation into account, particularly in arid areas; and

If significant problems are found or suspected, the post-construction monitoring should continue in conjunction with adaptive management and mitigations – accounting for the risks related to that particular site and those species involved.

An assessment guided by these principles is required not only to enact and test the effectiveness of different mitigation measures where significant mortality occurs but allow data to be collected that will benefit the welfare of avifauna at other renewable energy farms. This is also important for a study of cumulative avian impacts for the increasing number of Wind Energy Facility planned for South Africa.

Management interventions: Where avian fatalities are found to occur:

I. to *Critically Endangered/ Endangered/Vulnerable* Red Data species (at a level of one RD fatality per turbine year); or
II. should two or more individuals of other Red Data species (i.e *Near Threatened*) or a Least Concern Priority species be killed per turbine year, then a specific response must be implemented within 60 days for those turbines causing the fatalities. This should be tailored to the rarity of the species involved such that the more range-restricted or rare the species is the lower the threshold (i.e., 2 vs 3 vs 4 fatalities) is at which mitigation action is triggered.
III. a full threshold-response plan, as detailed above should be initiated for Priority species avian fatalities. This requires that where fatalities occur for *Vulnerable, Endangered* or *Critically Endangered* species at a threshold of <u>one</u> bird fatality per turbine per year then an immediate response (i.e within 2 months) must be enacted. This is to avoid protracted negotiations that may well see other individuals of the same species unnecessarily killed by the same turbine.

Experiments, with bird deterrent techniques such as patterned blades painted with Signal Red paint are encouraged (Morkel et al. 2023, Martin and Banks 2023), or the initiation of human-led, or automated, shut-down-on-demand (SDOD) within 60 days to reduce fatality rates. The results of these experiments should be publicised so that other Wind Energy Facility, with similar issues, can be informed.

We would encourage Developers to release the results of the annual monitoring to Birdlife South Africa, such that South Africa-wide fatality and displacement results can be collated and assessed. In this way cumulative impacts assessments, currently crudely estimated, can be refined, region by region.

A construction and operation monitoring plan must be developed and be implemented to survey impacts resulting from the infrastructure installation on bird communities, as well as continue to gather information on the bird communities present in the area and monitor the effectiveness of the migration measures for a minimum duration of at least three years during operation.

An avifaunal monitoring program to determine the actual impacts on the high priority birds for a minimum of three years must be developed and implemented. This must be done according to the latest SABAAP guidelines.

The pre-construction monitoring programme must be designed in accordance with the latest version of the "Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development areas in southern Africa"

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:

Impact	**Mitigation/Management Objectives**	**Mitigation/Management Actions**	**Monitoring**		
			Methodology	Frequency	Responsibility
DESIGN PHASE					
Negative impacts on bats.	Mitigate impacts on bat habitat caused by destruction, disturbance, and displacement.	Ensure the design of the wind energy facility takes the sensitivity mapping of the bat specialist into account to avoid and reduce impacts on bat species and bat important features. Maintain buffers around these sensitive areas.	Ensure that high-sensitivity areas are identified and excluded from turbine placement. High-sensitivity areas should be avoided and treated as No-go areas for operational wind turbine components during the planning and design phase.	Before construction during the design and planning phase.	Project Developer
	Prevent bat activity in sensitive areas.	Minimize artificial light at night during the design phase. Do not install roll-up garage doors.	Choice of lights and light placement is crucial. Bats can get trapped in roll-up garage doors and die.	Final design Site planning phase.	Project Developer
	Minimise the footprint of the construction to an acceptable level.	Turbines need to be approximately 250 m apart from blade tip to blade tip.	Final layout design	During design and before construction commences.	Project Developer

	Avoid habitat loss and destruction caused by the clearing of vegetation for the working areas and construction, and landscape modifications.	Appoint an ECO before construction to oversee that the EMPr is adhered to. Plan to use existing road networks as far as possible and ensure no off-road driving.	Monitor whether proposed measures are adhered to. ECO should be trained to recognise possible roost locations. If buildings, trees, or structures providing potential roosts need to be demolished, a specialist visit is required before the commencement of the work.	ECO should contact the bat specialist and be trained/informed before construction commences.	Project Developer Operational bat specialist should work with/inform ECO
CONSTRUCTION PHASE					
Active roost destruction, potential roost destruction, and habitat loss.	Minimise impacts on bats during construction activities. Keep construction out of high bat-sensitive areas as far as possible. Avoid the destruction of rock formations along ridge lines. Avoid the destruction of trees as far as possible. Take care before destroying dense bushes/trees to avoid unnecessary roost destruction. All aardvark holes, derelict holes, or excavations should be carefully investigated for roosts before destruction.	Adhere to high-sensitivity areas incorporated into the final layout. Appoint an independent ECO to oversee that the EMPr is being adhered to. Bat specialist to train ECO, if necessary, to identify possible bat roosts or signs of bat presence. Clearance and removal of natural vegetation should be kept to a minimum. Avoid pollution of water courses. No off-road driving.	Visual inspection and continuous monitoring of high-sensitivity areas. ECO to be in contact with a bat specialist if bat roosts are encountered.	Throughout construction. ECO to be present during all site clearance activities. Access to bat specialist if ECO needs information or confirmation concerning bat presence.	Project Developer. Holder of EA to appoint ECO. Appointed bat specialist to train the ECO, if necessary.
Creating new habitats amongst the turbines that	Avoid creating new bat habitats that might attract bats to the wind farm.	Inspect all existing buildings and infrastructure for possible roosting opportunities.	Carefully seal off the roofs of buildings to prevent bat roosting. Note that bats can move into a space of 1 X 1 cm.	Throughout construction phase.	Project Developer. ECO.

might attract bats. This includes buildings with roofs that could serve as roosting spaces or open water sources from quarries or excavations where water could accumulate.		No roll-up garage doors should be used on site.	Bats could roost in roll-up garage doors and get killed when the doors are opened.		
Construction noise, especially during night-time.	Prevent disturbance to bat activity and behaviour.	Noise levels should be prevented as far as possible.	Monitor construction to reduce noise and minimise disturbance in bat-sensitive areas. Avoid construction activities at night.	Throughout construction phase.	Project Developer. ECO. All on-site personnel.
OPERATIONAL PHASE					
The fatality of resident bats through direct collision or barotrauma.	Monitor potential impacts on bats during the operation of the wind farm. Prevent activities that will attract bats to the site.	Maintain a register of action taken regarding bat mortality/injury as well as queries or complaints. Adhere to mitigation measures as per the pre-construction bat monitoring report. Adapt mitigation measures in consultation with an operational bat specialist.	Relevant SABAA guideline documents. Monitoring reports.	Throughout operational bat monitoring.	Project Developer. ECO.
Bat fatality of migratory species.	Monitor potential impacts on bats during the operation of the wind farm. Prevent activities that will attract bats to the site.	Maintain a register of action taken regarding bat mortality/injury as well as queries or complaints. Adhere to mitigation measures as per the pre-construction bat monitoring report. Adapt mitigation measures in consultation with an operational bat specialist.	Relevant SABAA guideline documents. Monitoring reports.	Throughout operational bat monitoring.	Project Developer. ECO.

Loss of bats of conservation value.	Monitor potential impacts on bats during the operation of the wind farm. Prevent activities that will attract bats to high-risk areas on-site.	Bat fatalities should be monitored by fatality searches and a record kept of the date, time, location, sex, and cause of death. Carcasses should be photographed to be used for searcher efficiency and carcass removal trails. Adhere to mitigation measures as per the pre-construction bat monitoring report. Adapt mitigation measures in consultation with an operational bat specialist.	Relevant SABAA guideline documents. Monitoring reports.	Throughout operational bat monitoring.	Project Developer. ECO.
Bat fatality due to the attraction of bats to turbine blades.	Prevent activities that will attract bats to turbines.	Maintain a register of action taken regarding bat mortality/injury as well as queries or complaints. Adhere to mitigation measures as per the pre-construction bat monitoring report. Adapt mitigation measures in consultation with an operational bat specialist.	Relevant SABAA guideline documents. Monitoring reports.	Throughout operational bat monitoring.	Project Developer. ECO.
Loss of habitat and foraging space during operation of the wind turbines.	Monitor potential impacts on bats during the operation of the wind farm. Prevent activities that will attract bats to high-risk areas on-site.	Maintain a register of action taken regarding bat mortality/injury as well as queries or complaints. Adhere to mitigation measures as per the pre-construction bat monitoring report. Adapt mitigation measures in consultation with an operational bat specialist.	Relevant SABAA guideline documents. Monitoring reports.	Throughout operational bat monitoring.	Project Developer and ECO.
Reduction in size, genetic diversity, resilience, and persistence of bat populations.	Monitor potential impacts on bats during the operation of the wind farm. Prevent activities that will attract bats to high-risk areas on-site.	Maintain a register of action taken regarding bat mortality/injury as well as queries or complaints. Adhere to mitigation measures as per the pre-construction bat monitoring report.	Relevant SABAA guideline documents. Monitoring reports.	Throughout operational bat monitoring.	Project Developer. ECO.

		Adapt mitigation measures in consultation with an operational bat specialist.			
DECOMMISSIONING PHASE					
Decommissioning activities and noise, especially at night- time.	Mitigate disturbance due to decommissioning activities.	Develop a decommissioning and remedial rehabilitation plan and adhere to the compliance monitoring plan.	Implement the decommissioning and rehabilitation plan to reduce the footprint of the development to a pre-construction state.	During decommissioning phase.	Project Developer. ECO. Commitment from all levels of management.

23.1 FEATHERING OF TURBINES BELOW CUT-IN SPEED

Normally, operating turbine blades are at a right angle to the wind. To avoid bat fatality when turbines are not generating power, feathering as a mitigation measure is applied where the angle of the blades is pitched parallel to the wind direction so that the blades only spin at very low rotation with no risk to bats. The turbines do not need to be at a complete standstill, but the movement of the turbines will be minimal.

The cut-in speed is the lowest wind speed at which turbines generate power. Freewheeling occurs when turbine blades are allowed to rotate below the cut-in speed which increases the risk of collision in areas already sensitive to bat activity. As bats are more active at wind-still nights and nights with low wind speeds, fatalities during freewheeling should be prevented as much as possible, and to an extent that bat mortality is avoided below cut-in speed. It is recommended that this mitigation measure commences immediately after the installation of turbines, after the necessary tests on turbines have been concluded.

This mitigation measure might therefore be in place before the commercial operation date, and for the duration of the project. Turbine blades are usually feathered around 90 degrees to prevent freewheeling, but the angle will depend on the turbine make and model.

23.2 CURTAILMENT OF TURBINES IN MEDIUM -HIGH SENSTIVITY ZONES

Currently, the most reliable and effective mitigation is curtailment (Arnett and May 2016; Hayes 2019).

Curtailment entails locking or feathering the turbine blades during high bat activity periods to reduce the risk of bat mortality via collision with blades and barotrauma. This results in a reduction of power generation during conditions when electricity would usually be supplied.

Curtailment regimes are developed by examining the relationship between relative bat activity levels and weather conditions. The bat activity from the 100 m (A) system on the met masts was used as this system was within the sweep of the turbine blades the closest to the weather station. Unfortunately, personal experience supported by unpublished data in South Africa indicates that Molossidae bats in Southern

Africa fly at higher wind speeds than originally predicted. At Hugo WEF, see Section 6.8, this species tends to fly below 8 m/s, and is most active within the sweep of the turbine blades. At the development terrain, current data indicates that bats in general are more active in lower wind speeds, high temperatures, and humidity between 30% and 90 %. Bat mortality could be reduced by using these weather conditions to predict bat activity.

This relationship between bats and weather conditions, as well as seasonal and monthly activity, are used to inform curtailment schedules that should be applied when bat activity is high to reduce potential encounters of bats with wind turbine blades. These relationships are presented in Section 6 of this report and were used to compile the curtailment schedule in Table 9 below. Months with high bat activity informed the seasonal mitigation schedule.

At present no form of curtailment is recommended as yet, apart from curtailing turbines below cut-in speed as mentioned in Section 23.1, as there are no particular turbines or development zones, apart from those areas that have already been omitted for development, that indicate the potential for relatively high fatality. Close observation by the operational bat specialist should inform the curtailment during the first year of monitoring, preferably within the first half

of the operational monitoring. If curtailed turbines show consistently low activity through static recordings as well as mortality in the low threshold range, the bat specialist could adapt curtailment downwards again, but bat monitoring during seasons with high

fatality should follow any relaxation of curtailment. When more data has been collected, atmospheric pressure might be added if there is an indication that there is a correlation with bat activity on the wind energy facility.

24. NOISE MANAGEMENT AND MONITORING PLAN

Environmental Noise Monitoring can be divided into two distinct categories, namely:

- Passive monitoring – the registering of any complaints (reasonable and valid from NSR living within 2,500m from any WTG of the Khoe WEF) regarding noise; and
- Active monitoring – the measurement of noise levels at identified locations.

After the implementation of mitigation measures, worst-case noise levels could be higher than 42 dBA (more than 7 dBA of the night-time rating level of a rural noise district) and active noise monitoring is recommended and required.

In addition, should a reasonable and valid noise complaint be registered, the applicant should investigate the noise complaint as per the guidelines in sub-section 24.1.1 and 24.1.2. These guidelines should be used as a rough guideline as site-specific conditions may require that the monitoring locations, frequency or procedure be adapted.

25.1 Measurement localities and frequency

24.1 MEASUREMENT LOCALITIES AND FREQUENCY

Ambient sound levels could be measured at NSR K-3, two measurement locations near K-6, K-7, K8, K-9, K-10, K11 and K-15, as well as K-12 before the development of the WEF (at the minimum), with the measurements repeated after the first year of operation. In addition, should there be a valid and reasonable noise complaint, once-off noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint. The measurement location should consider the direct surroundings to ensure that other sound sources cannot influence the reading. These measurement locations can be reduced accordingly if the NSRs are relocated or the dwellings are no longer used for residential purposes.

24.2 MEASUREMENT PROCEDURES

Ambient sound measurements should be collected as defined in SANS 10103:2008. Due to the variability that naturally occurs in sound levels at most locations, it is recommended that semi-continuous measurements are conducted over a period of at least 5 days, covering at least five full night-time (22:00 – 06:00) periods. Spectral frequencies should also be measured to define the potential origin of noise. When a noise complaint is being investigated, measurements should be collected during a period or in conditions similar to when the receptor experienced the disturbing noise event

24.3 ENVIRONMENTAL MANAGEMENT

Environmental Management Objectives are difficult to be defined for noise because ambient sound levels would slowly increase as developmental pressures increase in the area. This is

due to increased traffic associated with increased development, human habitation, agriculture and even eco-tourism. While these increases in ambient sound levels may be low (and insignificant) it has the effect of cumulatively increasing the ambient sound levels over time.

The moment the WEF facility stops operation, ambient sound levels will drop to levels similar to the pre-WEF levels, or to new levels (typical of other areas with a similar developmental character) if other developments have occurred in the interim.

For the purpose of this report potential environmental management objectives would be:

- That the development (construction and operational phase) of the WEF project not result in noise levels exceeding 52 dBA (when measured over a period of at least 1 hour) during the day; and
- That the development (construction and operational phase) of the WEF project should not result in noise levels exceeding 45 dBA (when measured over a period of at least 1 hour) at night.

As noise levels will not exceed 52 dBA during both the construction and operational phases, Environmental Management is mainly focusing on the night-time period as summarized in:

Table 24-1 for the planning phase (to ensure that noise levels are with the acceptable limits during the future operational phase:

Table 24-2 for night-time activities during the construction phase; and

Table 24-3 for the operational of the WTG.

TABLE 24.1 ENVIRONMENTAL MANAGEMENT FOR PLANNING PHASE

Objective: **Calculated noise rating levels less than 7 dBA from the zone sound level (acceptable rating level)**		
Project Components:	Future construction and operational activities of WTG of the Khoe WEF	
Potential Impact:	Noise levels impacting on the quality of living of NSR	
Activity/Risk source	Future construction and operational activities	
Mitigation: Target	Daytime noise levels less than 52 dBA, night-time noise levels less than 45 dBA at locations used for residential purposes	
Mitigation: Action / Control	Responsibility	Timeframe
Applicant to re-evaluate the noise impact once the WTG specifications are finalised	Applicant	Planning phase, before development of WEF
If noise levels, after the evaluation of the selected WTG are higher than 45 dBA, the applicant must design a noise abatement programme (or define appropriate mitigation measures) that will ensure that operational noise levels are less than 45 dBA at all verified NSR;	Applicant	Planning phase, before development of WEF

Applicant to re-evaluate the noise impact should the layout be revised (as part of an amendment process post EA) where any WTG, located within 2,500 m from a confirmed NSR, are moved closer to the NSR.	Applicant	Planning phase, before development of WEF
Applicant to re-evaluate the noise impact should the layout be revised (as part of an amendment process post EA) where any new WTG are introduced within 2,500 m from an NSR	Applicant	Planning phase, before development of WEF
Applicant to re-evaluate the noise impact should the layout be revised (as part of an amendment process post EA) where the number of WTG within 2,500 m from an NSR are increased	Applicant	Planning phase, before development of WEF
Applicant to re-evaluate the noise impact should the applicant make use of a wind turbine with a maximum PWL exceeding 108.4 dBA re 1 pW	Applicant	Planning phase, before development of WEF
Applicant to implement noise monitoring program to define the ambient sound levels at selected locations (NSR H-6) before the construction phase start.	Applicant	Planning phase, before development of WEF
Performance Indicator	Calculated daytime noise levels should be less than 52 dBA, with night-time noise levels being less than 45 dBA at structures used residential purposes	
Monitoring	No monitoring required during planning phase	

TABLE 24.2 ENVIRONMENTAL MANAGEMENT FOR NIGHT-TIME CONSTRUCTION ACTIVITIES

Objective: **Construction activities not to result in noise levels exceeding 52 dBA during the day-time period** **Construction activities not to result in noise levels exceeding 45 dBA during the night-time period**		
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 NSR	
Activity/Risk source	Construction activities	
Mitigation: Target	Daytime noise levels less than 52 dBA, night-time noise levels less than 45 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 (and/or land owner(s)) before night-time construction activities are to take place within 1,200 m from an NSR (if the structures are used	ECO	Construction activities within 1,500 m from NSR, if

for residential activities during the proposed construction period).		NSR is used for residential purposes
Performance Indicator	Daytime noise levels from construction activities less than 52 dBA at NSR Night-time noise levels from construction activities less than 45 dBA at NSR	
Monitoring	Inspection of equipment by ECO. Measurement of noise levels at dwellings of NSR after noise complaints (	

TABLE 24.3 ENVIRONMENTAL MANAGEMENT FOR NIGHT-TIME OPERATIONAL PERIOD

Objective: **Operational activities not to result in noise levels exceeding 52 dBA during the day-time period** **Operational activities not to result in noise levels exceeding 45 dBA during the night-time period**			
Project Components:	Operation of WTG within 2,500 m from structure used for residential purposes		
Potential Impact:	Noises from WTG impacting on the quality of living of NSR		
Activity/Risk source	Operation of WTG		
Mitigation: Target	Daytime noise levels from operational activities less than 52 dBA at NSR Night-time noise levels from operational activities less than 45 dBA at NSR		
Mitigation: Action / Control		Responsibility	Timeframe
Applicant to conduct noise monitoring when a reasonable and valid noise complaint are received from an NSR living within 2,500m from a WTG of the project.		EO / Applicant	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.		EO	During the first year once the project is operational. Noise specialist to confirm need for future measurements.
Performance Indicator	Daytime noise levels from operating WTG less than 52 dBA, with night-time noise levels due to operating WTG being 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 on

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 Hugo & Khoe. 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 FIGURES

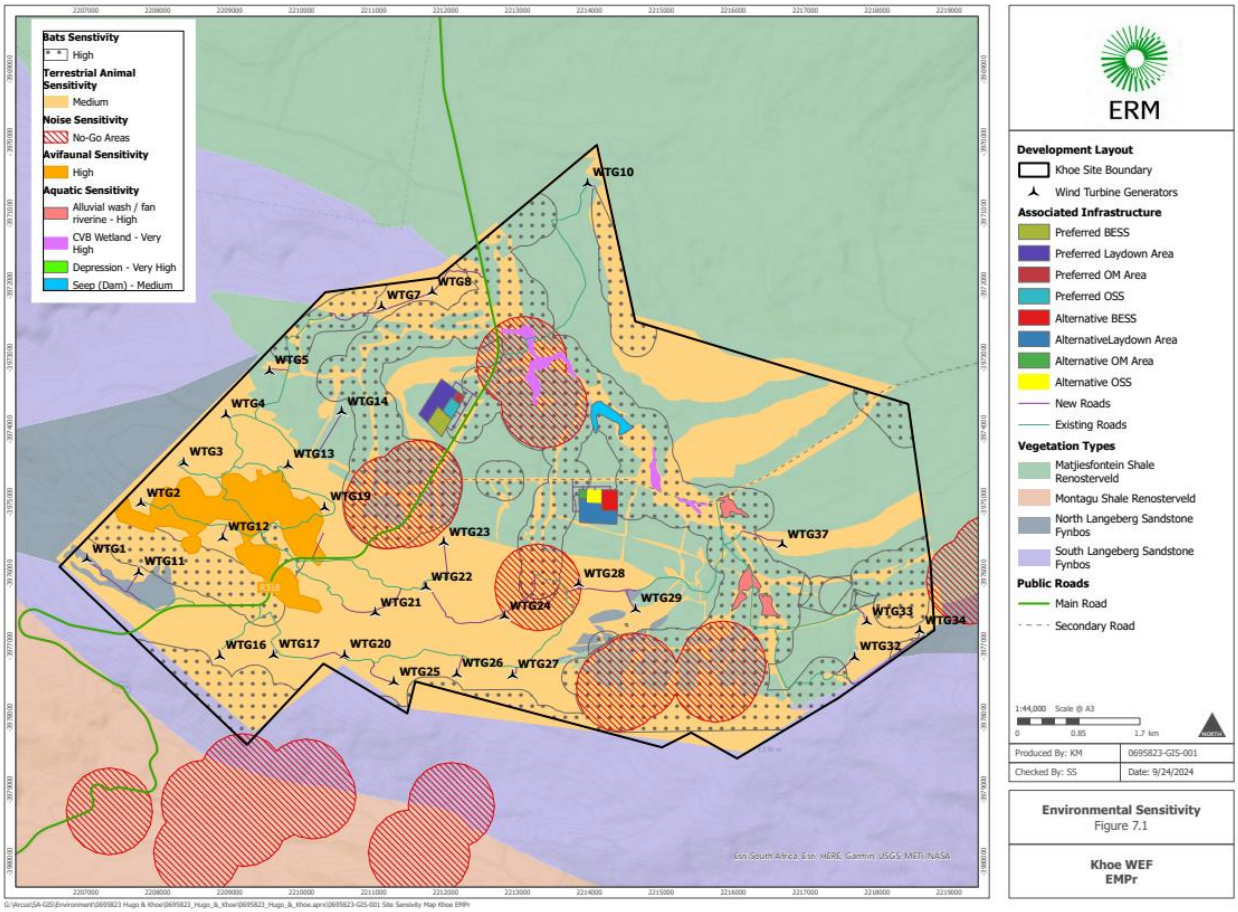


FIGURE 2: SENSITIVITY MAP

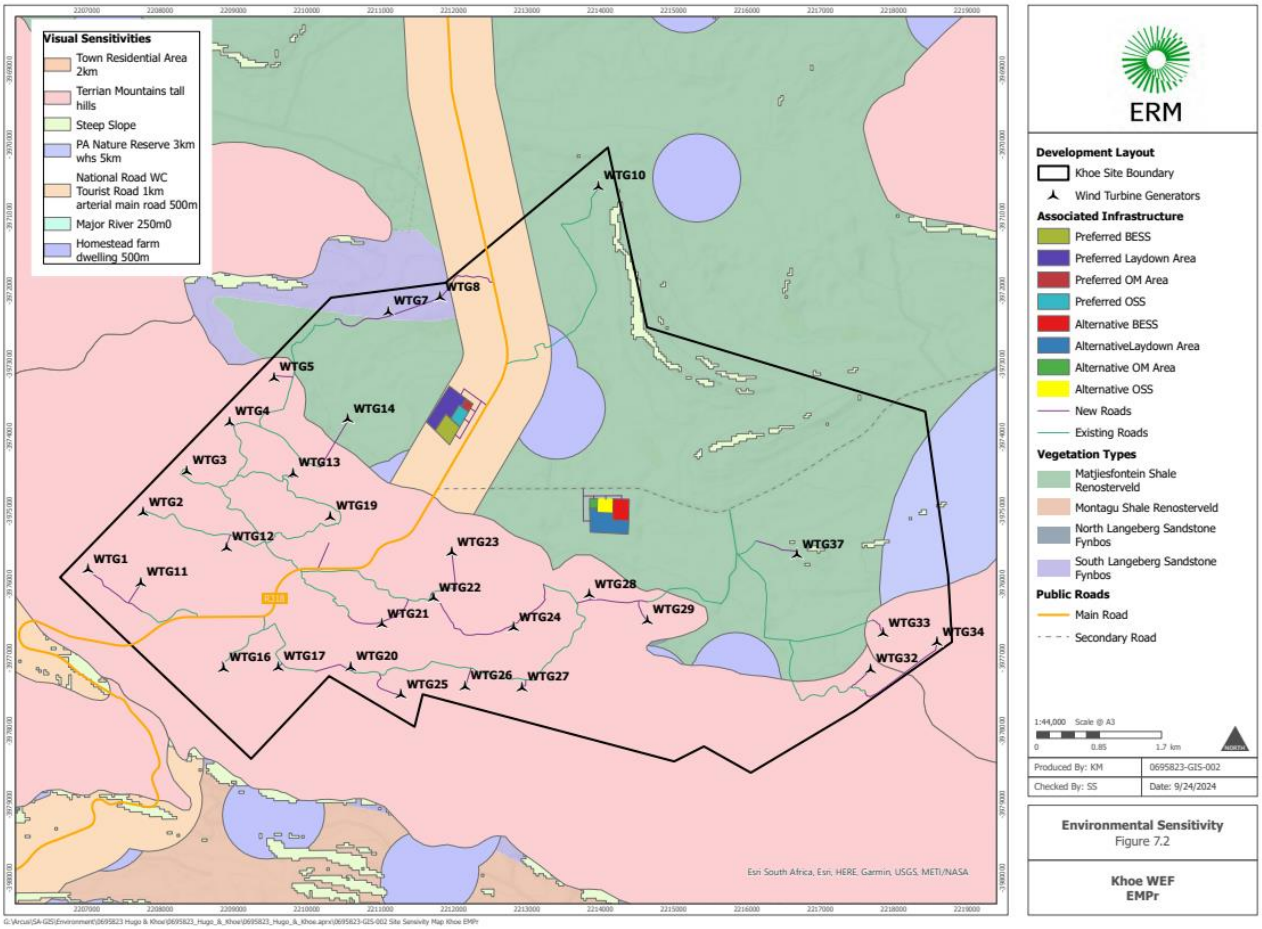


FIGURE 4: SENSITIVITY MAP (VISUAL)

ERM HAS OVER 160 OFFICES ACROSS THE FOLLOWING COUNTRIES AND TERRITORIES WORLDWIDE

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Ghana
Guyana
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
The Netherlands
New Zealand
Peru
Poland
Portugal
Romania
Senegal
Singapore
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