PROPOSED KOINGNAAS WIND ENERGY FACILITY, NORTHERN CAPE PROVINCE

CONSTRUCTION & OPERATION ENVIRONMENTAL MANAGEMENT PROGRAMME (EMP)

Submitted as part of the Final EIA Report
November 2011

Prepared for
Just Palm Tree Power
2nd Floor, 27 Buitenkant Street
Cape Town
8001

Prepared by
Savannah Environmental (Pty) Ltd
PO box 148, Sunninghill, 2157
Tel: +27 (0)11 234 6621
Fax: +27 (0)86 684 0547
E-mail: info@savannahsa.com

PROJECT DETAILS

DEA Reference No.	:	12/12/20/2154
Title	:	Environmental Basic Assessment Process Draft Environmental Management Programme: Proposed Koingnaas Wind Energy Facility, Northern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Alicia Govender & Jo-Anne Thomas
Specialists	:	Archaeology Contracts Office (ACO) (Heritage study) John Pether (Palaeontological study) Bergwind Botanical Surveys & Tours cc. (Botanical study) David Hoare Consulting cc (Fauna study) MENCO (M2 Environmental Connections cc) (Noise study) MetroGIS (Pty) Ltd (Visual study) Rob Simmons (Avifauna study) Tony Barbour Environmental Consulting and Terra Soil Science cc (Geology, soils and agricultural potential study) Research (Social study) Sustainable Futures ZA cc (Public Participation)
Client	:	Just Palm Tree Power
Report Status	:	EMP submitted as part of the final Basic Assessment Report for submission to DEA

When used as a reference this report should be cited as: Savannah Environmental (2011) Draft Environmental Management Programme: Proposed Koingnaas Wind Energy Facility, Northern Cape Province

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Betz Limit: It is the flow of air over the blades and through the rotor area that makes a wind turbine function. The wind turbine extracts energy by slowing the wind down. The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%. This value is known as the Betz Limit

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Cut-in speed: The minimum wind speed at which the wind turbine will generate usable power.

Cut-out speed: The wind speed at which shut down occurs.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

i. the land, water and atmosphere of the earth;
ii. micro-organisms, plant and animal life;
iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational programme that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Generator: The generator is what converts the turning motion of a wind turbine's blades into electricity

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do

not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and Affected Party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Nacelle: The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of up to 50 revolutions per minute (rpm).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Tower: The tower, which supports the rotor, is constructed from steel. It is approximately 32 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Wind power: A measure of the energy available in the wind.

Wind rose: The term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes

from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.

Wind speed: The rate at which air flows past a point above the earth's surface.

TABLE OF CONTENTS

List of Appendices:

PURPOSE & OBJECTIVES OF THE EMP CHAPTER 1

An Environmental Management Programme (EMP) is defined as "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 or mitigated, and that the positive benefits of the projects are enhanced"[1]. The objective of this Environmental Management Programme is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMP is to help ensure compliance with recommendations and conditions specified through an EIA process, as well as to ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMP is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMP provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (site clearing and site establishment) through those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site rehabilitation (soil stabilisation, re-vegetation) and operation. The EMP also defines monitoring requirements in order to ensure that the specified objectives are met.

The EMP has been developed as a set of environmental specifications (i.e. principles of environmental management for the proposed wind energy facility), which are appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation is provided through the inclusion of various monitoring and implementation for use of the EMP by the project implementer as well as compliance monitors).

The EMP has the following objectives:

» To outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation and operation phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the wind energy facility.

[1] Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans,* 2005

» To ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
» To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
» To propose mechanisms for monitoring compliance, and preventing long-term or permanent environmental degradation.
» To facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the EIA process.

The mitigation measures identified within the Basic Assessment process are systematically addressed in the EMP, ensuring the minimisation of adverse environmental impacts to an acceptable level.

Just Palm Tree Power must ensure that the implementation of the project complies with the requirements of any and all environmental authorisations and permits (once issued), as well as with obligations emanating from all relevant environmental legislation. This obligation is partly met through the development of the EMP, and the implementation of the EMP through its integration into the contract documentation for activities associated with both construction and operation. Since this EMP is part of the EIA process undertaken for the proposed wind energy facility, it is important that this guideline document be read in conjunction with the draft Basic Assessment (BA) Report (September 2011). This will contextualise the EMP and enable a thorough understanding of its role and purpose in the integrated environmental process. This EMP for construction and operation activities has been compiled in accordance with Regulation 34 of the EIA Regulations of 2006 and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project. This EMP should be considered a dynamic document, requiring regular review and updating as new information becomes available in order for it to remain relevant to the requirements of the site and the environment.

To achieve effective environmental management, it is important that Contractors are aware of their responsibilities in terms of the relevant environmental legislation and the contents of this EMP. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractors obligations in this regard include the following:

» Ensuring that employees have a basic understanding of the key environmental features of the construction site and the surrounding environment.
» Ensuring that a copy of the EMP is readily available on-site, and that all site staff are aware of the location and have access to the document. Employees must be familiar

with the requirements of the EMP and the environmental specifications as they apply to the construction of the facility.

» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an appropriate Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, the EMP specifications, and how they are to be implemented.
» Basic training in the identification of archaeological sites/objects, and protected or Red List flora and fauna that may be encountered on the site.
» Awareness of any other environmental matters, which are deemed to be necessary by the Environmental Control Officer (ECO).

PROJECT DETAILS *CHAPTER 2*

Just Palm Tree Power is proposing to establish a commercial wind energy facility and associated infrastructure on the farm Koingnaas 745located approximately 3 km west of Koingnaas in the Northern Cape Province. The proposed development site is located within the Kamiesberg Local Municipality. The larger site covers an area of approximately 100 ha. The facility, which will be appropriately placed on the larger site, will include the following infrastructure:

» A **wind energy facility** of up to 24 wind turbine generator units, appropriately spaced to make use of the wind resource on the site. The facility is proposed to have a generating capacity of up to 7.2 MW, with each turbine being 0.3 MW.
» **Cabling** between the turbines, to be lain underground where practical, which will connect to a new on-site switching station;
» A **switching yard** 50m x 40m will be constructed to convert the current from 33 kV to 11kV;
» A **short 11kV power line** to connect the facility to the existing Koingnaas Substation;
» **Existing roads** will be used as far as possible. However, where required, internal access roads of approximately 6m wide will be constructed between the turbines and the on-site substation;
» **Workshop** area for maintenance and storage purposes; and
» A component **laydown area** of approximately 1250m^2 (50m x 25m) will be required next to each turbine location.

The facility will be fuelled by wind. No other fuels will be used as a generating fuel during the operational phase of the project.

One layout alternative was considered in the Basic Assessment (BA) process. The preliminary layout of the facility, indicating 24 turbines and associated temporary and permanent infrastructure, is show in Figure 2.1. The alternate power line corridors assessed in the BA report are shown in Figures 2.2 and 2.3.

Option 1 for the power line which passes east of the tailings dump as indicated in figure 2.3 is considered as the preferred option in line with the Basic Assessment Report.

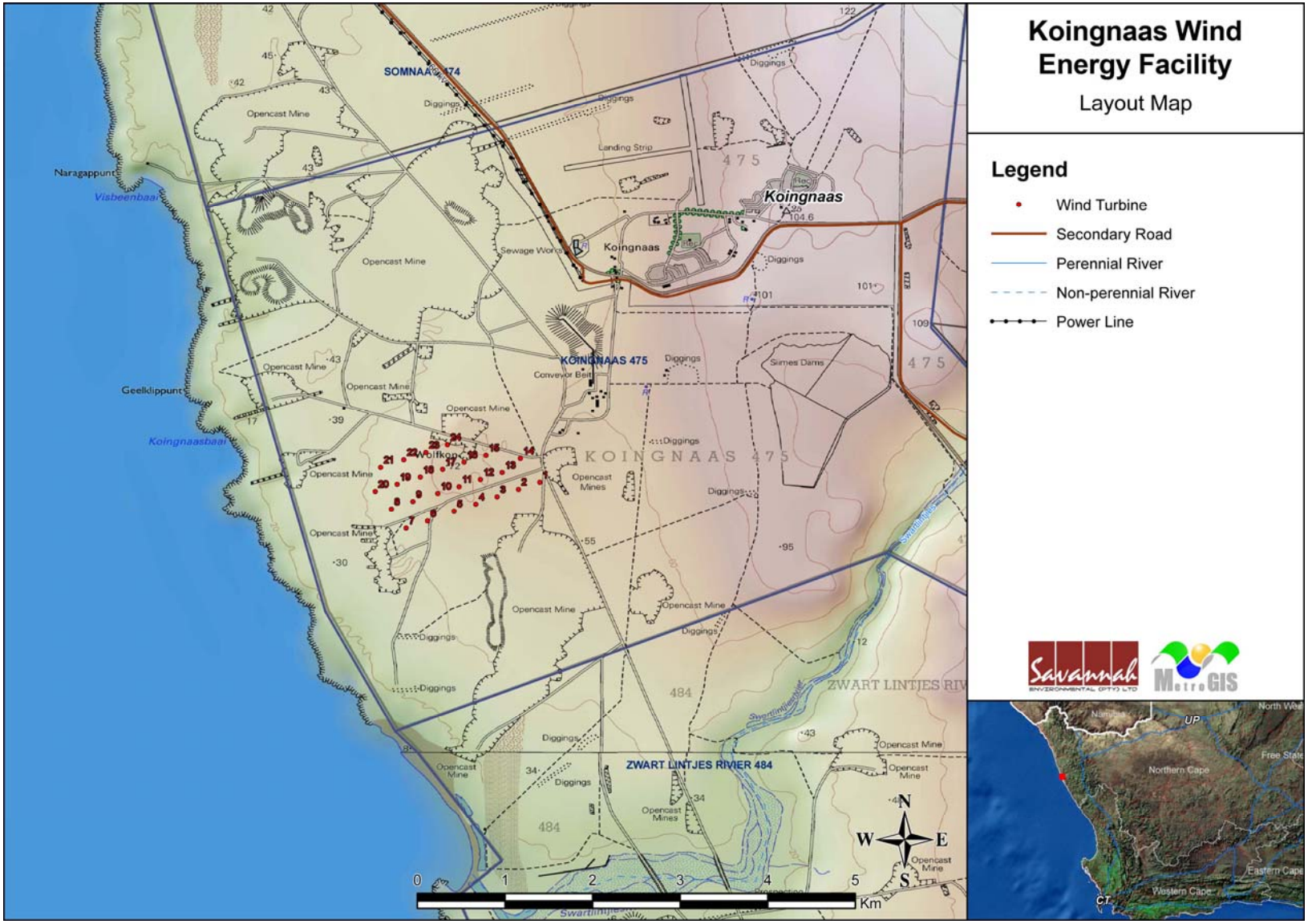


Figure 2.1: Preliminary layout for the proposed Koingnaas Wind Energy Facility west of Koingnaas

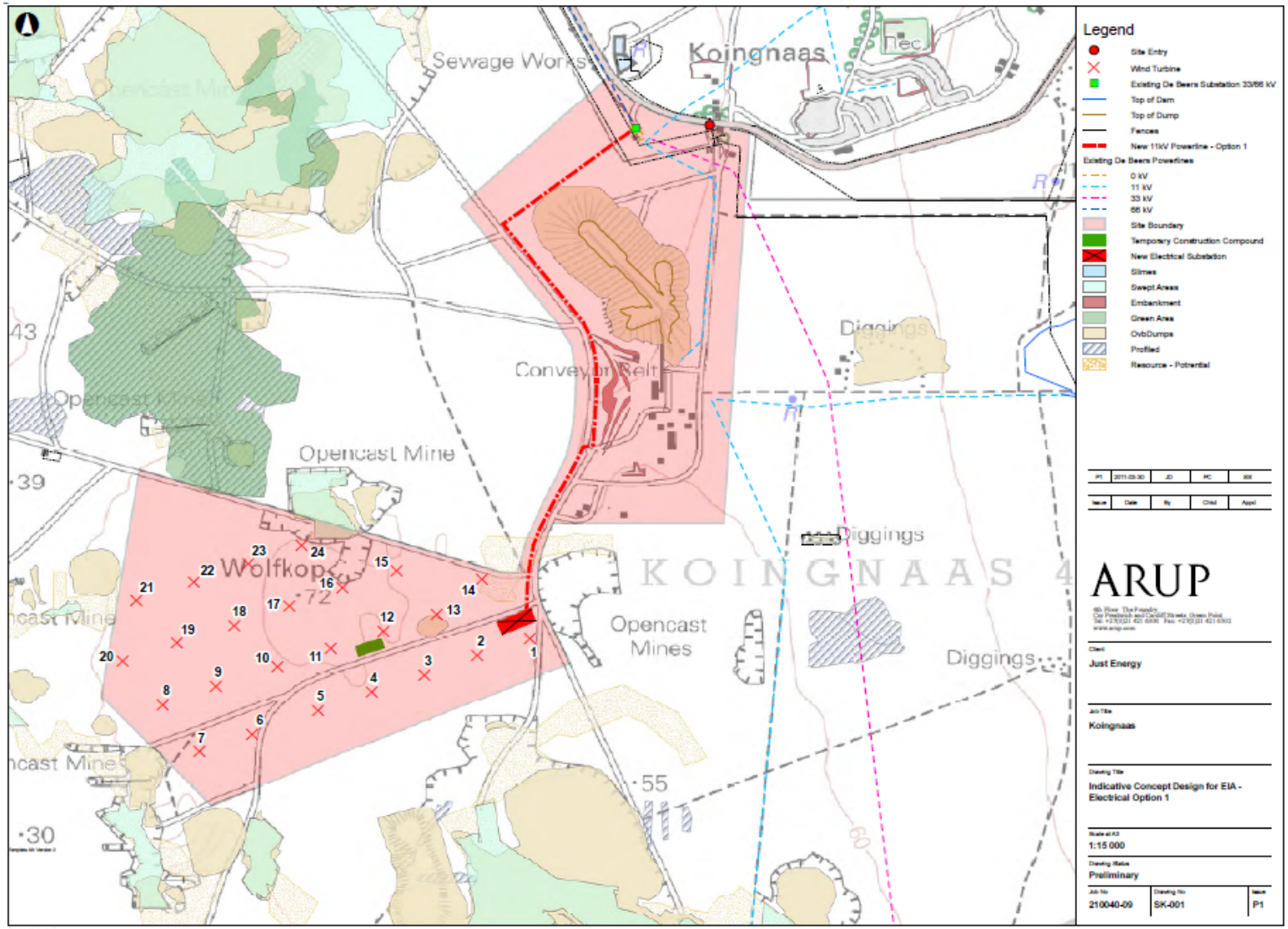


Figure 2.2: Map showing the proposed turbine layout and route of power line option 1 (passes west of the large tailings dam)

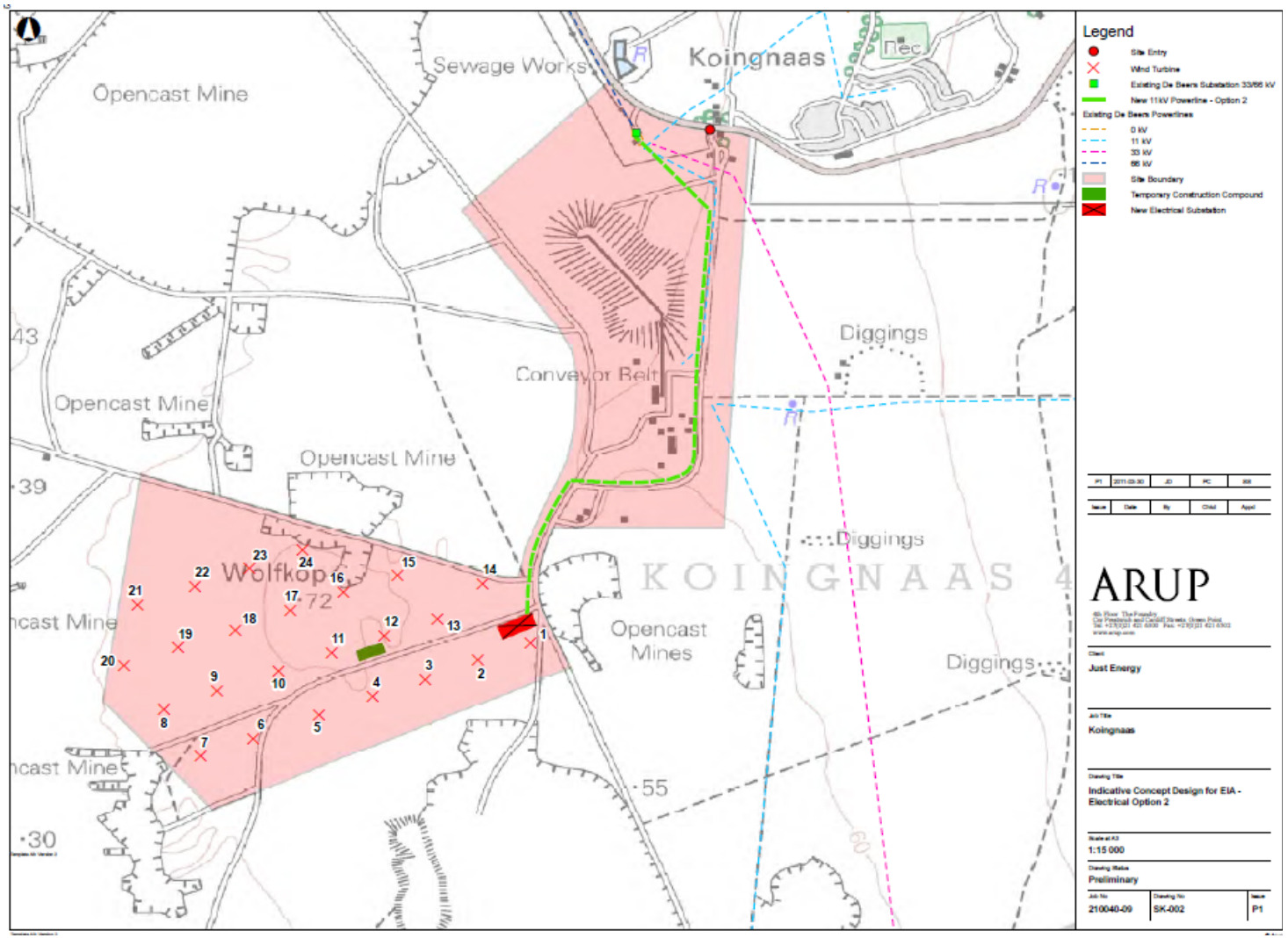


Figure 2.3: Map showing the proposed route of power line option 2 (skirts east of the tailings dam) (preferred option)

2.1 Activities and Components associated with the proposed Koingnaas Wind Energy Facility

The main activities/components associated with the wind energy facility comprise the following:

Main Activity / Project Component	Components of Activity	Details
	Planning	
Conduct surveys	» Geotechnical survey by geotechnical engineer » Site survey and confirmation of the turbine micro-siting footprints in consultation with a botanist, ornithologist and archaeologist » Survey of on-site switching yard (1) and selected power line route » Survey of new internal access routes	» Surveys to be undertaken prior to initiating construction.
	Construction	
Establishment of access roads to the site	» Upgrade access/haul roads to the site » Establish internal access roads: up to 6 m wide permanent roadway within the site between the turbines for use during construction and operation phase. » If required, temporary track (adjacent to and utilising part of the permanent road) of up to 13m in width for use by the crane during construction phase only.	» Access roads will be constructed in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary. » Existing access roads to the site will be utilised, and upgraded where required. Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. » The internal service road alignment will be informed by the final micro-siting/positioning of the wind turbines (as well as by surveys undertaken by ecological and archaeological specialists).
Undertake site preparation	» Site establishment of offices/ workshop with ablutions and stores, contractors yards	» These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site.

Main Activity / Project Component	Components of Activity	Details
	» Establishment of internal access roads (permanent and temporary roads) » Clearance of vegetation at the footprint of each turbine » Excavations for foundations	
Establishment of lay down areas on site	» Lay down areas (temporary footprint 1250m^2 (50m x 25m)) at each turbine position for the storage of wind turbine components and accommodation of construction and crane lifting equipment. » Construction of site office.	» The lay down area will need to accommodate the cranes required in tower/turbine assembly. » Lay down and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site. » A small lay down area will be required at each position where the main lifting all terrain crane may be required to be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane.
Construct wind turbine foundations	» Turbine foundations will be up to 13 m x 13m (octagonal shape). » Foundation holes will be excavated to a depth of approximately 5m, depending on the underlying geotechnical conditions on site.	» Foundation holes will be mechanically excavated. » Shoring and safety barriers will be erected.
Transport of components and equipment to site	» Articulated trucks will be used to transport all components to site: » The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement mixers, etc.) to be transported to site. » The components required for the establishment of the switching yard	» Turbine units consist of a lattice tower comprised of segments, a nacelle, and three rotor blades. » Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. mobile assembly crane and a crawler crane) to erect the wind turbines. » Other components include components required for the establishment of the switching yard (including transformers) and those required for the establishment of the power line (including towers and cabling). » The wind turbine, including tower, will be brought to site by the

Main Activity / Project Component	Components of Activity	Details
	(including transformers). » Components required for the establishment of the power line (including towers and cabling).	supplier in sections. As the PalmTree 300kW turbine is a relatively small turbine, the parts can be transported on standard articulated trucks. The generator will be the largest part of the turbine being transported on a standard low bed trailer. The developer intends to use standard horse and trailer transport vehicles, which include 12m tri-axle trailers. The blades will be delivered on an extendable 16m twin-axle trailer. » For a small turbine like the PalmTree 300kW, the vehicles being used to transport the turbine parts from origin of manufacture to site will be within the legal limitations and therefore specific permits for abnormal loads will not be required.
Erect turbines	» Lifting crane used for lifting of large, heavy components. » A small crane for the assembly of the rotor.	» The large lifting crane will lift the tower sections into place. » The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower. » The rotor (i.e. the blades of the turbine) will then be assembled or partially assembled on the ground by a crane. It will then be lifted to the nacelle by the crane, and bolted in place. » It will take approximately 3-4 weeks to erect each turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.
Construct switching yard and ancillary infrastructure.	» Switching yard components. » Security fencing around high-voltage (HV) Yard. » Workshop.	» Will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. » A lay down area for building materials and equipment associated with these buildings will also be required. » The switching yard will be constructed within a high-voltage (HV) yard footprint of up to (50m x 40m). » The switching yard would be constructed in the following simplified sequence:

Main Activity / Project Component	Components of Activity	Details
		* Step 1: Survey of the site * Step 2: Site clearing and levelling and construction of access road to switching yard site * Step 3: Construction of terrace and foundations * Step 4: Assembly, erection and installation of equipment * Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.
Connection of wind turbines to the on-site substation	» Wind turbines. » 33 kV underground electrical cabling connecting each turbine to the substation.	» The installation of these cables will require the excavation of trenches, approximately 1m in depth within which these cables can then be laid. » The underground cables would follow the internal access roads as far as reasonably possible.
Connect substation to power grid	» An 11 kV overhead distribution power line is proposed to connect the switching yard at the facility to the electricity distribution network/grid at the mine-owned Koingnaas Substation.	» The route for the power line will be assessed, surveyed and pegged prior to construction.
Commissioning of the facility	» Wind energy facility commissioning.	» Prior to the start up of a wind turbine, a series of checks and tests will be carried out, including both static and dynamic tests to make sure the turbine is working within appropriate limits. » Grid interconnection and unit synchronisation will be undertaken to confirm the turbine and unit performance. Physical adjustments may be needed such as changing the pitch of the blades.
Undertake site remediation	» Remove all construction equipment from the site. Rehabilitation of temporarily disturbed areas where practical and reasonable.	» On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.
Operation		

Main Activity / Project Component	Components of Activity	Details
Operation	» Operation of turbines within the wind energy facility. » Operation of the power line and switching station.	» Once operational, the wind energy facility will be monitored remotely. Based on information provided by the proponent, the proposed project will employ approximately 10 full time employees over the ~20 year operational phase of the project. It is anticipated that there will be full time security, maintenance and control room staff required on site. » Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities.
Maintenance	» Oil and grease – turbines. » Transformer oil – switching yard. » Waste product disposal.	» The wind turbines will be subject to periodic maintenance and inspection. Periodic oil changes will be required and any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation. » The turbine infrastructure is expected to have a lifespan of approximately 20 years, with maintenance.
Decommissioning		
Site preparation	» Confirming the integrity of the access to the site to accommodate required equipment and lifting cranes. » Preparation of the site (e.g. lay down areas, construction platform). » Mobilisation of decommissioning equipment.	» Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. » It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.
Disassemble and remove existing turbines	» A large crane will be used to disassemble the turbine and tower sections.	» Turbine components would be reused, recycled or disposed of in accordance with regulatory requirements.

2.2 Potential Environmental Impacts

In terms of the findings of the BA Report, various planning, construction and operation-related environmental impacts were identified, including:

» Disturbance of ecological environment (including impacts on vegetation, disturbance to habitats and impacts on avifauna)
» Impacts on heritage resources
» visual aesthetics
» Noise during construction
» Socio-economic impacts

From the specialist investigations undertaken for the proposed wind energy facility development site, a number of potentially sensitive areas were identified (refer to Figure 2.3) where further surveys are required to be undertaken to confirm the final placement of turbines, once this is known. In order to avoid and minimise impacts on sensitive areas or receptors, it was recommended that:

» Turbine positioning takes cognisance of sensitive areas (as indicated on **Figure 2.3**) by:
  * Relocating turbines 3; 11; 12; 13; 15 and 17 from areas of high ecological sensitivity to areas of low sensitivity.
  * It should be ensured that the road between turbines 16 and 17 does not impact upon the southern edge of the large cluster of mitigation-worthy heritage sites on the hill top if their mitigation is to be avoided.

Where this is not possible, additional mitigation should be investigated in consultation with the specialists. The EMP has thus been developed in line with these environmental sensitivities and must be implemented to protect sensitive on-site and off-site features through controlling construction and operation activities that could have a detrimental effect on the environment, and avoiding or minimising potential impacts.

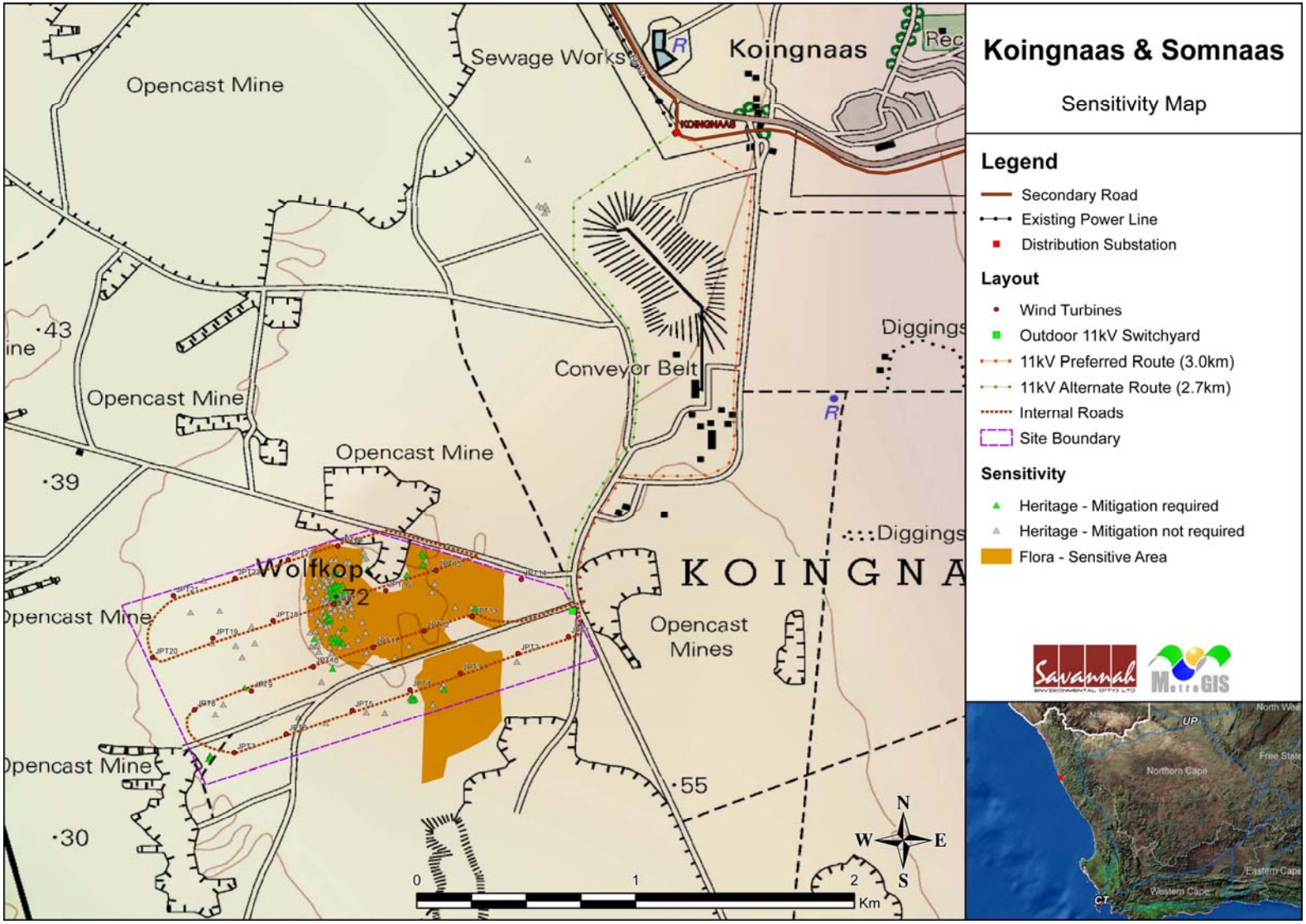


Figure 2.3: Environmental Sensitivity map for the project study area illustrating sensitive areas in relation to the Koingnaas wind energy facility layout

STRUCTURE OF THIS EMP CHAPTER 3

The first two chapters provide background to the EMP and the proposed project. The chapters which follow consider the:

» Planning and design activities
» Construction activities
» Operation activities
» Decommissioning activities

These chapters set out the procedures necessary for the wind energy facility to achieve environmental compliance. For each of the phases for the wind energy facility project, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The management plan has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions monitoring requirements and performance indicators. A specific environmental management programme table has been established for each environmental objective. The information provided within the EMP table for each objective is illustrated below:

OBJECTIVE: Description of the objective, which is necessary in order to meet the overall goals; these take into account the findings of the environmental impact assessment specialist studies

Project component/s	List of project components affecting the objective, i.e.: » wind turbines » access roads » switching yard » power line
Potential Impact	Brief description of potential environmental impact if objective is not met
Activity/risk source	Description of activities which could impact on achieving objective
Mitigation: Target/Objective	Description of the target; include quantitative measures and/or dates of completion

Mitigation: Action/control	**Responsibility**	**Timeframe**
List specific action(s) required to meet the mitigation target/objective described above.	Who is responsible for the measures	Time periods for implementation of measures

Performance Indicator	Description of key indicator(s) that track progress/indicate the effectiveness of the management plan.
Monitoring and Reporting	Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods and reporting

The objectives and EMP tables are required to be reviewed and possibly modified whenever changes, such as the following, occur:

» Planned activities change (i.e. in terms of the components of the facility).
» Modification to or addition to environmental objectives and targets.
» Additional or unforeseen environmental impacts are identified.
» Relevant legal or other requirements are changed or introduced.
» Significant progress has been made on achieving an objective or target such that it should be re-examined to determine if it is still relevant, should be modified, etc.

3.1. Project Team

This draft EMP was compiled by:

EMP Compilers	
Alicia Govender	Savannah Environmental
Jo-Anne Thomas	Savannah Environmental
Input from Specialists	
Flora	Bergwind Botanical Surveys & Tours cc.
Avifauna	Rob Simmons
Fauna	David Hoare Consulting cc
Geology, soils and agricultural potential study	TerraSoil Science
Visual	MetroGIS
Heritage	Archaeology Contracts Office (ACO)
Palaeontology	John Pether
Noise	MENCO (M2 Environmental Connections cc)
Social Impact	Tony Barbour (Environmental Consultant and Researcher)

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, having being involved in EIA processes over the past ten (10) years. They have managed and drafted environmental management plans / programmes for other wind energy facility projects throughout South Africa. In addition, they have been involved in compliance monitoring of major construction projects in South Africa.

MANAGEMENT PLAN FOR THE WIND ENERGY FACILITY: PLANNING & DESIGN — CHAPTER 4

4.1. Goal for Planning and Design

Overall Goal for Planning and Design: Undertake the planning and design phase of the wind energy facility in a way that:

» Ensures that the design of the facility responds to the identified environmental constraints and opportunities.
» Ensures that adequate regard has been taken of any landowner concerns and that these are appropriately addressed through design and planning (where appropriate).
» Ensures that the best environmental options are selected for all components of the project.
» Enables the wind energy facility construction activities to be undertaken without significant disruption to other land uses in the area.

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

4.2. Planning and Design

OBJECTIVE: To ensure that the design of the facility responds to the identified environmental constraints and opportunities

The final layout and preferred power line routes must be implemented.

Project component/s	Project components affecting the objective: » wind turbines » access roads » switching yard » power line
Potential Impact	» Design fails to respond optimally to the environmental consideration
Activities/risk sources	» Positioning of turbines and access roads » Positioning of switching yard » Alignment of power line
Mitigation: Target/Objective	» To ensure that the design of the facility responds to the identified environmental constraints and opportunities

Mitigation: Action/control	Responsibility	Timeframe

Mitigation: Action / control	Responsibility	Timeframe
Consider design level mitigation measures recommended by the specialists, especially with respect to ecology, visual aesthetics, archaeology and avifauna as detailed within the BA report and relevant appendices.	Engineering Design Consultant / turbine supplier Just Palm Tree Power	Tender Design & Design Review Stage
As far as possible, areas of sensitivity identified through the botanical and heritage studies should be avoided. Where this is not possible, appropriate mitigation must be implemented to minimise impacts.	Just Palm Tree Power	Design phase
Existing access roads to be used as far as possible. Where new access roads are required, these are to be carefully planned to minimise the impacted area and prevent unnecessary over compaction of soil. Keep natural units as intact as possible.	Just Palm Tree Power	Design phase
A comprehensive stormwater management plan to be compiled that details how stormwater off hard surfaces will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces.	Just Palm Tree Power	Design phase
The draft EMP should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and must be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.	Just Palm Tree Power	Tender Design & Design Review Stage
Pre-construction monitoring should be undertaken to confirm the bird species which are present in the area. The duration of this pre-construction monitoring should be confirmed in consultation with an appropriately qualified avifaunal specialist, and should take cognisance of the size of the proposed facility and the bird species expected to be present in the area.	Just Palm Tree Power Specialist	Pre-construction
The final location of the wind turbines and associated infrastructure (including the power line) must be informed by a survey undertaken by an ecological specialist to identify any Red List plant species that have a geographic distribution in the affected areas (i.e. *Aloe arenicola)*. The findings of this survey must be included in the updated EMP to be compiled for the project. Prior to construction, areas where this species is likely to occur must be searched for any populations of plant species of concern. If any	Just Palm Tree Power	Design phase

Mitigation: Action/control	Responsibility	Timeframe
populations are found in these areas, infrastructure should be moved to avoid impacts.		
The final design of the wind energy facility must take due cognisance of the current and future mining plans of De Beers and Trans Hex.	Just Palm Tree Power	Design phase
Mining permit/license to be obtained for any borrow pits to be established for the project (if applicable)	Just Palm Tree Power	Design phase
A detailed geotechnical investigation is required for the design phase.	Just Palm Tree Power	Design phase
Establishment of a community trust	Just Palm Tree Power	Pre-construction
Establishment of a monitoring forum		
Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.	Just Palm Tree Power	Pre-construction

Performance Indicator	» Design meets objectives and does not degrade the environment. » Design and layouts etc. respond to the mitigation measures and recommendations in the BA report. » Sensitive ecological areas avoided as far as possible. » Use is made of existing roads as far as possible.
Monitoring and Reporting	» Ensure that the design implemented meets the objectives and mitigation measures in the BA report through review of the design by the Project Manager and Environmental Control Officer (ECO) prior to the commencement of construction.

OBJECTIVE: Limit loss of botanically sensitive vegetation

From a botanical viewpoint the major concerns are (1) loss of sensitive plant communities and (2) loss of Red List plants species. Owing to the mining in the area of the proposed WEF there is already significant disturbance. It may be argued that this is of such a magnitude that there is little value is trying to conserve the remaining natural habitat in the proposed wind energy facility footprint. The main objective here is to argue for the conservation of the undisturbed habitat (described as botanically sensitive habitat) and to recommend mitigation that will enable that objective to be met.

The major mitigation is the proposal of an alternative layout of wind turbines and consequently an alternative layout of access roads. This will almost eliminate impacts on the botanically sensitive area while still allowing the proposed WEF development to go ahead in must the same area as approved by De Beers Consolidated Mines.

The second objective would be to limit loss of old, established vegetation outside the WEF footprint on the power-line routes. There is a stand of old dune vegetation that can and should be avoided if the route 2A power-line (preferred route passing west of the tailings dam) alignment is followed.

The third objective would be to limit loss of Red List plants species. There is a chance that *Aloe arenicola* would be impacted by power-line route 2A. If so, the plants affected must be relocated to suitable habitat nearby that would not be negatively impacted.

Project component/s	List of project components affecting the objective: » wind energy turbines and associated laydown areas » access roads and cabling » switching station » workshop area » temporary lay down areas » power line and associated access road
Potential Impact	» Loss of botanically sensitive dune communities » Loss of Red List species: Aloe arenicola
Activity/risk source	» Site preparation and earthworks » Construction-related traffic » Foundations » Mobile construction equipment » Power line construction activities
Mitigation: Target/Objective	» Although the botanically sensitive vegetation is not regarded as threatened in the broad context it should be seen as valuable habitat in the local context and conserved » Relocate any specimens of *Aloe arenicola* that may be impacted by construction or operation (maintenance) of the power-line

Mitigation: Action/control	Responsibility	Timeframe
Apply Alternative 3 turbine and road layout (Refer to figure 2.4)	Just Palm Tree Power	Prior to Construction
Sensitive areas should be avoided as much as possible, if not- other mitigation measures must be investigated in the final layout design in consultation with a qualified botanist	Just Palm Tree Power	Prior to Construction
A walk through survey must be conducted with a qualified botanist.	Just Palm Tree Power	Prior to Construction
Adjust route of power-line where required (minor adjustment) to accommodate localised sensitive vegetation	Just Palm Tree Power	Prior to Construction

Performance	» No loss of botanically sensitive habitat

Indicator	» No loss of Red List plant species
Monitoring and Reporting	» Bi-annual audit of condition of vegetation on WEF site. » Post-construction audit

OBJECTIVE: Maximise local employment and business opportunities associated with the construction phase

It is acknowledged that skilled personnel are required for the construction of the wind turbines and associated infrastructure. However, where semi-skilled and unskilled labour is required, opportunities for local employment should be maximised as far as possible.

Project component/s	Project components affecting the objective: » Construction activities associated with the establishment of the wind energy facility, including all infrastructure.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised. However, due to the relatively small size of the facility the number of employment and business opportunities for locals will be limited.
Activities/risk sources	» The employment of outside contractors to undertake the work and who make use of their own labour will reduce the employment and business opportunities for locals. » Employment of local labour will maximise local employment opportunities.
Mitigation: Target/Objective	» Just Palm Tree Power, in discussions with the Kamiesberg Municipality, should aim to employ a minimum of 80% of the low-skilled workers from the local area. This should also be made a requirement for all contractors. » Just Palm Tree Power should also develop a database of local BEE service providers

Mitigation: Action/control	Responsibility	Timeframe
Attempt to employ a minimum of 80% of the low-skilled workers are sourced from the local area	Just Palm Tree Power and contractors	Pre-construction
Where required, implement appropriate training and skills development programmes prior to the initiation of the construction phase to ensure that local employment target is met.	Just Palm Tree Power	Pre- construction

Mitigation: Action/control	Responsibility	Timeframe
Skills audit to be undertaken to determine training and skills development requirements.	Just Palm Tree Power	Within 1 month of commencement of construction phase
Develop a database of local BEE service providers and ensure that they are informed of relevant tenders and job opportunities.	Just Palm Tree Power	Pre-construction
Identify potential opportunities for local businesses.	Just Palm Tree Power	Tender Design and Review stage

Performance Indicator	» Employment and business policy document that sets out local employment and targets completed before construction phase commences; » A target of 80% of semi and unskilled labour locally sourced set and met as far as possible. » Database of potential local BEE services providers in place before construction phase commences. » Skills audit to determine need for training and skills development programme undertaken within 1 month of commencement of construction phase.
Monitoring and Reporting	» Just Palm Tree Power and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. » An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE: Maximise creation of income generation opportunities associated with the proposed wind energy facility and funding for community projects through the establishment of a Community Trust

Just Palm Tree Power has indicated that they are committed to establishing a Community Trust as a part owner of the project. In terms of the agreement a percentage of the dividends from the project will accrue to the Community Trust. This revenue will in turn be used to fund and support local economic development. The Community Trust will own ~ 10% of the project. In terms of the funding model, a percentage of the ownership will be donated to the community, while the remainder will be funded via a loan sourced at a competitive interest rate. The dividends from the project will then be used to pay off the loan. Once the loan has been repaid all of the dividends will accrue to the Trust. This is likely to be after year 5-6 of the project. Although it's a relatively small project, these revenues will still provide funding over a 20 year period that will be used to support local economic development activities. In an

area that has been dependent upon mining and where there are limited employment opportunities this is regarded as a significant social benefit.

Project Component/s	» Generation of revenue from the sale of energy
Potential Impact	» Generation of income that can be used to fund and support local projects and community development
Activities/Risk Sources	» Generation of revenue from the sale of energy to the national grid
Mitigation: Target/Objective	» Establish a Community Trust prior to the commencement of operations

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Just Palm Tree Power have committed to the establishment of a Community Trust.	Just Palm Tree Power	Community Trust should be established and signed before operations commence.

Performance Indicator	» Established Community Trust with elected Trustees that is audited on an annual basis
Monitoring and Reporting	» Community Trust audited on an annual basis

MANAGEMENT PLAN FOR THE WIND ENERGY FACILITY: CONSTRUCTION CHAPTER 5

5.1. Overall Goal for Construction

The construction phase of the wind energy facility should be undertaken in such a way that:

» ensures the construction activities are properly managed in respect of environmental aspects and impacts;
» enables the wind energy facility construction activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to noise impacts, traffic and road use, and effects on local residents.
» minimises the impact on the vegetation, fauna and avifauna on the site as well as on any archaeological and historical value the site may have, as determined by the BA report.

5.2. Institutional Arrangements: Roles and Responsibilities for the Construction Phase of the Wind Energy Facility

As the Proponent, Just Palm Tree Power must ensure that the construction and operation of the wind energy facility complies with the requirements of any and all environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development of the EMP, and the implementation of the EMP through its integration into the contract documentation. Just Palm Tree Power will retain various key roles and responsibilities during the construction of the wind energy facility. These are outlined below.

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Site Manager; Safety, Health and Environmental Representative; Environmental Control Officer and Contractor for the construction phase of this project are as detailed below.

The **Project Manager** will:

» Ensure of all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these.
» Ensure that Just Palm Tree Power and its Contractor(s) are made aware of all stipulations within the EMP.

» Ensure that the EMP is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
» Be fully conversant with the Basic Assessment for the project, the EMP, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.

The **Site Manager** (Just Palm Tree Power's On-site Representative) will:
» Be fully knowledgeable with the contents of the Basic Assessment.
» Be fully knowledgeable with the contents and conditions of the Environmental Authorisation (once issued).
» Be fully knowledgeable with the contents of the Environmental Management Programme.
» Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these.
» Have overall responsibility of the EMP and its implementation.
» Conduct audits to ensure compliance to the EMP.
» Ensure there is communication with the Project Manager, the Environmental Control Officer and relevant discipline Engineers on matters concerning the environment.
» Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.
» Confine activities to the demarcated construction site.

The **Safety, Health and Environmental Representative** (ER) will:
» Develop and compile environmental policies and procedures.
» Direct and liaise with the Environmental Control Officer (ECO) regarding monitoring and reporting on the environmental performance of the construction phase.
» Conduct internal environmental audits and co-ordinate external environmental audits.
» Liaise with statutory bodies on environmental performance and other issues as required.

The **Environmental Control Officer** (ECO) will be responsible for monitoring, reviewing and verifying compliance by the Contractor with the environmental specification. Accordingly, the ECO will:

» Be fully knowledgeable with the contents with the Basic Assessment.
» Be fully knowledgeable with the contents with the conditions of the Environmental Authorisation (once issued).
» Be fully knowledgeable with the contents with the Environmental Management Programme.
» Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.

- Ensure that the contents of this EMP are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
- Ensure that the compliance of the EMP is monitored through regular and comprehensive inspection of the site and surrounding areas.
- Ensure that if the EMP conditions or specifications are not followed then appropriate measures are undertaken to address this.
- Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.
- Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
- Ensure that activities on site comply with all relevant environmental legislation.
- Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMP.
- Ensure that the compilation of progress reports for submission to the Project Manager, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.
- Ensure that there is communication with the Site Manager regarding the monitoring of the site.
- Ensure that any non-compliance or remedial measures that need to be applied are reported.
- Independently report to DEA in terms of compliance with the specifications of the EMP and conditions of the Environmental Authorisation (once issued).

Contractors and Service Providers: All contractors (including sub-contractors and staff) and service providers are ultimately responsible for:

- Ensuring adherence to all environmental management specifications contained within this EMP (and the Environmental Authorisation, once issued), as well as any specific specifications detailed by RES.
- Ensuring that Method Statements are submitted to the Site Manager (and ECO) for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the EMP.
- Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to.
- Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting.
- Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO.
- Ensuring that a register of all public complaints is maintained.
- Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMP (i.e. ensure their staff are appropriately trained as to the environmental obligations).

5.3. Objectives for Construction

In order to meet the goal for construction, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE: Securing the site and site establishment

The proposed site falls within a restricted mining area. The Contractor must take all reasonable measures to ensure the safety of the occupants or users of the proposed development. The area will need to be fenced so that the workers on the site do not have access to the surrounding mining area and mining personnel do not have access to the proposed Wind Energy Facility.

Project component/s	Project components affecting the objective: » wind turbine foundations » access roads » switching yard » power line
Potential Impact	» Hazards to occupants or users of the proposed development Security of materials
Activities/risk sources	» Open excavations (foundations and cable trenches) » Movement of construction vehicles in the area and on-site
Mitigation: Target/Objective	» To secure the site against unauthorised entry » To protect landowners / occupants / users of the proposed land

Mitigation: Action/control	Responsibility	Timeframe
Secure site, working areas and excavations in an appropriate manner. Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.	Contractor	During site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure access to the site and entrances to the site.	Contractor	During site establishment Maintenance: for duration of Contract
Fence and secure Contractor's equipment camp.	Contractor	Erection: during site establishment Maintenance: for duration of

Mitigation: Action/control	Responsibility	Timeframe
		Contract
All development footprints for roads, buildings, underground cables, laydown areas and turbine footings should be clearly indicated with flags and/or danger tape strips.	Contractor	During site establishment Maintenance: for duration of Contract
Location of concrete batching plant/s to be approved by ECO, prior to its development.	ECO	During site establishment
Restrict access by construction workers to the surrounding mine area.	Contractor	During site establishment Maintenance: for duration of Contract
Provide suitable flagmen, barriers and/or warning signs in English and any other relevant indigenous languages, all to the approval of the Site Manager.	Contractor	During site establishment Maintenance: for duration of Contract
All unattended open excavations shall be adequately demarcated and/or fenced (fencing shall consist of a minimum of three strands of wire wrapped with danger tape).	Contractor	During site establishment Maintenance: for duration of Contract

Performance Indicator	» Site is secure and there is no unauthorised entry. » Access to mining area restricted. » No injuries to landowners / occupants / users of the proposed land
Monitoring and Reporting	» Regular visual inspection of fence for signs of deterioration/forced access. » An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site. » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager in terms of unauthorised entrance. » ECO to address any infringements with responsible contractors as soon as these are recorded.

OBJECTIVE: Avoid the potential impacts on family structures and social networks associated with presence of construction workers from outside the area

While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on the local community. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to the potential behaviour of male construction workers, including an increase in alcohol and drug use, an increase in crime levels, the loss of girlfriends and or wives to construction workers, an increase in teenage and unwanted pregnancies, an increase in prostitution and an increase in sexually transmitted diseases.

The potential risk to local family structures and social networks is, however, likely to be low. The low and semi-skilled workers are likely to be local residents and will therefore from part of the local family and social network.

Project component/s	Project components affecting the objective: » Construction and establishment activities associated with the establishment of the wind energy facility, including all associated infrastructure.
Potential Impact	» The presence of construction workers who live outside the area and who are housed in local towns can impact on family structures and social networks.
Activities/risk sources	» The presence of construction workers can impact negatively on family structures and social networks, especially in small, rural communities.
Mitigation: Target/Objective	» To avoid and or minimise the potential impact of construction workers on the local community. This can be achieved by maximising the number of locals employed during the construction phase and minimising the number of workers housed on the site.

Mitigation: Action/control	Responsibility	Timeframe
Attempt to ensure that a minimum of 80% of the low-skilled workers are sourced from the local area. This should be included in the tender documents. Construction workers should be recruited from the local towns in the area.	Just Palm Tree Power and contractors	Tender phase for construction
Identify local contractors who are qualified to undertake the required work.	Just Palm Tree Power	Prior to construction phase
Establishing a Monitoring Forum (MF) consisting of representatives from the local community, local police,	Just Palm Tree Power	Pre- construction

Mitigation: Action/control	Responsibility	Timeframe
local farming community and the contractor prior to the commencement of the construction phase. Develop a Code of Conduct to cover the activities of the construction workers housed on the site.		
Ensure that construction workers housed attend a briefing session before they commence activities. The aim of the briefing session is to inform them of the rules and regulations governing activities on the site as set out in the Code of Conduct.	Just Palm Tree Power and contractors	Code of Conduct drafted before construction phase commences.
Code of Conduct must be drafted before commencement of construction phase. Ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct.	Just Palm Tree Power and contractors	Prior to commencement of work on site
Ensure that construction workers who are found guilty of breaching the Code of Conduct are disciplined. Any dismissals must be in accordance with South African labour legislation.	Contractors	Duration of construction
Provide opportunities for workers to go home over weekends. The cost of transporting workers home over weekends and back to the site should be borne by the contractors.	Contractors	Duration of construction
On completion of the construction phase all construction workers must be transported back to their place of origin within two days of their contract ending. The costs of transportation must be borne by the contractor.	Contractors	Post-construction.

Performance Indicator	» Employment policy and tender documents that sets out local employment and targets completed before construction phase commences. » Target of 80% of semi and unskilled labour locally sourced set and met as far as possible. » MF set up prior to implementation of construction phase. » Code of Conduct drafted before commencement of construction phase. » Briefing session with construction workers held at outset of construction phase.
Monitoring and Reporting	» Just Palm Tree Power and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: To avoid and or minimise the potential impacts of safety, noise and dust and damage to roads caused by construction vehicles during the construction phase.

During the construction phase, limited gaseous or particulate emissions are anticipated from exhaust emissions from construction vehicles and equipment on-site, as well as vehicle entrained dust from the movement of vehicles on the internal access roads.

Project component/s	Project components affecting the objective: » wind turbines » access roads » switching yard » power line
Potential Impact	» Heavy vehicles can generate noise and dust impacts. Movement of heavy vehicles can also damage roads.
Activities/risk sources	» The movement of heavy vehicles and their activities on the site can result in noise and dust impacts and damage roads.
Mitigation: Target/Objective	» To avoid and or minimise the potential noise and dust impacts associated with heavy vehicles, and minimise damage to roads.

Mitigation: Action/control	Responsibility	Timeframe
Implement appropriate dust suppression measures for heavy vehicles on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.	Contractors	Duration of construction
Ensure that all vehicles are road-worthy, drivers are qualified and are made aware of the potential noise, dust and safety issues.	Contractors	Duration of construction phase
Ensure that drivers adhere to speed limits. Ensure that drivers are made aware of the potential safety issues and enforcement of strict speed limits when they are employed.	Contractors	Duration of construction
Ensure that any damage to roads which can be attributed to the construction activities associated with the wind energy facility is repaired before completion of construction phase.	Contractors	Duration of construction

Performance Indicator	» Dust suppression measures implemented for all heavy vehicles that require such measures during the construction phase. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a regular basis.
Monitoring and Reporting	» Just Palm Tree Power and appointed ECO must monitor indicators listed above to ensure that they have been met for

	the construction phase. » Complaints register » Incident Reporting

OBJECTIVE: Erosion control and mitigation

The natural soil on the site needs to be preserved as far as possible to minimise impacts on the environment. Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern in areas underlain by fine grained soil which can be mobilised when disturbed, even on relatively low slope gradients (accelerated erosion). Uncontrolled run-off relating to construction activity (excessive wetting, etc.) will also lead to accelerated erosion. Degradation of the natural soil profile due to excavation, stockpiling, compaction, pollution and other construction activities will affect soil forming processes and associated ecosystems.

A set of strictly adhered to mitigation measures are required to be implemented in order to effectively limit the impact on the environment. The disturbance areas where human impact is likely are the focus of the mitigation measures laid out below.

Project component/s	Project components affecting the objective: » wind turbines » access roads » switching yard » power line » Soil stabilisation, and erosion mitigation structures » All other infrastructure
Potential Impact	» Erosion and sediment generation » Soil loss
Activities/risk sources	» Poor planning of rainfall surface runoff and storm water management » Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Concentrated discharge of water from construction activity » Stormwater run-off from sealed surfaces » Mobile construction equipment movement on site » Power line construction activities » Project related infrastructure, such as buildings, turbines and fences
Mitigation: Target/Objective	» Prevention of eroded materials running off the site » To minimise damage to rock, soil and vegetation by construction activity » No accelerated overland flow related surface erosion as a result of a loss of vegetation cover » Minimal loss of vegetation cover due to construction related activities

Mitigation: Action/control	Responsibility	Timeframe
Plan and implement adequate erosion control measures: Implement run-off attenuation on slopes (sand bags, logs), silt fences, stormwater catch-pits, shade nets or temporary mulching over denuded areas.	Construction team and engineer	Erection: Before construction Maintenance: Duration of contract
Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. Limit the height of stockpiles as far as possible to reduce compaction.	Contractor	During site establishment and any activity related to earthworks as well as the duration of construction
New access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement and compaction of soil.	Engineer / ECO / Contractor	Before and during construction
Identify and demarcate construction areas for general construction work and restrict construction activity to these areas.	Contractor	Construction
Rehabilitate disturbance areas as soon as construction in an area is completed.	Contractor	During and after construction
Stockpiles not used in three (3) months after stripping must be seeded or appropriately covered to prevent dust and erosion - only if natural seeding does not occur.	Contractor	During and after construction
Control depth of all excavations and stability of cut faces/sidewalls.	Engineer / ECO / Contractor	Maintenance over duration of contract
Compile a comprehensive stormwater management plan as part of the final design of the project and implement during construction and operation.	Construction team, management, environmental control officer	Compile during design; implement during construction & operation

Performance Indicator	» Assessment of storm water structures and erosion mitigation measures. » Acceptable level of activity within disturbance areas, as determined by ECO » Acceptable level of soil erosion around site, as determined by ECO » Acceptable level of soil degradation, as determined by ECO » Acceptable state of excavations, as determined by ER & ECO
Monitoring and	» Continual inspections of the site by ECO

Reporting	» Reporting of ineffective sediment control systems and rectification as soon as possible.

OBJECTIVE: Protection of indigenous vegetation and control of alien invasive plants

Impacts on vegetation at the construction stage are expected to be mainly as a result of direct permanent loss of vegetation in development footprint areas. Due to removal of vegetation and disturbance of soil, there is a higher risk of alien species establishing on site. Therefore, control of alien invasive plants is required.

Project component/s	List of project components affecting the objective: » wind turbines and associated laydown areas » access roads and cabling » switching station » workshop area » temporary lay down areas » power line and associated access road
Potential Impact	» Loss of indigenous vegetation » Proliferation of alien plants
Activity/risk source	» Site preparation and earthworks » Construction-related traffic » Foundations » Mobile construction equipment » Power line construction activities » Dumping or damage by construction equipment outside of demarcated construction areas
Mitigation: Target/Objective	» To retain natural vegetation in the sensitive areas of the site » To minimise footprints of disturbance of vegetation/habitats on-site » No alien plants within project control area » No loss of species of conservation concern

Mitigation: Action/control	Responsibility	Timeframe
Internal access roads and underground cables should be aligned as far as possible along existing linear disturbances, e.g. roads on site. Where new roads are to be constructed, these should follow existing tracks or disturbed areas or the edges of disturbed areas.	Construction team, management (ECO)	Construction / design
Identify and demarcate areas within which activities are to be undertaken. Ensure that activities are restricted to these areas to ensure unnecessary impacts on surrounding natural vegetation are avoided.	Construction team, management (ECO)	Construction
A site rehabilitation programme should be compiled at the outset of the project, and implemented as soon as	Contractor in consultation with	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
construction is completed in an area.	Specialist	
Avoid creating conditions in which alien plants may become established: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible once construction is complete in an area » Do not import soil from areas with alien plants	Construction team, management (environmental officer)	Construction & Operation
Establish an on-going monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act, Act 43 of 1983 and NEM: Biodiversity)	Construction team, management (environmental officer)	Construction & Operation
Immediately control any alien plants that become established using registered control methods.	Construction team, management (environmental officer)	Construction & Operation

Performance Indicator	» Minimum disturbance outside of designated work areas. » No unnecessary clearing of existing/natural vegetation. » No loss of natural vegetation within sensitive areas. Loss of other natural vegetation only within designated footprint of infrastructure. » No significant fragmentation of areas of natural vegetation. » No uncontrolled alien infestation within project control area.
Monitoring and Reporting	» Observation of vegetation clearing activities and earthworks by ECO throughout construction phase. » Monitoring of alien plant establishment within the project control area on an on-going basis. » An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE: Limit disturbance to terrestrial fauna & avifauna and associated habitats

Infrastructure associated with the facility often impacts on habitats for birds and animals. Furthermore, the construction and maintenance of the power line linking the facility to the electricity grid will result in some disturbance and habitat destruction. New roads constructed will also have a disturbance and habitat destruction impact.

Project component/s	List of project components affecting the objective: » wind turbines and associated laydown areas

	» access roads and cabling » switching yard » workshop area » temporary laydown areas » power line and associated access road
Potential Impact	» Vegetation clearance and associated impacts on faunal habitats » Disturbance of birds and terrestrial fauna
Activity/risk source	» Site preparation and earthworks » Construction-related traffic » Foundations or plant equipment installation » Mobile construction equipment » Power line construction activities
Mitigation: Target/Objective	» To minimise footprints of habitat destruction » To minimise disturbance to resident and visitor faunal and avifaunal species

Mitigation: Action/control	Responsibility	Timeframe
Cover the lattice towers of the turbines with netting or other material to prevent larger species from roosting, perching and nesting on them.	Just Palm Tree Power	During construction
Paint the white blades with UV stripes (invisible to the human eye) to make them more visible to birds, both day and night.	Just Palm Tree Power	Pre-construction
Bird flappers to be put on all 11 kV lines newly erected around the wind energy facility	Just Palm Tree Power	Construction
Clearly mark areas to be cleared in order to eliminate unnecessary clearing/disturbance.	Contractor in consultation with Specialist	Pre-construction
The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on fauna and their habitats is restricted.	Contractor	Site establishment & duration of contract
A site rehabilitation programme should be compiled and implemented.	Contractor in consultation with Specialist	Duration of contract

Performance Indicator	» Limited impacts on avifauna species » Limited impacts on faunal species (i.e. noted/recorded fatalities) » Limited disturbance outside of designated work areas » No unnecessary clearing of existing/natural vegetation and habitats for fauna and avifauna
Monitoring and Reporting	» Observation and recordings of Bird fatalities during construction » Observation of vegetation clearing activities and earthworks by ECO throughout construction phase » An incident reporting system must be used to record non-conformances to the EMP.

	» Public complaints register must be developed and maintained on site.

OBJECTIVE: To observe and rescue fossil material that may be exposed in the various excavations made for installation foundations and cabling

The potential for finding important fossils on the development site, although low, is not altogether lacking. Interventions are particularly required if bones are turned up during excavation. These are rare and valuable and every effort should be made to spot them and affect rescue of them.

Project component/s	List of project components affecting the objective: » Foundation excavations for wind turbines. » Foundation excavations for substations. » Trenches for cabling linking turbines and substations. » Spoil from excavations.
Potential Impact	» Loss of fossils by their being unnoticed and/ or destroyed.
Activity/risk source	» All bulk earthworks.
Mitigation: Target/Objective	» To facilitate the likelihood of noticing fossils and ensure appropriate actions in terms of the relevant legislation.

Mitigation: Action/control	Responsibility	Timeframe
Inform staff of the need to watch for potential fossil occurrences.	Just Palm Tree Power, ECO, contractors.	Pre-construction.
Inform staff of the procedures to be followed in the event of fossil occurrences.	ECO/specialist.	Pre-construction.
Monitor for presence of fossils	Contracted personnel and ECO.	Construction.
Liaise on nature of potential finds and appropriate responses with SAHRA.	ECO and specialist.	Construction.
Retrieve main finds and record contexts.	Specialist.	Construction.
Obtain permit from SAHRA for finds.	Specialist.	Construction
In the event of possible fossil and/or archaeological finds, the contracted archaeologist or palaeontologist must be contacted. Appendices A and B outline monitoring by construction personnel and general Fossil Find Procedures. This is a general guideline, to be adapted to	Just Palm Tree Power, ECO, contractors.	Duration of construction

Mitigation: Action/control	Responsibility	Timeframe
circumstances		

Performance Indicator	» Reporting of and liaison about possible fossil finds with SAHRA. » Fossils observed and rescued.
Monitoring and Reporting	» Observation of excavation activities by ECO throughout construction phase. » Supervision of all clearing and earthworks. » An incident reporting system will be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site

OBJECTIVE: Minimisation of visual impacts associated with construction

During construction heavy vehicles, components, cranes, equipment and construction crews will frequent the area and may cause, at the very least, a visual nuisance to landowners and residents in the area as well as road users.

Project component/s	List of project components affecting the objective: » Construction site » access roads
Potential Impact	» The potential scarring of the landscape due to the creation of new access roads/tracks or the unnecessary removal of vegetation. » Construction traffic.
Activity/risk source	» The viewing of visual scarring by observers in the vicinity of the facility or from the roads traversing the site.
Mitigation: Target/Objective	» Minimal disturbance to vegetation cover in close vicinity to the proposed facility and its related infrastructure. » Minimised construction traffic, where possible.

Mitigation: Action/control	Responsibility	Timeframe
The general appearance of construction activities, construction equipment camps and lay-down areas must be maintained and kept neat and tidy by means of the timely removal of rubble and disused construction materials.	Contractor	Construction
The turbines must be painted a pale, matt, non-reflective colour (i.e. off white, as specified by CAA) before erection of the turbines.	Contractor	Erection of turbines
Limit access to the construction sites (during both construction and operational phases) to along existing access roads as far as possible.	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
Ensure all disturbed areas are appropriately rehabilitated once construction in an area is complete.	Contractor	Duration of construction

Performance Indicator	» Construction site maintained in a neat and tidy condition. » Vegetation cover that remains intact with no erosion scarring in close proximity of the facility. » Site appropriately rehabilitated after construction is complete.
Monitoring	» Monitoring of vegetation clearing by the ECO during the construction phase. » Monitoring of rehabilitation activities by the ECO to ensure appropriate rehabilitation of the site. » An incident reporting system will be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE: Appropriate handling and storage of chemicals, hazardous substances and waste

The construction phase of the wind energy facility will involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents. The main wastes expected to be generated by the construction of the facility will include general solid waste, hazardous waste and liquid waste.

Project component/s	List of project components affecting the objective: » wind turbines » switching yard » power line » concrete batching plant
Potential Impact	» Release of contaminated water from contact with spilled chemicals » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
Activity/risk source	» Vehicles associated with site preparation and earthworks » Power line construction activities » Switching yard construction activities » Packaging and other construction wastes » Hydrocarbon use and storage » Spoil material from excavation, earthworks and site preparation
Mitigation: Target/Objective	» To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons » To ensure that the storage and maintenance of machinery on-site

	does not cause pollution of the environment or harm to persons » To comply with waste management legislation » To minimise production of waste » To ensure appropriate waste storage and disposal » To avoid environmental harm from waste disposal

Mitigation: Action / control	Responsibility	Timeframe
The storage of flammable and combustible liquids such as oils must be in designated areas which are appropriately bunded, and stored in compliance with MSDS files, as defined by the ECO.	Contractor	Duration of contract
Any spills will receive the necessary clean-up action. Bioremediation kits are to be kept on-site and used to remediate any spills that may occur. Appropriate arrangements to be made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils (in accordance with a waste management plan).	Contractor	Duration of contract
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be complied with.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles is not to take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be used to contain any fuel or oils.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	Contractor	Duration of contract
Waste disposal records must be available for review at any time.	Contractor	Duration of contract
Construction contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	Duration of contract
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap) and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control.	Contractor	Duration of contract
Where possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation and	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
storage of waste streams (such as wood, metals, general refuse etc.).		
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors and licensed waste disposal sites. Waste will be disposed off with the mine's waste.	Contractor	Duration of contract
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract
Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Duration of contract
Documentation (waste manifest) must be maintained detailing the quantity, nature and fate of any hazardous waste.	Contractor	Duration of contract
An incident/complaints register must be established and maintained on-site.	Contractor	Duration of contract
Hazardous and non-hazardous waste must be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered.	Contractors	Erection: during site establishment Maintenance: for duration of Contract within a particular area
All solid waste collected must be disposed of at a registered waste disposal site. A certificate of disposal must be obtained and kept on file. The disposal of waste must be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site.	Contractors	Erection: during site establishment Maintenance: for duration of Contract within a particular area
Supply waste collection bins at construction equipment and construction crew camps.	Contractors	Erection: during site establishment Maintenance: for duration of Contract within a particular area
Construction equipment must be refuelled within designated refuelling locations, or where remote refuelling is required, appropriate drip trays must be utilised.	Contractor	Duration of contract
All stored fuels to be maintained within a bund and on a	Contractor	Duration of

Mitigation: Action/control	Responsibility	Timeframe
sealed surface.		contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function.	Contractor	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
Oily water from bunds at the substation must be removed from site by licensed contractors.	Contractor	Duration of contract
Spilled cement and concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures.	Contractor	Duration of contract
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents. Spill kits to be kept on-site	Contractor	Duration of contract
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of contract
Upon the completion of construction, the area will be cleared of potentially polluting materials.	Contractor	Completion of construction

Performance Indicator	» No chemical spills outside of designated storage areas » No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately » Provision of all appropriate waste manifests for all waste streams
Monitoring and Reporting	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase. » A complaints register must be maintained, in which any complaints from the community will be logged. Complaints must be investigated and, if appropriate, acted upon. » Observation and supervision of waste management practices throughout construction phase. » Waste collection to be monitored on a regular basis. » Waste documentation completed. » An incident reporting system must be used to record non-conformances to the EMP. » Just Palm Tree Power and appointed ECO must monitor indicators

	listed above to ensure that they have been met for the construction phase

OBJECTIVE: Ensure disciplined conduct of on-site contractors and workers

In order to minimise impacts on the surrounding environment, Contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the Environmental Authorisation (once issued), the EIA Report and this EMP, as well as the requirements of all relevant environmental legislation.

Project component/s	List of project components affecting the objective: » Wind energy facility and associated infrastructure
Potential Impact	» Pollution/contamination of the environment » Disturbance to the environment and surrounding communities
Activity/risk source	» Contractors are not aware of the requirements of the EMP, leading to unnecessary impacts on the surrounding environment
Mitigation: Target/Objective	» To ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment

Mitigation: Action/control	Responsibility	Timeframe
This EMP and the Environmental Authorisation must be included in all tender documentation and Contractors contracts.	Just Palm Tree Power	Tender process
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site (1 chemical toilet for every 15 workers). No abluting must be permitted outside the designated area. These facilities must be regularly serviced by appropriate contractors. Ablution facilities must not be placed within 50m from any river, wetland or drainage line.	Contractor (and sub-contractor/s)	Duration of contract
Cooking must take place in a designated area. No firewood or kindling may be gathered from the site or surrounds.	Contractor (and sub-contractor/s)	Duration of contract
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.	Contractor (and sub-contractor/s)	Duration of contract
No one other than the ECO or personnel authorised by the ECO, will disturb flora or fauna outside of the	Contractor (and sub-contractor/s)	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
demarcated construction area/s.		

Performance Indicator	» Compliance with specified conditions of Environmental Authorisation, EIA report and EMP » No complaints regarding contractor behaviour or habits » Code of Conduct drafted before commencement of construction phase & briefing session with construction workers held at outset of construction phase
Monitoring and Reporting	» Observation and supervision of Contractor practices throughout construction phase. » A complaints register must be maintained, in which any complaints from the community are to be logged. Complaints must be investigated and, if appropriate, acted upon » An incident reporting system must be used to record non-conformances to the EMP

OBJECTIVE: To avoid and or minimise the potential risk of increased veld fires during the construction phase.

Veld fires are unlikely in this area, but should it pose a threat, the following should be taken into consideration.

Project component/s	List of project components affecting the objective: » Wind energy facility and associated infrastructure
Potential Impact	» Fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences.
Activity/risk source	» Contractors are not aware of the requirements of the EMP, leading to unnecessary impacts on the surrounding environment
Mitigation: Target/Objective	» To ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment

Mitigation: Action/control	Responsibility	Timeframe
Ensure that open fires on the site for cooking or heating are not allowed except in designated areas.	Contractor	Construction
Provide adequate fire fighting equipment onsite.	Contractor	Construction
Provide fire-fighting training to selected construction staff.	Contractor	Construction
Compensate affected landowners at full market related replacement cost for any losses, damage to infrastructure etc.	Contractor	Construction

Performance Indicator	» Designated areas for fires identified on site at the outset of the construction phase. » Fire fighting equipment and training provided before the construction phase commences. » Compensation claims settled after claim verified by Community MF.
Monitoring	» A complaints register must be maintained, in which any complaints from the community are to be logged. Complaints must be investigated and, if appropriate, acted upon » An incident reporting system must be used to record non-conformances to the EMP

5.3. Detailing Method Statements

OBJECTIVE: Ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMP will be met. That is, the Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Site Manager and ECO.

A Method Statement is defined as "a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications". The Method Statement must cover applicable details with regard to:

» Construction procedures
» Materials and equipment to be used
» Getting the equipment to and from site
» How the equipment/material will be moved while on-site
» How and where material will be stored
» The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur
» Timing and location of activities
» Compliance/non-compliance with the Specifications, and
» Any other information deemed necessary by the Site Manager.

The Contractor may not commence the activity covered by the Method Statement until it has been approved, except in the case of emergency activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract.

5.4. Awareness and Competence: Construction Phase of the Wind Energy Facility

OBJECTIVE: To ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractors obligations in this regard include the following:

» Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
» Ensuring that a copy of the EMP is readily available on-site, and that all site staff are aware of the location and have access to the document.
» Employees will be familiar with the requirements of the EMP and the environmental specifications as they apply to the construction of the facility.
» Employees must undergo training for the operation and maintenance activities associated with a wind energy facility and have a basic knowledge of the potential environmental impacts that could occur and how they can be minimised and mitigated.
» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course.
» The course should be sufficient to provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
» Awareness of any other environmental matters, which are deemed to be necessary by the ECO.
» Ensuring that employee information posters, outlining the environmental “do’s” and “don’ts” (as per the environmental awareness training course) are erected at prominent locations throughout the site.
» Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances,

minimisation of disturbance to sensitive areas, management of waste, and prevention of water pollution.
» Records must be kept of those that have completed the relevant training.
» Training should be done either in a written or verbal format but must be in an appropriate format for the receiving audience.
» Refresher sessions must be held to ensure the contractor staff are aware of their environmental obligations as practically possible.

5.5. Monitoring Programme: Construction Phase of the Wind Energy Facility

OBJECTIVE: To monitor the performance of the control strategies employed against environmental objectives and standards

An environmental monitoring programme should be developed and implemented not only to ensure conformance with the EMP, but also to monitor any environmental issues and impacts which have not been accounted for in the EMP that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of environmental monitoring will most likely be stipulated by the Environmental Authorisation. Bird monitoring should take place in line with any guidelines or endorsed standards in South Africa, at the time of implementing the wind energy facility. Where this is not clearly dictated, Just Palm Tree Power will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

» Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications
» Ensure adequate and appropriate interventions to address non-compliance
» Ensure adequate and appropriate interventions to address environmental degradation
» Provide a mechanism for the lodging and resolution of public complaints
» Ensure appropriate and adequate record keeping related to environmental compliance
» Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site
» Aid communication and feedback to authorities and stakeholders.

The Environmental Control Officer (ECO) will ensure compliance with the EMP during construction, and will conduct monitoring activities on a regular basis. An independent ECO must be appointed, and have the appropriate experience and qualifications to

undertake the necessary tasks. The ECO will report any non-compliance or where corrective action is necessary to the Site Manager, DEA and/or any other monitoring body stipulated by the regulating authorities.

MANAGEMENT PLAN FOR THE WIND ENERGY FACILITY: REHABILITATION OF DISTURBED AREAS

CHAPTER 6

6.1. Overall Goal for the Rehabilitation of Disturbed Areas

Overall Goal for the Rehabilitation of Disturbed Areas: Undertake the rehabilitation measures in a way that:

» Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed

In order to meet this goal, the following objective, actions and monitoring requirements are relevant:

OBJECTIVE: To ensure appropriate rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed

Areas requiring rehabilitation as a result of construction of the wind energy facility and associated infrastructure will include all areas disturbed during the construction phase and that are not required for regular maintenance operations. It must be noted that rehabilitation will be required to be undertaken to pre-construction condition, which may not necessarily be a natural state.

Project component/s	» Access roads not required for operation and maintenance » power line servitude and service road for power line servitude » switching yard » concrete batching plant (if required) » temporary laydown areas
Potential Impact	» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention
Activity/risk source	» Temporary laydown areas » Temporary access roads/tracks » Other disturbed areas/footprints
Mitigation: Target/Objective	» To ensure and encourage site rehabilitation of disturbed areas » To ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed

Mitigation: Action/control	Responsibility	Timeframe
All temporary facilities, equipment and waste materials must be removed from site as soon as practically possible after construction is complete.	Contractor	Following execution of the works
All temporary fencing and danger tape must be removed once the construction phase has been completed.	Contractor	Following completion of construction activities in an area
Anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following completion of construction activities in an area
Disturbed natural areas must be stabilised and rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-use of native/indigenous plant species removed from disturbance areas in the rehabilitation phase.	Contractor in consultation with rehabilitation specialist	Following completion of construction activities in an area
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Just Palm Tree Power in consultation with rehabilitation specialist	Post-rehabilitation
Exposed areas to be utilised during maintenance activities must be stabilised to minimise erosion potential.	Just Palm Tree Power in consultation with rehabilitation specialist	Post-rehabilitation
Ongoing alien plant monitoring and removal must be undertaken on all areas of natural vegetation on an annual basis.	Just Palm Tree Power in consultation with rehabilitation specialist	Post-rehabilitation

Performance Indicator	» All portions of site, including construction equipment camp and working areas, cleared of equipment and temporary facilities » Topsoil replaced on all areas and stabilised » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites » Completed site free of erosion and alien invasive plants
Monitoring	» On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented (to be conducted quarterly for a period of at least two years). » On-going alien plant monitoring and removal should be undertaken on an annual basis for the life span of the facility.

MANAGEMENT PLAN FOR THE WIND ENERGY FACILITY: OPERATION CHAPTER 7

An environmental manager should be appointed during operation whose duty it will be to minimise impacts on surrounding sensitive habitat. In addition, it is important to monitor the incidence of bird and bat collisions with the wind turbines. Should any significant impacts of the facility on priority bird populations be detected by the monitoring programme, mitigation could be required to be investigated for those selected problem turbines.

7.1. Overall Goal for Operation

Overall Goal for Operation: To ensure that the operation of the wind energy facility does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the wind energy facility in a way that ensures that operational activities are properly managed in respect of environmental aspects and impacts and enables the wind energy facility operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to noise impacts, farming practices, traffic and road use, and effects on local residents as well as minimising impacts on birds and other fauna using the site.

7.2. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE: Securing the site

Safety issues may arise with public access to wind turbines or to the wind farm switching yard. Prevention and control measures to manage public access are therefore important. The site is however within the De Beers Mining area, and access to the general public is prohibited. This impact is therefore unlikely to occur. Appropriate measures are still required to ensure no access to the facility by mine workers.

Project component/s	Project components affecting the objective: » wind turbines » access roads » switching yard » power line

Potential Impact	» Hazards to public and mine workers
Activities/risk sources	» Uncontrolled access to the wind energy facility and associated infrastructure.
Mitigation: Target/Objective	» To secure the site against unauthorised entry » To protect members of the public/mine workers

Mitigation: Action/control	**Responsibility**	**Timeframe**
In order to control access, fence and secure access to the site and entrances to the site.	Just Palm Tree Power	Operation
Post information boards about public safety hazards and emergency contact information.	Just Palm Tree Power	Operation

Performance Indicator	» Site is secure and there is no unauthorised entry » No members of the public/ mine workers injured
Monitoring and Reporting	» Regular visual inspection of fence for signs of deterioration/forced access » An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE: Protection of indigenous natural vegetation, fauna and maintenance of rehabilitation

Indirect impacts on remaining natural vegetation in the study area and terrestrial fauna during operation could result from maintenance activities and the movement of people and vehicles on site. In order to ensure the long-term environmental integrity of the site following construction, maintenance of the areas rehabilitated post-construction must be undertaken until these areas have been successfully rehabilitated to pre-construction conditions.

Project component/s	» Areas requiring regular maintenance. » Route of the security team. » Areas disturbed during the construction phase and subsequently rehabilitated at its completion
Potential Impact	» Disturbance to or loss of vegetation and/or habitat. » Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention.
Activity/Risk Source	» Movement of employee vehicles within and around site.
Mitigation:	» Maintain minimised footprints of disturbance of vegetation/habitats

Target/Objective	on-site. » Ensure and encourage plant regrowth in non-operational areas of post-construction rehabilitation.

Mitigation: Action/Control	Responsibility	Timeframe
Vehicle movements must be restricted to designated roadways.	Just Palm Tree Power	Operation
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	Just Palm Tree Power	Operation
An on-going alien plant monitoring and eradication programme must be implemented, where necessary.	Just Palm Tree Power	Operation
A botanist familiar with the vegetation of the area should monitor the rehabilitation success and alien plant removal on an annual basis.	Just Palm Tree Power /Specialist	Annual monitoring until successful re-establishment of vegetation in an area

Performance Indicator	» No further disturbance to remaining natural vegetation or terrestrial faunal habitats. » Continued improvement of rehabilitation efforts.
Monitoring	» Regular inspections by environmental manager to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas.

OBJECTIVE: Monitor impacts on bats due to turbine blade collisions

Bats have been found to be particularly vulnerable to being killed by wind turbines. It has long been a mystery why they should be so badly affected since bat echo-location allows them to detect moving objects very well. A recent study in America has found that the primary cause for mortality is a combination of direct strikes and barotrauma (bats are killed when suddenly passing through a low air pressure region surrounding the turbine blade tips causing low pressure damage to the bat's lungs, Baerwald *et al*. 2008). The relative importance of this impact on bat populations depends on which species are likely to be affected, the importance of the site for those species and whether the site is within a migration corridor for particular bat species.

There are four bat species of potential conservation concern that could occur site or in the surrounding areas, Angolan Wing-gland Bat, Natal Long-fingered Bat, Cape Horseshoe Bat and Geoffroy's Horseshoe Bat. The Angolan Wing-gland Bat is listed as Vulnerable in South Africa (Friedmann & Daly 2004, Monadjem et al. 2010) and Near Threatened globally (www.iucn.org). The other three species are listed nationally as Near Threatened (Friedmann & Daly 2004, Monadjem et al. 2010) and globally as Least Concern (www.iucn.org).

Project component/s	» Wind Turbines
Potential Impact	» Loss of individuals of affected bat species
Activity/Risk Source	» Operation of the wind energy facility- rotating turbine blades
Mitigation: Target/Objective	» Low mortalities within project control area

Mitigation: Action/Control	Responsibility	Timeframe
A preconstruction survey for bats should be undertaken to determine whether bat species of concern occur on site or not and whether roosting habitats or known important maternity roosts occur within close proximity to the site.	Environmental Control Officer	Operation
If this preconstruction survey finds that the presence of bats or roosting habitats of concern occur, then a monitoring programme should be implemented to document the effect of wind turbines on bat species of concern.	Environmental Control Officer	Operation
If the turbines are found to have a significant negative impact on bats then further measures will need to be implemented to control the impact, for example, halting operation during low wind conditions.	Environmental Control Officer	Operation

Performance Indicator	» Number of individuals killed by turbine blades within project area
Monitoring	» Record bat mortalities and, as far as possible, the circumstances surrounding collisions. Standard protocols should be used when undertaking such surveys.

OBJECTIVE: Protection of avifauna, priority bird species and bat species

During operation of the facility, the threat of collision of birds and bats with the turbine blades is the most concerning issue. However, the real extent of this threat is not currently well understood within the South African context due to the limited numbers of turbines in South Africa with which bird and bat interactions have been monitored. Lighting of turbines and other infrastructure has the potential to attract birds, thereby increasing the risk of collisions with turbines. Infrastructure associated with the facility often also impacts on birds. A bird monitoring programme should be implemented to document the effect on birds in line with any endorsed guidelines in place at the time of commissioning the wind energy facilityThe duration of this pre-construction monitoring should be confirmed in consultation with an appropriately qualified avifaunal specialist, and should take cognisance of the size of the proposed facility and the bird species expected to be present in the area.

A pre-construction survey for bats should be undertaken to determine whether bat species of concern occur on site or not and whether roosting habitats or known important maternity roosts occur within close proximity to the site. If this preconstruction survey finds that the presence of bats or roosting habitats of concern occur, then a monitoring programme must be implemented to document the effect on bats of the turbines. The detail of this monitoring programme must be informed by the outcomes of the preconstruction survey.

Project component/s	List of project components affecting the objective: » wind energy facility (turbines) » power line » switching yard
Potential Impact	» Disturbance to or loss of birds and bats as a result of collision with the turbine blades » Disturbance to or loss of birds and bats as a result of collision with turbines » Electrocution and collision with the power line
Activity/risk source	» Spinning turbine blades » Power line » Switching yard
Mitigation: Target/Objective	» More accurately determine the impact of the operating wind energy facility on priority bird species » Minimise impacts associated with the power line and switching yard

Mitigation: Action/control	Responsibility	Timeframe
A site monitoring programme must be implemented for surveying bird movements in relation to the wind energy facility and fully documenting all collision and electrocution casualties with the turbines and associated power line.	Just Palm Tree Power / environmental manager	Operation
Start post-construction bird and bat monitoring as	Monitoring agency	Once facility is

Mitigation: Action/control	Responsibility	Timeframe
soon as possible for turbines and the power line (for birds).		operational
Pre-construction survey for bats should be undertaken to determine whether bat species of concern occur on site or not and whether roosting habitats or known important maternity roosts occur within close proximity to the site. If this preconstruction survey finds that the presence of bats or roosting habitats of concern occur, then a monitoring programme must be implemented to document the effect on bats of the turbines. The detail of this monitoring programme must be informed by the outcomes of the preconstruction survey.	Specialist	Prior to commissioning of facility
Periodically collate and analyse post-construction monitoring data.	Advising scientist	Every 3 months of monitoring

Performance Indicator	» No additional disturbance to bird or bat populations on the wind energy facility site. » Continued improvement of bird and bat protection devices, if any required. » Regular provision of clearly worded, logical and objective information on the interface between the local avifauna and the operating wind energy facility. » Clear and logical recommendations on why, how and when to institute mitigation measures to reduce avian impacts of the development, from pre-construction to operational phase.
Monitoring and Reporting	» Observation of avifaunal populations and incidence of injuries/death from collisions from turbine blades » Environmental manager to monitor turbine field for bird and bat fatalities. » Review of report on the full year of post-construction monitoring

OBJECTIVE: Minimisation of visual impact – lighting

The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate to any significant extent within this landscape. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible

as the CAA's Marking of Obstacles expressly states, "Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact. The potential for mitigation is therefore low or non-existent.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low. Indications are that the facility may not be required to fit a light to each turbine, but rather place synchronous flashing lights on the turbines representing the outer perimeter of the facility. In this manner less warning lights can be utilised to delineate the facility as one large obstruction, thereby lessoning the potential visual impact. The regulations for the CAA's *Marking of Obstacles* should be strictly adhered too, as the failure of complying with these guidelines may result in the developer being required to fit additional light fixtures at closer intervals thereby aggravating the visual impact.

The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an on-going basis.

Project component/s	List of project components affecting the objective: » Wind energy facility (including access roads) » Power line » Switching yard
Potential Impact	» Risk to aircraft in terms of the potential for collision » Enhanced visual intrusion
Activity/risk source	» Switching yard and associated lighting » Wind turbines and other infrastructure
Mitigation: Target/Objective	» To minimise potential for visual impact » To ensure that the facility complies with Civil Aviation Authority requirements for turbine visibility to aircraft » Minimise contrast with surrounding environment and visibility of the turbines to humans » The containment of light emitted from the substation in order to eliminate the risk of additional night-time visual impacts

Mitigation: Action/control	Responsibility	Timeframe
Aviation warning lights must be mounted on turbine hub or such measures required by the Civil Aviation Authority. Indications are that the facility may not be required to fit a light to each turbine, but rather place synchronous	Just Palm Tree Power	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
flashing lights on the turbines representing the outer perimeter of the facility.		
Maintain the general appearance of the facility in an aesthetically pleasing way.	Just Palm Tree Power	Operation and maintenance
Ensure that proper planning is undertaken regarding the placement of lighting structures for the switching yard and that light fixtures only illuminate areas inside the substation sites.	Just Palm Tree Power	Operation and maintenance
Undertake regular maintenance of light fixtures.	Just Palm Tree Power	Operation and maintenance

Performance Indicator	» Appropriate visibility of infrastructure to aircraft » The effective containment of the light to the switching yard site.
Monitoring and Reporting	» Ensure that aviation warning lights or other measures are installed before construction is completed and are fully functional at all times. » The monitoring of the condition and functioning of the light fixtures during the operational phase of the project.

OBJECTIVE: Appropriate handling and management of hazardous substances and waste

The operation of the wind energy facility will involve the generation of limited waste products. The main wastes expected to be generated by the operation activities includes general solid waste and hazardous waste.

Project component/s	List of project components affecting the objective: » wind energy turbines » power line » switching yard
Potential Impact	» Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
Activity/risk source	» Generators and gearbox - turbines » Transformers and switchgear – switching yard » Fuel and oil storage
Mitigation: Target/Objective	» To comply with waste management legislation » To minimise production of waste » To ensure appropriate waste disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe

Mitigation: Action/control	Responsibility	Timeframe
Hazardous substances must be stored in sealed containers within a clearly demarcated designated area.	Just Palm Tree Power	Operation
Storage areas for hazardous substances must be appropriately sealed and bunded.	Just Palm Tree Power	Operation
All structures and/or components replaced during maintenance activities must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling.	Just Palm Tree Power	Operation
Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and bunded area. Should any accidental spillage take place, it must be cleaned up according to specified standards regarding bioremediation.	Just Palm Tree Power	Operation and maintenance
Waste handling, collection and disposal operations must be managed and controlled by a waste management contractor.	Just Palm Tree Power / waste management contractor	Operation
Used oils and chemicals: » Where these cannot be recycled, appropriate disposal must be arranged with a licensed facility in consultation with the administering authority. » Waste must be stored and handled according to the relevant legislation and regulations.	Just Palm Tree Power	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	Just Palm Tree Power	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	Just Palm Tree Power	Operation
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Just Palm Tree Power	Operation
No waste may be burned or buried on site.	Just Palm Tree Power	Operation

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping » Internal site audits identifying that waste segregation, recycling and reuse is occurring appropriately » Provision of all appropriate waste manifests » No untreated contamination of soil or water
Monitoring and Reporting	» Waste collection must be monitored on a regular basis· » Waste documentation must be completed and available for inspection on request

	» An incidents/complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the environmental manager. All appropriate waste disposal certificates must accompany the monthly reports.

OBJECTIVE: Maximise local employment and business opportunities during operation

Based on information provided by the Just Palm Tree Power approximately 10 permanent employment opportunities will be created during the operational phase of the project. The operational phase is expected to last about 20 years.

Project component/s	List of project components affecting the objective: » Wind energy facility » Day to day operational activities associated with the wind energy facility including maintenance etc.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activity/risk source	» The operational phase of the wind energy facility will create approximately 10 full time employment opportunities.
Mitigation: Target/Objective	» In the medium to long term employ as many locals as possible to fill the 10 full time employment opportunities.

Mitigation: Action/control	Responsibility	Timeframe
Just Palm Tree Power should commit to implementing a 5-year training and skills development and training programme.	Just Palm Tree Power	Development during construction phase
Identify local members of the community who are suitably qualified or who have the potential to be employed full time.	Just Palm Tree Power	During the construction phase.

Performance Indicator	» 5 year training and skills development programme developed and designed before construction phase completed. » Potential locals identified before construction phase completed.
Monitoring and Reporting	» Just Palm Tree Power must monitor indicators listed above to ensure that they have been met for the operational phase.

MANAGEMENT PLAN FOR THE WIND ENERGY FACILITY: CHAPTER 8 DECOMMISSIONING

The turbine infrastructure which will be utilised for the proposed wind energy facility is expected to have a lifespan of up to 20 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. Decommissioning activities would need to comply with the environmental legislation relevant at the time.

8.1. Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate required abnormal load equipment and lifting cranes, preparation of the site (e.g. lay down areas, construction platform) and the mobilisation of construction equipment.

8.2 Disassemble Turbines

A large crane will be brought on site. It will be used to disassemble the turbine and tower sections. These components will be reused, recycled or disposed of in accordance with regulatory requirements (NEMA / NEM:WA). All parts of the turbine would be considered reusable or recyclable except for the blades.

OBJECTIVE: To avoid and or minimise the potential social impacts associated with the decommissioning phase

Project component/s	» Decommissioning phase of the wind energy facility and associated infrastructure.
Potential Impact	» Decommissioning will result in job losses, which in turn can result in a number of social impacts, such as reduced quality of life, stress, depression, etc. » Decommissioning is also similar to the construction phase in that it will also create temporary employment opportunities.
Activity/risk source	» Decommissioning of the wind energy facility.
Mitigation: Target/Objective	» To avoid and or minimise the potential social & environmental impacts associated with decommissioning phase of the wind energy facility.

Mitigation: Action/control	Responsibility	Timeframe
Retrenchments should comply with South African Labour legislation of the day.	Just Palm Tree Power	At decommissioning.
Mitigation measures as detailed in the construction phase EMP regarding impacts on flora, fauna, habitats would be applicable to this phase – See Chapter 5 of this document	Just Palm Tree Power	At decommissioning.

Performance Indicator	» Compliance with South African Labour legislation at the relevant time. » Compliance with NEMA
Monitoring	Occurrences of dismissals in-line with South African Labour Legislation.

FINALISATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME CHAPTER 9

The EMP is a dynamic document, which must be updated when required. It is considered critical that this draft EMP be updated to include site-specific information and specifications following the final walk-through survey by specialists of the power line, and development site. This will ensure that the construction and operation activities are planned and implemented taking sensitive environmental features into account.

APPENDIX A:
PROPOSED MONITORING FOR FOSSILS

MONITORING FOR FOSSILS:

A regular monitoring presence over the period during which excavations are made, by either an archaeologist or palaeontologist, is generally not practical.

The field supervisor/foreman and workers involved in digging excavations must be encouraged and informed of the need to watch for potential fossil and buried archaeological material. Workers seeing potential objects are to report to the field supervisor who, in turn, will report to the ECO. The ECO will inform the archaeologist and/or palaeontologist contracted to be on standby in the case of fossil finds.

To this end, responsible persons must be designated. This will include hierarchically:

» The field supervisor/foreman, who is going to be most often in the field.

» The Environmental Control Officer (ECO) for the project.

» The Project Manager.

Should the monitoring of the excavations be a stipulation in the Archaeo-logical Impact Assessment, the contracted Monitoring Archaeologist (MA) can also monitor for the presence of fossils and make a field assessment of any material brought to attention. The MA is usually sufficiently informed to identify fossil material and this avoids additional monitoring by a palaeontologist. In shallow coastal excavations, the fossils encountered are usually in an archaeological context.

The MA then becomes the responsible field person and fulfils the role of liaison with the palaeontologist and coordinates with the developer and the Environmental Control Officer (ECO). If fossils are exposed in non-archaeological contexts, the palaeontologist should be summoned to document and sample/collect them.

APPENDIX B:
PROPOSED FOSSIL FIND PROCEDURES

FOSSIL FIND PROCEDURES:

In the context under consideration, it is improbable that fossil finds will require declarations of permanent “no go” zones. At most a temporary pause in activity at a limited locale may be required. The strategy is to rescue the material as quickly as possible.

The procedures suggested below are in general terms, to be adapted as befits a context. They are couched in terms of finds of fossil bones that usually occur sparsely, such as in the aeolian deposits. However, they may also serve as a guideline for other fossil material that may occur.

In contrast, fossil shell layers are usually fairly extensive and can be easily documented and sampled.

Bone finds can be classified as two types: isolated bone finds and bone cluster finds.

1. Isolated Bone Finds

In the process of digging the excavations, isolated bones may be spotted in the hole sides or bottom, or as they appear on the spoil heap. By this is meant bones that occur singly, in different parts of the excavation. If the number of distinct bones exceeds 6 pieces, the finds must be treated as a bone cluster (below).

1.1. Response by personnel in the event of isolated bone finds

» Action 1: An isolated bone exposed in an excavation or spoil heap must be retrieved before it is covered by further spoil from the excavation and set aside.
» Action 2: The site foreman and ECO must be informed.
» Action 3: The responsible field person (site foreman or ECO) must take custody of the fossil. The following information to be recorded:
  - Position (excavation position).
  - Depth of find in hole.
  - Digital image of hole showing vertical section (side).
  - Digital image of fossil.
» Action 4: The fossil should be placed in a bag (e.g. a Ziplock bag), along with any detached fragments. A label must be included with the date of the find, position info., depth.
» Action 5: ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap. by email.

1.2. Response by Palaeontologist in the event of isolated bone finds

The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established.

2. Bone Cluster Finds

A bone cluster is a major find of bones, i.e. several bones in close proximity or bones resembling part of a skeleton. These bones will likely be seen in broken sections of the sides of the hole and as bones appearing in the bottom of the hole and on the spoil heap.

2.1. Response by personnel in the event of a bone cluster find

» Action 1: Immediately stop excavation in the vicinity of the potential material. Mark (flag) the position and also spoil that may contain fossils.
» Action 2: Inform the site foreman and the ECO.
» Action 3: ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap. by email.

2.2. Response by Palaeontologist in the event of a bone cluster find

The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established. It is likely that a Field Assessment by the palaeontologist will be carried out asap.

It will probably be feasible to “leapfrog” the find and continue the excavation farther along, or proceed to the next excavation, so that the work schedule is minimally disrupted. The response time/scheduling of the Field Assessment is to be decided in consultation with developer/owner and the environmental consultant.

The field assessment could have the following outcomes:

» If a human burial, the appropriate authority is to be contacted (see AIA). The find must be evaluated by a human burial specialist to decide if Rescue Excavation is feasible, or if it is a Major Find.
» If the fossils are in an archaeological context, an archaeologist must be contacted to evaluate the site and decide if Rescue Excavation is feasible, or if it is a Major Find.
» If the fossils are in an palaeontological context, the palaeontologist must evaluate the site and decide if Rescue Excavation is feasible, or if it is a Major Find.

3. Rescue Excavation

Rescue Excavation refers to the removal of the material from the just the “design” excavation. This would apply if the amount or significance of the exposed material appears to be relatively circumscribed and it is feasible to remove it without compromising contextual data. The time span for Rescue Excavation should be reasonably rapid to avoid any or undue delays, e.g. 1-3 days and definitely less than 1 week.

In principle, the strategy during mitigation is to “rescue” the fossil material as quickly as possible. The strategy to be adopted depends on the nature of the occurrence, particularly the density of the fossils. The methods of collection would depend on the preservation or fragility of the fossils and whether in loose or in lithified sediment. These could include:

» On-site selection and sieving in the case of robust material in sand.
» Fragile material in loose/crumbly sediment would be encased in blocks using Plaster-of Paris or reinforced mortar.

If the fossil occurrence is dense and is assessed to be a “Major Find”, then carefully controlled excavation is required.

4 Major Finds

A Major Find is the occurrence of material that, by virtue of quantity, importance and time constraints, cannot be feasibly rescued without compromise of detailed material recovery and contextual observations. A Major Find is not expected.

4.1. Management Options for Major Finds

In consultation with developer/owner and the environmental consultant, the following options should be considered when deciding on how to proceed in the event of a Major Find.

» Option 1: Avoidance
  Avoidance of the major find through project redesign or relocation. This ensures minimal impact to the site and is the preferred option from a heritage resource management perspective. When feasible, it can also be the least expensive option from a construction perspective.

  The find site will require site protection measures, such as erecting fencing or barricades. Alternatively, the exposed finds can be stabilized and the site refilled or capped. The latter is preferred if excavation of the find will be delayed substantially

or indefinitely. Appropriate protection measures should be identified on a site-specific basis and in wider consultation with the heritage and scientific communities. This option is preferred as it will allow the later excavation of the finds with due scientific care and diligence.

» Option 2: Emergency Excavation
Emergency excavation refers to the “no option” situation wherein avoidance is not feasible due to design, financial and time constraints. It can delay construction and emergency excavation itself will take place under tight time constraints, with the potential for irrevocable compromise of scientific quality. It could involve the removal of a large, disturbed sample by excavator and conveying this by truck from the immediate site to a suitable place for “stockpiling”. This material could then be processed later.

Consequently, emergency excavation is not a preferred option for a Major Find.

5 Exposure Of Fossil Shell Beds

5.1. Response by personnel in the event of intersection of fossil shell beds

» Action 1: The site foreman and ECO must be informed.
» Action 2: The responsible field person (site foreman or ECO) must record the following information:
  o Position (excavation position).
  o Depth of find in hole.
  o Digital image of hole showing vertical section (side).
  o Digital images of the fossiliferous material.
» Action 3: A generous quantity of the excavated material containing the fossils should be stockpiled near the site, for later examination and sampling.
» Action 4: ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap..

5.2. Response by Palaeontologist in the event of fossil shell bed finds

The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established. This will most likely be a site visit to document and sample the exposure in detail, before it is covered up.

APPENDIX C:
AVIFAUNA PRE-CONSTRUCTION MONITORING PROGRAMME

Avifauna pre-construction monitoring programme will include:

(i) Regular surveys of large terrestrial species, raptors and other collision-prone species within the study area to determine the relative importance of local populations of priority taxa,

(ii) estimates of the magnitude and direction of movements of these species through the impact zone of the wind energy facility, in relation to nesting or roosting sites (e.g. cliff-lines, wetland pans, existing power lines) and foraging areas (high productivity coastlines and inland wetlands).

(iii) identification of the numbers of resident species present and possibly breeding in the area using line-transect methods

(iv) these protocols should be followed in a paired control area, with similar habitat, distance from the coast and land-use, to compare with the bird data from the WEF.

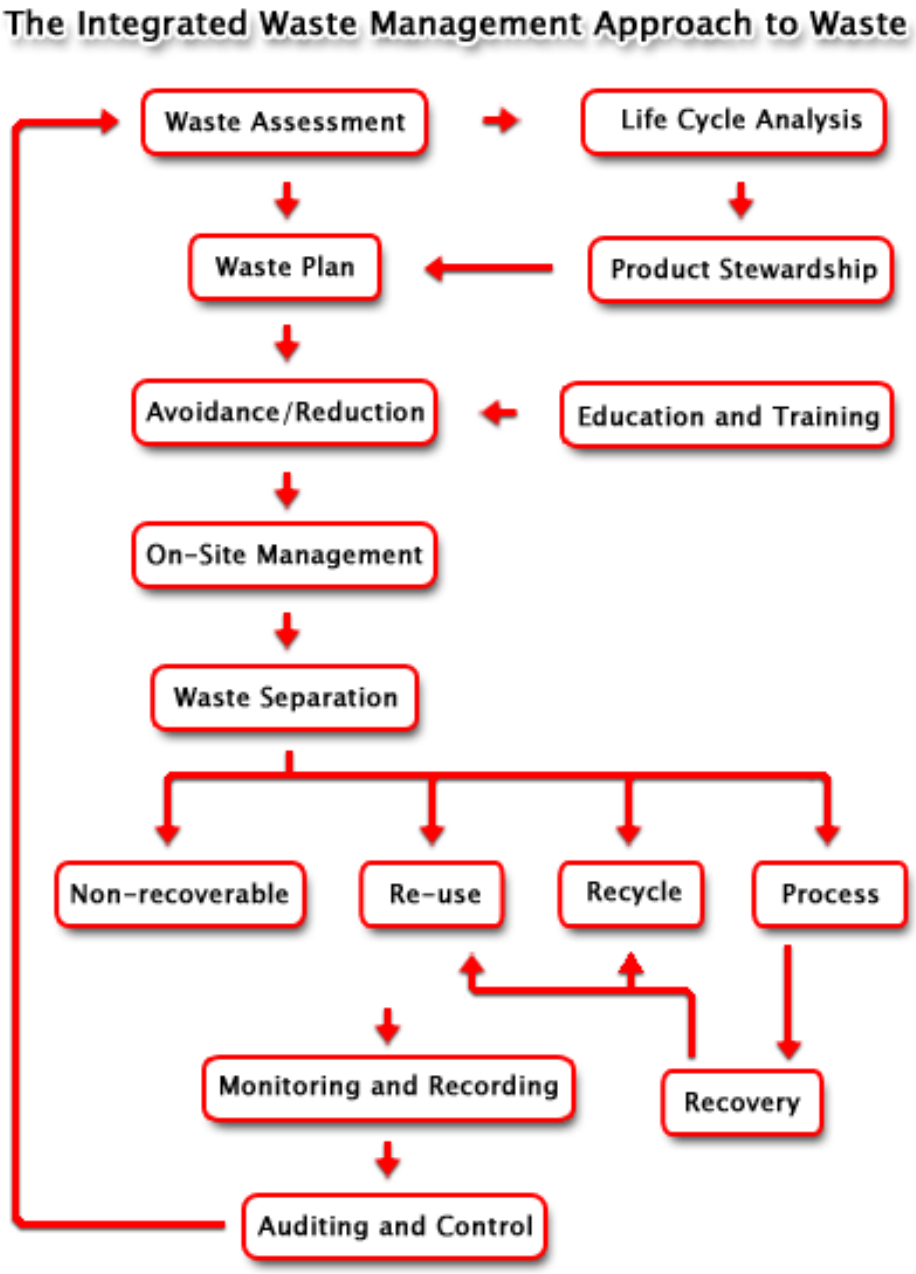
This is employed in the post-construction monitoring to determine if any changes in bird numbers or distribution is due to the wind farm or is a natural change outside the influence of the wind farm.

This phase should be followed up with a similar post-construction monitoring of 12 months following the protocol above. Both should be undertaken by trained observers and professional ornithologists. To reduce observer bias, the same observers should be used for both phases.

APPENDIX D:
GUIDELINE FOR INTEGRATED MANAGEMENT OF CONSTRUCTION WASTE

GUIDELINE FOR INTEGRATED MANAGEMENT OF CONSTRUCTION WASTE

Waste is broadly defined by the Department of Water Affairs in 1994 as: 'an undesirable or superfluous by-product, emission, residue or remainder of any process or activity'. An integrated approach to waste management on site is needed. Such an approach is illustrated in the figure below.



Source: http://www.enviroserv.co.za/pages/content.asp?SectionId=496

1. Waste Assessment

A detailed waste assessment is necessary to understand the waste types and volumes being produced. In order to achieve this, construction practices must be measured and analysed.

2. Waste Plan

A waste plan must be developed to provide appropriate solutions for managing the entire waste stream on site. The objective of the plan should be to reduce the volumes of waste to disposal and thereby to reduce the cost of management of the waste stream without compromising environmental standards. The plan should include recovery, re-use and recycle recommendations.

Construction Waste Management is the practice of reducing the actual waste that goes to the landfill site. Waste reduction is best met by recycling, and construction wastes offer several opportunities in this regard. In fact, 80% of the wastes found in construction waste piles are recyclable in some form or another. Wood, concrete, bricks, metals, glass and even paint offer several options for recycling.

There are three basic steps for construction waste management, i.e. Reduce, Reuse, and Recycle. **Reduce** is the prevention of the waste from arising and optimising material usage. Waste avoidance and waste reduction can be achieved through improved education and training - by improving efficiencies and by making staff environmentally aware.

Reuse is using existing materials instead of throwing these away. Reusing does not mean that it needs to be reused on the same construction site. Selling or donating waste materials to a third party is one option of construction waste management.

Recycle is somewhat limited since it only allows for those items that can be used on-site. The most important step for recycling of construction waste is on-site separation. Initially, this will take additional effort and training of construction personnel. Targets should be set for the levels of recycling. Once separation habits are established, on-site separation can be done at little or no additional cost.

3. What to Recycle

Before recycling construction waste, identify who will accept it. This is important in designating type of waste to separate, and in making arrangements for drop-off or delivery of materials. Materials that can be recycled include:

» Cardboard and Paper
» Wood

» Metals
» Plastics
» Glass
» Paints, Stains, Solvents and Sealants
» Oil

4. Materials Separation

Successful recycling requires good clean uniform collections of single waste types. This is most effectively achieved by separating the waste streams close to source rather than at the landfill site. Containers for material recycling must be set up on site and clearly labelled. Construction personnel must be trained in material sorting policy, and bins must be monitored periodically to prevent waste mixing as a result of construction employees throwing rubbish into the bins.

Some materials will require bins or storage that protect these from rain. Other bins may be locked to prevent tampering.

5. Recycling and Waste Minimisation Guidelines

» *Wood*
- Optimise building dimensions to correspond to standard wood dimensions in order to reduce the need for cutting.
- Store wood on level blocking under cover to minimize warping, twisting and waste.

» *Metals*
- During construction, separate metals for recycling, including copper piping, wire, aluminium, iron and steel, nails and fasteners, galvanized roofing. It is critical to keep lead out of landfills because it could leach into groundwater.

» *Cardboard and Paper*
- Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
- As far as possible, use recyclable packaging.
- Separate cardboard waste, bundle, and store in a dry place.
- Minimise the number of blueprints and reproductions necessary during the design and construction process.

» *Plastic*
- Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
- As far as possible, use recyclable packaging.

Since more than 60 different types of plastic resins exist, the Plastics Federation of South Africa has adopted a voluntary number coding system for each category of plastics to aid in their sorting by material type for recycling (Bruyns et al, 2002). The most common resin types are itemised in Table 1.

Table 1: Identification System for Plastic

Id Number	Plastic Resin Type
1	PET (polyethylene terephthalate)
2	HDPE (high-density polyethylene)
3	PVC (polyvinyl chloride) or V (vinyl)
4	LDPE (low-density polyethylene)
5	PP (polypropylene)
6	PS (polystyrene)
7	Other (laminates, etc.)

» *Paints, Stains, Solvents and Sealants*

- Unused materials should be taken to a hazardous waste collection facility.

6. On-site Management

Good supervision of the waste management programme on site is critical to success. Management of the entire on-site program is critical to ensure smooth operations.

7. Auditing and Control

The success of the waste plan is determined by measuring criteria such as waste volumes, cost recovery from recycling, cost of disposal. Recorded data can indicate the effect of training and education, or the need for education. It will provide trends and benchmarks for setting goals and standards. It will provide clear evidence of the success or otherwise of the plan. Finally, good record keeping and control, becomes a continuous waste assessment process, allowing the waste plan to be improved and adjusted as required.

8. Useful contacts:

http://www.transpaco.co.za/page5.htm
Transpaco, a manufacturing and distribution company operating extensively in the plastics and packaging industries, conducts plastic reclamation and recycling.

http://www.jclenterprises.co.za/
JCL Enterprises for plastic sales of quality recycled plastic materials as well as the recycling of plastic.

http://www.rosefoundation.org.za/
The Rose Foundation specialises in the collection and recycling of used motor (engine) oil.

Information Sources:

http://www.greenbuilder.com/sourcebook/ConstructionWaste.html#Guidelines
http://www.enviroserv.co.za/pages/Content.asp?SectionID=587
http://www.enviroserv.co.za/pages/content.asp?SectionId=496
Programme for the Implementation of the National Waste Management Strategy. DEAT, May 2000
Residential Construction Waste Management Demonstration and Evaluation. Prepared for U.S. Environmental Protection Agency by NAHB Research Center, May 2, 1995

APPENDIX E:
GUIDELINE FOR THE USE OF WIND NETS IN REHABILITATION

GUIDELINE FOR THE USE OF WIND NETS FOR REHABILITATION

Equipment:

Shade cloth: The standard shade cloth which is used is green with a thickness (i.e. the percentage light which is blocked) of 40%, with a 0,75 m width and sleeves for 'droppers' located every 2,5 m.

Droppers: These are fed into the sleeves of the shade cloth and secured in the ground in order to support the shade cloth. The dropper must be longer than the shade cloth is wide such that it can be secured into the ground. The standard length of the dropper is 1,2 m with a 10 mm thickness.

Hammers: Four-pound hammers are used to hammer the droppers into the ground. It is better to insert the droppers into the sleeves of the shade cloth before hammering them into the ground.

Methodology for use:

The following guidelines must be considered when erecting wind nets:

- It is important that the nets are erected perpendicular to the strongest general wind direction. The strongest general wind direction in the Namaqualand area is south (S) and south-south-west (SSW) in the summer, and warm berg winds from the opposite direction, the north-west (NW), in the winter. Nets must therefore be placed in a north-west (NW), south-east (SE) orientation in order to be perpendicular to the two mentioned wind directions.
- Before the nets are tensioned, it is recommended that the topsoil is tilled in order to create conditions which promote plant growth.
- For larger areas of flat grade, it is important that tilled furrows are established in the same direction as the wind nets are erected (i.e. SE to NW). Contours which are perpendicular to the direction in which the nets are erected result in the nets not reaching the ground over the till lines. The gaps between the nets and the till lines results in wind erosion making the plough lines deeper over time.
- It is very important that the nets are erected as soon as the topsoil is replaced and tilled in an area. Delays in erecting wind nets can result in the loss of valuable topsoil through wind erosion. In some instances, topsoil can be lost within a few days through wind erosion if not protected by wind nets. Extensive loss of topsoil will require that new topsoil will need to be sourced, laid and tilled.
- It is important that nets are erected the correct distance apart. If they are placed too far apart, then wind erosion is not combated at all, and soil will be lost from the rehabilitation area. From practical experience in the use of wind nets in the

Namaqualand area, it is recommended that the wind nets be placed a distance of 5 m apart.

» It is recommended that the wind nets are not fastened to the droppers, but that they are allowed to move freely up and down the poles. Fastening the net to the poles increases the wind pressure on the seams resulting in the nets tearing sooner. If the nets are loose, it can be tightened through sand build up, making it more effective.
» For the same reasons as stated above, it is recommended that no wire is used along the top of the nets. Practical experience with the use of wind nets in Namaqualand indicates that, rather than using wire at the top of the nets, a team of workers should be employed to dig the nets out when they have been buried in sand.
» Nets must also not be erected too tight, and must have some slack in order to reduce wear and tearing of the nets.
» The first few rows of wind nets in a rehabilitation area are exposed to the wind and are therefore more vulnerable to being blown away or torn. A practical solution has been shown to be the erection of one or two rows in the natural veld as the natural vegetation then acts as a buffer against the strong winds.
» The nets have the added advantage that they catch some of the mist resulting in the ground alongside the nets receiving more water, thereby promoting plant growth.
» Planting on the protected side of the nets (NE side) assists in promoting the growth of relocated and germinating plants.

Maintenance of wind nets:

It is as important to continually maintain the wind nets as it is to erect them correctly. The correct maintenance of wind nets extends the lifespan of the nets and assists in obtaining the maximum effectiveness of the nets. Maintenance includes:

» Tightening of the nets once they have slackened, or if there is too much sand which has built up against the net.
» Digging out of certain sections of the nets which have been buried beneath the sand.
» Replacement of torn sections of the nets.

Wind nets must be maintained until the area has successfully rehabilitated/reasonable plant regrowth has been achieved.

APPENDIX F:
REHABILITATION GUIDELINES

GUIDELINE FOR REHABILITATION

There is a high predictability that the top 5 - 10 cm of soil will contain the majority of the seedbank, but simply applying this topsoil to a well prepared rehabilitation site does not result in the same species richness and diversity as the surrounding areas. A primary reason for this is that not all plants produce dormant (i.e. soil stored) seeds. A study in coastal Namaqualand indicated that the seedbank represents only about 50% (108 out of 230) of the species in standing vegetation. The most abundant species in the seedbank were shown to be short-lived species, while the standing vegetation mostly consists of perennial species. Recruitment from the seedbank would therefore be biased in favour of short-lived species, which does not necessarily facilitate long-term vegetation recovery.

Restoration ecologists in Namaqualand cannot rely solely on the seedbank and seed dispersal. In order for rehabilitated areas to achieve similar species richness, composition, vegetation structure and ecosystem functioning as undisturbed areas, many perennial species need to be introduced with appropriate natural vegetation rescued from disturbed areas before construction activities begin and/or through the use of a local seed mix.

1. Plant groups

Plant species can be grouped according to their morphological form, their relationship with other plants and the function which they fulfil in the ecosystem. Plant species which belong to the same group looks similar and share certain characteristics.

Within natural, mature plant communities, there are generally a variety of plant species which fulfil different functions within the ecosystem. Dividing plant species into recognisable groups can assist in determining whether a rehabilitated area has a community of plant species with various forms and functions. The variety of plant groups which have established can be a good indication of successful rehabilitation in an area. The absence of one plant group can be an indication that an area has not successfully rehabilitated. In areas which have been recently rehabilitated, additional time may be required for the natural establishment of more diverse plant groups. In older rehabilitated areas where mature plant establishment is scarce and consists of only a few plant groups, it may be necessary to physically introduce certain plant groups through, for example, sowing of seeds or planting of certain plant species in order to improve the state of the rehabilitation in that particular area.

2. Plant groups present on the Wind Energy Facility development site

Namaqualand Strandveld:

Typical features of true Namaqualand Strandveld include a high percentage of succulents and leaf deciduous shrubs, moderate bulb diversity, and no Fynbos elements such as Ericaceae (heaths) and Proteaceae (proteas), with few Restionaceae (Cape reeds) (refer to Photograph 1).

Photograph 1: View of typical tall Namaqualand Strandveld, showing dominant succulent perennials

Typical indigenous species found in the Namaqualand Strandveld are listed Table 1.

Table 1: Typical indigenous species found in the Namaqualand Strandveld

Species name	Common name
Shrubs	
Zygophyllum morgsana	Skilpadbos; slaaibos
Othonna cylindrica	Ossierapuisbos
Tetragonia fruticosa	Klimopkinkelbossie
Othonna coronopifolia	
Tripteris oppositifolia	
Lycium cinereum	Muisbos
Salvia africana-lutea	Bruinstrandsalie
Berkheya fruticosa	
Lebeckia sericea	Fluitjiesbos

Species name	Common name
Ruschia floribunda	
Lampranthus watermeyeri	
Euphorbia caputmedusae	Volstruisnek
Euphorbia rhombophyllum	
Euphorbia burmannii	Steenbokmelkbos
Chrysanthemoides incana	Grysbietou
Mesembryanthemum crystallinum	Soutslaai
Hermannia scordifolia	
Hermannia trifurca	Poprosie
Hermannia sp. nov	
Thesidium spinosum	
Nenax arenicola	
Exomis microphylla	
Willdenowia incurvata	Sonkwasriet
Senecio bulbinifolius	
Vanzijlia annulata	
Cephalophyllum sp	
Microloma sagittatum	
Pteronia divaricata	
Pteronia ovalifolia	
Euryops multifidus	Gombos
Manulea cinerea	
Tylecodon wallichii	Krimpsiektebos
Stoeberia utilis	Asbos
Manochlamys albicans	Spanspekbos; seepbos; soutbos
Cissampelos capensis	
Conicosia elongata	Vetkousie
Arctotis canaliculata	
Eriocephalus racemosa	Kapokbossie; wilderoosmaryn
Asparagus africana	
Helichrysum tricostatum	
***Woody shrubs*[2]**	
Rhus glauca	Blue kuni bush
Gymnosporia buxifolia	Pendoring
Diospyros austro-africana	
Euclea racemosa	Sea guarrie
***Grasses*[3]**	
Ehrharta calycina	Rooisaadgras
Stipagrostis zeyheri	

[2] Scattered larger woody shrubs are a feature in some areas, especially in transitions to Sand Fynbos.

[3] Grasses may be prominent after rains.

Species name	Common name
Bulbs	
Babiana brachystachys	
Babiana grandiflora	
Lachenalia unifolia	
Oxalis flava	
Oxalis luteola	
Trachyandra divaricata	duinekool
Trachyandra falcata	veldkool
Drimia sp.	
Boophone haemanthoides	gifbol
Annuals	
Helichrysum moeserianum	
Oncosiphon spp	
Dischisma spp	
Polycarena spp	
Manulea spp	
Zalusianskya pusilla	
Dorotheanthus bellidiformis	bokbaaivygie
Ursinia spp.	

Photograph 2: *Babania* sp.

Photograph 3: *Lachenalia* sp.

Photograph 4: *Lachenalia rubida*

Photograph 5: *Boophone haemanthoides*

3. Succession

The definition of succession is the progress of one thing to another over time. In plant ecology, succession refers to the gradual replacement of one plant community with another plant community over time through natural processes. Plant succession occurs generally after a disturbance has occurred in an area.

For example, a **pioneer plant community** comprises mainly of emerging plant species which require high concentrations of nutrients and can survive on unstable soil surfaces. A pioneer plant species generally create conditions which would be favourable for the next plant community to establish in the area (e.g. through the stabilisation of the soil in an area, etc.).

Over time, one plant community replaces another until a stable equilibrium or **climax plant community** is established. In the Namaqualand Strandveld, plant species can be classified in the following categories: opportunistic or early emerging plant species, and early, middle and late succession plant species. Classification of plant species into these categories depends on the characteristics of the plant species and the period after disturbance when the plant species emerges and is most abundant. Plant species which are most successful on rehabilitated areas include those categorised as opportunistic or early emerging plant species, and early succession plant species. A climax plant community comprises mostly of middle and late succession plant communities with few emergent and early succession species.

Examples of plant species categories found in the study area are presented in the table below.

Species name	Common name	Functional plant groups
Mesembryanthemum crystallinum	Soutslaai	Emergent species
Zygophyllum morgsana	Skilpadbos; slaaibos	Middle succession species
Othonna cylindrica	Ossierapuisbos	Middle succession species
Othonna coronopifolia		Middle succession species
Lebeckia sericea	Fluitjiesbos	Middle succession species
Ruschia floribunda		Middle succession species
Lycium cinereum	Muisbos	Middle succession species
Chrysanthemoides incana	Grysbietou	Middle succession species
Manochlamys albicans	Spanspekbos; seepbos; soutbos	Middle succession species
Conicosia elongata	Vetkousie	Middle succession species
Tripteris oppositifolia		Late succession species
Salvia africana-lutea	Bruinstrandsalie	Late succession species
Hermannia scordifolia		Late succession species

Species name	Common name	Functional plant groups
Hermannia trifurca	Poprosie	Late succession species
Hermannia sp. nov		Late succession species
Pteronia divaricata		Late succession species
Pteronia ovalifolia		Late succession species
Eriocephalus racemosa	Kapokbossie; wilderoosmaryn	Late succession species
Asparagus africana		Late succession species
Rhus glauca	Blue kuni bush	Late succession species
Most small succulents		Late succession species

4. Seed Collection

Seed collection is an important aspect of rehabilitation work, and is one of the easiest and cheapest ways to collect indigenous plant species. It is also important as the seeds from perennial plant species (which are generally the emergent species) are poorly represented in the topsoil layer. Seed collection should be undertaken by a suitably qualified specialist who is familiar with the various seed types associated with the plant species and rehabilitation in the area.

4.1. Where to collect seed

In order to collect the maximum volume of seed in the shortest time, it is important to identify where the species which is to be collected is most abundant. The more plants which occur in an area, the more seed can be collected in as short a time as possible. Therefore, it is important to determine where specific plant species occur within the area such that seeds can be collected at the appropriate time (i.e. when these plants are seeding). The locality of these plant species should be recorded with a GPS and indicated on a map/plan of the development site.

4.2. When to collect seed

Most individuals of the same species which occur in the same area should flower and produce seed at the same time. It is preferable to wait until the majority of plants in an area are producing seed before collection begins. In areas where plants produce seeds at different times, it may be necessary to collect seeds more than once in a season.

It is important that seeds are collected when they are ripe. The collection of unripe seeds will reduce the percentage germination thereby reducing the effectiveness of the rehabilitation efforts. How to determine if seeds are ready for collection depends on the species being considered, and should be undertaken by a suitably qualified individual. In general, the following is applicable:

» *Vygies:*

- The seed capsules change from green to red/black and feel dry and 'woody' when the seed is ripe.
- The seed colour changes from a white/yellow to a brown colour.

» *Other species:*
- The husk is dry and breaks open with a racking sound (e.g. *Lebekia sericea*), or the seed wings change from green to brown in colour (e.g. *Tetragonia, Zygophyllum*).
- There is a colour change in the fruit (e.g. *Asparagus* from green to red or sometimes black; *Zygophyllum morgsnan* from green to brown).
- The seed is dry and hard.
- The seed rattles inside the seed pod (e.g. *Lebekia sericea*)

In general, the growing season of plants on the Wind Energy Facility development site occurs from May to October.

4.3. Equipment

Seed must not be collected in plastic bags, as these are likely to promote the growth of mould which reduces the viability of the seeds. It is better to use a Hessian sack or paper bag for smaller seeds. Larger seeds can be collected in cardboard boxes, provided these are closed to avoid the seeds from being blown away.

Most seeds can be picked directly from the plant by hand. Gloves generally hinder the effective and quick collection of seeds, but can be used for species which have small thorns or sharp branches (e.g. *Lycium* species).

A 'vacuum harvester' can be an effective tool for certain plant species (e.g. grasses), but does not work effectively for most Namaqualand species.

It is important to know whether any of the plant species from which seeds will be collected are poisonous. If poisonous plant species occur in the area, it must be ensured that the seed collectors are aware of these and that the necessary protective clothing is provided.

4.4. The drying and storage of seeds

For every 1% reduction in the moisture levels of a seed, the seed lifespan doubles. It is also important that seeds or other plant material is adequately dried before storage in order to reduce the possibility of mould growth which reduces the viability of the seeds. After the seeds (and any other plant material) are adequately dried, the seed should be stored according to the following guidelines:

» Store seeds in a cool, dry, dark place (not in direct sunlight).

» Store seeds in paper bags, large envelopes or cardboard boxes.
» Use appropriate insect and anti-mould spray or powder in order to combat insect infestations and the growth of mould. It is important not to use sprays or powders which are poisonous to humans, as they will need to handle the seeds during sowing.
» Ensure that there are no vermin (such as mice and rats) which can eat the seeds.
» Never leave seeds outside overnight.
» Under no circumstances must seed be temporarily stored in a vehicle standing in the sun. High temperatures inside the vehicle can destroy the seeds.

In general, the viability of seeds reduces over time. The germination is therefore expected to be highest in the first year after collection. It is therefore best to use seeds within one year after collection and should, in general, not be stored for longer than 2 years.

5. Relocation of plants

Some plants can be successfully rescued during construction and utilised for rehabilitation of disturbed areas. This is a fast and effective way of introducing mature plants into an area.

Replanting must be undertaken only during the middle of the winter season (i.e. June – August). The best time for planting is directly after a rainfall event while the ground is still wet. The chances of survival are very low when plants are planted in dry soils.

Rescue of the plants before construction must be undertaken by a suitably qualified specialist with experience in rehabilitation in the area. The following guidelines must be considered:

» Loosen the soil on all sides of the plant, without breaking or damaging the roots close to the plant. Dig down about 20 – 30 cm.
» Dig the spade under the plant, and lift the plant up with the spade.
» Pack the plant in a crate or on a wheelbarrow.
» Pack the plants onto a vehicle, keeping different species separate.
» Cover the vehicle if open in order to protect the plants during transportation, and to protect against drying out.
» It is important to replant the plants into bags the same day as they are collected. Never store the plants overnight or for a few days.
» Ensure that the plants are sufficiently watered in order to ensure their survival.
» Store the plants in an on-site nursery (if sufficient water is available), or at an appropriately located off-site nursery.

When replanting the plants, the following guidelines should be considered:

» In the area designated for the replanting of the plants, dig a hole which is slightly larger and deeper than the plant which must be placed therein.
» Place the plant in the hole and ensure that it is deep enough that the roots are covered.
» Replace enough soil in the hole to cover the roots and compact the soil to secure the plant in the hole. Use more soil if necessary and compact again.
» Make a depression around the plant with a spade such that water will drain towards the plant.
» Do not plant the plants in straight lines, but rather randomly as in the natural environment.
» Ensure that plants are sufficiently watered in order to ensure their survival.

Practical experience in Namaqualand with plant relocation has shown that it makes little difference to the success rate whether the soil is retained around the roots or not during the rescuing process. It has also been shown that smaller plant individuals are more successfully relocated than larger specimens.

Certain plant groups are more suitable for relocation than others. In general, those with succulent leaves or stems or underground bulbs are more successful. Plant groups which have been practically shown to be successfully relocated include:

» Upright vygies
» Creeping vygies
» Large succulents
» Bulbs
» Certain shrubs (only those with succulent leaves such as *Othonna* and *Teragonia*).

6. Monitoring and evaluation of rehabilitated areas

The Namaqualand Restoration Initiative (NRI) has developed a monitoring and evaluation system which is based on a points system. This system has been developed in order to establish whether are area has been successfully rehabilitated. More points are assigned for areas where more plant groups have established. In terms of this system, and area must obtain above a certain score in order to be classified as a successfully rehabilitated area. It is therefore important that the rehabilitation manager and team members can identify the different plant species and groups in order to make a conclusion regarding the number of plant groups which have established in an area. This is also important in order to ensure that recommendations can be made as to whether additional plant groups need to be introduced into an area.

Should rehabilitation in an area not appear to be successful, it may be necessary to investigate the use of restoration packs in consultation with the Namaqualand Restoration Initiative. The nature of the restoration pack required in an area will be dependent on the ecological characteristics of the area, and practical experience in

terms of rehabilitation and scientific research which has been undertaken in the Namaqualand area over the past few years. Restoration packs utilise the following principles:

» **Small soil indentations** which concentrate water and nutrients in one area, and protect seedlings from wind.
» **Soil additives** which aid in the faster growth of the seedlings and enhance the longevity of the seedlings (e.g. plant fertilizers).
» **Wind shields** which protect the seedlings from wind erosion and blowing sand particles, thereby allowing them to survive in the harsh conditions. Large wind shields comprise wind nets and stabilise the ground at a large scale. Smaller wind shields around areas where seeds are sown can be made from cardboard boxes and can be used to protect small seedlings.

7. Assistance with Namaqualand restoration and rehabilitation

Restoration of disturbed areas in Namaqualand is likely to be greatly facilitated by taking advantage of the specific adaptations of indigenous organisms to the prevailing environmental conditions. Successful rehabilitation will therefore require the intervention of individuals/organisations who understand the area and the vegetation common to the area. Support can be obtained from, *inter alia*, the following parties:

Namaqualand Restoration Initiative (NRI), an initiative of the Department of Botany Institute for Plant Conservation, University of Cape Town: provide training in Namaqualand restoration techniques through EcoSolutions: Telephone 021 650 4046; e-mail raldo.kruger@uct.ac.za

NM Restoration located in Koingnaas and currently undertaking restoration work for De Beers

APPENDIX G:
SPECIFICATIONS FOR EARTHWORKS (ENVIRONMENTAL MEASURES)

Standard Specifications for Earthworks: Environmental measures

Topsoil

Prior to construction, the topsoil areas to be disturbed should be stripped to a depth to be confrmed by the engineer and set aside for spreading to all areas to be reinstated after the construction. Temporary topsoil stock piles must be covered with net or shade cloth to protect them.

Once all grades have been finalised and prepared, topsoil should be spread evenly to all areas to be re-vegetated.

Erosion and sedimentation control

1. During construction the Contractor shall protect areas susceptible to erosion by installing necessary temporary and permanent drainage works as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring the slopes, banks or other areas.
2. A Method statement shall be developed and submitted to the Engineer to deal with erosion issues prior to bulk earthworks operations commencing.
3. Any erosion channels developed during the construction period or during the vegetation establishment period shall be backfilled and compacted and the areas restored to a proper condition.
4. Stabilisation of cleared areas to prevent and control erosion shall be actively managed. The method of stabilisation shall determine in consultation with the ECO. Consideration and provision shall be made for the following methods (or combination):

a) Brush cut packing
b) Mulch or chip cover
c) Straw stabilising
d) Watering
e) Planting/sodding
f) Hand seed-sowing
g) Hydroseeding
h) Soil binders and anti erosion compounds
i) Mechanical cover or packing structures
    i. Gabions & mattresses
    ii. Geofabric
    iii. Hessian cover
    iv. Armourflex
    v. Log/ pole fencing
    vi. Retaining walls

5. 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.
6. Anti-erosion compounds shall consist of all organic or inorganic material to bind soil particles together and shall be a proven product able to suppress dust and erosion. The application rate shall conform to the manufacturer's recommendations. The material used shall be of such a quality that indigenous seeds may germinate and not prohibit growth.

Blasting

1. A current and valid authorisation shall be obtained from the relevant authorities and copied to the Engineer prior to any blasting activity.
2. A Method Statement shall be required for any blasting related activities.
3. All Laws and Regulations applicable to blasting activities shall be adhered to at all times.
4. A qualified and registered blaster shall supervise all blasting and rock splitting operations at all times.
5. The Contractor shall ensure that appropriate pre blast monitoring records are in place (i.e. photographic and inspection records of structures in close proximity to the blast area.)
6. The Contractor shall allow for good quality vibration monitoring equipment and record keeping on site at all times during blasting operations.
7. The Contractor shall ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on site.
8. The Contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused by blasting / drilling shall be repaired at the Contractor's expense to the satisfaction of the Engineer.
9. The Contractor shall ensure that adequate warning is provided immediately prior to all blasting. All signals shall also be clearly given.
10. The contractor shall use blast mats for cover material during blasting. Topsoil may not be used as blast cover.
11. During demolition the Contractor shall ensure, where possible that trees in the area are not damaged.
12. Appropriate blast shaping techniques shall be employed to aid in the landscaping of blast areas, and a Method Statement to be approved by the Engineer, shall be required in this regard.
13. At least one week prior to blasting, the relevant occupants/owners of surrounding land shall be notified by the Contractor and any concerns addressed. 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. Failing to do so shall render the Contractor fully liable for any claim of whatsoever nature, which may arise. The Contractor shall indemnify the Employer in this regard.

Borrow pits and quarries

1. All borrow pit sites shall be clearly indicated on plan.
2. Prior to the onset of any quarrying or borrow pit activities the Contractor shall establish from the Engineer whether authorisation has been obtained, both in terms of the Minerals and Petroleum Resources Development Act 28 of 2002 (via the compilation of an Environmental Management Programme Report) and in terms of the National Environmental Management Act (via the Environmental Impact Assessment process). No excavation or blasting activities shall commerce before the necessary authorizations are in place.
3. Borrow pits to be used must be approved by the engineer and shall at all times be operated according to the regulations promulgated in terms of the Minerals Act (No 50 of

1991): Mine Health and Safety Act (NO 29 of 1996) and Noise and Nuisance Regulations of the Environment Conservation Act (No 73 of 1989).
4. Only a single lane access for construction vehicles shall be provided at borrow pit and quarry sites. New access roads require approval by the Engineer.
5. Stormwater and groundwater controls shall be implemented.
6. Machinery, fuels and hazardous materials vulnerable to flooding shall be stored out of flood risk areas.
7. Vehicles leaving borrow pits shall not deposit/shed mud, sand and debris onto any public road.
8. All loads shall be covered with a tarpaulin or similar to prevent dangers and nuisance to other road users.
9. Borrow pits shall be fenced to prevent unauthorized persons and vehicles from entering the area. Fences shall also be stock and game proof.
10. Rehabilitation and re-vegetation of borrow pits sites shall be according to a method statement to be approved by the ECO.
11. The contractor shall ensure that blasted faces of the pit shall be shape-blasted to the approval of the Site Manager.
12. Where required, dust and fly-rock prevention methods shall be detailed in a Method Statement to be approved by the Site Manager.
13. During the rehabilitation of borrow bits, the slope or the borrow pit shall be graded to blend with the natural terrain and be stabilized to prevent erosion.

Drilling and jackhammering

1. The Contractor shall submit a Method Statement detailing his proposals to prevent pollution during drilling operations. This shall be approved by the Site Manager prior to the onset of any drilling operations.
2. The Contractor shall take all reasonable measures to limit dust generation as a result of drilling operations.
3. Noise and dust nuisances shall comply with the applicable standards.
4. The Contractor shall ensure that no pollution results from drilling operations, either as a result of oil and fuel drips, or from drilling fluid.
5. All affected parties shall be informed at least one week prior to the onset of the proposed drilling/jackhammering operations, and their concerns addressed.
6. Drill coring with water or coolant lubricants shall require a Method Statement approved by the Site Manager.
7. Any areas or structures damaged by the drilling and associated activities shall be rehabilitated by the Contractor to the satisfaction of the Site Manager.

Earthworks

1. The excavations on site shall be done in accordance with SABS 1200 D or DB, as applicable.
2. Prior to Earthworks (including site clearance) starting on site, a search and rescue operation for shall be undertaken as per the requirements set out in the EMP.

2. All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities.
3. Defined access routes to and from the area of operations as well as around the area of operation shall be detailed in a Method Statement for approval by the Site Manager.
4. No equipment associated with the activity shall be allowed outside of these areas unless expressly permitted by the Site Manager.
5. Mechanical methods of rock breaking, including Montabert type breakers, jackhammers, have noise and dust impacts that shall be addressed.
6. Residents shall be notified at least one week prior to these activities commencing, and their concerns addressed.
7. Chemical breaking shall require a Method Statement approved by the Site Manager.

Trenching

1. Trenching for services shall be undertaken in accordance with the engineering specifications (SABS 1200DE) with the environmental amplifications contain herein, where applicable.
2. Trenching shall be kept to a minimum through the use of single trenches for multiple service provision.
3. The planning and selection of trench routes shall be undertaken in liaison with the Engineer and cognisance shall be given to minimising the potential for soil erosion.
4. Trench routes with permitted working areas shall be clearly defined and marked with painted stakes prior to excavation.
5. The stripping and separation of topsoil shall occur as stipulated by the Engineer. Soil shall be stockpiled for use as backfilling as directed by the engineer.
6. Trench lengths shall be kept as short as practically possible before backfilling and compacting.
7. Trenches shall be backfilled to the same level as (or slightly higher to allow for settlement) the surrounding lard surface to minimise erosion. Excess soil shall be stockpiled in an area approved by the engineer.
8. Immediately after backfilling, trenches and associated disturbed working areas shall be planted with a suitable plant species and regularly watered. Where there is a particularly high erosion risk, a fabric such as Geojute (biodegradable) shall be used in addition to planting.

Dust

1. The Contractors shall be solely responsible for the control of dust arising from the Contractor's operations and for any costs against the Employer for damages resulting from dust.
2. The Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the Site Manager.
3. Removal of vegetation shall be avoided until such time as soil stripping is required and similarly exposed surfaces shall be re-vegetated or stabilised as soon as is practically possible.

4. Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present.
5. During high wind conditions the Site Manager will evaluate the situation and make recommendations as to whether dust damping measures are adequate, or whether working will cease altogether until the wind speed drops to an acceptable level.
6. Where possible, soil stockpiles shall be located in sheltered areas where they are not exposed to the erosive effects of the wind. Where erosion of stockpiles becomes a problem, erosion control measures shall be implemented at the discretion of the Site Manager.
7. Vehicle speeds shall not exceed 40km/h along dust roads or 20km/h when traversing unconsolidated and non-vegetated areas.
8. Appropriate dust suppression measures shall be used when dust generation as unavoidable, e.g. dampening with water, particularly during prolonged periods of dry weather in summer. Such measures shall also include the use of temporary stabilising measures (e.g. chemical soil binders, straw, brush packs, clipping etc.)
9. Straw stabilisation shall be applied at a rate of one bale/ $10m^2$ and harrowed into the top 100mm of top material for all completed earthworks.

Imported materials

1. Imported materials shall be free of weeds, litter and contaminants.
2. Sources of imported material shall be listed and approved by the Engineer or the Engineer's representative (ER) on Site.
3. The Contractor shall provide samples to the ER for approval.
4. Stockpile areas shall be approved by the ER before any stockpiling commences.