VOLUME I: APPENDIX B
ENVIRONMENTAL MANAGEMENT PROGRAMME

PROPOSED PAULPUTS SOUTH WEF BATTERY ENERGY STORAGE FACILITY AND ASSOCIATED INFRASTRUCTURE, NORTHERN CAPE PROVINC

On behalf of

PAULPUTS WIND ENERGY FACILITY SOUTH (RF) (PTY) LTD

NOVEMBER 2021

FINAL VERSION

Prepared By:

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Glossary of Terms

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Palaeontological objects include any fossilised remains of animals or plants.

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

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

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

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

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

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

Rehabilitation: Measures implemented to restore a damaged Environment.

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

- Areas with high conservation value due to the presence of important plant specimens, pristine habitats, high biodiversity, important water resources or heritage features and artefacts;
- Areas particularly prone to erosion once disturbed (i.e. steep slopes);
- Vulnerable areas with low potential for rehabilitation / slow rate of recovery (i.e. rock outcrops, steep slopes); and
- Areas in close proximity of sensitive receptors, such as farm homesteads, viewpoints or tourist stopovers.

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

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

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1 INTRODUCTION

1.1 Background

Paulputs Wind Energy Facility (RF) (Pty) Ltd ('PWEF'), a wholly owned subsidiary of WKN Windcurrent SA (Pty) Ltd, was granted environmental authorisation for the 300 MW (75 turbines) Paulputs Wind Energy Facility (WEF) and its associated 132 kV OHPL on 11 December 2019 by the Department of Forestry, Fisheries and the Environment (DFFE) (DFFE Reference 14/12/16/3/3/2/1120). As part of the Environmental Impact Assessment (EIA)[1], three alternative on-site substation options (A, B and C) were assessed. The Competent Authority (CA), DFFE, chose to only issue a favourable authorisation for the preferred OHPL option 'C' and on-site substation option 'A'.

To comply with the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bidding requirements, the abovementioned 300 MW Paulputs WEF is being split into the 150 MW Paulputs South WEF and the 150 MW Paulputs North WEF (separate application processes). The authorised OHPL option 'C' and on-site substation option 'A' will be used for proposed Paulputs North WEF.

Paulputs Wind Energy Facility South (RF) (Pty) Ltd ('Paulputs South') will consist of a 150 MW Facility with up to 35 turbines, with a hub height of up to 180 m, blade length of up to 110 m and a rotor diameter of up to 220 m. The on-site substation will be included within this development and will include a Battery Energy Storage System, which will be housed within the approved temporary laydown area. All infrastructure (turbines, substation, BESS, etc.) will be located to the east of the N14 Highway (within the authorised development footprint).

The Paulputs South WEF, grid connection and substation is located approximately 35 km north-east of Pofadder and approximately 85 km north-west of Kakamas in the Northern Cape Province and is situated in two district municipalities, the Namakwa District Municipality and the ZF Mgcawu District Municipality, and within the Khâi-Ma Local Municipality and the Kai !Garib Local Municipality.

If awarded Preferred Bidder Status, Paulputs Wind Energy Facility South (RF) (Pty) (Ltd) would enter into an implementation agreement with the Department of Energy (DoE) and a Power Purchase Agreement (PPA) with the buyer of the energy, which is in the majority of cases Eskom. Once operational the electricity would be sold to Eskom under the PPA at the agreed bid price. Eskom then distribute the energy through the national grid to the energy users.

An application has been submitted to the competent authority of authorisation of an on-site substation and Battery Energy Storage System (BESS) to connect the proposed Paulputs South WEF to the national grid. This EMPr is prepared as part of the requirements of the EIA Regulations (2014) promulgated under the National Environmental Management Act (Act 107 of 1998), for the Paulputs South WEF BESS, and must be used in conjunction with the generic EMPr for the Paulputs South WEF on-site substation.

This document, the environmental management programme (EMPr) must be seen as dynamic, and be updated when and if required, throughout the lifecycle of the project.

The EMPr outlines measures to be implemented in order to minimise adverse environmental degradation associated with the operation of the BESS. It serves as a guide for the contractor and the construction workforce on their roles and responsibilities concerning

[1] The EIA was undertaken by Arcus Consultancy Services South Africa (Pty) Ltd in 2019, which assessed the Paulputs Wind Energy Facility (WEF) and its associated 132 kV grid connection, is hereon referred to as the **'EIA (Arcus, 2019)'**

environmental management on site, and it provides a framework for environmental monitoring throughout the operational period of the BESS.

1.2 Authors of the EMPr

Arcus Consultancy Services South Africa (Pty) Ltd (Arcus) drafted this EMPr as part of the application for the proposed Paulputs South WEF BESS.

Table 1-1: EMPr Authors and Co-authors

MANAGEMENT TEAM 2021		
Technical Discipline	Person	Organisation
Project Director	Ashlin Bodasing	Arcus Consultancy Services SA Pty Ltd
Project EAP	Ashleigh von der Heyden	Arcus Consultancy Services SA Pty Ltd
EAP Assistant	Aneesah Alwie	Arcus Consultancy Services SA Pty Ltd

1.3 Project Developer

The Project Developer - Paulputs Wind Energy Facility South (RF) (Pty) Ltd - is the 'owner' of the project and as such is responsible for ensuring that the conditions of the Environmental Authorisation issued by DFFE in terms of NEMA (should the project receive such authorisation) are fully satisfied, as well as ensuring that any other necessary permits or licences are obtained and complied with. It is expected that the Project Developer will appoint the Construction Manager and the Operations Manager.

1.4 Purpose and Aims of this Document

An Environmental Management Programme (EMPr) is defined as "an *environmental management tool used to ensure that undue or reasonably avoidable adverse impact of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the project are enhanced."*

This EMPr outlines measures to be implemented in order to minimise adverse environmental degradation and enhance positive impacts associated with BESS. It serves as a guide for the contractor and the workforce on their roles and responsibilities concerning environmental management on site, and it provides a framework for environmental monitoring throughout the operational periods. 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; and
  - 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.

All management plans and mitigation measures should be adaptive and amended as required based on audits of their effectiveness.

2 THE PROPOSED PAULPUTS SOUTH WEF BESS

The proposed development is located approximately 35 km north-east of Pofadder and approximately 85 km north-west of Kakamas. The Substation and BESS are situated within the ZF Mgcawu District Municipality within the Kai !Garib Local Municipality. The affected farm and development co-ordinates are provided in Table 2-1 and Table 2-2 below.

Table 2-1: Paulputs South WEF and Project Locality Details

Affected Farm Name and Farm Portion of the SS and BESS	Farm name and portion	Size in hectare	21 digit surveyor general codes
FLORES JOHANNES VAN DER COLFF	*LUCASVLEI 93/1*	*3193.78*	*C03600000000009300001*
	LUCASVLEI 93/2	*2895.08*	*C03600000000009300002*
Application area (ha)	The BESS will be located within the 1 ha temporary laydown area.		
Magisterial district	Ward 9 of the Kai !Garib Local Municipality of DC8 – ZF Mgcawu District Municipality		
Distance and direction from nearest town	The site is located 35 km north east of Pofadder.		

Table 2-2: Proposed Development Co-ordinates

Reference Point	Latitude	Longitude
BESS Development Area Co-ordinates		
North Corner	28°58'4.95"S	19°45'34.82"E
West Corner	28°58'7.32"S	19°45'32.26"E
South Corner	28°58'9.61"S	19°45'34.93"E
East Corner	28°58'7.24"S	19°45'37.48"E

Unlike conventional energy storage facilities, such as pumped hydro, a BESS has the advantage of being flexible in terms of site location and sizing. Therefore, they can be incorporated into, and placed in close proximity, to a wind or solar facility. They also have the advantage of being easily scaled and designed to meet specific demands.

The function of the BESS will be to store peak kinetic energy produced by the proposed Paulputs South WEF for use in the following ways:

- To power the operation of the Paulputs South 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 battery technology being considered is Flow, Solid-State, Lithium Ion (Li-Ion) and/or Sodium Sulphur batteries. With rapid developments in battery technology globally, and uncertainty regarding the preferred battery technology of choice, the EAP has undertaken

a high-level desktop study and risk assessment of the BESS. The battery technologies under consideration are explained further below, and compared in a table of advantages and disadvantages.

2.1 The NEMA and BESS

Although international BESS standards are currently being updated, current BESS regulations in South Africa are mostly written for backup power (uninterrupted power supply) applications.

As discussed in the Pre-Application meeting held with DFFE on 14 August 2020, the BESS will not trigger any listed activities on its own due to the fact that is to be located on an area already authorised for storage related activity. Furthermore, activities relating to storage of dangerous goods, such as Activity 14 of Listing Notice 1 and Activity 10 of Listing Notice 3, will not be triggered by the proposed battery storage facility installation, due to the following:

- A battery is not deemed to be a container; and
- Electrolytes that are used within battery storage facilities: their function is deemed to be like transformers within substations: converting high voltage electricity to lower voltage electricity for further distribution. The function of the battery is not for "storage" or "storage and handling" of a dangerous good.

Battery storage does not trigger any listed activities relating to the generation of electricity as technology does not 'generate' electricity, it simply stores electricity generated by a renewable energy facility (proposed Paulputs South WEF in this instance) and discharges the stored electricity as and when required by the grid.

2.2 BESS Technologies Considered

Typically, BESS consist of multiple battery cells that are assembled together to form modules. Each cell contains a positive electrode, a negative electrode and an electrolyte. A module may consist of thousands of cells working in conjunction. Modules are normally packaged inside containers (similar to shipping containers) and these containers are delivered pre-assembled to the WEF site (Plate 2-1 shows the inside of one such container).

Paulputs South anticipates the placement of containers within the area currently authorised for temporary laydown. Ancillary (or associated) infrastructure will include (but not limited to):

- a battery room;
- inverters;
- switch gear room; and
- Supervisory Control and Data Acquisition (SCADA) equipment.

The containers will have approximate dimension ranges of: height 2 m - 5 m, width 1.5 m - 3 m, length 7 m - 20 m. The containers are raised slightly off the ground and are bunded to prevent possible environmental damage resulting from any equipment malfunction. The proposed development is considering the option of stacking these containers vertically to a maximum of two container layers or a height of 10m.

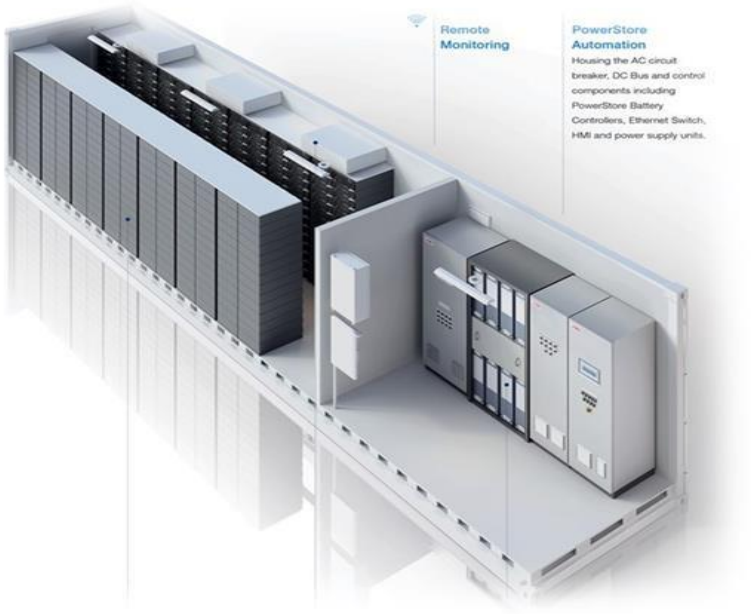


Plate 2-1: Typical representation of how batteries and battery modules are housed and assembled.

Preferred Technology - Lithium ion (Li-ion) batteries are the most common stationary battery in the market today. Simply put, the batteries consist of a graphite electrode and a lithium-based electrode immersed in a liquid. When the battery is in use, charged lithium atoms ions flow from the graphite electrode to the lithium-based electrode through the liquid, and that flow of charged particles is what generates electricity. When the battery is recharged the flow is reversed, sending the lithium ions back to the graphite anode where they are stored ready for discharge.

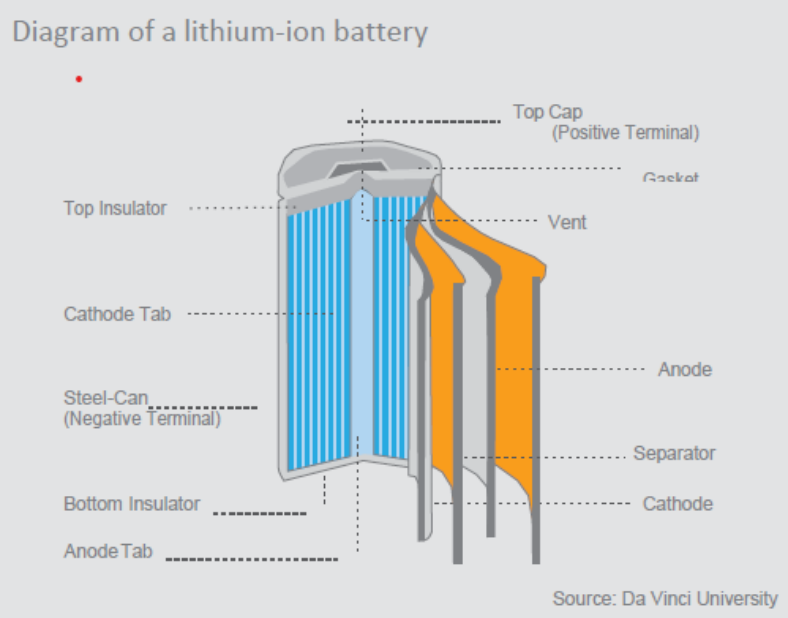


Plate 2-2: Diagram of a Lithium-Ion Battery

A sodium sulphur (NaS) battery is a molten state battery constructed from sodium (Na) and sulphur (S). The battery casing is the positive electrode while the molten core is the negative electrode. The battery operates at high temperatures of between 300-350 degrees Celsius (°C), while lower temperature versions are under development. In charging, the

sodium ions are transported through the ion selective conductor to the anode reservoir. Discharge is the reverse of this process. Since sodium ions move easily across the ion selective conductor, electrons cannot, therefore there is no self-discharge. When not in use the batteries are typically left under charge so that they will remain molten and be ready for use when needed. If shut down and allowed to solidify, a reheating process is initiated before the batteries can be used again.

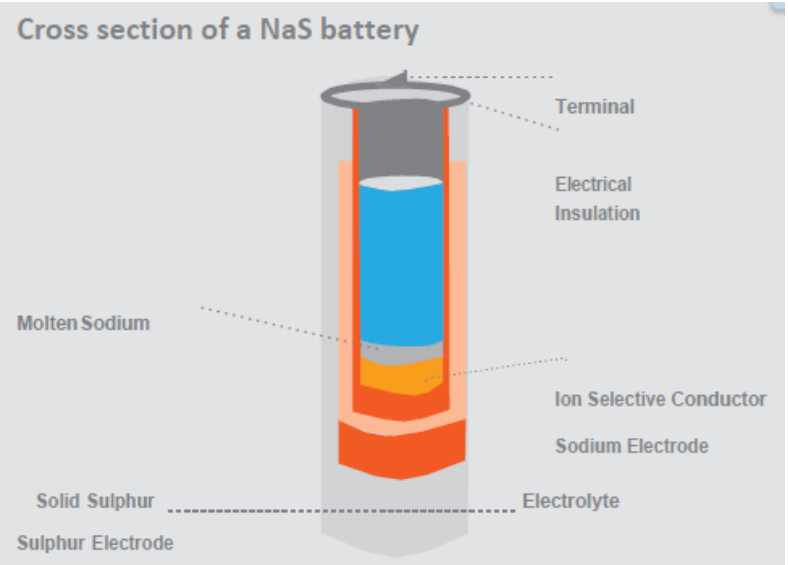


Plate 2-3: Diagram of a Sodium-Sulphur Battery

Solid State Battery is an acceptable solution to assist with reducing the fire risk Li-ion batteries pose. Unlike Li-Ion Batteries, Solid State Batteries have an ionic liquid made up of non-flammable molten salts with low melting points i.e. the electrolyte is considered a solid. Compared to Li-ion batteries with liquid electrolytes, SSBs offer an attractive option owing to their potential in improving safety and achieving both higher power and high energy densities. The trade-off with this type of battery is that electrically charged atoms do not move as freely and easily through a solid as they do through a liquid, so thus making them less efficient at generating electricity.

Flow Batteries consist of two tanks of liquids that feed into electrochemical cells. The main difference between flow and conventional batteries is that flow batteries store the electricity in the liquid rather than in the electrodes. They're far more stable than Li-ion, they have longer lifespans, and the liquids are less flammable. Not only that, but a flow battery can be scaled up by simply building bigger tanks for the liquids. The most widely known and used flow battery is vanadium flow battery.

Table 2-3 describes the most widely used technologies available in the market, and the most feasible technology for large utilities projects. It must be noted that the technology is constantly changing and evolving and as such the Applicant would utilise the best possible technology available at the time of placement.

Table 2-3: The technology options for the BESS

Activity Alternative	Advantage	Disadvantage
Preferred Technology: Li-Ion Batteries[2]	• Lithium ion has the smallest installation footprint when compared to the technologies for the similar energy capacity.	• Negative effects of overcharging / over discharging. • Volatility leading to Fire and Explosions.

[2]Li-Ion Battery: https://ensia.com/features/battery-innovations-renewable-energy/

Activity Alternative	Advantage	Disadvantage
	• Li-ion batteries are able to tolerate more discharge cycles than other technologies. • High efficiency. • Produce the highest voltage compared to other batteries by driving high electron flow.	• Potential for issues associated with overheating (Certain Lithium chemistry's). • The Lithium element in this technology is considered hazardous / dangerous goods. • Lithium is a finite resource with concerns of its availability in the long term.
NaS Batteries[3]	• Long life cycle. • Able to tolerate a high number of charge/discharge cycles. • ability to discharge fully with no effects to the performance.	• Low energy to size ratio. • Heating may be required. • Potential safety issues with the molten sodium. • Has the potential to catch on fire.
Flow Batteries[4]	• More stable than Li-Ion battery. • Are known to have the longest lifespan. • Less flammable liquids. • Technology is scalable for large grid infrastructure and renewable energy project.	• The liquids can be costly, so there's a greater up-front cost for the batteries. • Not as efficient as Li-Ion Battery.
Solid State Battery[5]	• Potential to substitute Lithium for another electrode material. • Marked improvement in safety at cell and battery levels: solid electrolytes are non-flammable when heated, unlike their liquid counterparts. • It permits the use of innovative, high-voltage high-capacity materials, enabling denser, lighter batteries with better shelf-life as a result of reduced self-discharge. • Simplified mechanics as well as thermal and safety management.	• Reduced conductivity. • Sourcing of a suitable electrolyte. • Not as well researched and widely accepted as Li-Ion batteries. • Narrow temperature range and cannot tolerate varying temperature.

Plate 2-4 provide a visual representation of a typical set up of an on-site substation and BESS. The proposed Paulputs South WEF will have similar project components and will be designed in a similar manner.

[3] Li-Ion Battery and Na-S Battery: https://ensia.com/features/battery-innovations-renewable-energy/
[4] Flow Battery: https://newatlas.com/energy/iron-aqds-flow-battery-usc/
[5] Solid State Battery: https://www.greentechmedia.com/articles/read/us-storage-companies-quietly-grow-bets-on-solid-state-batteries

Plate 2-4: A stock image of a similar development with an on-site substation and BESS. Source [https://reneweconomy.com.au/why-grid-based-battery-storage-is-already-a-no-brainer-in-australia-85967/]

A high-level Battery Energy Storage System (BESS) risk assessment has been conducted and is contained in Section 6 of this EMPr.

2.3 Additional Project Components

In terms of access routes and internal roads, the development site will have one (1) security controlled entry and exit point. As far as possible, existing gravel access roads will be utilised and where this is not possible, road will be constructed to run in a 2-way direction, approximately 4 – 6 m wide. Caution will be taken to preserve any road infrastructure such as culverts, and where necessary, these may be upgraded. The site is easily accessible from the N14 or R358 arterial road, however it is assumed that the same access roads as approved in the proposed Paulputs South WEF will be utilised for this project – these roads are located north of the proposed development site.

3 LEGAL FRAMEWORK

A Basic Assessment Application for Environmental Authorisation, in terms of the National Environmental Management Act, Act 107, 1998 (NEMA), Environmental Impact Assessment Regulations, 2014, as amended has been submitted to the Department of Forestry, Fisheries and the Environment.

Table 3-1: Listing Notice Activities Triggered by the Proposed Development

Listing Notices 1 and 3 07 April 2017	Listed Activity	Description of project activity that triggers listed activity
Listing Notice 1 GN R983 Activity 11	*The development of facilities or infrastructure for the transmission and distribution of electricity— (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.*	The on-site substation of up to 132 kV will be responsible for the distribution of electricity generated by the WEF for transmission via a double-circuit overhead powerline.
Listing Notice 1 GN R983 Activity 12	*The development of- (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs (a) within a watercourse;*	The cumulative footprint of all proposed development within 32 m of a watercourse will exceed 100 square meters.

	(c) if no development setback exists within 32 m of a watercourse, measured from the edge of a watercourse.	
Listing Notice 1 GN R 983 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 metres or more, but not exceeding 500 cubic meters.*	The proposed BESS will contain electrolyte solution considered to be a dangerous good. Although the BESS itself is not considered a facility for the storage of dangerous goods, the total volume of electrolyte solution used in the BESS may exceed 80m^3 but will be less than 500m^3. Depending on the preferred technology chosen by the Applicant, this solution will be stored temporarily on site during battery assembly.
Listing Notice 1 GN R983 Activity 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;*	Construction of the proposed development could include the excavation of soil in watercourses/drainage line areas, and infilling/deposition will exceed 5 cubic metres and, in some instances, exceed 10 cubic metres.
Listing Notice 1 GN R983 Activity 27	*The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation*	The infrastructure associated with the on-site substation and BESS will require clearing of more than 1 hectare of indigenous vegetation but less than 20 hectares.
Listing Notice 1 GN R983 Activity 28	*Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;*	Construction of the proposed development will change the land use from agriculture to mixed - agriculture and electricity transmission. The proposed development is outside an urban area and has a footprint that will exceed 1 ha.
Listing Notice 1 GN R983 Activity 48	The expansion of- *Infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion occurs- (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse*	Existing farm roads, tracks and bridges within 32 m of a watercourse will require expansion (upgrading). The cumulative footprint of all proposed development expansion within 32 m of a watercourse may exceed 100 square metres.
Listing Notice 3 GN R985 Activity 4	*The development of a road wider than 4 metres with a reserve less than 13,5 metres.* *(g) Northern Cape* *(ii) Outside Urban Areas* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Servitude roads and internal roads leading to the substation and BESS will be wider than 4m and less than 13.5 meters.
Listing Notice 3 GN R 985 Activity 10	*The development and related operation of facilities or infrastructure for the storage, or for the storage and handling of a dangerous good, where*	The proposed BESS will contain electrolyte solution considered to be a dangerous good. Although the BESS itself is not considered a facility for

	such storage occurs in containers with a combined capacity of 30 cubic metres or more, but not exceeding 80 cubic meters. *(g) Northern Cape Province* *(iii) Outside Urban Areas* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans*	the storage of dangerous goods, the total volume of electrolyte solution used in the BESS may exceed 30m^3 but will be less than 80m^3. Depending on the preferred technology chosen by the Applicant, this solution will be stored temporarily on site during battery assembly.
Listing Notice 3 GN R985 Activity 12	*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *(g) Northern Cape* *(ii) Within critical biodiversity areas identified in bioregional plans*	Clearance more than 300 sqm of indigenous vegetation within an CBA (1), CBA (2) and ESA.
Listing Notice 3 GN R985 Activity 14	*The development of—* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *(g) Northern Cape* *(ii) Outside urban areas:* *(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Bridges and infrastructure may be constructed within 32 m of watercourse(s). The site lies outside of an urban area and is within an CBA (1), CBA (2) and ESA.
Listing Notice 3 GN R985 Activity 18	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre* *(g) Northern Cape* *(ii) Outside Urban areas* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or* *in bioregional plan*	Existing farm roads will need to be widened or lengthened. The site lies outside of an urban area and is within an CBA (1), CBA (2) and ESA.

3.1 Legislative Requirement for Scope and Content of the EMPr

Table 3-2: Legislative Requirements for Scope of Assessment and Content of Environmental Management Programme

Appendix 4 Requirements NEMA, 1998 (Act No. 107 of 1998)		Location in EMPr
	Content of environmental management programme (EMPr)	Section 1.2 Appendix A
1	*(1) An EMPr must comply with section 24N of the Act and include-*	
(a)	*details of-* *(i) the EAP who prepared the EMPr; and* *(ii) the expertise of the EAP to prepare an EMPr, including a curriculum vitae;*	

Appendix 4 Requirements NEMA, 1998 (Act No. 107 of 1998)		Location in EMPr
(b)	*A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;*	Section 2
(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 1
(d)	*a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment processed for all phased of the development including-* *(i) planning and design;* *(ii) pre-construction activities;* *(iii) construction activities;* *(iv) rehabilitation of the environment after construction and where applicable post closure; and* *(v) where relevant, operation activities;*	Sections 4 - 6
(f)	*a description of proposed impact management actions, identifying the manner in which the impact management outcomes and contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to-* *(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;*	Sections 4 - 6
	(ii) comply with any prescribed environmental management standards or practices;	Sections 4 - 6
	(iii) comply with any applicable provisions of the Act regarding closure, whre applicable; and	Sections 4 - 6
	(iv) comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	Sections 4 - 6
(g)	*the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);*	Sections 4 - 6
(h)	*the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);*	Sections 4 - 6
(i)	*an indication of the persons who will be responsible for the implementation of the impact management actions;*	Sections 4 - 6
(j)	*the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;*	Sections 4 - 6
(k)	*the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);*	Sections 4 - 6
(l)	*a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;*	Sections 4 - 6
(m)	*an environmental awareness plan describing the manner in which-* *(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and* *(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and*	Sections 4 - 6
(n)	*any specific information that be required by the competent authority.*	Specific information required by the competent authority during the amendment process

Appendix 4 Requirements NEMA, 1998 (Act No. 107 of 1998)		Location in EMPr
		has been included throughout the EMPr.

4 ENVIRONMENTAL MANAGEMENT PROGRAMME

This section forms the core of the EMPr and outlines the specific mitigation measures for those key impacts identified in the section above.

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 National Environmental Management Act, 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.

4.2 Roles and Responsibilities for Good Environmental Management

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

Developer Representative – Environmental Manager

- Review and approve EMPr prior to authorisation by DFFE.
- Review and approve any EMPr updates or amendments.
- Ensure environmental requirements are integrated into the project plans, method statements and tender processes.
- Support the site environmental control officer during the construction phase, to ensure implementation of the EMPr.
- Follow up and close out all environmental incidents and non-conformances.
- Appointment a suitably qualified independent environmental control officer during the construction phase.

Principal Contractor Representative - Environmental Control Officer

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

The ECO will:

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

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

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

4.3 Training and Induction of Employees

The contractor 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 Contractor must ensure that all staff working on site has 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

- Fire management
- HIV/AIDS

4.4 Complaints Register and Environmental Incidents Book

The Contractor must record any complaints received from the community. The complaint must be brought to the attention of the site manager and Environmental Control Officer, 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 whom.

4.5 Construction Environmental Monitoring

Environmental audits must be undertaken by an independent environmental consultant who will act as the Environmental Control Officer on a schedule deemed necessary by the ECO during times of heavy earth works and vegetation clearing, in order to ensure compliance of all aspects of the EMPr.

In order to facilitate communication between the ECO and the Resident Engineer and Contractor, 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.

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 or environmental consultant, who may propose EMPr amendments on behalf of the developer or issue EMPr instructions, corrective actions, remediation or rehabilitation. These correction actions must be completed within the specified timeframes.

5 DESIGN PHASE / PRE-CONSTRUCTION PHASE MITIGATION MEASURES

The objectives of the pre-construction phase are:

- To promote environmental awareness.
- To define roles and responsibilities for environmental management;

- To ensure suitable environmental training and induction to all contractors, sub-contractors and labourers; and
- To ensure that all legal obligations and contractual conditions have been met prior to commencing of construction.
- To ensure the DFFE has an amended EMPr to approve based on micro-siting and specialist input. The EMPr must contain the final site layout for approval.

Mitigation measures for Legal Compliance.

- Appoint an independent environmental control officer
- Appoint an internal environmental co-ordinator or environmental officer, to oversee day to day environmental activities.
- Staff must 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.
- Before construction begins, all areas to be developed must be clearly demarcated with fencing, by a qualified surveyor.
- The contractor must ensure compliance with conditions described in the environmental authorisation.
- No workers are allowed to stay overnight in the construction area.
- Confirm with 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 must be drawn from the local market where possible.
- Training of site staff.
- Environmental awareness training for construction staff, 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.
- Project Manager shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks.
- Staff operating 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.

5.1 Method Statements

The Contractor shall provide Method Statements for approval by the ECO and the Engineer prior to work commencing on aspects of the project deemed or identified to be of greater risk to the environment and/or which may not be covered in sufficient detail in the construction phase of the EMPr, when called upon to do so by the Engineer or ECO.

A Method Statement is a "live document" in that modifications are negotiated between the Contractor and the ECO/project management team, as circumstances unfold. All Method Statements will form part of the construction phase / delivery of the BESS to the development site, of the EMPr documentation and are subject to all terms and conditions contained within the construction phase of the EMPr.

Note that a Method Statement is a 'starting point' for understanding the nature of the intended actions to be carried out and allows for all parties to review and understand the procedures to be followed in order to minimise risk of harm to the environment.

Changes to, and adaptations of Method Statements can be implemented with the prior consent of all parties.

A Method Statement describes the scope of the intended work in a step-by-step description in order for the ECO and the Engineer to understand the Contractors intentions. This will enable them to assist in devising any mitigation measures, which would minimize environmental impact during these tasks.

For each instance where it is requested that the Contractor submit a Method Statement to the satisfaction of the Engineer and ECO, the format must clearly indicate the following:

- What - a brief description of the work to be undertaken;
- How - a detailed description of the process of work, methods and materials;
- Where - a description/sketch map of the locality of work (if applicable); and
- When - the sequencing of actions with due commencement dates and completion date estimates.
- Who – The person responsible for undertaking the works described in the Method Statement; and
- Why – a description of why the activity is required.

All Method Statements are to be to the satisfaction of the ECO, Engineer and, where practical and deemed necessary, should be endorsed as being acceptable by the environmental representative of the Relevant Authority.

5.2 Additional Plans and Programmes

Before operation of the BESS, the operator is responsible of ensuring that the following plans and programmes are final for implementation.

- Lifecycle Battery Recycling Programme / End-of-Life Plan;
- An Emergency Response Plan;
- First Responder Training Manual;
- Thermal management and monitoring programme; and
- BESS operations and maintenance programme.

The adaptation of these plans and programmes can be made from the High Level BESS Risk Assessment provided in Section 6 of this EMPr.

5.3 Applicability of the generic EMPr for the Paulputs South WEF On-site substation

The authorisation of the Paulputs South WEF on-site substation and BESS will be provided in a single Environmental Authorisation, therefore, measures in the generic EMPr is also applicable to the BESS and associated infrastructure and must be used in conjunction with this EMPr. The BESS components will be delivered to site preassembled, any construction phase impacts will be related to the construction of the substation and therefore the generic EMPr must be used by the contractor.

6 OPERATIONAL PHASE MITIGATION MEASURES

The operator of the BESS and associated infrastructure has the responsibility to ensure that the mitigation measures proposed, and all revisions thereof, for the operational phase is implemented and conducted appropriately.

6.1 High Level BESS Risk Assessment

The risks associated with battery technologies are typically well researched and documented. The main concerns relating to a BESS are fire hazards and the potential for a condition known as '*thermal runaway*'. Thermal runaway occurs in situations where an

increase in temperature changes the conditions in a way that causes a further increase in temperature, often leading to a destructive result. As far as general environmental risks, the main concerns are surrounding the disposal of the batteries at end of their life.

The Risk Assessment mitigation measures provided below can be incorporated into a Battery Safety Management Plan, which is to be kept in both electronic and hard copy format on the project site. This Risk Assessment has been prepared to ensure that safety risks related to the BESS are understood, accounted for and mitigated as far as practicable.

The following international guidance has been considered during the preparation of this Risk Assessment:

- Allianz Risk Consulting (ARC), Tech Talk Volume 26 (2019). Battery Energy Storage Systems (BESS) using Li-ion batteries[6];
- National Fire Protection Association (NFPA) 855, Standard for the Installation of Stationary Energy Storage Systems, (2020 edition currently under development and not yet available)[7];
- UL 9540, Standard for Energy Storage Systems and Equipment[8]; and
- Consolidated Edison and New York State Energy Research and Development Authority - Considerations for ESS Fire Safety (February 2017)[9].
- The Energy Operators Forum "Good Practice Guide" (December 2014)[10];
- Institute of Engineering and Technology - Code of Practice for Electrical Energy Storage Systems (August 2017)[11]; and
- The Energy Institute: Battery Storage Guidance Note 1 - Battery Storage Planning (August 2019)[12].

At the time of writing, the above standards and legislation is not specifically applicable to the proposed BESS, but notwithstanding provided valuable guidance for the preparation of this Risk Assessment.

The Risk Assessment Matrix below assesses 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 resultant impact that these risks would cause;
3. The likelihood of these actual risks occurring.
4. Appropriate and practical mitigation measures and/or management actions to reduce likelihood of the risk occurring and/or the impact.
5. The significance/Risk Rating of the impacts should these risks take place.

The BESS has been considered by Specialists as forming part of the substation footprint. The BESS is proposed to be located on the area previously assessed in the original EIA on the footprint earmarked for temporary laydown.

[6] https://www.agcs.allianz.com/news-and-insights/risk-advisory/tech-talk-volume-26-bess-english.html

[7] https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=855

[8] https://standardscatalog.ul.com/standards/en/standard_9540_1

[9] https://www.nyserda.ny.gov/-/media/Files/Publications/Research/Energy-Storage/20170118-ConEd-NYSERDA-Battery-Testing-Report.pdf

[10] https://www.eatechnology.com/engineering-projects/electrical-energy-storage/

[11] https://shop.theiet.org/code-of-practice-for-electrical-energy-storage-systems

[12] https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fpublishing.energyinst.org%2Ftopics%2Fpower-generation%2Fbattery-storage%2Fbattery-storage-guidance-note-1-battery-storage-planning&data=01%7C01%7C%7Cfbce9f4783304951211308d72af01893%7C6b5953be6b1d4980b26b56ed8b0bf3dc%7C0&sdata=%2FgEjqDC2nzzxcKTWFaKkUEiiTiiOzTamrAsxsMz9Y4M%3D&reserved=0

Table 6-1: High-Level BESS Risk Assessment

Possible Risk	Resultant Impact	Likelihood of occurrence	Management / Mitigation	Risk Rating
Spillages Thermal Runaway Poor Maintenance	- 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.	Low	- 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 - Implementation of spill handling and management in line with the generic EMPr - Demarcate all no-go and sensitive areas - Avoid the placement of batteries near watercourses and sensitive features - MSDS Records to be kept, as well as incidents reporting register. - Source batteries from reputable suppliers - Battery inspection prior to installation. - Maintenance. - Appropriate battery design and venting control - Source from reputable manufacturers. - Safe and appropriate storage in line with the above and the generic EMPr. Safe handling which must include battery inspection prior to installation. - Development and implementation of Thermal Management Plan prior to installation/construction.	Low
Explosion / Overheating	- On-Site Fire - Fire Spread - Staff and personal injury	Medium	- Procuring components and using construction techniques which comply with all relevant legislation; - Including automatic fire detection systems in the development design; - Including automatic fire suppression systems in the development design; - Including redundancy in the design of the BESS to provide multiple layers of protection; - Designing the BESS and substation yard to contain and restrict the spread of fire through the use of fire-resistant materials, and adequate separation between elements of the BESS; and	Medium

Possible Risk	Resultant Impact	Likelihood of occurrence	Management / Mitigation	Risk Rating
			- Ensuring that Staff appointed to work within the BESS and substation area, as well as First Responders receive adequate emergency response training to a fire. - Work with first responders and relevant personnel to develop a Tactical Fire Response Plan in case of an incident	
Inappropriate Storage	- 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.	Low	- 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 - Implementation of spill handling and management in line with the generic EMPr - Demarcate all no-go and sensitive areas - Avoid the placement of batteries near watercourses and sensitive features - MSDS Records to be kept, as well as incidents reporting register. - Source batteries from reputable suppliers - Battery inspection prior to installation.	Low
Limited Employee Training and Experience	- Time lag for first respondent - Inability to contain spillage - Fire - Electrocution - Damage to exiting/surrounding infrastructure	Low	- During the construction phase of Paulputs South WEF, 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 BESS. Such training must be provided by the technology suppliers or an appointed service provider.	Low
Inappropriate disposal at the end of life	- Potential scenario of fluids from the batteries leaking into environment. The release of such chemicals through leaching, spills or air emissions can harm communities,	Medium	- The recycling of batteries and their potential use as e-waste. - Disposal at a licensed hazardous waste site. - Prior to construction of the Paulputs South WEF, the Applicant is to develop a dedicated Battery Recycling Programme to be adopted on-site.	Medium

Possible Risk	Resultant Impact	Likelihood of occurrence	Management / Mitigation	Risk Rating
	ecosystems and food production. - The potentially toxic materials contained in batteries means that they are classified as hazardous materials in terms of NEM:WA. There are only a few licensed hazardous waste sites in South Africa and recycling of batteries and e-waste has been identified as a sure way of improving the lifespans of such sites.		- Records of disposal at a licensed facility must be kept.	

In terms of minimising fire risk within the BESS and Substation site, the following design and implementation recommendations are proposed and should be considered prior to installation/construction of the BESS. These recommendations should form part of the Tactical Fire response plan where applicable.

Table 6-2: Proposed Design and Installation Considerations for the BESS:

Initial Design Recommendations:
1. Fire department • Invite the fire department to the project site to discuss BESS hazards. An adequate emergency response is the key to avoiding an uncontrolled fire. Keep in mind that some fire fighters will not fully understand the hazards and may assume that lithium-ion batteries are the same as lithium batteries. • Key questions to discuss with the fire department include: – What is the main difference between extinguishing and cooling? – How to handle a damaged battery? – How to manage the flammable and toxic gases? • Plan training exercises with the fire department when the system is commissioned. • Standard Operating Procedures (SOP) & Standard Operating Guidelines (SOG) are of major importance and should be updated and tested on a regular basis.
2. Construction and location

Initial Design Recommendations:
• Install the BESS outdoors, a minimum of 20 m from important buildings or equipment. Maintain a minimum of 3 m separation from lot lines, public ways and other exposures. • Within the module, maintain a minimum of 1 m separation distance between enclosures for all units up to 50 kWh when not listed, or up to 250 kWh when listed. • Install a thermal barrier where the minimum space separation cannot be provided. • If the BESS must be located indoors, install in a 2-hour fire rated cut-off room, which is accessible directly outdoors for manual firefighting. • Restrict the access to competent employees or sub-contractors. • Ensure enclosures are non-combustible.
3. Material, equipment and design • Paulputs South should consider a 'Testing Method' for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems. A possible international standard to consider would be UL 9540A. This standard evaluates thermal runaway, gas composition, flaming, fire spread, re-ignition and the effectiveness of fire protection systems. Data generated can be used to determine the fire and explosion protection requirements for a BESS. • Place capacitor, transformer, and switch gear in separate rooms according to best engineering practices.
4. Ventilation and temperature control • Install adequate ventilation or an air conditioning system to control the temperature. Maintaining temperature control is vital to the battery's longevity and proper operation as they degrade exponentially at elevated temperatures. • Ensure ventilation is provided in accordance with the manufacturer's recommendations. • Install and maintain the ventilation during all stages of a fire. Ventilation is important since batteries will continue to generate flammable gas as long as they are hot. Also, carbon monoxide will be generated until the batteries are completely cooled through to their core.
5. Gas detection and smoke detection • Install a very early warning fire detection system, such as aspirating smoke detection. • Install carbon monoxide (CO) detection within the container or BESS room.
6. Fire protection and water supply • Investigate the possibility of installing a sprinkler protection system within the BESS containers. The sprinkler system should be designed to provide (at a minimum) 12.2 l/min/m² over 232 m². Water has been proven to be the best agent to fight a fire involving lithium-Ion batteries. It is important to note that other extinguishing agents, such as aerosols or gaseous extinguishing systems, will extinguish the fire, but they do not provide cooling like water. Insufficient cooling allows a hot and deep-seated core to remain. The heat will rapidly spread back through the battery and reignite remaining active sections. • Implement a procedure for battery submersion in the Tactical Fire Reponses Plan, as well as the WEF Emergency Response Plan to be performed by the fire department. Submerging batteries in water (preferably outdoors) after they burn has proven to be effective at cooling the batteries and neutralizing the thermal

Initial Design Recommendations:
threat. They will continue to release gases, mostly carbon monoxide, but also flammable gas such as hydrogen. Therefore, it is not recommended to submerge several batteries in a confined space without adequate ventilation. • Ensure that sufficient water is available for manual firefighting. The ability of the fire department to control a fire involving a BESS depends on the presence of an adequate water supply and their knowledge of the hazards. The following should be considered: – An external fire hydrant should be located within 100 of the BESS room or containers. – The water supply should be able to extinguish the fire with an appropriate amount if water being administered in the first 2 hours.
7. Maintenance • Follow original equipment manufacturer recommendations for the inspection, testing and maintenance of the BESS. In addition, ensure that the following (at a minimum) is completed: – Measure the internal resistance of the battery cells. Replace the cells when a dramatic drop is detected. This will provide a good gauge of predictable battery life. – Perform infrared scanning at least once per year. – Check for fluid leakage. – Implement electric terminal torqueing procedures to maintain connection integrity.

7 ALIEN INVASIVE MANAGEMENT PLAN

7.1 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 activities. 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 and encroachment;
- Initiate and implement a monitoring and eradication programme for alien and invasive species; and
- Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

7.2 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.

7.2.1 Vulnerable Ecosystems and Habitats

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

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

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

7.2.1.1 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.

7.2.1.2 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.

7.2.1.3 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

7.3 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 and 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.

7.4 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 DFFE Working for Water Website https://www.environment.gov.za/sites/default/files/legislations/guideto_clearing_invasive_alienplants.pdf

7.5 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 *Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation* guideline must be followed.

8 ALIEN PLANT MANAGEMENT PLAN

8.1 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 should not occur unless the cleared areas are to be surfaced or prepared immediately afterwards.	Weekly
Where cleared areas will be exposed for some time, these areas must be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides must not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose must be brought onto site. Brush from cleared areas must be used as much as possible. The use of manure or other soil amendments is likely to encourage invasion.	Weekly
Clearing of vegetation is not allowed within 32 m of any wetland, 80 m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as	Weekly

building sand or dirty earth-moving equipment.) Stockpiles must be checked regularly and any weeds emerging from material stockpiles must be removed.	
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 DFFE 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

8.1.1 Monitoring Actions - Construction Phase

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

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

8.2 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

8.2.1 Monitoring Actions - Operational Phase

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

Monitoring Action	Indicator	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Quarterly
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

8.3 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

8.3.1 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

9 DECOMMISSIONING PHASE

Should the BESS be decommissioned a decommissioning plan must be produced Environmental monitoring plans must be produced so ensure no pollution occurs during this phase. The plan must include the steps that will be taken to rehabilitate the area after the BESS has been removed, as well as recycling options of the equipment and structures.

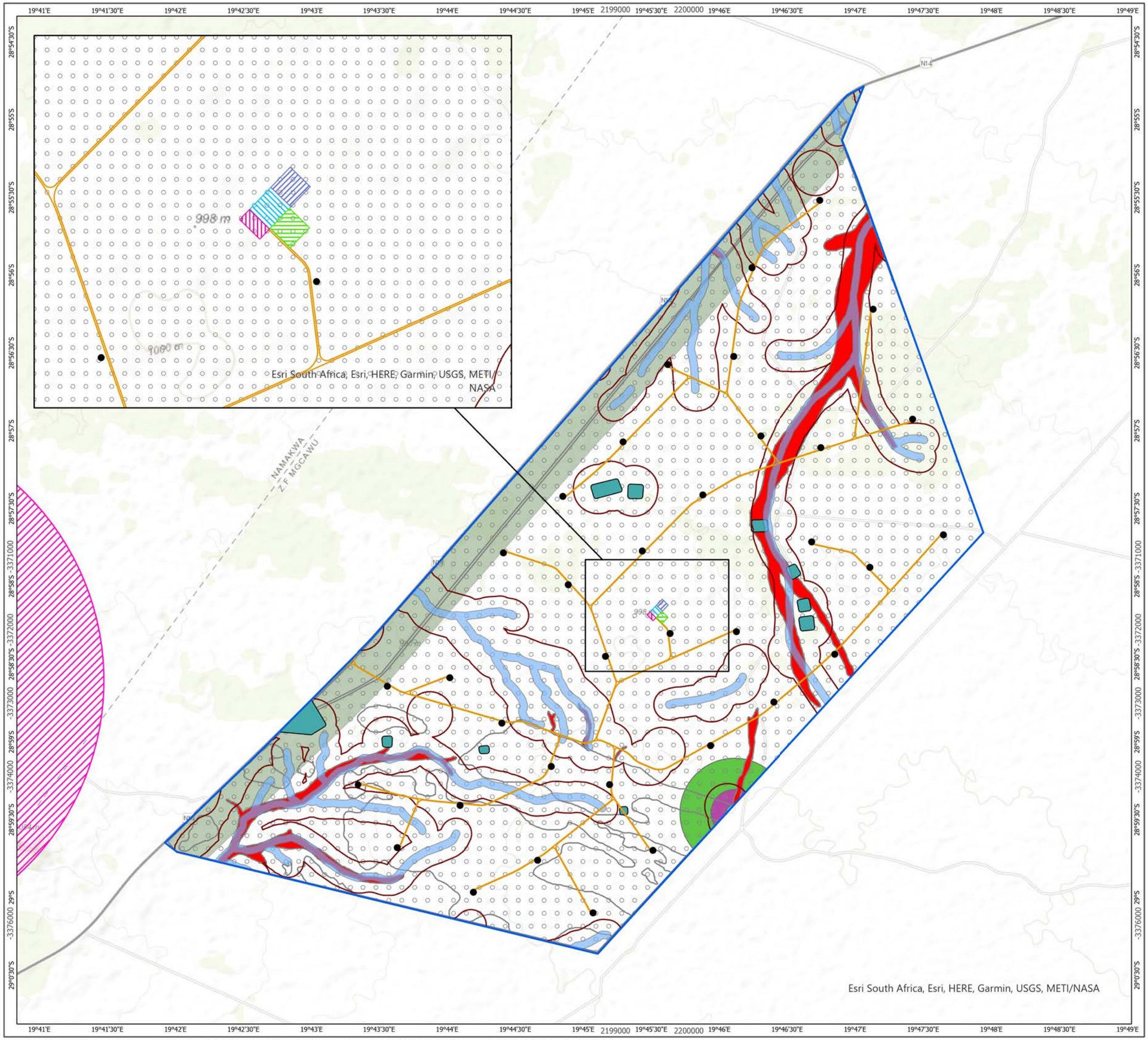
10 CONCLUSION

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) 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.

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 environmental management is well implemented, and a set of operational guidelines are developed by the long term site management body.

FIGURES



ARCUS

Paulputs South WEF

- Paulputs South WTG
- Paulputs South Internal Roads
- Proposed Paulputs South WEF Site
- Office Laydown
- Permanent Laydown
- Substation
- Temporary Laydown & BESS

Sensitivities

Bats

- Buffer 110m Blade

Avifauna

- Buffer 110m Blade

Drainage

- Buffer 45m

Heritage

- Heritage - Medium

Ecology

- Development Ok
- No Go Area
- No Turbines/Roads Ok

Noise

- Noise - High
- Noise - Medium
- Noise - No Go

Visual

- Visual - High

1:50,000 Scale @ A3

0 1 2 km

NORTH

Produced By: SC	Ref: 3944-GIS-049
Checked By: AA	Date: 16/11/2021

Environmental Sensitivity Map
Figure 1

Paulputs South WEF On-site Substation Yard and BESS EMPr

P:\Administration\GIS Administration\South Africa\3944 Paulputs Amendment Reports\3944 Paulputs Amendment Reports.aprx\3944-GIS-049 Fig01 Envrionmental Sensitivity Map

APPENDIX A - CURRICULUM VITAE OF THE EAP

CURRICULUM VITAE

Ashleigh Blackwell

Senior Environmental Consultant & Project Manager

Email: AshleighB@arcusconsulting.co.za Cell: +27 (0) 79 895 1456

Specialisms

- Project Management;
- Environmental Permitting;
- Environmental Licencing;
- Project Participation;
- Client Engagement;
- Review; and
- Due Diligence / Auditing.

Summary of Experience

Ashleigh Blackwell is a Senior Environmental Consultant and Project Manager Arcus Consultancy Services South Africa (Pty) Ltd. She is a registered SACNASP Environmental Consultant with over 4.5 years working experience in the environmental sector, namely the Renewable Energy and Mining sectors. In addition, she has reporting experience for the International Finance Corporation (IFC) and Equator Principles (EP) Performance Standards and the World Bank Environmental Guidelines in Africa. Ashleigh has a proven track record in managing environmental projects to the required quality standards, timeframes and budgets. Her core responsibilities include client management and project implementation, reporting and execution. Ashleigh completed her BSc (Hons) in Conservation Ecology at the University of Stellenbosch and is currently completing her MSc at the University of Witwatersrand and her Project Management Professional (PMP) Certification through the Project Management Institute (PMI). Ashleigh has attended certified workshops and training courses in Environmental Law, Environmental Waste Act Enforcement, Soil Survey and Soil Classification, and Section 21 Water use Licencing.

Professional History

2020 – Present – Senior Environmental Consultant & Project Manager, Arcus SA (Pty) Ltd
2019 – 2020 – Senior Environmental Consultant & Project Manager, Kongiwe Environmental (Pty) Ltd.
2017 – 2019 – Environmental Consultant, Kongiwe Environmental (Pty) Ltd.
2016 – 2017 – Environmental Consultant, Savannah Environmental (Pty) Ltd.

Qualifications and Professional Interests

- Shaw Academy, 2020
  Professional Diploma in Leadership and Management
- Project Management Institute (PMI), 2020
  Project Management Professional (Ongoing)
- University of Witwatersrand, 2020 - 2021
  Master of Science: Environmental Science (Ongoing)
- Stellenbosch University, 2011 - 2015
  Bachelor of Science Honours Degree: Conservation Ecology

Recent Conferences and Seminars

- February 2020, South African Coal Mining Conference, SAIMM
- November 2018 – EIA Law Event, Business Success Solutions
- February 2018 – Waste Compliance and Enforcement Training, Imbewu Sustainability Solutions (Pty) Ltd
- June 2017 - SAPVIA Conference

Additional Skills

- GIS Mapping
- Soil and Agricultural Impact Assessment
- Office Suite Proficient
- Afrikaans (2nd language)

CURRICULUM VITAE

Project Experience

Environmental Impact Assessments

- Paulputs Wind Energy Facility, 2020. Part II Amendment Reproting. Project Management Services. Project Manager, Team Lead, Peer Reviewer.
- De Aar 2 South (Pty) Ltd, 2020. Basic Assessment Reporting for BESS and Substation. Project Management Services. Project Manager, Team Lead, Peer Reviewer.
- Raubex Phase 1 and 2 Beitsbridge Border Expansion Project, Zimbabwe, 2019 - 2020. Project Management Services. Project Manager, Team Lead, Peer Reviewer.
- Ergo Mining (Pty) Ltd: The Marievale Project, Gauteng Province. 2019 - 2020. EIA and WULA. Project Manager, Senior EAP, Peer Review.
- Crown Gold Recoveries (Pty) Ltd: Reclamation of the Soweto Cluster Dumps, Gauteng Province. 2019 - 2020. EIA and WULA. Project Manager, Senior EAP, Peer Review.
- Ergo Mining (Pty) Ltd: The Valley Silts Project, Gauteng Province. 2019 - 2020. EIA and WULA. Project Manager, Senior EAP, Peer Review.
- Umsimbithi Mining (Pty) Ltd: The eMakhazeni Integrated Water Use Licence, Mpumalanga Province. 2019 – 2020. Team Lead, Project Manager.
- Ergo Mining: Reclamation and Reprocessing of the City Deep Dumps, Gauteng Province, 2018 – 2019. EIA and WULA. Project Manager, Senior EAP, Peer Review.
- Ergo Mining: Reclamation and Reprocessing of the Rooikraal TSF, Gauteng Province, 2018 – 2019. EIA and WULA. Project Manager, Senior EAP, Peer Review.
- Umsimbithi Mining Pty) Ltd: The eMakhazeni Mining Project Mpumalanga Province. 2017 – 2018. Project Manager and EAP for the EIA process.
- Rand Water: Tanganani Bulk Infrastructure Project, Gauteng Province. 2017 – 2018. Project Manager and EAP for the BA process.
- Eskom Holdings SOC Limited: Olifantshoek Substation and Powerline, Northern Cape Province, 2017 – 2018. Project Manager and EAP for the BA process.
- Johannesburg Development Agency: Lehae Training Academy and Fire Station, Gauteng Province, 2017. Project Manager and EAP for the BA process
- REDISA: Cato Ridge Pre-Processing Waste Tyre Depot, KwaZulu-Natal Province, 2017. Project Manager and EAP for the BA process.
- REDISA: Vishoek Pre-Processing Waste Tyre Depot, Mpumalanga Province, 2017. Project Manager and EAP for the BA process.
- REDISA: Nelspruit Pre-Processing Waste Tyre Depot, Mpumalanga Province, 2017. Project Manager and EAP for the BA process.
- Building Energy: Skuitdrift Solar Energy Facility, Northern Cape Province, 2016 -2017. Project Manager and EAP for the BA process.
- Building Energy: Klawer Watercourse Crossing, Western Cape Province, 2016 -2017. Project Manager and EAP for the BA process.
- ACED: Gunsfontein WEF, Northern Cape Province. 2016. Assistant EAP, Assistant PPP.
- Juwi Renewable Energies: Hartebeeste WEF, Western Cape Province. 2016. Assistant EAP, Assistant PPP.

Environmental Auditor

- Glencore Coal South Africa: Environmental Auditing, Mpumalanga Province. 2019. Auditing of Environmental Authorisation, Environmental Management Programme, Water Use Licencing and Waste Management Licencing Auditing, Mpumalanga Complexes. Lead Auditor of 43 Licences.
- Glencore Coal South Africa: Environmental Auditing, Mpumalanga Province. 2018. Auditing of Environmental Authorisation, Environmental Management Programme, Water Use Licencing and Waste Management Licencing Auditing, Mpumalanga Complexes. Lead Auditor of 43 Licences.

- Glencore Coal South Africa: Environmental Auditing, Mpumalanga Province. 2017. Auditing of Environmental Authorisation, Environmental Management Programme, Water Use Licencing and Waste Management Licencing Auditing, Mpumalanga Complexes, 2017. Lead Auditor of 43 Licences.

Environmental Licencing

- Section 24G Ramification Application for Hossam Soror, Gauteng Provinces. 2017. Compilation of the Section 24G Application, Client Liaison and Authority Liaison
- Section 53 Application for the Suurplaat WEF, Northern cape and Western Cape Provinces. 2016. Compilation and Submission of the Section 53 Application, Client Liaison and Authority Liaison.
- Section 53 Application for the Tshivhaso Coal-Fired Power Station, Limpopo Provinces. 2016. Compilation and Submission of the Section 53 Application, Client Liaison and Authority Liaison
- Section 53 Application for the Thabametsi Coal water pipeline, Limpopo Provinces. 2017. Compilation and Submission of the Section 53 Application, Client Liaison and Authority Liaison
- Section 53 Application for the Suurplaat WEF, Northern cape and Western Cape Provinces. 2016. Compilation and Submission of the Section 53 Application, Client Liaison and Authority Liaison
- Various Part II Amendment Applications for Solar and Wind Energy Facilities. Compilation and Submission of the Part II Amendment Applications, Report Compilation, Client Liaison and Authority Liaison
- Various Part I Amendment Applications for Solar and Wind Energy Facilities. Compilation and Submission of the Part I Amendment Applications, Report Compilation, Client Liaison and Authority Liaison

Soil and Agricultural Impact Reporting

- Anglo Operations South Africa (Pty) Ltd: Leslie 1 Coal Project, Mpumalanga Province. 2018. Soil and Agricultural Potential impact Assessment and reporting.
- H2 Clean Energy (Pty) Ltd: H2 Energy Power Station, Mpumalanga Province. 2017. Soil and Agricultural Potential impact Assessment and reporting.
- Genesis Orkney Solar (Pty) Ltd: Orkney Solar Farm, North West Province. 2016. Soil and Agricultural Potential impact Assessment and reporting.
- **Eskom Holdings SOC Ltd: Richard's Bay Gas to Power, KwaZulu**-Natal Province. 2016. Soil and Agricultural Potential impact Assessment and reporting.

CURRICULUM VITAE

Ashlin Bodasing

Technical Director and Environmental Assessment Practitioner

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Specialisms

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

Summary of Experience

Ashlin Bodasing is a Technical Director at Arcus Consultancy Services South Africa (Pty) Ltd. She manages the Arcus South African office and the team based in Cape Town.
Having obtained her Bachelor of Social Science Degree (Geography and Environmental Management) from the University of Kwa-Zulu Natal; she has over fourteen years' experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment, green and brown field coal mines, as well as renewable energy facilities, both wind and solar. Ashlin has excellent Project Management experience and has gained major project experience in the development of Environmental Impact Assessments, Environmental Management Plans and the monitoring of construction activities. Her areas of expertise include project management, environmental scoping and impact assessments, environmental management plans, environmental compliance monitoring and environmental feasibility studies. Experience also includes International Finance Corporation Performance Standards and World Bank Environmental Guidelines environmental due diligence reviews. She has worked in Mozambique, Namibia, Botswana, Lesotho and Zimbabwe.

Professional History

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

Ashlin spent over 2 years at the Glencore (previously Xstrata Coal SA) – Tweefontein Optimisation Project, as the sole environmental officer permanently on site overseeing all their construction projects, ensuring contractor compliance to EMP and Environmental Authorisations. This included the construction of the internal and external infrastructure packages. Roles include ensuring all construction and development are in line with the EIA and EMP for the project. Areas of responsibility include the Mine Infrastructure Area, the Explosives Magazine Area, construction of a secondary school, construction of residential houses, and the rail load out facility. Role also included review of environmental impact assessment applications and reports submitted to the department of environmental affairs for the project.

Qualifications and Professional Interests

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

CURRICULUM VITAE

Project Experience

Environmental Impact Assessments

- **Highlands North, South and Central Wind Energy Facilities, 2018-present**. Project Director (client liaison) and Lead EAP.
- **Paulputs Wind Energy Facility, 2018-present.** Project Director (client liaison) and Lead EAP.
- **San Kraal Wind Energy Facility, 2016- 2018**. Project Director (client liaison) and Lead EAP.
- **Phezukomoya Wind Energy Facility, 2016 – 2018**. Project Director (client liaison) and Lead EAP.
- **Kolkies and Karee Wind Energy Facilities, 2016-2016**. Project Director (Client liaison) and Lead EAP.
- **Komsberg East and West Wind Energy Facilities 2015-2016**. Project Director (Client Liaison) and EAP.
- **Umsinde Emoyeni Wind Energy Facilities, 2015-2018.** Project Director (Client Liaison) and EAP.

Ecological Impact Assessments and Monitoring

- **Confidential Wind Farm, 2017-2018, Northern Cape Province**. Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Paulputs Wind Energy Facility 2017-present, Northern Cape Province.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Highlands Wind Energy Facilities 2017 – 2018, Northern Cape Province.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Komsberg Wind Farms, 2015-2016.** Project Director (Client Liaison), coordination and management of ecologists (bird and bat), review of technical and specialists impact assessments.
- **Kolkies and Karee Wind Energy Facilities 2015-2016.** Project Director (Client Liaison), coordination and management of bird and bat specialists and review of technical and impact assessment reports.
- **Umsinde Wind Energy Facilities, Additional Bird Monitoring**. Project Director. Coordination and management of bird specialists and review of technical reports.
- **Kap Vley Wind Energy Facility, Bird and Bat Pre-Construction Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Highlands Wind Energy Facility, Bird and Bat Pre-Construction Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.
- **Hopefield Wind Farm –Operational Monitoring.** Project Manager. Coordination and management of bird and bat specialists, review of technical reports.
- **Gouda Wind Farm – Operation Monitoring.** Project Director. Coordination and management of bird and bat specialists, review of technical reports.

Feasibility Studies and Due Diligence Reviews

- **Ecological due diligence for IFC PS6 – Wind Energy Developments:** Project Manager. Review and reporting on bird and bat specialist reports to IFC/World Bank Standards – Various sites across South Africa.
- **Power Plant – Ghana**. Project Manager Compilation of environmental due diligence for refinancing, IFC and World Bank Standards, on behalf of Botswana Development Corporation.
- **Ecological Feasibility Study.** Project Director. Review of the feasibility of a site for a wind energy facility in relation to bats.

- **Environmental Feasibility Study.** Project Director and EAP. Review of a proposed site for the development of industrial facility.

Previous Project Experience

Environmental Scoping and Impact Assessments and Project Management for:

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

Environmental Management Plans and Compliance Monitoring

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

Training and Auditing

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

Environmental Reviews / Terms of Reference

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

Pre-Feasibility Studies

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