

**PROPOSED WIND ENERGY FACILITY,
NEAR COPPERTON, NORTHERN CAPE**

**LIFE-CYCLE ENVIRONMENTAL
MANAGEMENT PROGRAMME**

JANUARY 2012

DRAFT



CONSULTANT
Aurecon South Africa (Pty) Ltd
PO Box 494
Cape Town
8000

Tel: (021) 527 6027
Fax: (021) 527 9500
Email: louise.corbett@arecongroup.com



PROPONENT
Plan 8 Infinite Energy (Pty) Ltd
100 New Church St
Cape Town
8001

Tel: (021) 801 7272
Fax : (021) 422 2621
Email : zuben.jessa@plan-8.co.za

PROJECT DETAILS

REFERENCE NO.	12/12/20/2099
PROJECT NO.	106563
TITLE	Life-cycle Environmental Management Programme (Draft)
AUTHORS & PREPARED BY	Louise Corbett and René Stewart of Aurecon South Africa (Pty) Ltd
CLIENT	Plan 8 Infinite Energy (Pty) Ltd
CLIENT REPRESENTATIVE	Zuben Jessa
REPORT STATUS	Draft
REPORT NUMBER	5748/106563
REPORT DATE	24 January 2012

Prepared by:

RENE STEWART (*Pr.Sci.Nat.*)
Practitioner: Environmental & Advisory Services

LOUISE CORBETT (*Pr.Sci.Nat.*)
Practitioner: Environmental & Advisory Services

Approved by:

BRETT LAWSON (*Pr.Sci.Nat., Cert. EAPSA*)
Technical Director: Environmental & Advisory Services

This report is to be referred to in bibliographies as: Aurecon (2012). Life-Cycle Environmental Management Programme (Draft) for the Proposed Wind Energy Facility, near Copperton Northern Cape. Report No. 5748/106563

TABLE OF CONTENTS

Table of contents	ii
1 Overview	1
2 Planning and design	5
3 Compliance monitoring	9
4 Construction Phase EMP	12
5 Operational Framework EMP	20
6 Monitoring programmes	Error! Bookmark not defined.
7 Decommissioning	25
8 Conclusion	26

List of Tables:

- Table 1:** Section 33 of EIA Regulation R543 listing the requirements of an EMP
- Table 2:** Section 24N (2) and (3) of NEMA listing the requirements of an EMP
- Table 3:** Framework OEMP
- Table 4:** Provisional breakdown of time required in the field for each component of the pre-construction monitoring project required to inform the final layout and mitigation strategy of the Copperton Wind Energy Facility

List of Appendices:

- Appendix A:** Curriculum Vitae of Environmental Assessment Practitioners
- Appendix B:** Construction EMP General Specifications (Comprehensive)

ABBREVIATIONS

CEMP	Construction Phase Environmental Management Programme
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DWA	Department of Water Affairs
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Reports
EMP	Environmental Management Programme
LEMP	Life-Cycle Environmental Management Programme
NEMA	National Environmental Management Act (No. 107 of 1998)
OHS	Occupational Health and Safety Act (No. 85 of 1998)
OEMP	Operational Phase Environmental Management Programme
SDEMA	Specification Data Environmental Management
SPEC EMA	Specification Environmental Management

1 OVERVIEW

This document represents the Life-Cycle Environmental Management Programme (LEMP) for the proposed construction of the wind energy facility, near Copperton, Northern Cape.

1.1 Purpose of the LEMP

The LEMP has been included in the Environmental Impact Assessment Report (EIAR) in order to provide a link between the impacts identified in the EIA Process and the actual environmental management on the ground during project implementation and operation. The purpose of this document is to provide for environmental management throughout the various life-cycle stages of the proposed development. The following stages are included:

- Planning and design,
- Pre-construction and construction,
- Operation, and
- Decommissioning.

Furthermore, this LEMP aims for alignment and optimisation of environmental management processes with conditions of authorisation that may arise, thereby ensuring that identified environmental considerations are efficiently and adequately taken into account during all stages of development.

1.2 Legal requirements of Environmental Management Programmes

In terms of the EIA Regulations (Regulation 543 of 18 June 2010) enacted in terms of the National Environmental Management Act (no. 107 of 1998) (NEMA), the proposed project triggers Activity 10, 11 and 18 of Regulation R544 (18 June 2010), Activity 1 and 7 of Regulation R545 (18 June 2010) as well as Activity 14 of Regulation R546 (18 June 2010). As the proposed project triggers listed activities in terms of Regulation R544, R545 and R546 it is necessary to submit an Environmental Impact Assessment Report (EIAR) for Environmental Authorisation (EA) to the Department of Environmental Affairs (DEA). Section 22 (l) of the EIA Regulations require that a draft EMP is submitted as part of the EIAR.

The contents of the EMP must meet the requirements outlined in Section 24N (2) and (3) of NEMA (as amended) and Section 33 of the EIA Regulations. The EMP must address the potential environmental impacts of the proposed activity on the environment throughout the project life-cycle including an assessment of the effectiveness of monitoring and management arrangements after implementation. The Department requires that the EMP be submitted together with the EIAR so that it can be considered simultaneously. Table 1 lists the requirements of an EMP as stipulated by Section 33 of the EIA Regulations R543. Table 2 lists the requirements of an EMP as stipulated by Section 24N (2) and (3) of the NEMA (as amended).

Table 1: Section 33 of EIA Regulation R543 listing the requirements of an EMP

33.	<i>A draft environmental management programme must comply with section 24N of the Act and include –</i>
(a)	<i>details of –</i>
	<i>(i) the person who prepared the environmental management programme; and</i>
	<i>(ii) the expertise of that person to prepare an environmental management programme;</i>
(b)	<i>information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of—</i>
	<i>(i) planning and design;</i>
	<i>(ii) pre-construction and construction activities;</i>
	<i>(iii) operation or undertaking of the activity;</i>
	<i>(iv) rehabilitation of the environment; and</i>
	<i>(v) closure, where relevant.</i>
(c)	<i>a detailed description of the aspects of the activity that are covered by the draft environmental management programme;</i>
(d)	<i>an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);</i>
(e)	<i>proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;</i>
(f)	<i>as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures;</i>
(g)	<i>a description of the manner in which it intends to—</i>
	<i>(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;</i>
	<i>(ii) remedy the cause of pollution or degradation and migration of pollutants;</i>
	<i>(iii) comply with any prescribed environmental management standards or practices;</i>
	<i>(iv) comply with any applicable provisions of the Act regarding closure, where applicable;</i>
	<i>(v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;</i>
(h)	<i>time periods within which the measures contemplated in the environmental management programme must be implemented;</i>
(i)	<i>the process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;</i>
(j)	<i>an environmental awareness plan describing the manner in which—</i>
	<i>(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and</i>
	<i>(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;</i>
(k)	<i>where appropriate, closure plans, including closure objectives.</i>

The legislation hereby aims to ensure that effective environmental management is implemented throughout the life cycle of the project via the translation of EIA management actions into the LEMP.

The Department of Environmental Affairs & Development Planning (DEA&DP)'s¹ *Guideline for Environmental Management Plans* (2005) aims to inform and guide the preparation and implementation of EMPs. The guideline defines EMPs as:

¹ Please note that DEA&DP's guideline is used even though the proposed project is based in the Northern Cape, as DEA has not compiled a guideline on EMPs.

“an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the project are enhanced”.

The guideline further provides *“situations [that] could trigger the need for an EMP requiring authority approval”.* One such trigger is:

“EMPs covering specific activities assessed through an over-arching EIA and incorporated into a Strategic Environmental Management Plan. A tiered system of EIA leading to a [Strategic EMP] and multiple EMPs may apply to large-scale complex developments with several sub-projects. In this case, an over-arching EIA may serve as the basis for environmental approval for the overall development. This may be supported by a [Strategic EMP] that is approved by the authorities. However, one or more EMPs may be required for the specific activities that form part of the larger development”.

Table 2: Section 24N (2) and (3) of the NEMA (as amended) listing the requirements of an EMP

- 24N.(2)** *the environmental management programme must contain-*
- (a) *information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts or objectives in respect of –*
 - (i) *planning and design;*
 - (ii) *pre-construction and construction activities;*
 - (iii) *the operation or undertaking of the activity in question;*
 - (vi) *the rehabilitation of the environment; and*
 - (vii) *closure, where relevant.*
 - (b) *details of –*
 - (i) *the person who prepared the environmental management programme; and*
 - (ii) *the expertise of that person to prepare an environmental management programme*
 - (c) *a detailed description of the aspects of the activity that are covered by the draft environmental management plan;*
 - (d) *information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);*
 - (e) *information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance.*
 - (f) *as far as is reasonable practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and*
 - (g) *a description of the manner in which it intends to-*
 - (i) *modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;*
 - (ii) *remedy the cause of pollution or degradation and mitigation of pollutants; and*
 - (iii) *comply with any prescribed environmental management standards or practices.*
- (3)** *the environmental management programme must , where appropriate-*
- (a) *set out time periods within which the measures contemplated in the environmental management programme must be implemented;*
 - (b) *contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of prospecting or mining operations or related mining activities which may occur inside and outside the boundaries of the prospecting area or mining area in question; and*
 - (c) *develop an environmental awareness plan describing the manner in which-*

- (i) *the applicant intends to inform his or her employees of any environmental risk which may result from their work; and*
- (ii) *risks must be dealt with in order to avoid pollution or the degradation of the environment.*

The LEMP aims to meet the EMP requirements as legislated by the NEMA Regulations (as amended) as well as falling in line with the DEA&DP guideline document for an Environmental Management Plan². It should however be noted that no guideline or guidance exists in terms of best practice approach to LEMPs. This document should thus be seen in an iterative context allowing for amendments throughout the life-cycle of the project, allowing for adjustments as new information is made available.

1.3 Structure of the LEMP

As discussed above, the LEMP aims to address environmental management throughout the project life-cycle, from planning and design, through construction, to operation and potential decommissioning. The LEMP has been structured to include the following sections:

1. Discussion summarising environmental management influencing the planning and design of the proposed project (Chapter 2);
2. Construction EMP based on identified impacts and mitigation measures from the EIAR(Chapter 3);
3. Operational Framework based on identified impacts and mitigation measures from the EIAR (Chapter 4); and
4. Decommissioning Framework providing guidance on key considerations to be considered during decommissioning/closure (Chapter 5).

1.4 Expertise of Environmental Assessment Practitioners

Section 33 of EIA Regulations and Section 24N (2) and (3) of the NEMA (as amended) requires that an EMP must include the details of the person(s) who prepared the EMP, and the expertise of that person to prepare an EMP. In this regard, the *Curriculum Vitae* of the Environmental Assessment Practitioners who compiled the LEMP are included in **Appendix A**.

² Lochner, P. 2005. *Guideline for Environmental Management Plans*. CSIR Report No ENV-S-C 2005-053 H. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

2 PLANNING AND DESIGN

This section has been divided into subsections which outline how environmental considerations have informed and been incorporated into the planning and design phases of the proposed wind energy facility. Detailed design is usually undertaken as part of the pre-construction phase as it is a costly undertaking which is generally only costed for once all required authorisations have been obtained. Thus, the planning and design phases discussed are limited to those associated with the pre-authorisation phases. Mitigation measures have been recommended for the detailed design phase.

2.1 Project Description

Plan 8 Infinite Energy (Pty) Ltd (Plan 8) proposes to construct a 140 MW wind energy facility, consisting of 56 turbines of 2.5 MW each, on the farm Struisbult (Farm No. 103 Portions 4 and 7 and Farm No. 104 Portion 5) near Copperton in the Northern Cape. As part of the proposed project it would also be necessary to rebuild the airstrip adjacent to the site. This would be moved to Portions 1 and 2 of Farm No. 105, approximately 7 km east of the site. The facility would include an on-site substation, and would link into the national power grid either by means of a new, 8.6 km 132 kV line linking the facility to the existing Eskom Cuprum substation at the old Copperton mining site or onsite to the existing grid.

2.2 Summary of Alternatives

To summarise, the feasible alternatives assessed in the EIAR included the following:

- Location alternatives:
 - One location for the proposed wind energy facility;
 - Electricity distribution via onsite linkage to the existing grid; and
 - Electricity distribution via an 8.6 km 132 kV connection to Cuprum substation.
- Activity alternatives:
 - Wind energy generation via wind turbines; and
 - “No-go” alternative to wind energy production.
- Site layout alternatives:
 - One layout alternative.
- Technology alternatives:
 - N100 turbine; and
 - N117 turbine.

2.3 Design of the project

The design for the proposed development should respond to the identified environmental constraints and opportunities. The following mitigation measures related to the design for the proposed development have been recommended to reduce the environmental impacts.

Botanical

- Plan location of roads, cabling and other infrastructure in order to avoid drainage lines as far as possible; and
- Plan location of the proposed project in such a way that the development footprint is minimized.

Avifauna

- Implement planning and design mitigation measures for protection of avifauna based on the outcome of the comprehensive bird monitoring programme. Outcomes may recommend the following:
 - Site turbines away from key avifaunal habitats and any areas of high avifaunal density or aggregation, regular commute routes or hazardous flight behaviour areas;
 - Differentiate blades by markings, painting a single blade per turbine black, or some other means, should it be identified that raptors are likely to be frequent collision casualties. The evidence for this as an effective mitigation measure is not conclusive, and as such it may be best to adopt an experimental approach to blade marking, identifying a sample of pairs of potentially high risk turbines in pre-construction monitoring, and marking the blades on one of each pair. Post-construction monitoring should test the efficiency, which would inform subsequent decisions about the need to mark blades more widely in this facility;
 - Site turbines away from any areas of high avifaunal density or aggregation, regular commute routes or hazardous flight behaviour areas;
 - Use low risk turbine designs and configurations, which discourage birds from perching on turbine towers or blades, and allow sufficient space for commuting birds to fly safely through the turbine rows;
- Plan location of the proposed project in such a way that the development footprint is minimized;
- Should above-ground power lines be used, bird-safe structures (ideally with critical air gaps greater than 2 m) should be used. Birds should be physically excluded from high risk areas of live infrastructure and such areas should be comprehensively insulated to avoid bird electrocution;
- Minimise the length of any above-ground power lines and mark all new lines with bird flight diverters. Above-ground lines should be marked for their entire length as there is currently insufficient data to indicate high risk areas. Recommendations from bird monitoring could indicate high risk areas to remain marked in the future. Where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line; and
- Restrict lighting of turbines to coloured (red or green) intermittent, lighting, as required by CAA.

Bats

- No turbines should be placed within the high sensitivity areas and a buffer area of 500 m should be applied to Modderpan (a high sensitive area). Moderate sensitivity areas should be avoided as far as possible for the location of turbines but where unavoidable additional mitigation measures should apply to any turbines placed in moderate sensitivity areas). A buffer area of 100 m should apply to all moderately sensitive areas as well as the buildings indicated to be of high sensitivity for bats (refer to Figure 2.1).

- Implement planning and design mitigation measures for protection of bats and fine tune mitigation measures based on the programme;
- Curtail turbines to a preliminary cut-in speed of 5 - 5.5 m/s as a mitigation measure to lessen bat mortalities . This is where the turbine cut-in speed is raised to a higher wind speed premised on the principle that bats will be less active in strong winds due to the fact that their insect food can't fly in strong wind speeds, and the small insectivorous bat species need to use more energy to fly in strong winds. This measure should only be implemented after long term monitoring has indicated under which weather conditions, times of day, season, etc it should be implemented and the recommended cut-in speed has been suitably refined by a bat specialist; and
- Consider implementing an ultrasonic deterrent device so as to repel bats from wind turbines if any turbines are placed in moderate sensitivity areas. This measure may negate the need for curtailment but this would need to be informed by long term monitoring.

Heritage and Palaeontology

- No development should be allowed within 250 m of the centre of Modderpan nor within 100 m from the centre of the stone kraals (refer to **Figure 2.1**); and
- Do not exceed 1 m on the northern side of the existing access road nor 2 m on the southern side of the road when upgrading the existing access road which is within 250 m of Modderpan. Do not move the fence on the northern side in order to minimise disturbance, however the fence on the southern side could be moved if required

Visual

- Consider temporary hardstandings for cranes in place of permanent hardstandings;
- As much as possible, place any new structures where they are least visible to the greatest number of people;
- Paint nacelles and towers in matte white or off-white. Where it does not conflict with other specialist recommendations (e.g. avifauna) rotors should be painted in the same colour as the remainder of the turbine structure;
- Do not display brand names on turbines; and
- Fit aircraft warning lights with shields so that they are only visible to aircraft, not to receptors on the ground.

Socio-Economic

- Obtain a list of locally available labour and skills. Preference should be given to local communities for employment opportunities;
- Base recruitment on sound labour practices and with gender equality in mind; and
- Provide appropriate training, which would enable individuals to apply their skills to other construction and development projects in the region once construction is complete.

Surrounding Landuses

- Implement design measures to avoid impacts on the Square Kilometre Array (SKA)(a radio astronomy observatory) based on the outcome of the modelling to be undertaken by SKA to determine the impacts of the proposed project on the SKA.

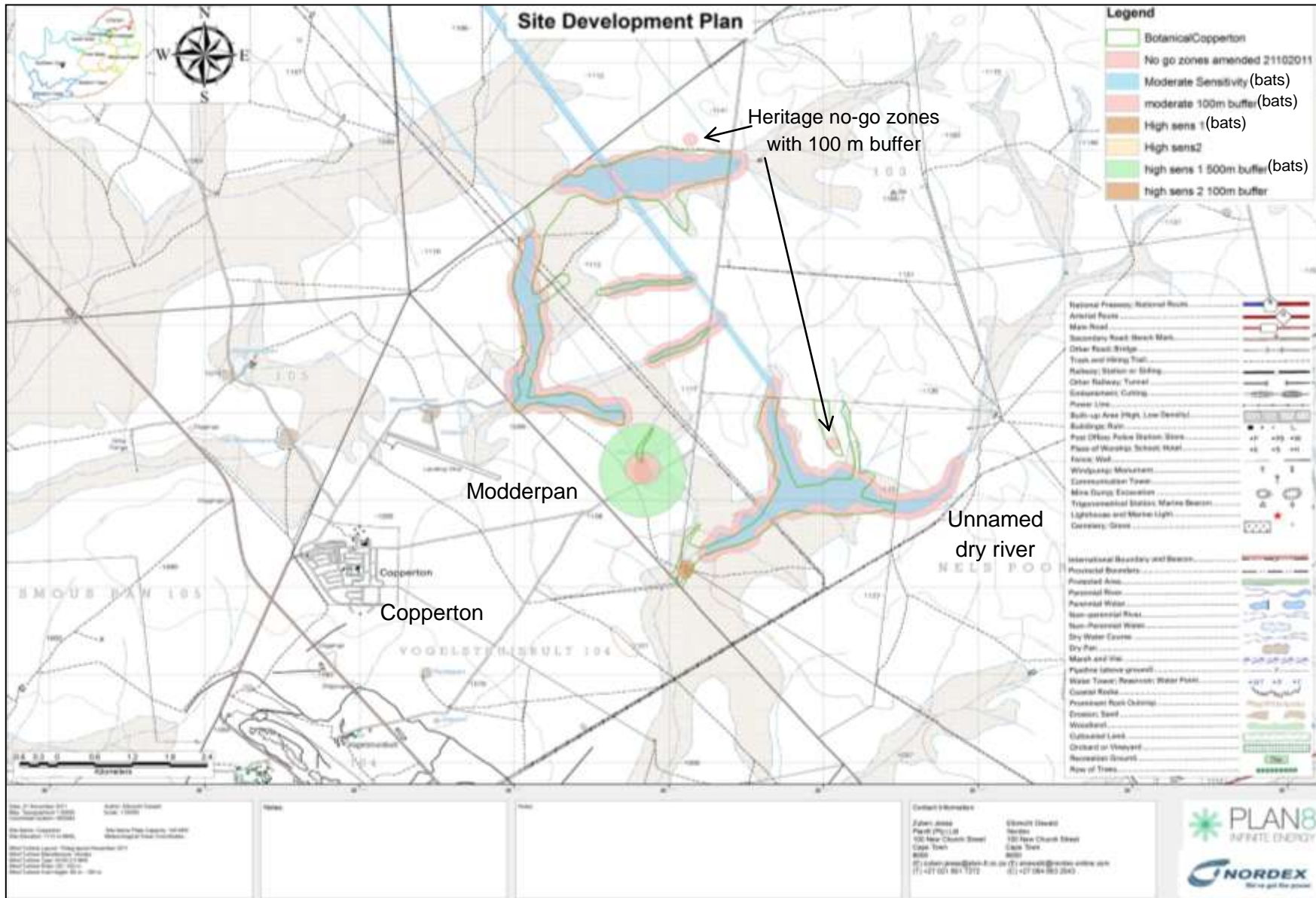


Figure 2.1 Sensitive ecological areas

Transportation

- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc are scheduled.

3 COMPLIANCE MONITORING

Prior to the commencement of construction and operation of the project a suitably qualified and experienced Environmental Control Officer (ECO) shall be appointed by the proponent to ensure that the mitigation rehabilitation measures and recommendations referred to in the EA are implemented and to ensure compliance with the provisions of the LEMP, thereby ensuring that identified environmental considerations are efficiently and adequately taken into account during all stages of development.

3.1 Roles and responsibilities

Client

Plan 8 shall:

- Assume overall responsibility for the administration and implementation of the LEMP through an identified Project Manager or Engineer;
- Appoint or engage a suitably qualified Project Manager or Engineer; and
- Appoint or engage a suitably qualified independent ECO to monitor compliance with the LEMP and undertake monthly and close out audits of compliance with the requirements of the LEMP and provide a copy of the audit reports to DEA and the Contractor.

Project Manager

The Project Manager or Engineer shall:

- Have overall responsibility for the environment;
- Have the authority to stop works and issue fines, as necessary;
- Receive reports from the ECO and shall report to Plan 8; and
- Support the ECO in his/her roles and responsibilities.

ECO

Roles and responsibilities

The role of the ECO will be to oversee and monitor compliance with and implementation of the construction phase EMP and Operational Phase EMP, which includes compliance with the relevant conditions contained in the EA. This includes the following responsibilities:

The duties of the ECO during construction phase will include:

- i) Liaison with the Client, Project Manager or Engineer and DEA;
- ii) Monitoring of all of the Contractor's activities for compliance with the various environmental requirements contained in the construction Specification;
- iii) Monitoring of compliance with the EA related to the construction phase as issued by DEA as well as other relevant environmental legislation;
- iv) Reviewing of the Contractor's environmental Method Statements;
- v) Ensuring that the requisite remedial action is implemented in the event of non-compliance;
- vi) Ensuring the proactive and effective implementation and management of environmental protection measures;
- vii) Ensuring that a register of public complaints is maintained by the Contractor and that any and all public comments or issues are appropriately reported and addressed;

- viii) Routine recording and reporting of environmental activities on a weekly and monthly basis;
- ix) Recording and reporting of environmental incidents.

The duties of the ECO during operation phase will include:

- i) Liaison with the Client and DEA;
- ii) Monitoring of the operation of the project for compliance with the various environmental requirements contained in the Framework Operational EMP;
- iii) Ensuring the proactive and effective implementation and management of environmental protection measures; and
- iv) Monitoring of compliance with the EA related to the operational phase as issued by DEA as well as other relevant environmental legislation.

4 CONSTRUCTION PHASE EMP

The Construction EMP aims to address mitigation measures pertaining to the construction phase as identified during the course of the EIA. This section includes both General Specifications as well as Draft Specification Data, addressing general construction issues and issues that are not addressed by the General Specifications, respectively. It should be noted that the Draft Specification Data should be revised as required post authorisation to ensure that all relevant conditions of the EA have been addressed.

4.1 Construction EMP General Specifications

The complete General Specifications have been included in **Appendix B** and include the following sections:

- Scope
- Normative References
 - Supporting Specifications
- Definitions
- Requirements
 - Material
 - Material handling, use and storage
 - Hazardous substances
 - Shutter oil and curing compound
 - Bitumen
 - Plant
 - Ablution facilities
 - Solid waste management
 - Contaminated water
 - Site structures
 - Noise control
 - Lights
 - Fuel (petrol and diesel) and oil
 - Workshop, equipment maintenance and storage
 - Dust
 - Methods and procedures
 - Environmental awareness training
 - Construction personnel information posters
 - Site clearance
 - Site division
 - Site demarcation
 - "No go" areas
 - Protection of natural features
 - Protection of flora and fauna
 - Protection of archaeological and paleontological remains
 - Access routes/ haul roads
 - Cement and concrete batching
 - Earthworks
 - Pumping
 - Bitumen
 - Fire control
 - Emergency procedures
 - Community relations
 - Erosion and sedimentation control
 - Aesthetics
 - Recreation
 - Access to site
 - Crane operations
 - Trenching
 - Demolition
 - Drilling and jack hammering
 - Stockpiling
 - Site closure and rehabilitation
 - Temporary re-vegetation of the areas disturbed by construction
 - Temporary site closure
- Compliance with requirements and penalties
 - Compliance
 - Penalties
 - Removal from site and suspension of Works
- Measurement and Payment
 - Basic principles
 - General
 - All requirements of the environmental management specification
 - Work "required by the Specification Data"
 - Billed items
 - Method Statements: Additional work
 - All requirements of the environmental management specification

The following section provides the Draft Specification Data which, along with the General Specifications, will be included in all contract documentation associated with the proposed project and will accordingly be binding on the Contractor.

4.2 Project Specifications

SDEMA ENVIRONMENTAL MANAGEMENT (SPEC EMA)

SCOPE: The general principles contained within this Specification Data: Environmental Management (SDEMA) shall apply to all construction related activities. All construction activities shall observe any relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment.

SDEMA2 INTERPRETATIONS

SDEMA2.1 Application

This Specification contains clauses specifically applicable and related to the environmental requirements for the wind energy facility, near Copperton, Northern Cape.

Where any discrepancy or difference occurs between this SDEMA and the Specification: Environmental Management (Comprehensive), the provision of this Specification shall prevail.

Definitions (Subclause 3)

For the purposes of this Specification the following definitions shall be added:

Working area: The land and any other place on, under, over, in or through which the Works are to be executed or carried out, and any other land or place made available by the Employer in connection with the Works. The Working Area shall include the site office, construction camp, stockpiles, batching areas, the construction area, all access routes and any additional areas to which the Engineer permits access. The construction footprint must be kept to a minimum.

SDEMA3 MATERIALS

SDEM3.1 Materials handling, use and storage (Subclause 4.1.1)

The Engineer shall be advised of the areas that the Contractor intends to use for the stockpiling of both natural and manufactured materials. No stockpiling shall occur outside of the working area (as designated by the engineer) and without the Engineer's prior approval of the proposed stockpiling areas. Imported material shall be free of litter, contaminants or exotic plant seed. The Contractor shall ensure that material is not stockpiled along the border of any water body (permanent or seasonal).

Location and treatment of material stockpiles shall take consideration of prevailing wind directions and dwellings. Stockpiles shall be stored under cover so as to prevent erosion and run off during rainy periods.

Topsoil (100 -150 mm) from construction areas where vegetation clearing is required shall be removed and stockpiled for rehabilitation purposes. This shall be spread over the top of the turbine foundation after the turbine has been erected and any other disturbed areas which are to be rehabilitated and seeded with indigenous species. Ground shall be returned as far as possible to original levels/gradients and any excess material shall not be left in piles, but shall be removed off-site.

Dust suppression measures shall be used particularly during dry periods of weather during the summer months.

SDEM3.2 Hazardous substances (Subclause 4.1.2)

Procedures detailed in the Materials Safety Data Sheets (MSDS) shall be followed in the event of an emergency situation.

Potentially hazardous substances shall be stored, handled and disposed of as prescribed by the Engineer.

SDEM3.3 Shutter oil and curing compound (Subclause 4.1.2.1)

Shutter oil and curing compound shall be stored and dispensed within a bunded area, and not located closer than 32 m from the top of the river banks/water courses/drainage lines.

SDEMA4 REQUIREMENTS

SDEMA4.1 Ablution facilities (Subclause 4.2.1)

A sufficient number of chemical toilets shall be provided by the Contractor in the construction camp area and at appropriate locations approved by the Engineer. Temporary/ portable toilets shall not be located within 32 m from the top of the river banks/water courses/drainage lines. The ratio of ablution facilities for workers should not be less than that required by the Construction Regulations of 2003 of the Occupational Health and Safety Act. All temporary/ portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause.

SDEMA4.2 Solid Waste Management (Subclause 4.2.2)

Hazardous wastes (if any) shall only be sent to landfill sites registered for hazardous wastes. Burying or burning of solid waste shall be prohibited on site. A waste management system shall be established to ensure regular waste removal.

SDEMA4.3 Contaminated Water (Subclause 4.2.3)

The Contractor shall prevent the discharge of any pollutants, such as soaps, detergents, cements, concrete, lime, chemicals, hydrocarbons, glues, solvents, paints and wastewater into the surrounding terrestrial and aquatic environment. Should any discharge be necessary it will require the engineer's approval prior to discharging any contaminated water into a lined sump,

which will allow sediment particles to settle. Surface contaminants shall be separated by skimming off the surface. Dried particulates collected from the sump and skimmed pollutants such as oils and petrochemicals shall be collected and disposed of at a registered landfill site. The remaining water shall then be drained into an unlined drainage pond where the water can filter into the ground. The pond shall be located in an area approved by the ECO and Engineer. To excavate the pond the top 300 mm of soil shall be removed and stored separately. Once construction is complete the pond shall be backfilled and the top material replaced to cover the area for rehabilitation.

SDEMA4.4 Site Structures (Subclause 4.2.4)

No site structures shall be located within 32 m from the top of the river banks/water courses/drainage lines. Construction yards should be restricted in extent as far as possible and should be screened by visually impermeable material.

Ensure the camp is neat and tidy at all times. Site offices, if required, should be limited to single storey and should be sited carefully using temporary screen fencing to screen from the wider landscape.

SDEMA4.5 Fuel (Petrol and Diesel) and oil (Subclause 4.2.7)

Fuels in the form of diesel and petrol shall not be stored within 32 m from the top of the river banks/water courses/drainage lines.

SDEMA4.6 Equipment Maintenance and Storage (Subclause 4.2.8)

Wastewater generated from construction or the washing of vehicles shall not be permitted to enter water courses, either directly or via a stormwater system.

SDEMA4.7 Stormwater Erosion Control (Add Section 4.2.10)

The Contractor shall take reasonable measures to control the erosive effects of stormwater runoff. Any runnels or erosion channels developed during the construction period or during the maintenance period shall be backfilled and compacted to limit the impacts of sediment deposition into the surrounding aquatic environment.

Establish the stormwater system as a priority, so that all runoff is led to the designated drainage from the site.

Construction activities shall be scheduled to take place in the dry season (winter) as far as possible.

SDEMA4.8 Method Statements (Subclause 4.3.1)

The following additional method statements shall be provided by the Contractor within 14 days of the receipt of the Letter of Acceptance and prior to the activity covered by the Method Statement being undertaken:

- Logistics for the environmental awareness course for all the Contractors employees.
- Emergency procedures for fire, accidental leaks and spillages of hazardous materials including:
 - who shall be notified in the event of an emergency, including contact numbers for the relevant local authority,
 - where and how any hazardous spills will be disposed of,
 - the size of spillage which the emergency procedures could contain,
 - location of all emergency equipment and an indication of how regularly the emergency equipment will be checked to ensure that it is working properly.
- Location and layout of the construction camp in the form of a plan showing offices, stores for fuels, hazardous substances, vehicle parking, access point, equipment cleaning areas and staff toilet placement.
- Location, layout and preparation of cement/concrete batching facilities including the methods employed for the mixing of concrete and the management of runoff water for such areas. An indication shall be given of how concrete spoil will be minimised and cleared.
- Method of undertaking earthworks, including spoil management, erosion, dust and noise controls.
- Method of undertaking blasting.
- Management measures to be undertaken in instances where traffic flows may be interrupted.
- Extent of areas to be cleared, the method of clearing and the preparation for this clearing so as to ensure minimisation of exposed areas.
- Measures to be put in place during temporary closure periods, e.g. December holidays.
- Measures to be put in place to limit sediment deposition into the surrounding terrestrial and aquatic environment.

SDEMA4.9 Site Clearance (Subclause 4.3.4)

The Contractor shall strip the top material and root material of cleared vegetation (top 100-150 mm layer), for subsequent use during rehabilitation and re-vegetation. Top material shall be stripped from all areas of the Working Area where topsoil will be impacted by construction activities, including areas for temporary facilities, as directed by the Engineer. The Contractor shall not make use of herbicides or other chemical methods to clear the proposed site especially near the identified water courses. In order to limit erosion the Contractor shall retain original groundcover, as far as practically possible, adjacent to the aquatic environment and to the trenching line.

SDEMA4.10 No go areas (Subclause 4.3.7)

All works to be undertaken shall be within the boundary of the site. A “no go” area shall extend on either side of the working area i.e. all areas outside of the defined working area and designated access roads. The working area shall be demarcated in an appropriate manner determined by the Engineer. The “no-go” area shall be demarcated by a semi-permanent fence to prevent workers from entering the undisturbed areas.

Based on the ecological importance, all construction activities shall remain outside of all aquatic environments, with special efforts implemented to maintain a 32 m buffer between construction related activities and any rivers/water courses/drainage lines. These no go areas shall stay in place until construction of the infrastructure within the buffer area must commence.

The recommended 100 m buffer around moderate bat sensitivity areas and 500 m around high bat sensitive areas shall be demarcated as “no go” areas and construction activities shall remain outside these designated areas.

The recommended 250 m buffer around Modderpan and 100 m buffer around the stone kraals shall be demarcated as “no go” areas and construction activities shall remain outside these designated areas.

No equipment associated with earthworks shall be allowed outside of the site and defined access routes, or within “no go” areas, unless expressly permitted by the Engineer.

SDEMA4.11 Protection of flora and fauna (Subclause 4.3.9)

No flora shall be removed or damaged, outside of the designated working area, without specialist botanical input. The collection of firewood by construction workers should be prohibited.

Any snakes found on site shall be removed from site and released into an area away from the site, without harm.

The contractor shall ensure that the time a trench is left exposed is kept to a minimum, and that open trenches are inspected on a daily basis for animals which may have fallen or become trapped. Any animals found trapped in any trenches shall be freed without harm.

SDEMA4.12 Protection of archaeological and paleontological remains (Subclause 4.3.10)

Should substantial fossil remains be exposed during construction, these should be safeguarded by the ECO, preferably *in situ*, and the South African Heritage Resources Association (SAHRA) should be notified by the ECO so that appropriate mitigation can be undertaken.

The three no-go areas (Modderpan and stone kraals) and their buffer zones must be cordoned off during the construction phase (See 4.11 above).

The excavation of the foundations for the turbines will open up pits 20 x 20 m and up to 3 m deep. The recording of the varying depth of the Kalahari sands, the calcrete layers and the quartzitic bedrock will provide excellent information to complement the work done by Kiberd (2002, 2006) and the open site surveys. Section drawings, measurements and photographs shall be taken of the pit for each turbine and for each pit wall (i.e. 4 sections per pit with a metre scale) by the contracted engineer assigned to the construction phase. The format for this report shall be drawn up in consultation with the archaeologist. The engineer shall be briefed on the recording requirements by the archaeologist before excavations are done. This report must be

submitted to the consultant archaeologist for dissemination to SAHRA, Mr Kiberd and the McGregor Museum to aid others in the development of a broader understanding of the Pleistocene landscape of this area.

SDEMA4.13 Access routes/ haul roads (Subclause 4.3.11)

The contractor shall ensure that all regulations relating to traffic management are observed and local traffic officials are informed of the proposed construction activities. As far as possible, attempts shall be made to ensure that high construction related road usage coincides with low traffic flow periods. If the gravel road through Copperton is used as the access road, make use of this road only between 08h00 to 17h00 Monday to Friday for construction traffic.

Transport turbine components overnight as far as possible.

Signage and safety measures during the construction of the access roads shall comply with the guidelines as set out in the latest issue of the SADC Road Traffic Signs Manual. Standard “construction ahead” warning signs should be placed on all relevant roads in the area. Ensure access roads are kept clean and storage of materials is screened.

SDEMA4.14 Cement and concrete batching (Subclause 4.3.12)

No cement and / or concrete batching shall occur within the “no-go” areas or within 32 m from the top of river banks/water courses/drainage lines. Reasonable measures shall be implemented to limit contaminated surface run-off into the surrounding vegetation.

SDEMA4.15 Earthworks (Subclause 4.3.13)

Any blasting is to be executed by a suitably qualified person.

Controlled blasting techniques shall be employed to minimise dust and fly rock during blasting.

Prior to blasting the Contractor shall notify the relevant occupants/ owners of surrounding land and address any concerns. Buildings within the potential damaging zone of the blast shall be surveyed preferably with the owner present, and any cracks or latent defects pointed out and recorded either using photographs or video. All Local Authority regulations are to be adhered to and all service infrastructures are to be located prior to commencement of blasting activities.

Blasting or drilling shall take place during normal working hours. The Contractor shall notify emergency services, in writing, a minimum of 24 hours prior to any blasting activities commencing on site. Adequate warning must be issued to all personnel on site prior to blasting activities taking place. All legally required signals are to be clearly indicated. The Engineer shall be issued daily updates of the days intended blasting activities.

The Contractor shall prevent damage to special features and the general environment, which includes the removal of flyrock. Damage caused by blasting / drilling shall be repaired to the satisfaction of the Engineer.

Minimise areas disturbed at any one time and protect exposed soil against wind erosion, e.g. by dampening with water or covering with hessian.

SDEMA4.16 Community relations (Subclause 4.3.18)

Appropriate training shall be provided for workers, which would enable the individuals to apply their skills to other construction and development projects in the region once the construction phase is completed.

Maintain a register that shall contain details of the measures taken to resolve complaints and the details of the communication of these measures to the person who raised the complaint.

SDEM4.17 Erosion and sedimentation control (Subclause 4.3.19)

Where necessary, sedimentation barriers shall be laid between the Work Area and the “no-go” areas to limit sediment deposition. The sedimentation barrier shall consist of a geotextile fabric stretched across and attached to supporting posts and stabilised with sandbags. The barrier shall be inspected daily and any damage shall be repaired immediately. Sediment deposits shall be removed once they reach half the height of the barrier.

SDEMA4.18 Site closure and rehabilitation (Subclause 4.3.28)

All construction debris found within the disturbed areas shall be removed and disposed of at a registered landfill site.

A vegetation rehabilitation plan shall be compiled with the aid of a rehabilitation specialist, for inclusion in the Construction EMP. The plan shall recommend species to be used in rehabilitation as well as any special measures for rehabilitation such as shade-netting and alien vegetation removal. The construction footprint associated with the activity shall be re-vegetated with indigenous vegetation, as directed by the rehabilitation plan. Disturbed areas shall be rehabilitated as soon as possible after construction.

Vegetated areas should preferably be watered if planted in the dry season to aid in establishment of plants; alternately rehabilitation should take place in the wet season; or as agreed with the rehabilitation specialist in the rehabilitation plan.

SDEMA4.19 Labour requirements (Add Subclause 4.3.32)

Recruitment shall be based on sound labour practices and with gender equality in mind. Obtain a list of locally available labour and skills. Preference shall be given to local communities.

Appropriate training shall be provided to enable individuals to apply their skills to other construction and development projects in the region once the construction phase is completed.

SDEMA5 COMPLIANCE WITH REQUIREMENTS AND PENALTIES**SDEMA5.1 Penalties (Subclause 5.2)**

Stop order works will be issued for the transgressions listed below. Stop order works may be issued per incident at the discretion of the Engineer.

- a) Any employees, vehicles, plant, or thing related to the Contractor's operations operating within the designated boundaries of a "no-go" area.
- b) Any vehicle driving in excess of designated speed limits.
- c) Persistent and unrepaired oil leaks from machinery.
- d) Persistent failure to monitor and empty drip trays timeously.
- e) The use of inappropriate methods for refuelling.
- f) Litter on site associated with construction activities.
- g) Deliberate lighting of illegal fires on site.
- h) Employees not making use of the site ablution facilities.
- i) Failure to implement specified noise controls
- j) Failure to empty waste bins on a regular basis.
- k) Inadequate dust control.
- l) A spillage, pollution, fire or any damage to any watercourse/ wetland resulting from negligence on the part of the Contractor.
- m) Any act, that in the reasonable opinion of the Engineer, constitutes a deliberate contravention of the requirements of these Specifications

The Engineer will determine what constitutes a transgression in terms of this clause, subject to the provisions of Clause 57(1) of the General Conditions of Contract. In the event that transgressions continue the Contractor's attention is drawn to the provisions of Sub-clause 55(1) of the General Conditions of Contract 2004 under which the Engineer may cancel the Contract.

5 OPERATIONAL FRAMEWORK EMP

The information is summarised in tabular format illustrating the activity, aspect, impact, mitigation measure, performance indicators, resources, schedule and verification. These criteria are listed and explained below:

The following components are identified/ described:

- **Activity:** component/ activity of the project for which the impact has been identified;
- **Aspect:** the aspect of the above activity which will be impacted;
- **Impact:** the environmental impact identified and to be mitigated;
- **Mitigation measure:** measures identified for implementation in terms of environmental management to reduce, rectify or contain the identified environmental impact – mitigation is divided into the following:
 - **Objective:** desired outcome of mitigation measure,
 - **Mechanism:** method of achieving the objective;
- **Performance indicators:** outcomes that will indicate achievement of objective/s;
- **Responsibility:** party or parties identified for implementation of mitigation measure/s;
- **Resources:** available resources to aid implementation of mitigation;
- **Schedule:** timeframe in which identified impact and mitigation measure is anticipated to occur; and
- **Verification:** party or parties identified as responsible for review and assessment of final outcome.

This section contains the Operational Framework EMP table which constitutes the Operational Framework EMP. It is important to note that this Framework EMP has been compiled prior to authorisation of the proposed project and will be updated to include the conditions of the EA that will be issued by DEA as part of the EA.

Operational Framework Environmental Management Programme Table

NO.	ACTIVITY	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	RESOURCES	SCHEDULE	VERIFICATION
1.	All Activities (wind energy facility)	Environmental management documentation and procedures	No framework within which to locate the management of the operational phase. No procedures against which to assess environmental performance during the operational phase and thus no measure of compliance.	Objective: To ensure that the operation of the wind energy facility does not result in avoidable impacts on the environment, and that any impacts that do occur are anticipated and managed. Mechanism: 1) Appoint a suitably qualified ECO to monitor compliance (either independent or in-house). 2) Audit the compliance with the requirements of the environmental specification contained within the OEMP.	Environmental impacts effectively monitored and managed during the operational phase. Comprehensive record of compliance and remedial actions available to Plan 8 and the authorities.	ECO Plan 8	OEMP	Twice in the 1 st three years and then once every five years	Plan 8 DEA
2.	Operational Activities (wind energy facility)	Protection of the surrounding environment (aquatic and terrestrial)	Effects that the operation and maintenance of the wind energy facility would have on the surrounding environment (including bats and avifauna)	Objective: To ensure that impacts on the surrounding biophysical environment are minimised during the operational phase. Mechanism: 1) Curtail turbine locations to a preliminary cut-in speed of 5 to 5.5 meters/second. 2) Undertake affordable long term monitoring of	No dead birds or bats are found on site.	ECO Avifaunal Specialist Bat Specialist Plan 8	Environmental Management Procedures OEMP	As per the schedule of the avifaunal monitoring programme detailed in Section 5 below. As per the schedule of the bat monitoring	Plan 8 DEA

Operational Framework Environmental Management Programme Table

NO.	ACTIVITY	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	RESOURCES	SCHEDULE	VERIFICATION
				<p>bats and the potential impacts of turbines on them and fine tune mitigation based on the outcome of the monitoring programme compiled with the aid of a bat specialist³.</p> <p>3) Implement mitigation measures for protection of avifauna based on the outcome of the avifaunal monitoring programme.</p>				programme to be established.	
3.	All Activities (wind energy facility)	Protection of the surrounding environment (aquatic and terrestrial)	<p>Effects that the operation and maintenance of the wind energy facility would have on the surrounding environment</p> <p>(including local flora, fauna, bats, avifauna and watercourses around the proposed development.</p>	<p>Objective: To ensure that impacts on the surrounding biophysical environment are minimised during the operational phase.</p> <p>Mechanism:</p> <p>1) During maintenance activities limit movement in disturbed areas</p> <p>2) Any areas disturbed during maintenance should be rehabilitated.</p>	The surrounding environment including aquatic and terrestrial ecology is not impacted on.	ECO Plan 8	Environmental Management Procedures OEMP	As maintenance is required on site.	Plan 8 DEA

³ This should include 12 month long term monitoring (preferably prior to construction) where bat detectors are deployed on the site and passively recording bat activity every night. Additionally the site should be visited by a bat specialist quarterly to assess and compare the bat activity on a seasonal basis. The wind speed data gathered by meteorological masts can then be correlated with bat activity to determine the most feasible cut-in speed and fine tune other mitigation measures.

Operational Framework Environmental Management Programme Table

NO.	ACTIVITY	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	RESOURCES	SCHEDULE	VERIFICATION
4.	All Activities (wind energy facility)	Environmental management of the operational phase	Positive impacts on socio-economic environment during operation	<p>Objective: To ensure that the operation of the wind energy facility maximises positive impacts on the socio-economic environment.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) Train local people for operation and maintenance of facility. 2) Employ local labour for the operational phase, where possible, and particularly for day to day operations and maintenance. 	Consult annual skills and training records, employment records and proof of staff residency in the area prior to employment	ECO Plan 8	Environmental Management Procedures OEMP	During Operational Phase (full lifetime) when the need arises to employ people.	Plan 8 DEA
5.	All Activities (wind energy facility)	Visual aesthetics	Impact of the proposed development on the surrounding visual aesthetics of the area	<p>Objective: To ensure that impacts on the visual aesthetics are minimised during the operational phase.</p> <p>Mechanism:</p> <ol style="list-style-type: none"> 1) During operation, the maintenance of the turbines, the internal roads, the power line servitude and other ancillary structures and infrastructure will ensure that the facility does not degrade, thus aggravating visual impact. 2) Turbines should not 	Condition of the project infrastructure and roads.	ECO Plan 8	Environmental Management Procedure OEMP	As required based on annual inspections of the project	Plan 8 DEA

Operational Framework Environmental Management Programme Table

NO.	ACTIVITY	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	RESOURCES	SCHEDULE	VERIFICATION
				display brand names. 3) A small education centre or office should provide information on the proposed project to local people; 4) Turbines should be maintained in operational condition.					

6 DECOMMISSIONING

It is highly unlikely that decommissioning would be proposed in the near future (within 20 years). However should decommissioning of the proposed wind energy facility be proposed the materials used and its associated infrastructure would need to be disposed of at an approved landfill site. Infrastructure should be removed and disturbed areas rehabilitated during decommissioning.

Since the proposed wind energy facility comprises of inert materials (mostly concrete), the residual risks associated with decommissioning would be negligible. Should the need arise to decommission the wind energy facility; a decision would need to be made as to whether the infrastructure would be removed or left *in situ*. Roads which are no longer required after decommissioning should be scarified and the areas rehabilitated with the assistance of a rehabilitation specialist.

Materials will be recycled where appropriate, and any hazardous substances shall be removed and disposed of in terms of the requirements of relevant legislation (e.g. Hazardous Substances Act, No. 15 of 1973).

7 CONCLUSION

In conclusion it should be noted that the LEMP should be regarded as a living document and changes should be made to the LEMP as required by project evolution, while retaining the underlying principles and objectives on which the document is based.

The compilation of the LEMP has incorporated impacts and mitigation measures from the EIAR as well as incorporating principles of best practice in terms of environmental management. By identifying the potential impacts, mitigation measures, performance indicators, responsibilities, available resources, potential schedule and verification responsibility, the LEMP has provided a platform on which both the construction phase and the operational phase EMPs can be founded. The LEMP has ensured that the individual EMPs will be able to incorporate mitigation measures based on the project in its entirety as opposed to phase-specific measures.

APPENDIX A
CURRICULUM VITAE OF
ENVIRONMENTAL ASSESSMENT
PRACTITIONERS

APPENDIX B
CONSTRUCTION EMP GENERAL
SPECIFICATIONS
(COMPREHENSIVE)
