
**Longyuan Mulilo De Aar Maanhaarberg
Wind Energy Facility**

ENVIRONMENTAL MANAGEMENT PROGRAMME

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TABLE OF CONTENTS

1. INTRODUCTION 1
 1.1 Purpose of the EMP 1
 2. PROJECT DESCRIPTION 1
 3. COMMUNICATION PROCEDURES 4
 4. ENVIRONMENTAL SENSITIVITY AND MITIGATORY MEASURES 7
 5. PRE CONSTRUCTION 13
 6. CONSTRUCTION PHASE 15
 7. MATERIALS MANAGEMENT 18
 8. WASTE HANDLING: SOLID WASTE 19
 9. WASTE HANDLING: WASTE WATER 20
 10. MACHINERY MANAGEMENT 20
 11. NOISE 21
 12. SEARCH AND RESCUE 21
 13. PENALTIES AND BONUSES 22
 14. MEASUREMENT AND PAYMENT 23
 15. POST CONSTRUCTION 23
 16. OPERATIONAL EMP 24
 17. DECOMMISSIONING EMP 24
 18. GENERAL 24

List of Figures

Figure 1: Final site layout and environmental sensitivity areas 2

List of Tables

Table 1: The construction activities and their potential impacts 7
 Table 2: Mitigatory measures to be implemented as proposed by the various specialist consultants 8

List of Appendices

Appendix 1:	Responsibilities and Authority
Appendix 2:	Details of the persons who prepared the EMP
Appendix 3:	Environmental Authorisation
Appendix 4:	Operational Phase EMP
Appendix 5:	Decommissioning Phase EMP
Appendix 6:	Traffic Impact Assessment Addendum
Appendix 7:	Avifaunal Post-Construction Monitoring Programme
Appendix 8:	Operational Phase Bat Monitoring Programme
Appendix 9:	Plant Rescue Plan
Appendix 10:	Vegetation Rehabilitation Plan
Appendix 11:	Alien Invasive Plant Management Plan
Appendix 12:	Stormwater and Erosion Management Plan
Appendix 13:	Open Space Management Plan
Appendix 14:	Final Site Layout and Preliminary Design Report

Abbreviations

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
NEMA	National Environmental Management Act (No. 107 of 1998)
OEMP	Operational Phase Environmental Management Programme

1. INTRODUCTION

This document represents the Environmental Management Programme (EMP) for the environmental management of the approved 100MW wind energy facility (WEF), referred to as Longyuan Mulilo De Aar Maanhaarberg WEF, near De Aar in the Northern Cape. This EMP includes updates to management measures in line with all conditions of the Environmental Authorisation (EA).

This project was granted authorisation from the Department of Environmental Affairs (DEA) on 15 August 2011. An amendment to the EA was granted on 24 October 2011 authorising the substitution of “Mulilo Renewable Energy (Pty) Ltd” with “Longyuan Mulilo De Aar Wind Power (Pty) Ltd” (see Appendix 3 for a copy of the EA and amended EA).

1.1 Purpose of the EMP

The EMP was compiled during the Environmental Impact Assessment (EIA) process, undertaken in 2009/2010, to provide a link between the mitigation measures identified for the assessed project impacts and the actual environmental management on the ground during project implementation and operation.

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

The broad objectives of the EMP are to ensure that:

- All environmental safeguards are carried out correctly;
- Site activities are well-managed;
- Adverse impacts on the environment are minimised;
- The biodiversity of the site is conserved or enhanced; and
- All relevant legislation is complied with; and the project is monitored for possible environmental impacts.

2. PROJECT DESCRIPTION

2.1 Final layout

Detailed designs have been undertaken as part of the pre-construction phase. The final layout is included in Appendix 14 together with the Preliminary Design Report prepared by AECOM. In developing the final layout, AECOM have taken into consideration the mitigation measures and buffer zones proposed by the respective specialists as well as sensitive onsite ecological features (Figure 1).

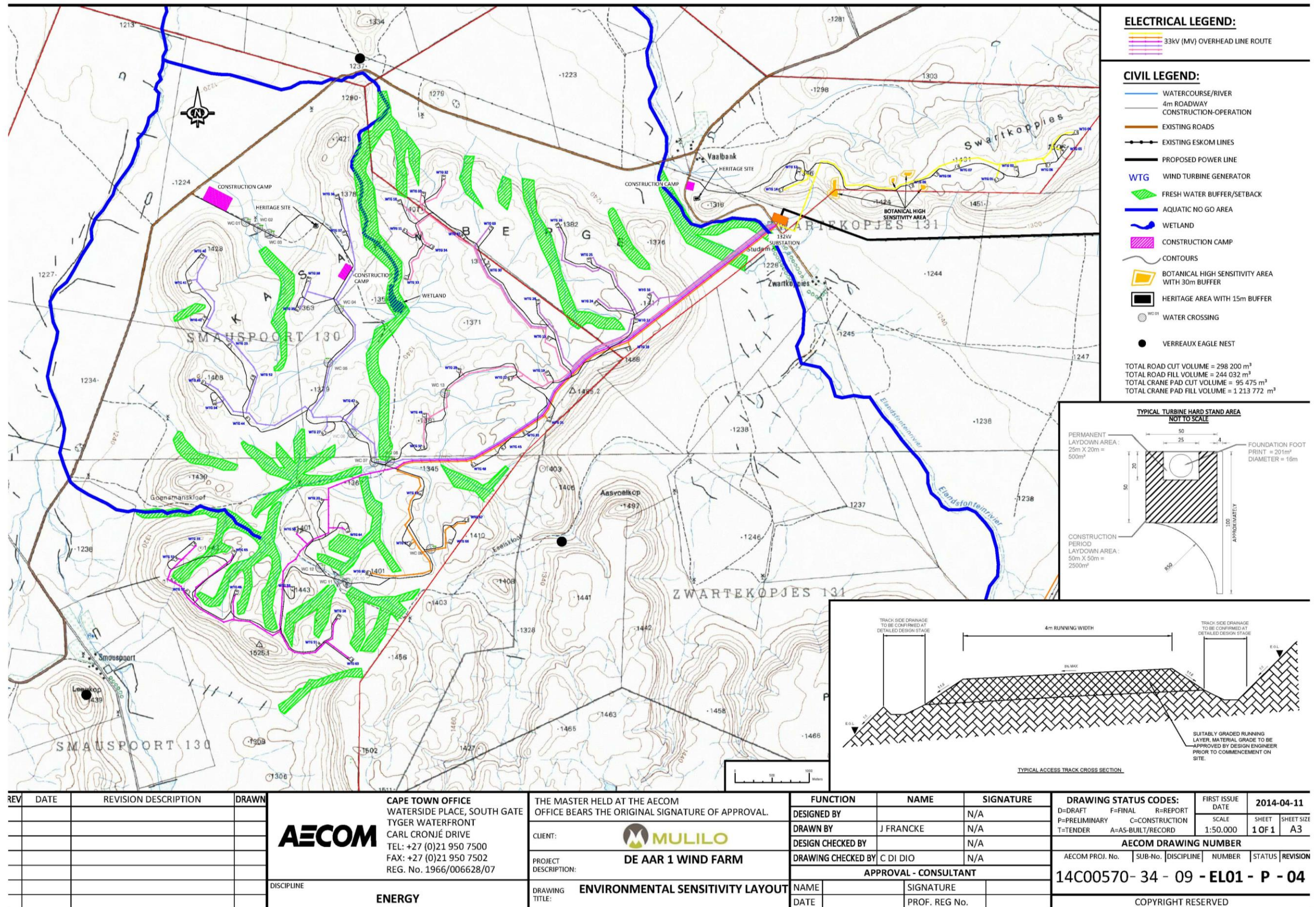


Figure 1: Final site layout indicating environmental sensitivity areas and all no-go areas

The EA approved the construction of a 100MW WEF situated 22 kilometres from the Hydra substation, where electricity will be fed into the national grid. The WEF consists of 67 wind turbines each with a generation capacity of 1.5MW. The wind farm will be built in one phase, over a total construction period of an estimated 20 months.

The total wind farm footprint (67 ha) is spread over an area of 11 766 hectares (ha) accounting for 0.6% of the total area, with a required spacing¹ of 200 m to 600 m between the turbines depending on the topography and prevailing wind direction.

Materials to be imported will be shipped to Cape Town or Coega harbour, and then transported by road over a distance of 800km to the site. Specialised high lifting and heavy load capacity cranes will be utilised to erect the turbine. A proposed gravel road will provide access to the turbine sites.

2.2 Proposed construction methodology

Delivery of turbine components

The turbine components will be delivered on a low-bed abnormal load truck. To provide access to the site, existing gravel roads will be upgraded and will have a width of approximately four meters. The access roads are shown in Figure 1.

The turbine assembly

The tower consists of three sections, with the first being fitted onto the foundation by the crane. The other sections are then fitted onto the bottom section, on top of each other. The Nacelle is then fitted, followed by the hub and the rotor blades. Hard standing areas (50 m x 50 m) to support the crane will be constructed adjacent to each turbine location.

Foundation and materials

Foundations would be required to support the turbine towers. These foundations will consist of circular concrete foundations with a diameter of 16 m. Cement and reinforced steel will be used in the foundation.

All excavated material shall be used for road works and no material will be stored on site. Cut material shall be used, where possible, in construction or on site (e.g. in grading gravel roads), or removed from site.

Three temporary construction yards would be required (details of the construction yards are included in the Preliminary Design Report in Appendix 14). Two construction yards would be located close to the main access gates and the third construction yard would be located on the plateau. These layouts were selected based on the location of the access roads and the wind turbine generator locations.

A site camp for the construction phase will not be established for the construction period.

¹ The spacing between the turbines is required to ensure optimal energy generation and to prevent the wake effect.

Main dimensions:

The turbine components will have the following dimension and specifications:

Component		Weight (unit: ton)	Dimension (m) Length x width x height
Blade	UP40.2	6.2	40.24 x 1.9 x 3.2
Nacelle		61	10.2 x 3.8 x 3.8
Hub		15.1	3.75 x 3.75 x 3
Tower		Refer to following table	

Tower weight and dimensions:

Section	80m 3A+	
	weight	Dimension (m) Length x bottom outer diameter
Upper	30580	28.629 x 3.282
Middle	47161	26.564 x 3.787
Bottom	5811	21.680 x 4.200

Transmission infrastructure:

The on-site substation / control building and Eskom switching / metering station footprint will be 100 x 200 m in extent. This area includes a temporary construction yard that will be used to house equipment and materials needed for the construction of the on-site substation, control building and switching / metering station.

Overhead electrical reticulation lines (33 kV) would connect the turbines to the onsite substation. The electrical reticulation lines would follow the route of the access roads where possible. The wind turbines will generate electricity at a voltage of 33 kV which will be stepped up via a transformer to 132 kV for evacuation to the Hydra substation located 22 km to the north-east of the study area

Proposed service infrastructure:

Apart from the 4m wide gravel access road, no services are required for the operation of the wind turbines. The turbines operate automatically and no on-site personnel are required.

3. COMMUNICATION PROCEDURES

- 3.1 An Environmental Control Officer (ECO) will be appointed prior to commencement of the construction phase to ensure that the EMP is being adhered to. Should modifications to this document be required these should be agreed to by all parties concerned, namely the engineer, the contractor and the ECO.
- 3.2 Duties of the ECO are listed in Appendix 1. The engineer must be recognised as the senior authority on site and all communications and instructions between the ECO and the contractor should occur via the engineer.
- 3.3 Problematic issues - should problematic issues arise, the ECO has the authority to call a special meeting with the Engineer, and if necessary work can be stopped if no agreement is reached to resolve the matter.
- 3.4 Environmental register - an environmental register (can be recorded in the site instruction book) should be kept on site in which incidents related to actual impacts

are recorded. This may include information related to such aspects as mismanaged, rescue programme for extant vegetation on the site, dust generation and complaints from adjacent neighbours. It should also contain information relating to actions taken. Any party on site may complete the register, however, it is envisaged that the engineer, the contractor and the ECO will be the main contributors, and who will also be the main parties involved in mitigatory actions.

Method statements - these will be required for activities which may result in significant impacts/nuisance effects. One of the underlying principles of a method statement is to ensure sustainable natural resource management. 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 EMP, when called upon to do so by the Engineer or ECO.

Method statements are written submissions by the Contractor in response to requirements of this EMP or to a request by the ECO. This is submitted to the ECO and Engineer and, where practical and deemed necessary, should be endorsed as being acceptable by the environmental representative of the Relevant Authority.

Method statements must be submitted at least five (5) days prior to the date on which approval is required (start of the activity). Failure to submit a method statement may result in suspension of the activity concerned until such time as method statement has been submitted and approved.

An approved method statement shall not absolve the Contractor from any of his obligations or responsibilities in terms of the contract. However, any damage caused to the environment through activities undertaken without an approved method statement shall be rehabilitated at the contractor's cost.

The method statements shall cover relevant details with regard to:

- Construction procedures and location of the construction site.
- Start date and duration of the procedure.
- Materials, equipment and labour to be used.
- How materials, equipment and labour would be moved to and from the site as well as on site during construction.
- Storage, removal and subsequent handling of all materials, excess materials and waste materials of the procedure.
- Sustainable management and use of natural resources.
- Emergency procedures in case of any reasonably potential accident / incident which could occur during the procedure.
- Compliance / non-compliance with the EMP specification and motivation if non-compliant.

Method statements required:

Based on the specifications in this EMP, the following method statements are required as a minimum:

- Logistics for the environmental awareness course for all the Contractors employees.
- Location and structure of fuel storage on site.

- Solid waste (refuse) control and removal of waste from the site.
- Method statement on integrated waste management shall be compiled by the contractor.
- Contaminated water management system.
- Dust control.
- Layout of the construction yards in the form of a plan showing offices, stores for fuels, hazardous substances, vehicle parking, access point, equipment cleaning areas and staff toilet placement.
- Site access routes and proposed traffic safety measures.
- Emergency procedures for fire and accidental leaks and spillages of hazardous materials.
- 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 for undertaking earthworks, including spoil management, erosion, dust and noise control.
- Method of undertaking blasting (if required).
- Site clearing.
- Erosion remediation and stabilisation.
- Fire control and emergency procedures.
- Vegetation rehabilitation (this method statement must be in line with the Vegetation Rehabilitation plan included in Appendix 10).

3.6 Environmental Education Programme - The Contractor shall ensure that adequate environmental awareness training of senior site personnel takes place and that all construction workers receive an induction course on the importance and implications of the EMP.

As a minimum, training should include:

- Explanation of the importance of complying with the EMP.
- Discussion of the potential environmental impacts of construction activities.
- The benefits of improved personal performance.
- Employees' roles and responsibilities, including emergency preparedness.
- Explanation of the mitigation measures that must be implemented when carrying out their activities.
- Explanation of the specifics of this EMP and its specifications (no-go areas, etc.)
- Explanation of the management structure of individuals responsible for matters pertaining to the EMP.

Contractor general site staff members are to attend an initial presentation of approximately one hour. Approximately half an hour a month thereafter for the duration of the contract shall be allowed for employees to attend any follow-up lectures, should such follow-up lectures be deemed necessary by the ECO. In addition, all new staff and sub-contractor's employees that spend more than one day a week or four days in a month on site are to attend the environmental education program within 1 (one) week of commencement of work. The Contractor shall supply the ECO with a monthly report indicating the number of employees that will be

present on site during the following month and any changes in this number that may occur during the month.

No more than 20 people shall attend each course and the cost, venue and logistics for this / these course(s) shall be the Contractor's responsibility. This is also to allow for the cost of environmental signage the ECO may require to be erected in the main contractor's construction camp and any handouts given to site staff during initial environmental awareness training presentations. The ECO shall keep a register of all personnel attending the Environmental Education Program.

The contractor shall keep records of all environmental training sessions, including names, dates and the information presented.

4. ENVIRONMENTAL SENSITIVITY AND MITIGATORY MEASURES

A variety of potential impacts are associated with the construction activities for this project.

Table 1: The construction activities and their potential impacts

Activities	Potential Impacts	EMP mitigation / rehabilitation
The use of heavy machinery and equipment	<ul style="list-style-type: none"> • Generate high noise levels and create dust problems and nuisance • Cause erosion due the damage creating to natural terraces • Compact soil and changing surface water flows • Contaminate water and soil as a result of oils spills and machinery fluids dumping • Damage wild life habitats 	Refer to Sections 6.2, 8.3, 10 and 11
Hazardous substances	<ul style="list-style-type: none"> • Damage valuable ecosystems and habitats 	Refer to Sections 7, 8.3 and 10.1
Clearing and levelling	<ul style="list-style-type: none"> • Destroy ecosystems and habitats • Produce areas of bare soil which cause erosion 	Refer to Sections 5, 6.12 and 12
Excavation	<ul style="list-style-type: none"> • Cause erosion when excavated soil is piled inappropriately 	Refer to Sections 6.3 and 6.11
Cut and fill	<ul style="list-style-type: none"> • Cause soil erosion • Alter hydrology and degrade water quality • Damage ecosystems and habitats 	Refer to Sections 6.11
Disturbance of drainage lines	<ul style="list-style-type: none"> • Altered drainage regimes potentially surface water resources and riparian vegetation 	Refer to Sections 6.3 and 9

Specific management recommendations: The following recommendations have been made by the specialists involved.

Table 2: Mitigatory measures to be implemented as proposed by the various specialist consultants

IMPACT	MITIGATION
Archaeology	<p>The access road to the wind turbine location sites on the Kasarmberge on the Farm Smauspoort must avoid the very important site known as zwk95 that contains graves, stone artefacts and portable art. The affected section of the road must be moved at least 10 – 15 m away from the archaeological site.</p> <p>The site must also be permanently fenced off during the proposed upgrading of the road. The fencing must be undertaken under the supervision of the archaeologist. A gate should be included that will provide access to the site. The site must not be disturbed in any way.</p>
Botany	<ol style="list-style-type: none"> i. All turbines and the substation must be located at least 30 m from any mapped high sensitive areas on site (see Figure 1). ii. If the sensitive habitats on the dolerite hills and flats can be largely avoided this is the best way to reduce botanical impacts of the proposed development. This means that all depressions and pan-like areas should be avoided, and buffered from any development by natural vegetation. iii. An ECO must be permanently on site throughout the road construction, cable laying, turbine foundation excavation and blasting, and during the erection of the turbines. iv. Any excavation, including those for cables, must be supervised by the ECO. No excavation may be left open for more than 1 week, and they should preferably be closed within 1 day, using the carefully stockpiled soil that came out of the trench. In the case of turbine footings some 45m³ of soil and rock will presumably be displaced by the concrete, and this should not be dumped on any undisturbed natural vegetation, but must rather be set aside within a portion of the turning circle of the trucks that deliver the components, and must be spread over the foundations once the turbines are erected, or used as access road fill elsewhere on the site. v. In order to minimize blasting and excavation impacts in very rocky areas cable trenches should not be excavated in these areas, and the cables should instead run above ground or on the surface. vi. No dumping or temporary storage of any materials may take place outside designated and demarcated laydown areas. vii. An EMP and OEMP should be drawn up, which must outline management steps for all areas of natural vegetation on the site (refer to the Open Space Management Plan included in Appendix 13). viii. Alien vegetation management, included in Appendix 11, must be undertaken in the powerline servitude and along the edges of all on-site infrastructure on an annual basis.
Avian	<p>Lesser Kestrel</p> <ul style="list-style-type: none"> • Pre-construction Phase: <ul style="list-style-type: none"> • Counts must be conducted during the summer months at the De Aar roosting sites.

	<ul style="list-style-type: none"> • Potentially suitable roosting sites in the vicinity of the WEF must be identified and inspected to establish if the birds are using these sites as roosting sites. • Construction Phase: <ul style="list-style-type: none"> • Counts must be conducted during the summer months at the De Aar roosting sites and at any additional roosting sites that were identified during the pre-construction phase in the vicinity of the WEF. • Operational Phase: <ul style="list-style-type: none"> • Adaptive management must be implemented for the influx of Lesser Kestrel linked to locust invasions and species' presence during the summer season at the WEF area. • Counts must be conducted during the summer season at the De Aar roosting sites and any additional roosting sites in the vicinity of the WEF. <p>Verreux's Eagle</p> <ul style="list-style-type: none"> • Pre-construction Phase: <ul style="list-style-type: none"> • Initiate an Argos / GPS satellite tracking programme to record the exact number of eagle pairs, their movements, main hunting areas, home ranges and use of different habitats, nests and cliffs. The expected duration of the programme is three years. This satellite tracking programme commenced in January 2014. • The proposed micro-siting has already been considered and implemented by the developed in the most recent layout (Figure 1). • Construction Phase: <ul style="list-style-type: none"> • An active monitoring of Verreux's Eagle active nests will take place in order to avoid disturbance during the deployment of turbines and associated traffic through the area. Mitigation measures will be established accordingly, such as reducing traffic for certain periods during the breeding season. • Continue with the Argos / GPS satellite tracking. • Monitor the breeding activity of eagles in the area by assessing the number of pairs and breeding success (productivity and fledgling rates), including (if feasible) the identification of individual adult birds. • Operational Phase: <ul style="list-style-type: none"> • Continue with the Argos / GPS satellite tracking. • Implement adaptive management for the Verreux's Eagle based on the satellite tracking monitoring results. • Monitor the breeding activity of eagles in the area by assessing the number of pairs and breeding success (productivity and fledgling rates), including (if feasible) the identification of individual adult birds. • Implement specific management measures as part of adaptive management, which will increase the resident eagles' productivity based on the results of ongoing research.
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	<p>Blue crane:</p> <ul style="list-style-type: none"> • Results indicate that the species does not occur regularly on the plateaus where the turbines are located, but rather on the surrounding plains below the plateaus. • No specific mitigation is required at this stage, but ongoing monitoring should be performed to record any potential changes in this pattern of occurrence. <p>Waterbirds:</p> <ul style="list-style-type: none"> • Waterbodies on the plateau are less frequented by waterbirds than those in the surrounding plains. This could be due to a variety of factors such as size, availability of water, shelter and access. • No specific mitigation measures are required at this stage as far as the turbines are concerned. • The fitting of Bird Flight Diverters on the 33 kV power line which crosses the narrow kloof between Smouspoort and Swartkoppies is recommended.
Social	<p>Employment creation During the construction phase, local contractors and service providers need to be utilised as far as possible.</p> <p>Increased Pressure on Infrastructure The increase in labourers to the local area might put a strain on the current housing conditions in the local town, but can be managed via proper communication with the local and regional communities in order to prevent possible unrest in the towns.</p> <p>Safety and Security Potentially harmful areas on the construction site as well as en route to the proposed wind farm site, should be demarcated and managed in order to prevent any accidents.</p> <p>Noise, Pollution and Loss of Tranquillity Only the required erection procedures should be done on site.</p> <p>Loss of Visual Value The turbine masts, rotors and nacelle should all be finished in a non-reflective matte white paint without decals or logos. There must be no visual clutter visible on the site.</p> <p>Visible scarring damage to the landscape should be minimised.</p> <p>The main visual aim of a layout should be to convey a sense of clarity, as there is concern that the various groups of turbines will bring a degree of discord into the visual landscape.</p>
Visual	<p>Location of construction access: The contract time must be kept to the minimum, the road junctions needs to have good sightlines, traffic control measures needs to be in place as well as good signage.</p>

	<p>Dust generation, movement of machinery and vehicles: Access roads to be kept clean and storage of materials to be screened. Storage of builder's rubble to be controlled.</p> <p>Visibility of site offices / construction camps: Site offices should be limited to single storey and they should be sited carefully using topography to screen from the wider landscape.</p> <p>Construction camps must be screened from local receptors.</p> <p>Fires and litter: All site operatives should receive training in awareness of fires and litter. In particular, no fires will be allowed. Littering is regarded as a serious offence and no contaminants will be allowed to enter the environment by any means.</p> <p>Infrastructure New roads into the site The existing roads will be upgraded and should be gravel roads if appropriate to the needs of construction traffic. Required is a 4 m wide road with 15 m turning circles. The new roads connecting the turbines to permit free access for construction, maintenance and inspection vehicles in the site should also be gravel, 4 m wide with 15 m turning circles.</p> <p>Roadways should be low-key in appearance; gravel is the most appropriate surface material as there are many gravel roads locally. Roadways should fit onto the land as closely as possible with the minimum of cut and fill. Too much disturbance will result in wide scarring of the landscape.</p> <p>Concrete footings Following construction of the foundation, installation of the turbine, and removal of spoil and rock, only local scarring around the foundation will remain. If surplus rock is visible, it should be removed from the site.</p> <p>Retention of the first 50 mm of naturally occurring substrate, conserving it, and then spreading it over finished levels may be of some benefit but this would have to be examined by the Botanical Specialist to ascertain if it would be worthwhile. Failing that, the developer will be asked to ensure that any excess material is not left around in piles, and the ground is returned as far as possible to original gradients.</p> <p>Buildings and other infrastructure The largest would be the sub-station and the control building. It is proposed that these are placed where they are least visible to the greatest numbers of people, be finished in materials and colours which fit in with the landscape, and in places where topography can offer shielding.</p>
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	<p>Transmission towers, whether pylons or monopoles</p> <p>It is noted that the proponent intends to underground certain lengths of cable where local geology renders this feasible. Ideally the power lines should be buried as they introduce horizontal lines above ground which conflict with the strong vertical element of the turbine structures, affecting their visual clarity. In this instance, pylons rather than monopoles, because all the other transmission lines in the locality are pylons and because of their weaker visual form, are the preferred option.</p> <p>Lighting at night</p> <p>The Masts will carry aircraft warning lights; there are no mitigation measures to propose, as this is a requirement of the South African Civil Aviation Authority, however it may be possible to consider shields to limit downward light.</p> <p>The Psychological Effect of the turbines in the Landscape</p> <p>By use of certain materials and finishes</p> <ul style="list-style-type: none"> • The use of plain galvanised finish seems to imply to most receptors that this is a technically primitive installation • It is generally preferable to use white as a finishing colour • Blades, nacelle and tower should all be the same colour.
Heritage	<p>That as the proposal be endorsed subject to the understanding that as impacts are largely visual/spatial and that as the character of the landscape is affected, the recommendations of the draft VIA of 2010 be endorsed. These would include the following:</p> <ul style="list-style-type: none"> • That should work at Maanhaarberg proceed the mitigation measures, relating to the construction phase, the turbine finishes and the involvement with the public are undertaken. • That use of pylons rather than monopoles which are not used locally. • Turbine masts, rotors and nacelle will all be finished in a non-reflective matte white paint without decals or logos. • That visible scarring damage to the landscape must be minimised.
Bats	<p>Construction Phase:</p> <ul style="list-style-type: none"> • No specific mitigation measures are considered during the construction phase as no fatalities are predicted until turbines are operational. <p>Operational Phase:</p> <ul style="list-style-type: none"> • The minimal number of visits would be 24 over a period of 12 months. • During the first two years post-construction monitoring would be required. Based on the results, changes could be considered in terms of: time within a year, number of visits and frequency, and number of turbines sampled. • Special attention should be devoted from October to April as the pre-construction monitoring results show that this is a peak period for bat activity.

	<ul style="list-style-type: none"> • Implement an Operational Phase Bat Monitoring programme (included in Appendix 8). • Apply an Adaptive Management Plan based on the results of the Operational Phase Bat Monitoring Programme.
Traffic	<ul style="list-style-type: none"> • It is recommended that instead of using the proposed access off the R348, access to the Swartkoppies section of the development should be pursued off the Smauspoort Road in the vicinity of the De Aar Dumping Site • It is recommended that Smauspoort Road should be maintained on a regular basis. The road should be graded and sprayed with water regularly to improve the road surface and restrict dust pollution and gravel loss. • After construction of the development is completed, the Smauspoort Road must be repaired where necessary and restored to satisfactory condition (refer to Traffic Impact Assessment Addendum in Appendix 6).
Palaeontological	<ol style="list-style-type: none"> i. Given the limited effective palaeontological potential of rocks in the region, the comparatively small footprint of the proposed wind farm and the shallow excavations envisaged here, no further palaeontological mitigation is recommended for this development. ii. Should substantial fossil remains be exposed during construction, however, the ECO should alert SAHRA so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist.

5. PRE CONSTRUCTION

5.1 Site boundaries - the site boundaries within which the contractor may operate should be agreed to prior to the start of the site operations. The contractor should fence or demarcate these at the very start of the project. Specific areas should be set aside within this area for various types of activity ranging from materials storage to chemical toilet facilities. Access to risk areas such as the hazardous substances store (oils, fuels etc.) should be restricted.

5.2 No-go areas - any particularly sensitive areas should be demarcated as “no-go” or restricted access areas. These areas should be delineated on plan and on the site with pegs or fencing and which are out of bounds to unauthorised persons. Authorisation must be obtained prior to entry.

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 (refer to the Open Space Management Plan in Appendix 13). The working area shall be demarcated in an appropriate manner determined by the Engineer.

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.

5.3 Site Layout - The location of the contractor's camp, toilet facilities and storage areas should be agreed to prior to the commencement of work at the site and should be agreed in conjunction with the ECO, Engineer and Contractor. These should all be kept in secure, neat and in good condition throughout the project to prevent environmental degradation.

5.4 Site Clearance

(a) Vegetation clearance

Removal of vegetation (uprooting) must be kept to a minimum. Only those areas where it is imperative to remove vegetation i.e. construction areas, identified storage areas, roads and minor tracks should be cleared. All other areas should remain vegetated. If brush-cutting is required as a minimum intervention, this should be applied with discretion; however, it would always be preferred to uprooting. If vehicle movement is required off designated roads and tracks, it would be advisable to drive over the shrubs (crush) rather than to uproot them. This would prevent loss of these shrubs since they would be able to regrow if not uprooted. In places where shrubs are uprooted, the plant material must be stockpiled and retained for rehabilitation purposes.

Site clearance shall occur in sections as required and rehabilitated according to the Vegetation Rehabilitation Plan (see Appendix 10), as soon as the work on that specific section has been completed.

(b) Topsoil

Topsoil / top material that is stripped from the site during the earthworks operation shall be retained for future rehabilitation/landscaping use, where feasible. Top material should exclude litter, building rubble, alien plant material or any other waste. Topsoil shall be stored in areas demarcated by the ECO and Engineer and in piles not higher than 2 m.

The stockpiles shall not be compacted or disturbed, and shall be domed at the top to promote runoff. Should significant erosion (e.g. through rain or wind) of the stockpiled material occur, the stockpiles should be covered with shade cloth or Geotech fabrics or similarly suitable material to prevent such erosion.

5.5 Drinking Water - The Contractor shall ensure that drinking water is available for all staff on site. If no potable water source is available on site then the Contractor shall import drinking water to the site.

5.6 Eating Areas - If employees are to eat elsewhere on site other than in the campsite, the Contractor shall designate restricted places for eating within the specified working areas, in consultation with the ECO. The Contractor shall provide adequate refuse bins with lids in all these places.

5.7 Working Hours – The hours of operation shall be restricted to those stipulated by the Employer and/or the local authority.

6. CONSTRUCTION PHASE

- 6.1 ECO Visits** - the ECO should visit the site twice weekly for the duration of the construction period. On the performance of the contractor, the frequency of the site visits may be altered. If required, the ECO may introduce some form of penalty system should compliance with the EMP prove problematic.
- 6.2 Appropriate Machinery** - The contractor shall at all times carefully consider what machinery is appropriate to the task while minimising the extent of environmental damage. Areas where machinery and vehicles are stored and used must be bunded to prevent pollutants such as fuel and oil from spilling onto the soil.
- 6.3 Soil erosion and sedimentation control** - The Contractor shall, as an ongoing exercise, implement erosion and sedimentation control measures to the satisfaction of the ECO and Engineer (Stormwater and Erosion Management Plan included in Appendix 12). During construction, the Contractor shall protect all areas susceptible to erosion by installing necessary temporary and permanent drainage works as soon as possible and by taking any other measures necessary to prevent stormwater from concentrating in streams and scouring slopes, banks, etc.

Any runnels or erosion channels developed during the construction or maintenance period shall be backfilled and compacted and the areas restored to a proper condition. Stabilisation of cleared areas to prevent and control erosion and/or sedimentation shall be actively managed. The method of stabilisation shall be determined in consultation with the ECO.

Consideration and provision shall be made for the following methods (or combination thereof): brushcut packing or chip cover, straw stabilising, watering, planting/sodding, soil binders and anti-erosion compounds, mechanical cover or packing structures (including the use of geofabric, log/pole fencing, etc.).

Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised areas shall be repaired and maintained to the satisfaction of the ECO. In areas where construction activities have been completed and where no further disturbance would take place, rehabilitation and revegetation should commence as soon as possible.

- 6.5 Fires** – No fires will be allowed outside the construction area and adequate fire fighting equipment according to the fire hazard must be available on site in good working order. Any welding and cutting activities will only be permitted inside the working areas.
- 6.6 Fire fighting Equipment** - In order to define what fire fighting equipment is necessary at the site, it is recommended that the local fire department be contacted for advice in this area.
- 6.7 Health and Safety** – All people working on site are responsible for their own safety and those of others on site. Contractors and Engineers must comply with all the Regulations as including the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993). A comprehensive first aid kit and suitably trained personnel should be available on site at all times.

6.8 Traffic disruption – traffic and personnel using the road that provides access to the site shall not be disrupted and standard traffic management procedures will be implemented in these areas where necessary to maintain access at all times. In this regard it shall be noted that the adjacent erven remains occupied by others and vehicular access to these areas shall be maintained at all times.

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.

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 and that that all road junctions have good sightlines.

The roads authorities shall be contacted prior to construction to ensure that the necessary road upgrades, permits, traffic escorts, etc. are scheduled.

All access roads are to be kept tidy, and measures shall be taken to minimise dust from construction traffic on gravel roads.

6.9 Fauna – Catching of wild animals (including reptiles, amphibians, birds and invertebrates, etc.) by any means, including setting of snares, poisoning, shooting and trapping is illegal. All incidents of harm to any animal must be reported to the ECO. The contractor is to report any problem animals (e.g. a snake that will not move off site on its own) to the ECO who will organise for their relocation.

6.10 Archaeology and Palaeontology – Should anything of an archaeological nature be found on site by the Contractor (or any other party), e.g. stone hand tools, remnants of old structures not previously visible, old ceramic shards etc, work is to be stopped in the area immediately, and the ECO / Engineer notified. Failure to notify the ECO of a find will result in a penalty. This aspect must be carefully explained to workers during the Environmental Education Programme undertaken by the ECO. The ECO will advise on demarcation of this area, and notify a relevant specialist to view material and ascertain whether further study of the area is required. Should a specialist confirm a genuine artefact or fossil and recommend further study of the area, work in the applicable area is to cease until further notice. Should any human remains be disturbed, exposed or uncovered during earthworks, these should immediately be reported to the ECO and a professional archaeologist.

6.11 Excavation and Trenching - During excavation and trenching activities, care is to be taken to ensure that the stockpiling of top material is kept separate from sub-soils. Top material saved is to be replaced as top material and is to serve as the final layer when back-filling. The Contractor shall reinstate all working areas to the satisfaction of the Engineer. Areas opened for trenching should be restricted to the minimum required to be worked in and closed up in a working day or as dictated by technical requirements such as length of pipe or cable. Trenches are to be closed as soon as possible after

services have been laid in them, to prevent them from posing safety hazards to people, traffic and animals and to prevent rainwater erosion. Trenches shall be refilled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion. No excavations may be left open for more than 1 week. Excess soil shall be stockpiled in an appropriate manner. In the event of material removed during trenching being excessive after backfilling or being unsuitable as overburden, the excess material must be removed from the construction site to a site agreed upon by the Engineer. Dewatering systems shall make use of filtered extraction points to prevent silt uptake and extracted water shall be released in such a manner as to avoid erosion on the site and prevent siltation or pollution of any stormwater system.

6.12 Blasting - 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.

The use of explosives of any type within 500 m of Eskom's services shall only occur with Eskom's previous written permission. If such permission is granted the Contractor must give at least fourteen working days prior notice of the commencement of blasting. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued in terms of the blasting process. It is advisable to make application separately in this regard.

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.

6.12 Protection of Natural Vegetation - The Contractor shall be responsible for informing all employees about the need to prevent any harmful effects on natural vegetation on or around the construction site as a result of their activities. Clearing of natural vegetation shall be kept to a minimum. The removal, damage and disturbance of natural vegetation without the written approval of the ECO are prohibited.

Before vegetation clearing takes place in any construction area, search and rescue and seed collection shall be undertaken in accordance with the Plant Rescue Plan (Appendix 9) and Vegetation Rehabilitation Plan (Appendix 10).

The use of herbicides is prohibited unless approved by the ECO.

6.13 Protection of fauna – The Contractor shall ensure that no hunting, trapping, shooting, poisoning or otherwise disturbance of any fauna takes place. The feeding of any wild animals is prohibited. The use of pesticides is prohibited unless approved by the ECO. No domestic pets or livestock are permitted on site.

6.14 Community relations - 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. Information on the project shall be provided to local people, such as through a poster at the entrance to the site.

7. MATERIALS MANAGEMENT

7.1 All potentially hazardous substances should be stored in a defined area (hazardous substances store), which is covered, has secondary containment and has restricted access. This area should be constructed in such a manner that any spillages can be contained within this area and to prevent entry into the underlying subsoil and groundwater. Fuel kept on site shall be contained in suitable tanks that shall be constructed within the required concrete/brick bunds.

Depending on the types of materials stored on site, suitable product recovery materials should be readily available. The location of the hazardous substances store should be agreed between the ECO, Engineer and Contractor prior to site establishment.

7.2 The contractor shall keep Material Safety Data Sheets on site for all potentially hazardous materials used. Suitably trained personnel shall be available on the site during working hours so that in the event of human exposure to any hazardous materials that the correct first aid actions are taken.

7.3 All material used by the contractor during the construction phase shall be managed in such a way that it does not cause pollution, or that minimises pollution. All building materials should be stored away and the areas bunded appropriately such that there will be no runoff from these areas. All building materials must be removed after construction.

7.4 Concrete works – cement powder has a high alkalinity which can contaminate soil, groundwater and surface water. The following recommendations are made:

- Mixing areas to be defined on site and carefully located.
- Cement contaminated water should be fed to a container, neutralised and suitably disposed of (to sewer if acceptable to the Municipality) or sent to a suitable landfill site. In the latter case, chain of custody documentation should be provided to ensure a suitable end recipient. The latter should be kept with the environmental register.
- If possible, the use of ready mix concrete should be considered.

- Cement bags should be suitably stored and the used bags disposed of via the solid waste stream.
- Excess or spilled concrete should be disposed of to a suitable landfill site, with chain of custody documentation provided.
- Cement is to be stored in a secure weatherproof location to avoid contamination of the environment.
- Suitable screening and containment shall be in place to prevent windblown contamination associated with bulk cement silos, loading and batching.

7.5 No materials containing invasive plant seeds, litter or contaminants may be imported to site. The Engineer shall be informed of the sites of origin of imported gravel, sand, stone etc. and shall have the authority to reject imported material if deemed necessary.

7.6 All imported materials (e.g. sand) must be stockpiled within the Contractor's camp or agreed demarcated area. Stockpile areas must be approved by the Engineer before any stockpiling commences. Material stockpiles must be protected against wind and water erosion (for prevention of dust, clogging of the stormwater system and other problems).

8. WASTE HANDLING: SOLID WASTE

8.1 Waste should be categorised by the contractor and disposed of in a suitable manner into different waste streams (including general and hazardous waste). Wherever possible recycling should be carried out. No dumping within the surrounding area is to be permitted. Where potentially hazardous substances are being disposed of, a chain of custody document should be kept with the environmental register as proof of final disposal. General waste is to be collected either by the Municipality or via a waste disposal contractor. The frequency of collections will be such that waste containment receptacles do not overflow.

8.2 The contractor should provide an adequate number of waste receptacles for general waste at points around the construction site, and a single collection point for hazardous waste. The contractor will be responsible for emptying these at regular intervals and for ensuring that the site is kept clean from litter. Particular care shall be taken with the disposal of materials that could be wind-borne or waterborne to ensure that the release of these materials is minimised (the latter is considered advisable for hazardous waste). The use of netting covers or sealed containers may be considered. Areas should be demarcated for specific activities including food consumption, with suitable waste receptacles provided.

8.3 The contractor shall be required to prepare a method statement to indicate how and where solid waste will be disposed of based on the following requirements:

Hazardous waste

- Hazardous wastes shall only be disposed at landfill sites registered for hazardous waste;
- Spills or leaks of construction hazardous materials including but not limited to concrete curing compounds, asphalt products, paints, petroleum products from equipment operation and maintenance, pesticides and herbicides, shall be monitored and remediated immediately if detected.

- No hazardous waste may be buried or burned under any circumstances.
- A certificate of disposal by shall be obtained the Contractor and kept on file, if relevant.
- MSDS shall be available for all hazardous substances stored on site.
- Appropriate hazardous waste spill kits shall be available on site.
- An approved waste disposal contractor must be employed to remove and recycle waste oil, if practical.
- Burying or burning of solid waste shall not be allowed.

General waste

- Regular disposal of general waste to registered landfill sites shall be required to prevent nuisance factors such as odours, vermin and flies. No burning of waste shall be allowed.
- Provide adequate waste bins.
- Set up system for regular waste removal to an approved landfill facility.
- Minimise waste by sorting wastes into recyclable and non-recyclable wastes, if practical.
- No waste may be buried or burned under any circumstances.
- A housekeeping team should be appointed to regularly maintain the litter and rubble situation on the construction site.
- Littering by the employees shall not be allowed under any circumstances.
- The ECO shall monitor the neatness of the work sites as well as the Contractor campsite.
- Skip waste containers should be maintained on site. These should be kept covered and arrangements made for them to be collected regularly to prevent vermin and odours.
- A certificate of disposal by shall be obtained the Contractor and kept on file, if relevant.

9. WASTE HANDLING: WASTE WATER

- 9.1** No construction fluids should be allowed to enter any watercourses or onto any adjacent land.
- 9.2** No wastewater shall be disposed of into the soil. This does not include clean groundwater from rainwater.
- 9.3** Chemical toilet facilities are to be supplied and managed by the contractor. These are to be located in a specific area agreed to by the ECO prior to placement and to be used by all personnel. A minimum of one toilet per 15 persons.

10. MACHINERY MANAGEMENT

- 10.1** All vehicles, equipment, fuel and petroleum services and tanks must be maintained in good condition that prevents leakage and possible contamination of soil or groundwater.

An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage shall be

implemented. This shall include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.

Measures should include:

- Daily vehicle inspection to detect any leakages and or spillages.
- Weekly visual inspection of plant and standing equipment.
- Weekly visual inspection of fuel tanks.
- A record of these inspections needs to be kept to demonstrate compliance.
- The contractor needs to provide a method statement for “emergency procedures to deal with leakage and spillage of hazardous substances”.
- Spill remediation kits shall be kept on site and all staff members shall be informed of where it is located.

Construction machinery should be located away from sensitive areas when parked for extended periods of time. A dedicated parking area should be defined with drip trays beneath any leaking equipment. Fuel/lubricant absorbing media (peat/moss type products) within these drip trays should be used to hold the spilled liquids. These materials should be replaced regularly to prevent over-saturation and potential spillage of free product. This material should be disposed of as hazardous waste and be collected by an approved contractor/delivered to a suitable waste site. Chain of custody documentation should be provided as proof of final end recipient.

10.2 Machinery should not be located beneath the foliage of any trees.

All spills are to be recorded in the Environmental Register, including any clean-up actions taken to remediate the spillage. Such actions are to be agreed with the ECO prior to taking place.

11. NOISE

11.1 Noise generation is likely to be one of the most significant impacts at the site during the construction phase. Every attempt should be made to reduce noise levels considering the construction site.

11.2 The contractor should use modern equipment, which produces the least noise. Any unavoidably noisy equipment should be identified and located in an area where it has least impact. The use of noise shielding screens should be considered and the operation of such machinery restricted to when it is actually required.

11.3 No noise generating work can be conducted after 8 p.m. and before 7 a.m. on any workday or during any Sunday, without the prior approval of the engineer. Due to contractual commitments, it is possible the contractor may need to work longer periods than those stipulated to avoid being penalised for time delays. Any such issues will be discussed and agreed upon by the engineer, contractor and ECO.

12. SEARCH AND RESCUE

Search and rescue of all rare or localised plant species within construction areas shall be undertaken before any site clearing takes place (Plant Rescue Plan included in Appendix 9).

Search and rescue shall include the collection of plants, cuttings and, where applicable, seed. The ECO should give permission to clear vegetation only once all search and rescue operations have been completed.

13. PENALTIES AND BONUSES

Where the Contractor inflicts damage upon the environment or fails to comply with any of the environmental specifications contained within this EMP, he/she shall be liable to pay a penalty for breach of the conditions of the environmental specifications which form part of the works contract. The Contractor is deemed NOT to have complied with this Specification if:

- within the boundaries of the site, site extensions and haul / access roads there is evidence of contravention of the Specification;
- environmental damage ensues due to negligence;
- the Contractor fails to comply with corrective or other instructions issued by the Resident Engineer/ECO within a specific time;
- the Contractor fails to respond adequately to complaints from the ECO or public.

Penalties shall be issued per incident and per individual for the Contractor's responsibility at the discretion of the Engineer in consultation with the ECO. The amount of the penalty shall be determined by the Engineer, in consultation with the ECO. The Engineer shall inform the Contractor of the contravention and the amount of the penalty, and will deduct the amount from monies due under the Contract. Payment of any penalties in terms of the contract shall not absolve the offender from being liable from prosecution in terms of any law.

The following penalties (not an exclusive list) shall be issued in addition to any remedial costs incurred as a result of non-compliance with the environmental specifications and shall be imposed by the Engineer on the Contractor for contraventions of the environmental specifications by individuals or operators employed by the Contractor and/or his sub-contractors. Where there are ranges, the amount shall depend on the severity and extent of the damage done to the environment:

a)	An individual entering a "no-go" area by foot (without Engineer's /ECO's permission)	R 500
b)	An individual failing to adhere to speed limit on site	R 500
c)	An individual driving a vehicle in a "no-go" area	R 1 000 – R 3 000
d)	An individual driving any earthmoving plant in a "no-go" area	R 1 000 – R 3 000
e)	A plant operator ignoring a verbal warning to have an oil leak from his machinery repaired	R 300
f)	An individual littering on site	R 50
g)	An individual not making use of the ablution facilities	R 50
h)	An individual making an illegal fire on site	R 200 – R 10 000
i)	An individual causing unnecessary damage to fauna on site	R 100 – R 2 000
j)	An individual / team wasting water	R 100 – R 2 000

k)	An individual not reporting a suspected archaeological find to the ECO	R 200 – R 2 000
l)	An individual / team contaminating the site or stormwater system with paint/hazardous substances	R 200 – R 2 000

For each subsequent similar offence committed by the same team or individual, the penalty shall be doubled in value to a maximum value of R 10 000.

The following penalties are suggested for transgressions where damage has been done to the environment:

a)	Erosion	A penalty equivalent in value to the cost of rehabilitation plus 20%
b)	Oil spills	A penalty equivalent in value to the cost of clean-up operation plus 20%
c)	Damage to sensitive environments	A penalty equivalent in value to the cost of restoration plus 20%
d)	Damage to archaeological finds	A penalty to a maximum of R100 000 shall be paid for any damage to any archaeological sites / finds

All monies collected through penalties shall be held by the proponent and be accounted for. A summary page is to be included with the monthly payment certificates as a record of penalties issued to date. A portion of these funds may be used for token monetary bonuses to individual site staff members that have shown exceptional diligence in applying good environmental practice on the site. The remaining funds shall be allocated for the purposes of contributing to environmental education efforts in the local community e.g. posters, excursions or trees for the local school or environmental resource material for the local public library. A committee consisting of the Developer, ECO, Engineer and possibly the local authority, will make a final decision regarding the precise allocation of all penalty funds.

14. MEASUREMENT AND PAYMENT

All aspects covered in this document shall be deemed to be included as a sum in the Preliminaries tendered by the Contractor in the Schedule of Quantities.

15. POST CONSTRUCTION

14.1 Final site cleaning and rehabilitation - the contractor shall clear and clean the site and ensure that everything not forming part of the permanent works is removed from site before issuing the completion certificate or as otherwise agreed.

The Vegetation Rehabilitation Plan, included in Appendix 10, shall be implemented. The construction footprint associated with the activity shall be re-vegetated with indigenous vegetation, as directed by this rehabilitation plan. Rehabilitation of disturbed areas shall commence as soon construction of the specific section have been completed.

16. OPERATIONAL EMP

The overall goal of the OEMP will be to ensure that the operation of the WEF does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action is taken (OEMP included in Appendix 4).

17. DECOMMISSIONING EMP

The overall goal of the Decommissioning EMP (DEMP) will be to ensure that the decommissioning of the WEF does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action is taken (DEMP included in Appendix 5).

18. GENERAL

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

The compilation of the EMP has incorporated impacts and mitigation measures from the approved EIA Report as well as additional input from specialists. The EMP has ensured that the mitigation measures shall be implemented throughout the project lifecycle in its entirety as opposed to phase-specific measures.