PROPOSED KLIPHEUWEL/DASSIESFONTEIN WIND ENERGY FACILITY & ASSOCIATED INFRASTRUCTURE WESTERN CAPE PROVINCE

CONSTRUCTION & OPERATION ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE KLIPHEUWEL/DASSIESFONTEIN WIND ENERGY FACILITY PROJECT

Submitted as part of the Draft EIA Report
November 2010

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PROJECT DETAILS

DEA Reference No.	:	12/12/20/1746
Title	:	Environmental Impact Assessment Process Draft Environmental Management Plan: Proposed Klipheuwel/ Dassiesfontein Wind Energy Facility, near Caledon, Western Cape Province
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Client	:	BioTherm Energy (Pty) Ltd
Report Status	:	EMP submitted as part of the Draft Environmental Impact Assessment Report for public review

When used as a reference this report should be cited as: Savannah Environmental (2010) Draft Environmental Management Programme: Proposed Kliphuewel/Dassiesfontein Wind Energy Facility & Associated Infrastructure, Western Cape

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.

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 plan 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).

Regional Methodology: The Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) have developed a guideline document entitled *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006). The methodology proposed within this guideline document is intended to be a regional level planning tool to guide planners and decision-makers with regards to appropriate areas for wind energy development (on the basis of planning, environmental, infrastructural and landscape parameters).

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 about 15 to 28 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 tubular steel. It is approximately 80 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. Larger wind turbines are usually mounted on towers ranging from 40 to 80 m tall. 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 speed: The rate at which air flows past a point above the earth's surface.

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PURPOSE & OBJECTIVES OF THE EMP CHAPTER 1

An Environmental Management Plan (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 EMP 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 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 remediation (soil stabilisation, revegetation) and operation.

The EMP has been developed as a set of environmental specifications (i.e. principles of environmental management for the proposed Klipheuwel/Dassiesfontein 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 tools for assisted use of the EMP by the project implementer as well as compliance monitors). During its lifecycle, projects journey through four distinctive phases, i.e. planning, construction, operational, and decommissioning phases. The EMP is accordingly separated into measures dealing with the various project phases.

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 and frequency 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 Environmental Impact Assessment process are addressed in the EMP, ensuring the minimisation of adverse environmental impacts to an acceptable level. The EMP has been developed on the basis of the findings of the EIA, 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 through avoiding or minimising potential impacts.

BioTherm Energy must ensure that the implementation of the project 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 and the implementation of the EMP through its integration into the contract documentation. Since this EMP is part of the EIA process undertaken for the proposed Klipheuwel/Dassiesfontein Wind Energy Facility, it is important that this document be read in conjunction with the Scoping Report (July 2010) and EIA Report (November 2010), as well as the Environmental Authorisation (once issued). This will contextualise the EMP and enable a thorough understanding of its role and purpose in the integrated environmental management process. This EMP for construction and operation activities has been compiled in accordance with Section 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.

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 Contractor's 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 will 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 Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.

» Providing basic training in the identification of archaeological sites/objects, and protected flora and fauna that may be encountered on the site.

» Ensuring awareness of any other environmental matters, which are deemed to be necessary by the Environmental Control Officer (ECO).

PROJECT DETAILS CHAPTER 2

BioTherm Energy (Pty) Ltd, an independent producer of electricity, is proposing to establish a single commercial wind energy facility which will be known as the Klipheuwel/Dassiesfontein Wind Energy Facility and associated infrastructure on two sites in the Overberg area within the Western Cape Province. A study area of approximately 602 ha is being considered as a larger study area for the construction of the proposed wind energy facility, and would include:

» **16 wind turbine units,** including a 100 m high steel tower, a nacelle and 3 blades of up to 54m in length.
» **Concrete foundations** to support the turbine towers.
» **Internal roads** (approximately 6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible.
» **Underground cabling** (~ 1m deep) 33 kV, linking the wind turbines to the two proposed 33/66 kV substations. In as far as possible, cabling will follow the internal access roads.
» 2 x 33/66 kV **substations**. Each of these substations will have a high-voltage (HV) yard footprint of approximately 80m x 90m.
» An **on-site office/workshop** building(s)/equipment store complex, with a combined footprint of approximately 400 m².

The site proposed for the Klipheuwel/Dassiesfontein Wind Energy Facility area falls within the Theewaterskloof (TWK) Local Municipality, which falls under the Overberg District Municipality of the Western Cape Province.

The proposed project will comprise a single wind energy facility to be developed over two sites located in close proximity to one another (refer to Figure 2.1). The **Klipheuwel** site is proposed to accommodate 10 wind turbines within an area of approximately 350 ha, including the following farm portions:
» Klip Heuvel no. 410/5 (Remaining Extent) & 410/9;
» Klip Heuvel no: 410/8 (also known as Kruis Vley) & 410/10 (also known as Haasjes Kop);
» Boontjieskraal no. 417/0 and Farm 418 no. 418/0 (Remaining Extent).

The **Dassiesfontein** site is proposed to accommodate 6 wind turbines within an area of approximately 252 ha, including the following farm portions:
» 1 (Remaining Extent) & 5 Huveltjes Kraal 426; and
» Heuwelkraal a portion of the farm Pampoenkraal 843/0.

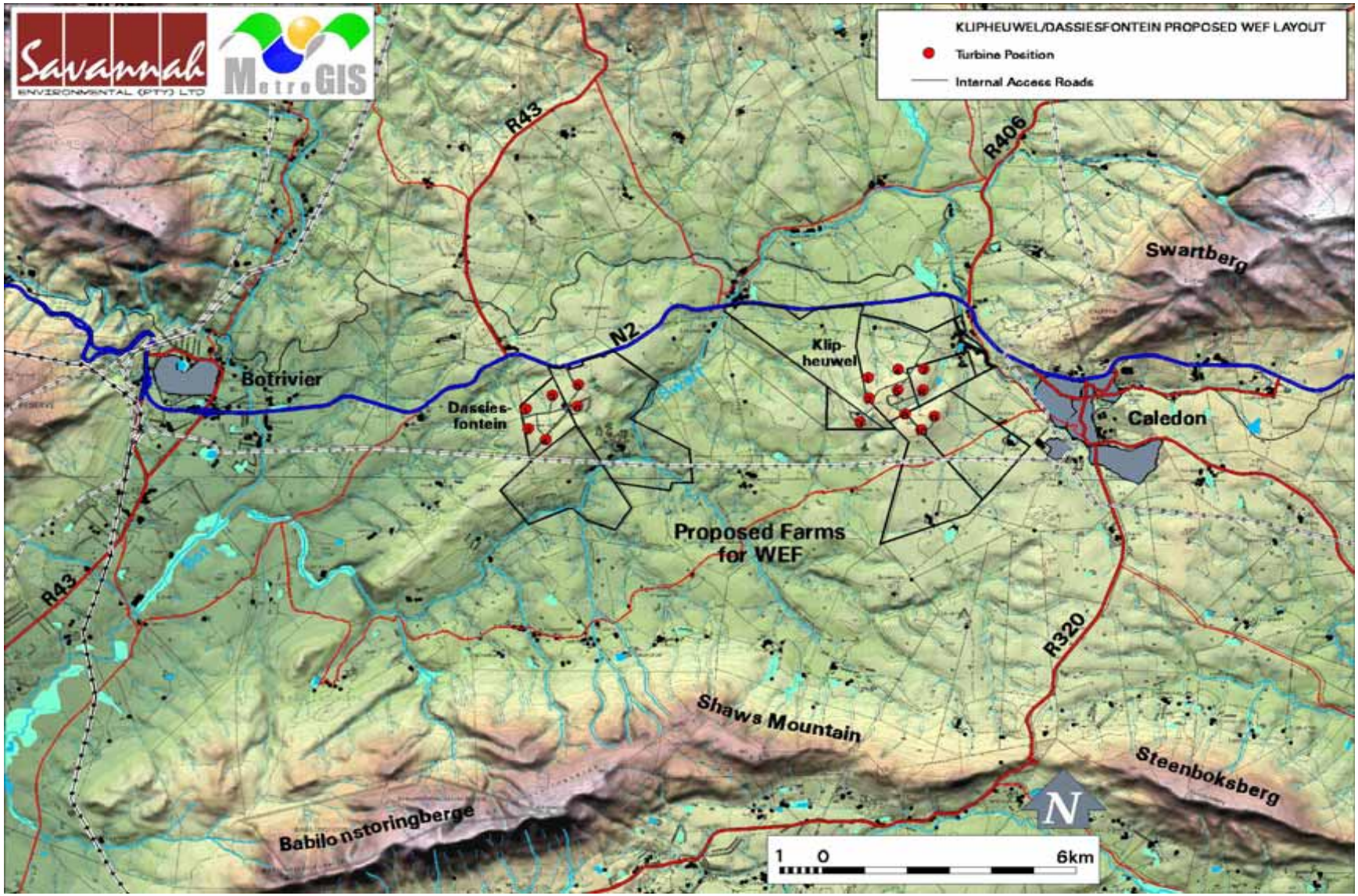


Figure 2.1: Locality map showing provisional wind turbine layout.

Through the assessment of impacts associated with the proposed Klipheuwel/Dassiesfontein Wind Energy Facility, both potentially positive and negative impacts have been identified. The most significant environmental impacts associated with the proposed project include:

» Visual impacts on the natural scenic resources of the region imposed by the components of the facility.
» Impacts on biodiversity as a result of the construction and operation of the facility.
» Impacts on the social environment.
» Benefits of the proposed wind energy facility.

The majority of potential impacts on natural vegetation and onsite habitats have been avoided through the consideration of identified environmentally sensitive areas on the site by BioTherm Energy during the design of the preliminary layout of the facility. The only areas of potential impact identified include that associated with the construction of the Dassiesfontein substation and the local access road and cabling between turbines 2 and 3 and turbines 2 and 6. Impacts in this regard can be avoided through the relocation of the infrastructure outside of the natural vegetation areas.

2.1 Activities and Components associated with the Wind Energy Facility

The main activities/components associated with the Klipheuwel/Dassiesfontein Wind Energy Facility are detailed in Table 2.1.

Table 2.1: Activities Associated with Planning, Construction, Operation and Decommissioning of the Facility

Main Activity/Project Component	Components of Activity	Details
Construction		
The construction phase of the wind energy facility is dependent on the number of turbines to be erected, but can be estimated at 16 weeks. It is expected that the project will create between 30-50 direct construction employment opportunities over this period. Workers will be accommodated in nearby towns (Caledon and Botrivier, etc), and transported to and from site on a daily basis. Given the relative proximity of the site to Caledon and Botrivier it is likely that a significant proportion of workers may choose to commute from home on a daily basis. Overnight on-site worker presence will be limited to security staff. Commencement of construction is dependent on the project being approved by DEA, a generating license being issued by NERSA, and a Power Purchase Agreement being secured with Eskom. The lifespan of the facility is approximated at 20 to 30 years. In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken.		
Pre-construction surveys	» Access roads » Turbine positions » Substation sites	» Prior to initiating construction, a number of surveys will be required including, but not limited to, geotechnical survey, site survey and confirmation of the turbine micro-siting footprint and survey of substation sites. » Several environmental surveys may be required (such as ecological and heritage) as part of the final design phase for infrastructure located in identified sensitive areas.
Establishment of access roads to the site	» Upgrade access/haul roads to the site, as required » Establish internal access roads: 6 m wide permanent roadway within the site between the turbines for use during construction and operation phase. » Temporary track (adjacent to and utilising part of the permanent road) of ~13m in width for use by the	» Access to the sites will be via existing gravel access roads from the N2 National Road. » 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. » Access roads will be constructed/upgraded 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.

Main Activity/Project Component	Components of Activity	Details
	crawler crane during construction phase only.	» The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines (as well as specialist surveys).
Undertake site preparation	» Establishment of offices / workshop with ablutions and stores, contractors yards » Establishment of internal access roads (permanent and temporary roads) » Clearance of vegetation at the footprint of each turbine » Excavations for foundations	» These activities will require the stripping of topsoil, which will need to be appropriately stockpiled for use in rehabilitation. » Site preparation will be undertaken in a systematic manner to reduce the risk of open ground to erosion. » Site preparation will include search and rescue of floral species of concern (where required), as well as identification and excavation of any sites of cultural/heritage value (where required).
Establishment of lay down areas on site	» Lay down areas (temporary footprint 40m x 40m) at each turbine position for the storage of wind turbine components and accommodation of construction and crane lifting equipment. » Temporary lay down area for crane assembly.	» Each turbine needs a flat and hardened lay down area of 40 m x 40 m during the construction process. » This area can be rehabilitated after construction. » 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 large lay down area will be required at each position where the main lifting crawler 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, which would need to access the crawler crane from all sides. » Lay down areas are to make use of already compacted areas as far as possible, such as roadways or other laydown areas.
Construct wind turbine foundations	» Concrete foundations of up to approximately 15 x 15m and 2m in depth at each turbine location (final dimensions to be defined by	» Foundation holes will be mechanically excavated. » Shoring and safety barriers will be erected. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of a small concrete

Main Activity/Project Component	Components of Activity	Details
	geotechnical survey of the site)	batching plant close to the activities possible. » The reinforced concrete foundation will be poured and will support a mounting ring. » The foundation will then be left for up to a week to cure.
Transport of components and equipment to site	» Flatbed trucks will be used to transport all components to site: * Turbine units consist of a tower comprised of 3 segments, a nacelle, and three rotor blades (each of up to 50 m in length) and a pad mount transformer. * Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. mobile assembly crane and main lift crawler crane) to erect the wind turbines. * The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement mixers, etc.). * The components required for the establishment of the substations (including transformers) * Components required for the establishment of the power line (including towers and cabling) * Ready-mix cement trucks for turbine and substation foundations	» The Cape Town Port has been identified as the as most suitable port for ease of access and storage facilities for wind turbine components. As the sites are both located within 1 km of the N2, this is considered the easiest route of access to the site. » Turbine units consist of a tower comprised of 3 segments, a nacelle, and three rotor blades and a pad mount transformer. Components of various specialised construction, lifting equipment and counter weights etc. are required on site to erect the wind turbines. Other components are required for the establishment of the substations (including transformers). » The wind turbine, including the tower, will be brought to site by the supplier in sections. The individual components are defined as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). » The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.) and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc) as a result of abnormal loading. » An estimated 8 trucks will be used for the shipment of each turbine.

Main Activity/Project Component	Components of Activity	Details
Construct turbines	» Large lifting crane will be used for lifting of large, heavy components » A small crane will be used 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. It will then be lifted to the nacelle and bolted in place. » It will take approximately 2 days 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 substations and ancillary infrastructure.	» Substations » Other substation components » Security fencing around high-voltage (HV) Yard » Workshop	» A temporary construction area is needed for containers, toilets and equipment. » 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 33/66kV on site substations will be constructed with a high-voltage (HV) yard footprint of up to 80m x 90m. » The substations would be constructed in the following simplified sequence: * Step 1: Survey of the site * Step 2: Site clearing and levelling and construction of access road to substation site * Step 3: Construction of terrace and foundations * Step 4: Assembly, erection and installation of equipment (including transformers) * Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.

Main Activity/Project Component	Components of Activity	Details
Connection of wind turbines to the on-site substations	» Wind Turbines » 33 kV underground electrical cabling connecting each turbine to the substations	» 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 will follow the internal access roads as reasonably possible.
Connect substations to power grid	» Substations » Existing power line crossing the development sites	» There is an existing Eskom grid 66kV power line that crosses each site (i.e. one for Klipheuwel, and one for Dassiesfontein). There would therefore be no need for BioTherm to construct any new overhead power lines to connect the proposed wind energy facility to the power grid.
Undertake site rehabilitation	» Remove all construction equipment from the site » Rehabilitation of temporarily disturbed areas where practical and reasonable	» On full commissioning of the facility (or a phase thereof), any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.
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.
Operation Estimates provided by BioTherm Energy indicate that a total compliment of approximately 10 administrative, management, monitoring and maintenance staff will be required for the operation of the Klipheuwel/Dassiesfontein facility at full rollout. No permanent staff will be required on site for any extended period of time. It is anticipated that there will be full time security, maintenance and control room staff required on site.		
Operation	» Operation of turbines within the wind energy facility	» Once operational, the wind energy facility will be monitored remotely. » 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	» The wind turbines will be subject to periodic maintenance and

Main Activity/Project Component	Components of Activity	Details
	» Transformer oil – substations » Waste product disposal	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 20-30 years, with maintenance.
Decommissioning		
The turbine infrastructure which will be utilised for the proposed Klipheuwel/Dassiesfontein wind energy facility near Caledon is expected to have a lifespan of approximately 20 - 30 years (with maintenance). 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 discussed in this EIA would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.		
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 construction 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 replace 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. » The hours of operation for noisy construction activities are guided by the Environment Conservation Act (noise control regulations). If the project requires construction work outside of the designated hours, regulatory authorities and affected stakeholders will be consulted and subsequent negotiations will be made to ensure the suitability of the revised activities.

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 BioTherm Energy to achieve environmental compliance. For each of the phases of implementation 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 programme 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 » substations » power lines
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	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 and/or layout of the facility).
» Modification to or addition to environmental objectives and targets.
» 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:

	Name	**Company**
EMP Compilers:	Alicia Govender	Savannah Environmental
	Jo-Anne Thomas	Savannah Environmental
Specialists:	David Hoare - ecologist	David Hoare Consulting cc
	Andrew Jenkins - ornithologist	Avisense Consulting
	Nick Helme - Botanist	Nick Helme Botanical Surveys
	Ian Paton - Soils and erosion potential specialist	Outeniqua Geotechnical Services cc
	Lourens du Plessis – visual specialist	MetroGIS
	Tim Hart - archaeology and heritage specialist	Archaeology Contracts Office (ACO) Department of Archaeology: University of Cape Town
	Morne de Jager – noise specialist	MENCO (M2 Environmental Connections cc)
	Tony Barbour - social specialist	Tony Barbour Consultants

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, having been involved in EIA processes over the past ten (10) years. They have managed and drafted Environmental Management Plans for other power generation projects throughout South Africa, including numerous wind energy facilities.

MANAGEMENT PLAN FOR 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. Objectives

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

From the specialist investigations undertaken for the proposed wind energy facility development site, no absolute *'no go'* areas were identified. However, a number of potentially sensitive areas were identified to be associated with the proposed project. These have been considered by BioTherm Energy in the micro-siting undertaken for the preliminary layout of the facility. Therefore, the majority of potential impacts on natural vegetation and onsite habitats have been avoided. The only areas of potential impact identified include that associated with the construction of the Dassiesfontein substation and the local access road and cabling between turbines 2 and 3 and turbines 2 and 6. Impacts in this regard can be avoided through the relocation of the infrastructure outside of the natural vegetation areas.

Project component/s	Project components affecting the objective: » wind turbines

	» internal access roads/cable trenches » substations
Potential Impact	» Design fails to respond optimally to the identified environmental considerations
Activities/risk sources	» Positioning of turbines and internal access roads » Positioning of substations
Mitigation: Target/Objective	» To ensure that the design of the facility responds to the identified environmental constraints and opportunities

Mitigation: Action/control	Responsibility	Timeframe
Undertake pre-construction vegetation surveys where infrastructure encroaches on natural vegetation areas.	Vegetation specialist	Design phase
Undertake pre-construction heritage surveys where archaeological material may exist. The need for mitigation (in the form of slight realignment of the infrastructure or recording of sites to be destroyed) to be determined.	Heritage specialist	Design stage. Once layout is finalized.
Consider design level mitigation measures recommended by the specialists as detailed within the EIA report and relevant appendices. These recommendations are to be supplemented by information collected during the pre-construction surveys.	Engineering Design Consultant / turbine supplier BioTherm Energy	Tender Design & Design Review Stage
Access roads to be carefully planned to minimise the impacted area and prevent unnecessary compaction of soil.	BioTherm Energy	Design phase
The noise emission specifications of wind turbine generators should be considered when selecting the equipment in order to ensure impacts on this regard are minimised.	BioTherm Energy	Design phase
The position of the Dassiesfontein substation, and access roads (and underground cabling) between turbines 5, 6 and 7, as well as first 275m of access road connecting turbine 2 and 3 at the Klipheuwel site must be relocated outside of natural vegetation areas as far as possible.	Engineering Design Consultant BioTherm Energy	Design phase
A detailed geotechnical investigation must be undertaken on site during the design phase.	BioTherm Energy	Design phase
Compile a comprehensive stormwater management plan for hard surfaces (e.g. substation footprints) as part of the final design of the project.	BioTherm Energy	Design phase
Balance technical and financial considerations against environmental constraints and opportunities in finalising the design of key elements.	BioTherm Energy	Tender Design & Design Review Stage

Performance Indicator	» Design meets objectives and does not degrade the environment » Design and layouts respond to the mitigation measures and recommendations in the EIA report.
Monitoring	» Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the Project Manager and Environmental Control Officer (ECO) prior to the commencement of construction.

Performance Indicator	» Location of turbines, substation sites and access roads minimise any negative environmental impacts and maximises any benefits.
Monitoring	» Ensure that sensitive areas are avoided as far as possible.

OBJECTIVE: Initiate Bird/Bat Monitoring Program

A monitoring programme should be implemented by BioTherm Energy (in consultation with an avifauna specialist) to document the effect of the wind energy facility on birds and bats. This should take place before construction (to provide a benchmark), and continue during construction and during operation. This is seen as critical to furthering the understanding of avifaunal impacts and wind energy facilities on the site and in South Africa. Further details are included in Appendix A of this EMP.

Project component/s	List of project components affecting the objective » wind turbines
Potential Impact	» Mortality of birds due to collision with turbines
Activity/risk source	» Turbines and power infrastructure
Mitigation: Target/Objective	» The delivery of an effective impact mitigation scheme for the facility, informed initially by influence of pre-construction monitoring on final construction plans, and refined by post-construction monitoring of actual impacts, and resulting adjustments in management practices and mitigation measures applied.

Mitigation: Action/control	Responsibility	Timeframe
Appoint advising scientist and agency to conduct pre- construction monitoring	BioTherm Energy	Pre-construction
Refine monitoring protocol and determine the extent of radar deployment required	Advising scientist, in negotiation with BioTherm Energy	Pre-construction, construction, operation
Appoint radar technologists to service the	Advising scientist, in	Pre-construction,

Mitigation: Action/control	Responsibility	Timeframe
project, and acquire/hire hardware, software and relevant expertise, IF radar use is approved	negotiation with BioTherm Energy	construction, operation
Start pre-construction monitoring	Monitoring agency	1 year before construction is due to start
Periodically collate and analyse pre-construction monitoring data	Advising scientist and radar specialist (if applicable)	Every 3 months of monitoring
Review report on the 6-12 months of pre-construction monitoring, and integrate findings into construction EMP and broader mitigation scheme	Advising scientist, monitoring agency and radar specialist (if applicable), in negotiation with BioTherm Energy	After a year of pre-construction monitoring
Implement appropriate additional mitigation as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the priority species, or when collision or electrocution mortalities are recorded for any of the priority species.	BioTherm Energy in consultation with specialist	Pre-construction, Construction and Operation
Refine post-construction monitoring protocol in terms of results of pre-construction, and determine the extent of radar deployment required. Periodically collate and analyse post-construction monitoring data.	BioTherm Energy in consultation with specialist	Pre-construction, Construction and Operation

Performance Indicator	» 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	» An incident reporting system should be used to record non-conformances to the EMP.

MANAGEMENT PLAN FOR WIND ENERGY FACILITY: CONSTRUCTION CHAPTER 5

5.1. Overall Goal for Construction

Overall Goal for Construction: Undertake the construction phase of the wind energy facility in a way that:

» Ensures that 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 regards to noise impacts, farming practices, traffic and road use, and effects on local residents and the tourism industry.
» Minimises the impact on the vegetation and habitats value of the site and where possible adds to the botanical record of this area.
» Minimises the impact on the archaeological and historical value of the site and where possible adds to the archaeological record of this area.
» Minimises impacts on birds, bats and other fauna using the site.
» Establishes an environmental baseline during construction activities on the site, where possible, particularly with regard to priority bird species using the site.

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

As the Proponent, BioTherm Energy must ensure that the implementation 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. BioTherm Energy will retain various key roles and responsibilities during the construction of the wind energy facility. These are outlined below.

OBJECTIVE: To establish clear reporting, communication and responsibilities in relation to environmental incident

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Site Manager; Safety, Health and Environment 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 BioTherm Energy 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 Environmental Impact Assessment for the project, the EMP, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.

The **Site Manager** (BioTherm Energy's On-site Representative) will:

» Be fully knowledgeable with the contents of the Environmental Impact 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 Plan.
» 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 Environment Representative** (SHE officer) 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 Environmental Impact 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 Plan.
» Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
» Ensure that the contents of this document 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.

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

» Ensuring adherence to the environmental management specifications.
» 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

In order to meet the goal outlined in Section 5.1, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE: Site establishment and securing the site

Site establishment is the first activity which is to be undertaken within the construction phase. The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. Where the public could be exposed to danger by any of the works or site activities, the Contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English, Afrikaans and any other relevant local languages, all to the approval of the Project Manager.

Project component/s	Project components affecting the objective: » wind turbines » access roads » substations
Potential Impact	» Hazards to landowners and public » Security of materials » Substantially increased damage to adjacent sensitive vegetation, due largely to ignorance of these sensitive areas.
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 members of the public/landowners/residents

Mitigation: Action/control	Responsibility	Timeframe
Secure site, working areas and excavations in an appropriate manner, as agreed with the ECO.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure area.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Fence and secure Contractor's equipment camp.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Minimise vegetation clearance associated with site establishment activities.	Contractor	Site establishment
All development footprints for roads, buildings, underground cables, laydown areas and turbine footings should be appropriately demarcated. There is to be no disturbance outside these demarcated areas.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Establish the necessary ablution facilities with chemical toilets. Provide adequate sanitary facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site.	Contractor	Erection: during site establishment Maintenance: for duration of Contract
Ablution or sanitary facilities should not be located within 100 m from a 1:100 year flood line including water courses, wetlands or within a horizontal distance of less than 100 m, whichever is applicable	Contractor	During site establishment, construction and maintenance
Supply adequate waste collection bins at site where construction is being undertaken.	Contractor	Erection: during site establishment Maintenance: for duration of Contract within a particular area

Performance Indicator	» No unnecessary environmental impacts associated with site established » Site is secure and there is no unauthorised entry » No members of the public/ landowners injured
Monitoring	» An incident reporting system will be used to record non-conformances to the EMP » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager in terms of non-conformances recorded.

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

The construction phase is expected to extend over a period of approximately 6 months and will create between 50 and 100 temporary employment opportunities. The estimated lifespan of the facility is 25-30 years and the annual wage bill will be in the region of R 2.5 million.

Project component/s	Construction and establishment activities associated with the establishment of the wind energy facility, including associated infrastructure.
Potential Impact	The opportunities and benefits associated with the creation of local employment and business should be maximised.
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 where possible will maximise local employment opportunities.
Mitigation: Target/Objective	BioTherm Energy, in consultation with the Theewaterskloof Local Municipality (TWK LM), 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. BioTherm Energy should also develop a database of local BEE service providers.

Mitigation: Action/control	Responsibility	Timeframe
Ensure that low-skilled workers are sourced from the local area as far as possible.	BioTherm Energy and contractors	Before construction phase commences.
Where required, implement appropriate training and skills development programmes prior to the initiation of the construction phase to ensure that local labour	BioTherm Energy	Prior to the initiation of the construction phase.

Mitigation: Action/control	Responsibility	Timeframe
is employed as far as possible.		
Skills audit to be undertaken to determine training and skills development requirements for the facility's workforce.	BioTherm Energy	Undertaken within 1 month of commencement of construction phase commencing.
Develop a database of local BEE service providers and ensure that they are informed of relevant tenders and job opportunities.	BioTherm Energy	Before construction phase commences.
Identify potential opportunities for local businesses for the tender process.	BioTherm Energy	Tender Design and Review stage

Performance Indicator	» Employment and business policy document that sets out local employment and targets completed before construction phase commences. » Semi and unskilled labour locally sourced. » 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	» An independent organisation must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: To avoid and/or minimise the potential impact of the activities during the construction on the safety of local communities and the potential loss of stock and damage to farm infrastructure

The facility could result in increased risk of stock theft, poaching and damage to farm infrastructure associated with presence of construction workers on the site.

Project component/s	Construction and establishment activities associated with the establishment of the wind energy facility, including associated infrastructure.
Potential Impact	Impact on safety of farmers and communities (increased crime, etc) and potential loss of livestock due to stock theft by construction workers and also damage to farm infrastructure, such as gates and fences.
Activities/risk sources	The presence of construction workers on the site could pose a potential safety risk to local farmers and communities and may also result in stock thefts. The activities of construction workers may also result in damage

	to farm infrastructure.
Mitigation: Target/Objective	To avoid and or minimise the potential impact on local landowners and communities and their livelihoods.

Mitigation: Action/control	Responsibility	Timeframe
The housing of construction workers on the site should be limited to security personnel.	BioTherm Energy and contractor	Duration of construction
Establish a Monitoring Forum with the adjacent farmers and develop a Code of Conduct for construction workers.	BioTherm Energy	Duration of construction
Ensure that construction workers who are found guilty of breaching the Code of Conduct are dismissed. All dismissals must be in accordance with South African labour legislation.	Contractors	Construction phase
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.	Contractor	Conclusion of construction
Compensate farmers / community members at full market related replacement cost for any proven losses, such as livestock, damage to infrastructure etc associated with the construction of the facility.	Contractors	Duration of construction
Conduct fire fighting training with construction workers.	Contractor	Prior to construction

Performance Indicator	» No unauthorised fires on site at during the construction phase. » Fire fighting equipment and training provided before the construction phase commences. » Compensation claims settled within 1 month of claim being verified by Community Monitoring Forum.
Monitoring	» An independent organisation must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: To avoid and or minimise the potential impact on current and future farming activities during the construction phase

Construction activities of the proposed facility could lead to the loss of productive farm land. BioTherm Energy has ensured that all centre pivot irrigation systems are avoided by the proposed layout of the wind energy facility through consideration of the identified sensitive areas for the site.

Project component/s	Construction phase activities associated with the establishment of the wind energy facility and associated infrastructure.
Potential Impact	The footprint of the wind energy facility and associated infrastructure will result in a loss of land that will impact on farming activities on the site.
Activities/risk sources	The footprint taken up by the wind energy facility and associated infrastructure (approximately 20 ha).
Mitigation: Target/Objective	To minimise impacts on agricultural activities and to enable farming activities to continue where possible, specifically grazing.

Mitigation: Action/control	Responsibility	Timeframe
Investigate the possibility of allowing farmers in the area to continue to use the site for grazing, or the option of leasing the land for grazing to other local farmers and possibly emerging farmers.	BioTherm Energy	Duration of construction
Compile and implement a rehabilitation plan to ensure rehabilitation of disturbed areas on completion of the construction phase.	BioTherm Energy and specialist	Construction and post-construction

Performance Indicator	» No complaints regarding impacts on farming activities.
Monitoring	» ECO to monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: Management of dust and emissions to air

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 main and internal access roads.

Project component/s	Construction and establishment activities associated with the establishment of the wind energy facility and associated infrastructure.
Potential Impact	» Dust and particulates from vehicle movement to and on-site, foundation excavation, road construction activities, road maintenance activities, temporary stockpiles, and vegetation clearing affecting the surrounding residents and visibility. » Release of minor amounts of air pollutants (for example NO_2, CO and SO_2) from vehicles and construction equipment.
Activities/risk sources	» Clearing of vegetation and topsoil » Excavation, grading, scraping » Transport of materials, equipment and components on internal access roads

	» Re-entrainment of deposited dust by vehicle movements » Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces » Fuel burning vehicle engines
Mitigation: Target/Objective	» To ensure emissions from all vehicles are minimised, where possible, for the duration of the construction phase » To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements for the duration of the construction phase

Mitigation: Action/control	Responsibility	Timeframe
Roads must be maintained to a manner that will ensure that dust from road or vehicle sources is not visibly excessive. Ensure that damage to roads is repaired on completion of construction phase.	Contractor	Site establishment; Duration of construction
Appropriate dust suppressant must be applied on all exposed areas and stockpiles as required to minimise/control airborne dust.	Contractor	Duration of contract
Haul vehicles moving outside the construction site carrying material that can be wind-blown must be covered with tarpaulins.	Contractor	Duration of contract
Speed of construction vehicles must be restricted, as defined by the ECO.	Contractor	Duration of contract
Disturbed areas must be re-vegetated as soon as practicable once construction is completed in an area.	Contractor	At completion of the construction phase
Construction vehicles and equipment must be maintained in a road-worthy condition at all times.	Contractor	Duration of contract
If monitoring results or complaints indicate inadequate performance against the criteria indicated, then the source of the problem must be identified, and existing procedures or equipment modified to ensure the problem is rectified.	Contractor	Duration of contract

Performance Indicator	» No complaints from affected residents or community regarding dust or vehicle emissions. » Dust suppression on roads used by construction vehicles. » 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 monthly basis.
Monitoring	Monitoring must be undertaken to ensure emissions are not exceeding the prescribed levels via the following methods: » Visual daily inspections of dust generation by construction activities throughout the construction phase.

	» Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Project Manager/ ECO. » A complaints register must be maintained, in which any complaints from residents/the community will be logged. Complaints will be investigated and, where appropriate, acted upon. » An incident reporting system must be used to record non-conformances to the EMP.

OBJECTIVE: Control noise pollution as a result of construction activities

Projected noise levels during construction of the Wind Energy Facility were modelled using the methodology as proposed by SANS 10357:2004. The resulting future noise projections indicated that the construction activities as modelled for the worst-case scenario would comply with both the Noise Control Regulations as well as the SANS 10103:2004 guidelines (projected noise levels generally lower than the acceptable day rating level).

Various other construction activities would be taking place during the development of the facility, and the combined noise level of the activities listed might impact on sensitive receptors. Current modelled activities do not include wind conditions in any direction. It should be noted that wind could increase the noise levels at a downwind receptor due to refraction (the "bending" of the sound waves).

The higher traffic volumes down the N2 due to construction would not impact significantly on any potentially Sensitive Receptor along that route due to the high traffic volume, but care must be taken when considering or reconsidering access routes to the various construction turbine sites.

While the significance of the noise impact is low, the following measures are recommended to define the performance of the developer in reducing/improving the noise impacts via mitigating the projected impacts.

Project component/s	Construction of infrastructure, including but not limited to: » turbine system (foundation, tower, nacelle and rotor), » Substations, » access roads
Potential Impact	» Increased noise levels at potentially sensitive receptors » Potentially changing the acceptable land use capability
Activity/risk source	Any construction activities taking place within 500 meters from potentially sensitive receptors (PSR)
Mitigation:	» Ensure equivalent A-weighted noise levels below 45 dBA at potentially

Target/Objective	sensitive receptors. » Ensure that maximum noise levels at potentially sensitive receptors be less than 65 dBA. » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors. » Ensuring compliance with the Noise Control Regulations

Mitigation: Action/control	**Responsibility**	**Timeframe**
Establish a line of communication and notify all stakeholders and potentially sensitive receptors of the means of registering any issues, complaints or comments.	Environmental Control Officer	All phases of project
Notify potentially sensitive receptors about work to take place at least 2 days before the activity is to start. The following information to be presented in writing: » Description of Activity to take place » Estimated duration of activity » Working hours » Contact details of responsible party	Contractor Environmental Control Officer	Duration of construction At least 2 days, but not more than 5 days before activity is to commences
Ensure that all construction equipment is maintained and fitted with the required noise abatement equipment.	Environmental Control Officer	Weekly inspection
Where possible construction work should be undertaken during normal working hours (06H00 – 18H00), from Monday to Saturday. If agreements can be reached (in writing) with the surrounding (within a 500m distance) potentially sensitive receptors, these working hours can be extended.	Contractor	As required

Performance Indicator	» Equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors (8 hours). » Ensure that maximum noise levels at potentially sensitive receptors are less than 65 dBA. » No noise complaints are registered.
Monitoring	» No complaints received from surrounding areas.

OBJECTIVE: Minimise impacts on identified sensitive areas

Prior to any earthworks within High sensitivity Renosterveld areas a plant Search and Rescue program should be undertaken. Note: Provided that all recommended mitigation is put in place this should only be applicable for Dassiesfontein substation, and in a 275m portion of the road areas between turbines 2 and 3 at Klipheuwel. Search and

Rescue (S&R) of certain translocatable, selected succulents, shrubs and bulbs occurring in long term & permanent, hard surface development footprints (i.e. all buildings, new roads and tracks, laydown areas, and turbine positions) should take place. All such development footprints must be surveyed and pegged out as soon as possible, and then a local horticulturist with Search and Rescue experience should be appointed to undertake the S&R. All rescued species should be bagged (and cuttings taken where appropriate) and kept in the horticulturist's nursery, and should be returned to site once all construction is completed and rehabilitation of disturbed areas is required. Replanting should only occur in autumn or early winter (April – May), once the first rains have fallen, in order to facilitate establishment. Genera that can be considered for rescue are all bulbs and tuberous species plus selected specimens of succulents such as Ruschia and Lampranthus species.

A number of watercourses have been identified on the Kliphewuel site. These areas provide habitat to many of the identified sensitive plant and animal species identified to be associated with the site. Therefore, avoidance of these areas as far as possible is recommended.

Project component/s	» 275m portion of the road areas between turbines 2 and 3 at Klipheuwel » Dassiesfontein substation » Wind turbines » Access roads » Underground cabling » Substations
Potential Impact	» Impacts on or loss of indigenous natural vegetation due to construction activities » Loss of individuals of the protected / near threatened plant species » Damage to watercourse areas by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material within wetlands). The focus should be on the functioning of the wetland as a natural system. » Impacts on habitat of fauna, avifauna, and bats
Activity/risk source	» Site preparation and earthworks » Construction-related traffic » Mobile construction equipment » Dumping or damage by construction equipment outside of demarcated construction areas.
Mitigation: Target/Objective	» To retain natural vegetation in the highly sensitive areas on the site » To minimise footprints of disturbance of vegetation/habitats on-site » To minimise loss of indigenous vegetation » No alien plants within project control area » No loss of species of conservation concern » Rescue, maintenance and subsequent replanting of at least 20% of the natural vegetation in all development footprints within any areas

	of High sensitivity natural vegetation on site. » No damage to watercourse areas within project area » To minimise impacts on fauna, avifauna, and bats

Mitigation: Action/control	Responsibility	Timeframe
All bulbs and tuberous species of plants can be considered for rescue, as well as selected specimens of succulents such as Ruschia and Lampranthus species. Material to be bagged up or stored in suitable conditions in a greenhouse (with irrigation where needed); to be replanted in areas requiring rehabilitation in May/June following cessation of all construction related disturbance in particular area.	ECO and appointed horticultural subcontractor	Pre-construction – construction. May following cessation of disturbance, and replanting of material in May/June.
Areas to be cleared must be clearly marked on-site to eliminate the potential for unnecessary clearing.	Contractor in consultation with Specialist	Pre-construction
Where possible, locate any crossings at sites where there are existing road crossings.	BioTherm Energy ECO	Site establishment & duration of contract
For any new watercourse crossings, apply the following measures: » use adequate bridge or culvert structures that do not limit water or sediment flow through the river bed. » ensure bridge structures do not cause canalization or erosion. » implement adequate erosion control measures below river crossings » obtain a permit from DWA for any infrastructure to be located within a watercourse.	BioTherm Energy ECO	Site establishment & duration of contract
The extent of clearing and disturbance to the natural vegetation must be kept to a minimum so that impact on flora and habitats is restricted.	Contractor	Site establishment & duration of contract
Construction activities must be restricted to demarcated areas so that impact on flora and sensitive habitats is restricted.	Contractor	Site establishment & duration of contract
Unnecessary impacts on surrounding natural vegetation must be avoided, e.g. driving around in the veld. Use demarcated access roads only.	Contractor	Site establishment & duration of contract
Avoid creating conditions in which alien plants may become established: » Keep disturbance of indigenous vegetation to a	Construction team, management (environmental	Construction & Operation

Mitigation: Action/control	Responsibility	Timeframe
minimum » Rehabilitate disturbed areas as quickly as possible once construction in an area is complete » Do not import soil from areas with alien plants	officer)	
Establish an ongoing 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)	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
A site rehabilitation programme must be developed and implemented.	Contractor in consultation with Specialist	Duration of contract
Align underground cables and internal access roads as far as possible along existing infrastructure.	Contractor and ECO	Design; Construction
Internal access road between turbines 5 and 6 on the Klipheuwel site should be moved slightly to the north-east OR obtain a permit from DWA to impact on any wetland or water resource.	Contractor and ECO	Design; Construction
Rehabilitate any disturbed areas as quickly as possible once construction in an area is completed.	Contractor and ECO	Construction
Control stormwater and runoff water through the implementation of an appropriate stormwater management plan.	Contractor and ECO	Construction
Appoint an independent environmental control officer during construction operation whose duty it will be to minimise impacts on surrounding sensitive habitats	Contractor and ECO	Construction - Operation
Continue bird and bat monitoring programme implemented in pre-construction phase.	Contractor and ECO	Construction - Operation

Performance Indicator	» Zero disturbance outside of designated work areas » Minimised clearing of existing/natural vegetation » Loss of natural vegetation equivalent to the exact footprint of the proposed project » Horticulturist to submit list of target species to botanist for approval; rescue of material; replanting in rehabilitation areas to cover 20% of these areas within 3 months of replanting. » No impacts on wetland vegetation or natural status of watercourses.
Monitoring	» Observation of vegetation clearing and soil management activities by ECO throughout construction phase » Before construction, determine required number of hectares to accommodate footprint of proposed infrastructure and demarcate

	construction areas. » An incident reporting system will be used to record non-conformances to the EMP. » ECO to monitor Search and Rescue; horticulturist to liaise with botanist. Botanist to review rehabilitation success after 3 months of replanting of rehabilitation areas. » Habitat loss in watercourses should be monitored before and after construction. » Single post-construction report is sufficient.

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

The natural vegetation in the study area is known to be at risk of fire. The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

Project component/s	Construction and establishment activities associated with the establishment of the wind energy facility and associated infrastructure.
Potential Impact	Veld 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.
Activities/risk sources	The presence of construction workers and their activities on the site can increase the risk of veld fires.
Mitigation: Target/Objective	To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

Mitigation: Action/control	Responsibility	Timeframe
Ensure that open fires on the site for cooking or heating are not allowed except in designated areas.	BioTherm Energy & Contractor	Duration of construction
Provide adequate fire fighting equipment onsite.	BioTherm Energy & Contractor	Duration of construction
Provide fire-fighting training to selected construction staff.	Contractor	Duration of construction
Compensate farmers / community members at full market related replacement cost for any losses, such as livestock, damage to infrastructure for losses associated with fires resulting from negligence or non-compliance.	Contractor	As required

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 within 1 month of claim being verified by Community Monitoring Forum.
Monitoring	» BioTherm Energy and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: Control runoff and soil erosion & degradation

The soil resource on the site needs to be conserved as far as possible to minimise the cumulative impact on the local environment.

A set of strictly adhered to mitigation measures are required 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	» Wind turbines » Access roads » Substations » Workshop
Potential Impact	» Degradation of soil » Degradation of local geology » Soil erosion » Siltation of drainage lines
Activities/risk sources	» Water and wind erosion of cleared and excavated areas » Excavation, mixing, dumping, stockpiling and compaction of soil » Concentrated discharge of water from construction activity » Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site » River/stream/drainage line road crossings.
Mitigation: Target/Objective	» To minimise degradation of rock and soil by construction activity » To conserve topsoil by stockpiling and re-using in disturbance areas » To minimise erosion of soil from site during construction » To minimise deposition of soil into drainage lines

Mitigation: Action/control	Responsibility	Timeframe
Restrict construction activity to avoid disturbance to sensitive areas.	ECO/Contractor	Pre-construction and Construction
Access roads to be carefully planned and constructed to	Engineer/ECO/	Pre-construction

Mitigation: Action/control	Responsibility	Timeframe
minimise the impacted area and prevent unnecessary excavation, placement and compaction of soil.		and Construction
Erosion features must be immediately stabilised with appropriate erosion control measures, if they develop	Contractor	Construction
Where new access roads cross natural drainage lines, culverts must be designed to allow free flow. Regular maintenance must be carried out.	BioTherm Energy Contractor	Design Pre-construction and Construction
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
Rehabilitate any disturbed areas immediately after construction in an area is complete in order to stabilise landscapes.	Contractor	Post-construction
Any stockpiles must be protected against wind erosion (e.g. surrounded by shadecloth fences or damped down on a regular basis).	Contractor	Duration of contract
Erosion control measures: Run-off attenuation on slopes (sand bags, logs), silt fences, stormwater catch-pits, shade nets or temporary mulching over denuded areas.	Contractor/ECO	Erection: Before construction Maintenance: Duration of contract
Vehicular traffic must be controlled during construction, confining access and roadways, where possible, to proposed or existing road alignments.	Contractor	Duration of contract
As far as possible, access to the wind energy facility construction site should be restricted to a single access point for both sites.	Contractor	Duration of contract
Construction of new internal access roads should be kept to a minimum. Use existing roads wherever possible.	Contractor	During site establishment
Movement of vehicles on-site is to be on approved and formalised access roads only, which shall be adequately maintained throughout construction. Where temporary tracks are required (e.g. for use by crawler crane) these are to be ripped and rehabilitated as soon use of the track in an area is no longer required.	Contractor	Duration of contract
Control depth of excavations and stability of cut faces/sidewalls.	Engineer/ECO/ Contractor	Before construction and

Mitigation: Action/control	Responsibility	Timeframe
		maintenance over duration of contract

Performance Indicator	» Acceptable level of soil erosion around site, as approved by ECO » Acceptable level of increased siltation in drainage lines, as approved by ECO » Acceptable level of soil degradation, as approved by ECO » Acceptable state of excavations, as approved by ECO » No activity in restricted areas
Monitoring	» Monitoring of area by environmental control officer during construction » Weekly inspections of the site by ECO » Fortnightly inspections of sediment control devices » Fortnightly inspections of surroundings, including drainage lines » Immediate reporting of ineffective sediment control systems » An incident reporting system will record non-conformances

OBJECTIVE: Protection of sites of heritage value / fossil resources

The archaeological significance of the study area is very low with only one locality at Dassiesfontein requiring limited mitigation. The scientific record would benefit by having a systematic record of the material at this site. The material is not significant enough to warrant moving the turbine location. There is the possibility that archaeological material could be unearthed during the construction of foundations. Should this occur, appropriate mitigation (as detailed below) should be implemented.

Project component/s	» Wind turbines » Access roads » Substations » Workshop
Potential Impact	» Heritage objects or artefacts found on site are inappropriately managed or destroyed » Disturbance to fossil resources
Activity/risk source	» Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site
Mitigation: Target/Objective	» To ensure that any heritage objects found on site are treated appropriately and in accordance with the relevant legislation

Mitigation: Action/control	Responsibility	Timeframe
Training of personnel to recognise heritage/ archaeological/fossil finds.	Contractor in consultation with Specialist	Pre-construction
Prior to disturbance or destruction of the site identified on Dassiesfontein, the site should be appropriately recorded by a heritage specialist. A permit for the disturbance or destruction of this site will be required from Heritage Western Cape.	BioTherm Energy in consultation with Specialist	Pre-construction
Areas required to be cleared during construction must be clearly marked in the field to avoid unnecessary disturbance of adjacent areas (which will not be surveyed in detail by a heritage specialist).	Contractor in consultation with Specialist	Pre-construction
If a heritage object is found work in that area must be stopped immediately, and appropriate specialists brought in to assess to site, notify the administering authority of the item/site, and undertake due/required processes.	BioTherm Energy /Contractor in consultation with Specialist	Duration of contract

Performance Indicator	» Zero disturbance outside of designated work areas » All heritage items located are dealt with as per the legislative guidelines » A record is kept of all instances of accidental disturbance of heritage material, as well as post construction review of impacts on landscape context.
Monitoring	» Supervision of all clearing and earthworks by ECO throughout construction phase

OBJECTIVE: Minimisation of visual impacts associated with construction

The construction phase of the facility should be sensitive to potential observers in the vicinity of the construction site. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future perception of the facility.

Secondary visual impacts associated with the construction phase, such as the sight of construction vehicles, dust and construction litter must be managed to reduce visual impacts. The use of dust-suppression techniques on the access roads (where required), timely removal of rubble and litter, and the erection of temporary screening will assist in doing this.

Project component/s	» Wind turbines » Substations » Access roads
Potential Impact	» Temporary visual intrusion
Activity/risk source	» Transportation of wind energy facility and substation components to the site » Construction activities on-site
Mitigation: Target/Objective	» Minimise contrast with surrounding environment and visibility of the construction activities to people in the area

Mitigation: Action/control	Responsibility	Timeframe
Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas thereby limiting the removal of natural vegetation to a minimum.	Contractor	Duration of contract
The activities and movement of construction workers and construction site vehicles must be restricted to the immediate construction site.	Contractor	Construction
Limit access to the construction sites along existing access roads.	Contractor	Construction
The general appearance of construction activities, construction equipment camps and lay-down areas must be maintained 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) and it will be ensured that the specified paint colour is complied with before erection of the turbines.	Contractor	Erection of turbines
Implement an environmentally responsive planning approach to roads and infrastructure to limit cut and fill requirements.	BioTherm Energy Contractor	Pre-construction Construction
Rehabilitate all disturbed areas, including cut and fill slopes to acceptable visual standards.	Contractor	Post-construction

Performance Indicator	» No complaints regarding visual intrusion associated with construction activities
Monitoring	» Ensure that mitigation measures are implemented during construction to minimise visual impacts on surrounding communities

OBJECTIVE: Traffic management and transportation of equipment and materials to site

The construction phase of the project will be the most significant in terms of generating traffic impacts; resulting from the transport of equipment (including turbine components) and materials and construction crews to the site and the return of the vehicles after delivery of materials. Potential impacts associated with transportation and access relate to works within the site boundary (i.e. the wind energy facility and ancillary infrastructure) and external works outside the site boundary.

Project component/s	» Wind turbines » Substations
Potential Impact	» Traffic congestion » Risk of accidents » Deterioration of road pavement conditions (both surfaced and gravel road) due to abnormal loads
Activity/risk source	» Transportation of project components to site
Mitigation: Target/Objective	» To minimise impact of traffic associated with the construction of the facility on local traffic » To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction » To ensure all vehicles are roadworthy and all materials/equipment are carried appropriately and within any imposed permit/licence conditions.

Mitigation: Action/control	Responsibility	Timeframe
All relevant permits for abnormal loads must be applied for from the relevant authority.	Contractor (or appointed transportation contractor)/ BioTherm Energy	Pre-construction
A designated access (or accesses) to the development sites must be created to ensure safe entry and exit.	Contractor	Pre-construction
No deviation from approved access routes within the site must be allowed.	Contractor	Duration of contract
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor (or appointed transportation contractor)	Pre-construction
Any traffic delays as a result of construction traffic must be co-ordinated with the appropriate authorities.	Contractor	Duration of contract
Signage must be established at appropriate points	Contractor	Duration of

Mitigation: Action/control	Responsibility	Timeframe
warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards as per Occupational Health and safety (Act No. 85 of 1993).		contract
Appropriate maintenance of all vehicles must be ensured.	Contractor	Duration of contract
All vehicles travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license – Proof to be presented to Contractor prior to contract being awarded.	Contractor	Duration of contract

Performance Indicator	» No traffic incidents involving BioTherm Energy personnel or appointed contractors » Appropriate signage in place » No complaints resulting from traffic congestion, delays or driver negligence associated with construction of the wind energy facility
Monitoring	» Visual monitoring of traffic control measures to ensure they are effective » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » An incident reporting system will be used to record non-conformances to the EMP

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. A guideline for integrated management of construction waste is included as Appendix B of this EMP.

Project component/s	Storage and handling of chemicals, hazardous substances and waste
Potential Impact	» Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation » Pollution of the surrounding environment through inappropriate waste management and/or material handling practices
Activity/risk source	» Wind turbine construction activities » Substation 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 guidelines developed by the contractor » To minimise production of waste » To ensure appropriate waste handling, storage and disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
Dispose of all solid waste collected at an appropriately registered waste disposal site. The disposal of waste shall be in accordance with all relevant legislation.	Contractor	Duration of Contract
Where a registered waste site is not available for waste disposal, provide a method statement with regard to waste management.	Contractor	Pre-construction
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	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.	Contractor	Duration of contract
Spilled cement must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Soil contaminated/ polluted as a result of a major spill must be removed from the site and disposed of at a licensed hazardous waste disposal facility. Soils contaminated/ polluted through minor spills can be treated on site provided they are contained and have not penetrated the soil surface.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles must not take place on-site outside of designated areas (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
place on site, an appropriate drip tray must be used to contain any fuel or oils.		
All stored fuels to be maintained within a bunded area and on a sealed surface.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function.	Contractor ECO	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
Oily water from bunds at the substations must be removed from site by licensed contractors.	Contractor	Duration of contract
The storage of flammable and combustible liquids such as oils will be in designated areas which are appropriately bunded, and stored in compliance with MSDS files.	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 compiled with.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	Contractor	Duration of contract
Construction contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	Pre-construction
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 storage of waste streams (such as wood, metals, general refuse etc).	Contractor	Duration of contract
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract
No waste may be buried or burnt on site	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	Contractor	Duration of

Mitigation: Action/control	Responsibility	Timeframe
minimum and must be transported by approved waste transporters to sites designated for their disposal.		contract
Documentation (waste manifest) must be maintained detailing the quantity, nature and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor	Duration of contract
Upon the completion of construction, the area must 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 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	» 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 will 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 » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » An incident reporting system will be used to record non-conformances to the EMP

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

The presence of construction workers poses a potential risk to family structures and social networks. 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 local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky 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
» An increase in sexually transmitted diseases (STDs)

Project component/s	Construction and establishment activities associated with the establishment of the wind energy facility, including 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, 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
Identify local contractors who are qualified to undertake the required work.	BioTherm Energy	Tender stage Pre-construction
Tender documents for contractors include conditions set out in the SIA, including transport of workers home over weekends, transportation of workers home on completion of construction phase, establishment of Monitoring forum.	BioTherm Energy	Tender stage Pre-construction
Ensure that low-skilled workers are sourced from the local area as far as possible. This requirement should be included in the tender documents. Construction workers should be recruited from the local area in and around the towns of Caledon and Botrivier.	BioTherm Energy and contractors	Pre-construction
Construction workers should be able to provide proof of having lived in the area for five years or longer.	BioTherm Energy and contractors	Pre-construction
Identify local contractors who are qualified to undertake the required work.	BioTherm Energy and contractors	Pre-construction
Establish a Monitoring Forum (MF) consisting of representatives from the local community, local police, local farming community and the contractor prior to the commencement of the construction phase.	BioTherm Energy and contractors	Pre-construction
Ensure that construction workers attend a brief 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.	BioTherm Energy and contractors	Pre-construction

Mitigation: Action/control	Responsibility	Timeframe
Ensure that construction workers who are found guilty of breaching the Code of Conduct are dismissed. All dismissals must be in accordance with South African labour legislation.	Contractors	Construction phase
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	Construction phase
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	Construction phase

Performance Indicator	» Employment policy and tender documents that sets out local employment and targets completed before construction phase commences. » Semi and unskilled labour locally sourced as far as possible. » Construction workers employed have proof that they have lived in the area for five years or longer. » Code of Conduct drafted before commencement of construction phase. » Briefing session with construction workers held at outset of construction phase.
Monitoring	» Independent monitoring 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	» Construction workers on site and residing in surrounding areas
Potential Impact	» Pollution/contamination of the environment » Disturbance to the environment

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
The terms of this EMP and the Environmental Authorisation (once issued) will be included in all tender documentation and Contractor's contracts.	BioTherm Energy	Tender process
Conduct environmental awareness training with construction workers before the commencement of construction.	ECO/ Contractor	Prior to commencement of construction
An ECO must be permanently on site throughout the road construction, cable laying, and turbine foundation excavation periods, and at other times should visit the site at least once a week.	BioTherm Energy	Duration of construction
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no abluting will be permitted outside the designated area. These facilities must be regularly serviced by appropriate contractors.	Contractor (and sub-contractor/s)	Duration of contract
Cooking/meals 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 must disturb flora or fauna outside of the demarcated construction area/s.	Contractor (and sub-contractor/s)	Duration of contract
Contractors appointed by BioTherm Energy must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.	Contractor (and sub-contractor/s)	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	Contractor (and sub-contractor/s)	Construction

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 regarding environmental requirements and Code of Conduct.
Monitoring	» Observation and supervision of Contractor practices throughout construction phase. » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system will be used to record non-conformances to the EMP.

5.4. Detailing Method Statements

OBJECTIVE: To ensure all construction activities/practices/procedures are undertaken with the appropriate level of environmental awareness to minimise environmental risk, in line with the specifications of the EMP.

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 by the ECO, 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.

5.5. 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.
» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
» Basic training in the identification of archaeological sites/objects, paleontological sites, and protected flora and fauna that may be encountered on the site.
» Awareness of any other environmental matters, which are deemed to be necessary by the ECO.

» Ensuring that appropriate communication tools are used to outline the environmental "do's" and "don'ts" (as per the environmental awareness training course) to employees.
» Records must be kept of those that have completed the relevant training.
» Refresher sessions must be held to ensure the contractor's staff are aware of their environmental obligations.

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

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

A monitoring programme must be in place 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 monitoring will be stipulated by the Environmental Authorisation (once issued). Where this is not clearly dictated, BioTherm Energy 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 to the ECO.

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 ECO will ensure compliance with the EMP, and to conduct monitoring activities. The Environmental Control Officer must 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 and/or any other monitoring body stipulated by the regulating authorities.

MANAGEMENT PLAN FOR 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

6.2. Objectives

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 will include all areas disturbed during the construction phase and that are not required for regular maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.

The main areas requiring rehabilitation will be the laydown areas adjacent to the turbines, the crane tracks alongside the permanent access roads, any cable routings where these fall outside the above-mentioned areas, and disturbed areas around the substation and maintenance building, and disturbed areas associated with, substation sites and access roads.

Project component/s	» Laydown areas » Substation site and associated access road » Access roads not required for operation and maintenance
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
Necessary drainage works and 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 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.	BioTherm Energy 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.	BioTherm Energy 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 WIND ENERGY FACILITY: OPERATION CHAPTER 7

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 operation activities are properly managed in respect of environmental aspects and impacts.
» 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.
» Minimises impacts on birds, bats and other fauna using the site.
» Monitors and evaluates the impacts of the wind energy facility on birds and bats that frequent the area, in particular monitoring of bird strikes, bird nesting activities.
» Establishes an environmental baseline for wind energy facility sites in South Africa, particularly with regard to priority bird species 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: Protection of avifauna

The threat of collision of avifauna with the turbine blades is the most concerning issue associated with the operation of the facility. 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 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. Large terrestrial species (especially Blue Crane *Anthropoides paradiseus*, which regularly occurs in large, non-breeding flocks and/or as a number of breeding pairs in pastures and cultivated land), resident and breeding and/or visiting raptors (in particular Black Harrier *Circus maurus*, which is likely to occur

regularly on site, and may breed within it in wet years), and a suite of endemic passerines (in particular Agulhas Long-billed Lark *Certhilauda brevirostris*) are probably the species of greatest conservation significance which are most likely to be impacted by the wind energy facility, both in terms of the anticipated collision and disturbance impacts of the development.

Project component/s	» wind energy facility (turbines) » substations
Potential Impact	» Disturbance to or loss of birds as a result of collision with the turbine blades » Disturbance to or loss of birds as a result of collision with the overhead power lines » Electrocution on power lines and substations
Activity/risk source	» Spinning turbine blades » substations
Mitigation: Target/Objective	» More accurately determine the impact of the operating wind energy facility on priority bird species » Minimise impacts associated with collisions and electrocutions

Mitigation: Action/control	Responsibility	Timeframe
Minimise habitat destruction caused by the construction of the facility by keeping the lay-down areas as small as possible, building as few temporary roads as possible, and reducing the final extent of developed area to a minimum.	BioTherm Energy Environmental Manager	Construction
Minimising the disturbance impacts associated with the construction of the facility, by abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.	BioTherm Energy Environmental Manager	Construction
Refine post-construction monitoring protocol in terms of results pre-construction, and determine the extent of radar deployment required	Advising scientist, monitoring agency and radar specialist (if applicable), in negotiation with the client	As soon as possible / practical after construction completed
Start post-construction monitoring	Monitoring agency	6 months after construction is completed
Periodically collate and analyse post-construction monitoring data	Advising scientist and radar specialist (if applicable)	Every 3 months of monitoring
Review report on the full year of post-construction monitoring, and integrate findings into operational EMP and broader mitigation scheme	Advising scientist, monitoring agency and radar specialist (if	1 year post-construction

Mitigation: Action/control	Responsibility	Timeframe
	applicable), in negotiation with the client	
Review the need for further post-construction monitoring	Advising scientist, monitoring agency and radar specialist (if applicable), in negotiation with the client	1 year post-construction

Performance Indicator	» No additional disturbance to avifaunal populations on the wind energy facility site » Regular provision of clearly worded, logical and objective information on the interface between the local avifauna and the proposed/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, construction and operational phase
Monitoring	» Observation of avifaunal populations and incidence of injuries/death from collisions from turbine blades or power line.

OBJECTIVE: Protection of vegetation

Indirect impacts on natural vegetation patches during operation could result from maintenance activities and the movement of people and vehicles on site. In addition, establishment of alien vegetation on the site could pose a risk to the protection of the natural vegetation patches on the site.

Project component/s	» Wind energy facility (including access roads) » Substations and access to substations
Potential Impact	» Disturbance to or loss of vegetation and/or habitat
Activity/risk source	» Movement of employee vehicles within and around site
Mitigation: Target/Objective	» To maintain minimised footprints of disturbance of vegetation/habitats on-site » To ensure and encourage plant regrowth in areas of post-construction rehabilitation » Removal of all woody alien invasive vegetation within the project area, within two years of project commencement, and particularly within the High sensitivity areas of natural vegetation. To be undertaken from project inception, on an ongoing basis.

Mitigation: Action/control	Responsibility	Timeframe
Vehicle movements must be restricted to designated roadways.	BioTherm Energy	Operation
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	BioTherm Energy	Operation
An on-going alien plant monitoring and eradication programme must be implemented, where necessary.	BioTherm Energy	Operation
DWA approved methodology should be employed for all alien clearing operations. Dense areas should be tackled last – the priority is to prevent their spread, and then gradually clear the entire area, maximising cost efficiency. Areas should not be burnt until an area has been clear for at least one year, in order to prevent coppicing and massive seed germination. *Acacia saligna* (Port Jackson), Hakea sericea (silky hakea) and *Pinus radiata* (pine) are the primary invasive aliens. No bulldozing or removal by any machinery is allowed, as this disturbs the soil and creates ideal conditions for re-invasion. All stems must be cut as close to ground level as possible, using loppers or chainsaws (depending on size), and stumps must be immediately hand painted with a suitable Triclopyr herbicide (e.g. Garlon, Timbrel, with colour dye) to prevent resprouting. If this is not done within 5 minutes of being cut Port Jackson will resprout, wasting the original effort. No herbicide spraying should be undertaken anywhere, due to the extensive collateral damage. All cut branches should be stacked into a pyramid (cut end up) and left to dry – where rodents will eat the available seed under the pile, reducing seed germination. Annual follow ups are required in all areas that have been previously cleared (to be undertaken Oct-April). Small seedlings may be hand pulled.	BioTherm Energy	Operation

Performance Indicator	» No further disturbance to vegetation » Continued improvement of rehabilitation efforts » No colonisation of the site by alien vegetation
Monitoring	» Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas

OBJECTIVE: Preservation of high sensitivity areas

It is strongly recommended that the landowners should refrain from grazing livestock in the high sensitivity vegetation areas in the main winter and spring growing and flowering periods (1 May – end October). One of the primary reasons for this is that removal of livestock grazing pressure will have a beneficial effect on the natural vegetation, particularly in terms of natural rehabilitation, in that flowering and seed set of the remaining natural plants (especially pioneers such as the annuals) will be significantly better in the absence of grazing (which removes the flowers). If the nearby annuals and other plants are not grazed this means that natural rehabilitation of the areas disturbed by the project will be significantly improved, as there will be much more locally indigenous seed available nearby for establishment in the disturbed areas, and the site may also act as a seed source for some nearby overgrazed areas.

Project component/s	» Wind energy facility » Substation site and associated access roads
Potential Impact	» Grazing and trampling substantially decreases rehabilitation success, posing a risk of erosion and biodiversity loss; grazing and trampling impacts negatively on flowering and seed set of many rare plant species
Activity/risk source	» Grazing within high sensitivity areas on the site
Mitigation: Target/Objective	» To ensure high sensitivity areas are preserved

Mitigation: Action/control	Responsibility	Timeframe
Removal of all livestock from all High sensitivity areas of natural vegetation on site from 1 May to end October.	ECO (construction phase) site manager and landowners	Ongoing from construction into operational phase

Performance Indicator	» Successful preservation of high sensitivity areas
Monitoring	» Botanist to review regeneration and seed set success in palatable species every two years, and to check site for compliance in terms of livestock.

OBJECTIVE: Minimisation of visual impacts

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. Due to the nature of the area within which the facility is planned, there are only a few potentially sensitive receptors.

Other impacts include impacts associated with lighting of substations, and the aircraft warning lights mounted on top of the hub of the wind turbines. The regulations for the CAA's *Marking of Obstacles* should be strictly adhered to, 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.

Mitigation of lighting impacts includes the pro-active design, planning and specification lighting for the facility by a lighting engineer. The correct specification and placement of lighting and light fixtures for both the turbines and the ancillary infrastructure will go far to contain rather than spread the light.

Project component/s	» Wind energy facility (including access roads) » Substations
Potential Impact	» Risk to aircraft in terms of the potential for collision » Enhanced visual intrusion » Impact on ambient lighting conditions
Activity/risk source	» Size/scale of turbines » Substation and associated lighting » Aviation lighting » Access roads » Other associated 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 substations 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 flashing lights on the turbines representing the outer perimeter of the facility.	BioTherm Energy	Erection and maintenance
Ensure that proper planning is undertaken regarding the placement of lighting structures for the substations and that light fixtures only illuminate areas inside the substation site.	BioTherm Energy	Construction, Operation and maintenance
A lighting engineer must be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.	BioTherm Energy	Erection and maintenance
Maintain the general appearance of the facility in an aesthetically pleasing way.	BioTherm Energy	Operation and maintenance
Undertake regular maintenance of light fixtures.	BioTherm Energy	Operation and maintenance
Limit access to the wind energy facility site, and substations to along existing access roads.	BioTherm Energy	Operation and maintenance
Additional mitigation measures include the following: » Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); » Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; » Making use of minimum lumen or wattage in fixtures; » Making use of down-lighters, or shielded fixtures; » Making use of Low Pressure Sodium lighting or other types of low impact lighting. » Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.	BioTherm Energy	Operation and maintenance

Performance Indicator	» Minimised visual intrusion on surrounding areas » Appropriate visibility of infrastructure to aircraft » The effective containment of the light to the substation site.
Monitoring	» Ensure that aviation warning lights or other measures are installed before construction is completed » Ensure that Aviation warning lights or other measures are 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 and maintenance 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, hazardous waste and liquid waste.

Project component/s	» Wind turbines » Substations
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 - substations » Water storage tank » Fuel and oil storage » Maintenance building
Mitigation: Target/Objective	» To comply with waste management guidelines » To minimise production of waste » To ensure appropriate waste disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
Hazardous substances must be stored in sealed containers within a clearly demarcated designated area.	BioTherm Energy	Operation
Storage areas for hazardous substances must be appropriately sealed and bunded.	BioTherm Energy	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.	BioTherm Energy	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 will be cleaned up according to specified standards regarding bioremediation.	BioTherm Energy	Operation and maintenance
Waste handling, collection and disposal operations must be managed and controlled by a waste management contractor.	BioTherm Energy /waste management contractor	Operation

Mitigation: Action/control	Responsibility	Timeframe
Used oils and chemicals: » 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.	BioTherm Energy	Operation
It must be ensured that volumes of any hazardous waste stored on site do not exceed 30m^3. Should this volume be exceeded, a waste license will be required to be obtained.	BioTherm Energy	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	BioTherm Energy	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	BioTherm Energy	Operation
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	BioTherm Energy	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 contamination of soil or water
Monitoring	» 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 SHE Representative. All appropriate waste disposal certificates accompany the monthly reports.

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

Project component/s	Day to day operational activities associated with the wind energy facility including maintenance.
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
BioTherm Energy should commit to implementing a 5-year training and skills development and training programme. The initial local content target is 30%. However, after 5 years the objective is to have all the employment opportunities taken up by locals.	BioTherm Energy	Develop programme during the construction phase
Identify local members of the community who are suitably qualified or who have the potential to be employed full time.	BioTherm Energy	Identify members during the construction phase

Performance Indicator	» 5 year training and skills development programme developed and designed before construction phase completed » Potential local community members identified before construction phase completed.
Monitoring	BioTherm Energy must monitor indicators listed above to ensure that they have been met for the operational phase.

OBJECTIVE: Maximise the potential tourism opportunities during the operational phase. Highlight the benefits of renewable energy projects.

The wind energy facility has potential for the area to benefit from local tourism. The proposed facility may, however, also have a negative impact on tourism in the area.

Project component/s	Operational phase of the project.
Potential Impact	» The proposed wind energy facility has the potential to provide the Theewaterskloof Municipality with an attraction that would improve its

	attraction to tourists. The development also has the potential to promote the benefits of renewable energy projects.
Activity/risk source	» The establishment of a wind energy facility has the potential to create and attraction for visitors to the area. The development also has the potential to promote the benefits of renewable energy projects.
Mitigation: Target/Objective	» To enhance the potential tourism and renewable energy opportunities associated with the proposed wind energy facility.

Mitigation: Action/control	Responsibility	Timeframe
Liaise with representatives from the Theewaterskloof Municipality and tourism organisations to raise awareness of the proposed wind energy facility	BioTherm Energy	During the construction phase
Establish a renewable energy interpretation centre at the Dassiesfontein Farm Stall. The centre should be equipped with information boards that provide visitors with information on the project and other relevant information. Information should also be provided on renewable energy and its benefits. Information should presented in the three main languages in the Western Cape, namely Afrikaans, English, and Xhosa.	BioTherm Energy	Establish centre at the outset of the construction phase. This will create an opportunity to provide tourists with information on both the construction and operational phases of the project.

Performance Indicator	Establishment of interpretation centre at the outset of the construction phase.
Monitoring	BioTherm Energy must monitor indicators listed above to ensure that they have been met for the operational phase.

7.3. Monitoring Programme: Operational Phase of the Wind Energy Facility

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

A monitoring programme must be in place 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 monitoring will be stipulated by the Environmental Authorisation (once issued). Where this is not clearly dictated, BioTherm Energy 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 to the environmental manager.

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 Manager will ensure compliance with the EMP throughout construction and operation, and to conduct monitoring activities. The Environmental Manager must have the appropriate experience and qualifications to undertake the necessary tasks.

MANAGEMENT PLAN FOR WIND ENERGY FACILITY: DECOMMISSIONING CHAPTER 8

The turbine infrastructure which will be utilised for the proposed wind energy facility is expected to have a lifespan of 20 to 30 years (with maintenance). 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.

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 and Replace Existing Turbine

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

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. All parts of the turbine would be considered reusable or recyclable except for the blades.

Project component/s	» Decommissioning phase of the wind energy facility.
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. However, the number of people affected is relatively small. 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 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.	BioTherm Energy	At decommissioning.
» In as far as practically feasible, workers should be redeployed within other operations run by BioTherm Energy	BioTherm Energy	At decommissioning.

Performance Indicator	South African Labour legislation at the relevant time.
Monitoring	Retrenchments should comply with South African Labour legislation of the day.

FINALISATION OF THE ENVIRONMENTAL MANAGEMENT PLAN 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 and when results from on-site monitoring are avialable. This will ensure that the construction and operation activities are planned and implemented taking sensitive environmental features into account.

Appendix A:
Outline of bird monitoring programme

PROPOSED BIRD MONITORING PROGRAMME

The primary aims of a long-term monitoring programme would be to:

(i) Determine the densities of birds (especially Blue Crane, Black Harrier and Agulhas Long-billed Lark) resident within the impact area of the wind energy facility before construction of the facility, and afterwards, once the facility, or phases of the facility, become operational.

(ii) Document patterns of bird activity and movements in the vicinity of the proposed wind energy facility before construction, and afterwards, once the facility is operational.

(iii) Identify sensitive and no-go areas for turbine placement to inform the final layout of the facility and the environmental management plan for both the construction and operational phases of the project.

(iv) Monitor patterns of bird activity and movement in relation to weather conditions, time of day and season for at least a full calendar year after the facility is commissioned.

(v) Register and as far as possible document the circumstances surrounding all avian collisions with the turbines for at least a full calendar year after the facility becomes operational.

Bird density and activity monitoring should focus on rare and/or endemic, potentially disturbance or collision prone species, which occur with some regularity in the area (as indicated in the table below). Ultimately, the study should provide much needed quantitative information on the effects of the facility on the distribution and abundance of birds, and the actual risk it poses to the local avifauna, and serve to inform and improve mitigation measures to reduce this risk. It will also establish a precedent and a template for research and monitoring of avian impacts at possible, future wind energy sites in the region. This programme outline is informed by monitoring studies established in other countries (e.g. Erickson *et al.* 1999, Scottish National Heritage 2005), but is based substantially on those developed for both the Darling and the Klipheuwel wind power demonstration facilities in South Africa (Jenkins 2003, Küyler 2004). The bulk of the work involved should be done by an expert ornithologist or under the supervision of such.

Monitoring protocols

Avian densities before and after

A set of at least 10 walk-transect routes, each of at least 1000 m in length, should be established in areas representative of all the avian habitats present within a 10 km

radius of the centre of the development site. Each of these should be walked at least once every two months over at least six months immediately preceding construction, and at least once every two months over the same calendar period, at least six months after the facility is commissioned. The transects should be walked after 06h00 and before 09h00, and the species, number and perpendicular distance from the transect line of all birds seen should be recorded for subsequent analysis and comparison.

In addition, any cliff-lines or quarry faces within the broader development area (for e.g. the quarry immediately north-east of the site) should be surveyed for cliff-nesting raptors at least once every six months using documented protocols (Malan 2009), all sightings of key species (Table 2) on site should carefully plotted and documented, and the major waterbodies on and close to the development area should be surveyed for wetland species on each visit to the study area, using the standard protocols set out by the CWAC initiative (Taylor *et al.* 1999).

Bird activity monitoring

Monitoring of bird activity in the vicinity of the facility should be done over a 2-3 day period at least every two months for at least the six months preceding construction, and at least once per quarter for a full calendar year starting at least six months after the facility is commissioned. Each monitoring day should involve:

(i) Half-day counts of all priority species flying over or past the impact area (see passage rates below)

(ii) Opportunistic surveys of large terrestrial species and raptors seen when travelling around the site.

Passage rates of priority bird species

Counts of bird traffic over and around the proposed/operational facility should be conducted from suitable vantage points (and a number of these should be selected and used to provide coverage of avian flights in relation to all areas of the site), and extend alternately from dawn to midday, or from midday to dusk, so that the equivalent of four full days of counts is completed each count period. This should provide an adequate (if minimal) sample of bird movements around the facility in relation to a representative cross-section of conditions and times of day, for all seasons of the year.

Once in position at the selected count station, the observer should record (preferably on a specially designed data sheet) the date, count number, start-time and conditions at start - extent of cloud cover, temperature, wind velocity and visibility – and proceed with the count. The counts should detail all individuals or flocks of the stipulated priority

bird species, all raptors, and any additional species of particular interest or conservation concern, seen flying within 500 m of the envisaged or actual periphery of the facility. Each record should include the following data: time, updated weather assessment, species, number, mode of flight (flapping, gliding, soaring), flight activity (commuting, hunting other), direction of flight, vertical zoning relative to the envisaged or actual turbine string (low – below or within the rotor arc, medium – within *c.*100 m of the upper rotor arc, high – >100 m above the upper rotor arc), and horizontal zoning relative to the envisaged or actual turbine string (near – through the turbine string or within the outer rotor arc, middle – within *c.*100 m of the outer rotor arc, distant - >100 m beyond the outer rotor arc) and, for post construction monitoring, notes on any obvious evasive behaviour or flight path changes observed in response to the wind energy facility. The time and weather conditions should again be noted at the end of each count.

Avian collisions

Collision monitoring should have two components: (i) experimental assessment of search efficiency and scavenging rates of bird carcasses on the site, and (ii) regular searches of the vicinity of the wind farm for collision casualties.

Assessing search efficiency and scavenging rates

The value of surveying the area for collision victims only holds if some measure of the accuracy of the survey method is developed (Morrison 2002). To do this, a sample of suitable bird carcasses (of similar size and colour to the priority species – e.g. Egyptian Goose *Alopochen aegyptiacus*, domestic waterfowl and pigeons) should be obtained and distributed randomly around the site without the knowledge of the surveyor, some time before the site is surveyed. This process should be repeated opportunistically (as and when suitable bird carcasses become available) for the first two months of the monitoring period, with the total number of carcasses not less than 20. The proportion of the carcasses located in surveys will indicate the relative efficiency of the survey method.

Simultaneous to this process, the condition and presence of all the carcasses positioned on the site should be monitored throughout the initial two-month period, to determine the rates at which carcassess are scavenged from the area, or decay to the point that they are no longer obvious to the surveyor. This should provide an indication of scavenge rate that should inform subsequent survey work for collision victims, particularly in terms of the frequency of surveys required to maximise survey efficiency and/or the extent to which estimates of collision frequency should be adjusted to account for scavenge rate (Osborn *et al.* 2000, Morrison 2002). Scavenger numbers and activity in the area may vary seasonally so, ideally, scavenge and decomposition rates

should be measured twice during the monitoring year, once in winter and once in summer.

Collision victim surveys

The area within a radius of at least 50 m of each of the turbines at the facility should be checked regularly for bird casualties (Anderson *et al.* 1999, Morrison 2002). The frequency of these surveys should be informed by assessments of scavenge and decomposition rates conducted in the initial stages of the monitoring period, but they should be done at least weekly for the first two months of the study. The area around each turbine, or a larger area encompassing the entire facility, should be divided into quadrants, and each should be carefully and methodically searched for any sign of a bird collision incident (carcasses, dismembered body parts, scattered feathers, injured birds). All suspected collision incidents should be comprehensively documented, detailing the precise location (preferably a GPS reading), date and time at which the evidence was found, and the site of the find should be photographed with all the evidence *in situ*. All physical evidence should then be collected, bagged and carefully labeled, and refrigerated or frozen to await further examination. If any injured birds are recovered, each should be contained in a suitably-sized cardboard box. The local conservation authority should be notified and requested to transport casualties to the nearest reputable veterinary clinic or wild animal/bird rehabilitation centre. In such cases, the immediate area of the recovery should be searched for evidence of impact with the turbine blades, and any such evidence should be fully documented (as above).

In tandem with surveys of the wind farm for collision casualties, sample sections of any new lengths of power line associated with the development should also be surveyed for collision victims using established protocols (see Jenkins *et al.* 2009, Jenkins *et al.* 2010, Shaw *et al.* 2010 a & b).

Annotated list of the bird species considered likely to occur within the impact zone of the proposed Klipheuwel/Dassiesfontein Wind Energy Facility. Species seen during the July site visit appear in **bold**.

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
Common Ostrich	*Struthio camelus*	-	-	X	X	X	X	
Grey-winged Francolin	*Francolinus africanus*	-	Endemic		X	X		
Cape Spurfowl	*Pternistis capensis*	-	Endemic		X			
Common Quail	*Coturnix coturnix*	-	-		X	X		
Helmeted Guineafowl	***Numida meleagris***	**-**	**-**	**X**		**X**		
Egyptian Goose	***Alopochen aegyptiaca***	**-**	**-**	**X**		**X**		**X**
South African Shelduck	*Tadorna cana*	-	Endemic	X				
Spur-winged Goose	***Plectropterus gambensis***	**-**	**-**	**X**		**X**		
Cape Teal	*Anas capensis*	-	-	X				
African Black Duck	*Anas sparsa*	-	-	X				
Mallard	*Anas platyrhynchos*	-	-	X			X	
Yellow-billed Duck	***Anas undulata***	**-**	**-**	**X**				
Cape Shoveler	*Anas smithii*	-	-	X				
Red-billed Teal	*Anas erythrorhyncha*	-	-	X				
Hottentot Buttonquail	*Turnix hottentottus*	-	Endemic		X			

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
Greater Honeyguide	*Indicator indicator*	-	-					X
Lesser Honeyguide	***Indicator minor***	**-**	**-**					**X**
Ground Woodpecker	*Geocalaptes olivaceus*	-	Endemic		X			
Cardinal Woodpecker	*Dendropicos fuscescens*	-	-					X
Acacia Pied Barbet	*Tricholaema leucomelas*	-	-					X
African Hoopoe	*Upupa africana*	-	-				X	X
Malachite Kingfisher	*Alcedo cristata*	-	-	X				
Giant Kingfisher	*Megaceryle maximus*	-	-	X				
Pied Kingfisher	*Ceryle rudis*	-	-	X				
White-backed Mousebird	*Colius colius*	-	Endemic		X			X
Speckled Mousebird	*Colius striatus*	-	-		X			X
Red-faced Mousebird	*Urocolius indicus*	-	-		X			X
Jacobin Cuckoo	*Clamator jacobinus*	-	-		X			X
Red-chested Cuckoo	*Cuculus solitarius*	-	-					X
Klaas's Cuckoo	*Chrysococcyx klaas*	-	-					X
Diderick Cuckoo	*Chrysococcyx caprius*	-	-					X
Burchell's Coucal	*Centropus burchellii*	-	-	X				
Alpine Swift	***Tachymarptus melba***	**-**	**-**	**X**	**X**	**X**	**X**	
Common Swift	*Apus apus*	-	-					

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
African Black Swift	*Apus barbatus*	-	-					
Little Swift	***Apus affinis***	**-**	**-**				**X**	
Horus Swift	*Apus horus*	-	-					
White-rumped Swift	*Apus caffer*	-	-				X	
Barn Owl	*Tyto alba*	-	-		X	X	X	X
African Grass-Owl	*Tyto capensis*	Vulnerable	-	X				
Cape Eagle-Owl	*Bubo capensis*	-	-		X			
Spotted Eagle-Owl	*Bubo africanus*	-	-		X			X
Rock Dove	***Columba livia***	**-**	**-**			**X**	**X**	
Speckled Pigeon	***Columba guinea***	**-**	**-**			**X**	**X**	
Laughing Dove	***Streptopelia senegalensis***	**-**	**-**			**X**	**X**	
Cape Turtle-Dove	***Streptopelia capicola***	**-**	**-**		**X**	**X**	**X**	
Red-eyed Dove	*Streptopelia semitorquata*	-	-			X	X	X
Namaqua Dove	***Oena capensis***	**-**	**-**			**X**		
Denham's Bustard	*Neotis denhami*	Vulnerable	-		X	X		
Karoo Korhaan	*Eupodotis vigorsii*	-	Endemic		X	X		
Southern Black Korhaan	*Afrotis afra*	-	Endemic		X	X		
Blue Crane	***Anthropoides***	**Vulnerable**	**Endemic**	**X**		**X**		

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
	paradiseus							
Red-chested Flufftail	*Sarothrura rufa*	-	-	X				
Common Moorhen	*Gallinula chloropus*	-	-	X				
Red-knobbed Coot	*Fulica cristata*	-	-	X				
African Snipe	*Gallinago nigripennis*	-	-	X				
Marsh Sandpiper	*Tringa stagnatilis*	-	-	X				
Wood Sandpiper	*Tringa glareola*	-	-	X				
Common Sandpiper	*Actitis hypoleucos*	-	-	X				
Spotted Thick-knee	*Burhinus capensis*	-	-	X		X		
Black-winged Stilt	*Himantopus himantopus*	-	-	X				
Pied Avocet	*Recurvirostra avosetta*	-	-	X				
Kittlitz's Plover	***Charadrius pecuarius***	**-**	**-**	**X**				
Three-banded Plover	*Charadrius tricollaris*	-	-	X				
Blacksmith Lapwing	***Vanellus armatus***	**-**	**-**	**X**				
Crowned Lapwing	*Vanellus coronatus*	-	-	X		X		
Kelp Gull	*Larus dominicanus*	-	-			X		
Black-shouldered Kite	*Elanus caeruleus*	-	-			X		X
African Fish-Eagle	***Haliaeetus vocifer***	**-**	**-**	**X**		**X**		
Cape Vulture	*Gyps coprotheres*	Vulnerable	Endemic			X		

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
Black-chested Snake-Eagle	*Circaetus pectoralis*	-	-		X	X		
African Marsh-Harrier	*Circus ranivorus*	Vulnerable	-	X	X	X		
Black Harrier	*Circus maurus*	Near-threatened	Endemic		X	X		
African Goshawk	*Accipiter tachiro*	-	-				X	X
Rufous-chested Sparrowhawk	*Accipiter rufiventris*	-	-					X
Black Sparrowhawk	*Accipiter melanoleucus*	-	-			X		X
Steppe Buzzard	*Buteo vulpinus*	-	-		X	X		X
Jackal Buzzard	*Buteo rufofuscus*	-	Endemic		X	X		X
Verreauxs' Eagle	*Aquila verreauxii*	-	-					
Booted Eagle	*Aquila pennatus*	-	-			X		
Martial Eagle	*Polemaetus bellicosus*	Vulnerable	-		X	X		
Secretarybird	*Sagittarius serpentarius*	Near-threatened	-		X	X		
Lesser Kestrel	*Falco naumanni*	Vulnerable	-		X	X		X
Rock Kestrel	***Falco rupicolus***	**-**	**-**		**X**	**X**	**X**	
Eurasian Hobby	*Falco subbuteo*	-	-					
Lanner Falcon	*Falco biarmicus*	Near-threatened	-		X	X	X	
Peregrine Falcon	*Falco peregrinus*	Near-threatened	-		X	X	X	
Little Grebe	***Tachybaptus***	**-**	**-**	**X**				

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
	ruficollis							
Great-crested Grebe	*Podiceps cristatus*	-	-	X				
Reed Cormorant	***Phalacrocorax africanus***	**-**	**-**	**X**				
White-breasted Cormorant	*Phalacrocorax lucidus*	-	-	X				
Little Egret	*Egretta garzetta*	-	-	X				
Yellow-billed Egret	*Egretta intermedia*	-	-	X				
Grey Heron	***Ardea cinerea***	**-**	**-**	**X**				
Black-headed Heron	*Ardea melanocephala*	-	-	X		X		X
Cattle Egret	***Bubulcus ibis***	**-**	**-**	**X**				**X**
Hamerkop	*Scopus umbretta*	-	-	X				X
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	-	X				
Lesser Flamingo	*Phoenicopterus minor*	Near-threatened	-	X				
Hadeda Ibis	***Bostrychia hagedash***	**-**	**-**	**X**				**X**
African Sacred Ibis	***Threskiornis aethiopicus***	**-**	**-**	**X**				
African Spoonbill	***Platalea alba***	**-**	**-**	**X**				
Great White Pelican	*Pelecanus onocrolatus*	Near-threatened	-	X				
Black Stork	*Ciconia nigra*	Near-threatened	-	X				

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
White Stork	*Ciconia ciconia*	-	-			X		
Fork-tailed Drongo	***Dicrurus adsimilis***	**-**	**-**					**X**
Southern Tchagra	*Tchagra tchagra*	-	-		X			X
Southern Boubou	*Laniarius ferrugineus*	-	Endemic		X			X
Bokmakierie	*Telophorus zeylonus*	-	Near-endemic		X			X
Cape Batis	*Batis capensis*	-	Endemic					X
Cape Crow	***Corvus capensis***	**-**	**-**			**X**		**X**
Pied Crow	***Corvus albus***	**-**	**-**			**X**		**X**
White-necked Raven	*Corvus albicollis*	-	-		X	X		
Common Fiscal	***Lanius collaris***	**-**	**-**		**X**			**X**
Grey Tit	*Parus afer*	-	Endemic		X			
Brown-throated Martin	***Riparia paludicola***	**-**	**-**	**X**				
Banded Martin	*Riparia cincta*	-	-					
Barn Swallow	*Hirundo rustica*	-	-	X				
White-throated Swallow	***Hirundo albigularis***	**-**	**-**	**X**				
Pearl-breasted Swallow	***Hirundo dimidiata***	**-**	**-**	**X**	**X**	**X**		
Greater Striped Swallow	***Hirundo cucullata***	**-**	**-**	**X**			**X**	

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
Rock Martin	*Hirundo fuligula*	-	-					
Cape Bulbul	*Pycnonotus capensis*	-	Endemic		X			
Cape Grassbird	*Sphenoeacus afer*	-	Endemic		X			
Long-billed Crombec	*Sylvietta rufescens*	-	-		X			
Little Rush-Warbler	*Bradypterus baboecala*	-	-	X				
African Reed-Warbler	*Acrocephalus baeticatus*	-	-	X				
Lesser Swamp-Warbler	*Acrocephalus gracilirostris*	-	-	X				
Chestnut-vented Tit-Babbler	*Parisoma subcaeruleum*	-	-		X			
Cape White-eye	***Zosterops virens***	**-**	**Endemic**		**X**			**X**
Grey-backed Cisticola	*Cisticola subruficapilla*	-	-		X			
Levaillant's Cisticola	*Cisticola tinniens*	-	-	X				
Zitting Cisticola	*Cisticola juncidis*	-	-			X		
Cloud Cisticola	*Cisticola textrix*	-	Near-endemic			X		
Karoo Prinia	*Prinia maculosa*	-	Endemic		X	X		
Bar-throated Apalis	*Apalis thoracica*	-	-					X
Cape Clapper Lark	*Mirafra apiata*	-	Endemic		X	X		
Agulhas Long-billed Lark	*Certhilauda brevirostris*	Near-threatened	Endemic		X	X		
Grey-backed Sparrowlark	*Eremopterix verticalis*	-	-		X	X		

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
Red-capped Lark	***Calandrella cinerea***	**-**	**-**			**X**		
Large-billed Lark	***Galerida magnirostris***	**-**	**Endemic**			**X**		
Cape Rock Thrush	*Monticola rupestris*	-	Endemic		X			
Sentinel Rock Thrush	*Monticola explorator*	-	Endemic		X			
Olive Thrush	*Turdus olivaceus*	-	-					X
Fiscal Flycatcher	*Sigelus silens*	-	Endemic					X
African Dusky Flycatcher	*Muscicapa adusta*	-	-					X
Cape Robin-Chat	***Cossypha caffra***	**-**	**-**		**X**			**X**
Karoo Scrub-Robin	*Cercotrichas coryphoeus*	-	Endemic		X			
African Stonechat	***Saxicola torquatus***	**-**	**-**		**X**	**X**		
Capped Wheatear	***Oenanthe pileata***	**-**	**-**			**X**		
Familiar Chat	*Cercomela familiaris*	-	-					
Red-winged Starling	*Onychognathus morio*	-	-				X	
Pied Starling	*Spreo bicolor*	-	Endemic			X		
Wattled Starling	*Creatophora cinerea*	-	-			X		
Common Starling	***Sturnus vulgaris***	**-**	**-**				**X**	
Orange-breasted Sunbird	*Anthobaphes violacea*	-	Endemic		X			
Malachite Sunbird	***Nectarinia famosa***	**-**	**-**		**X**			

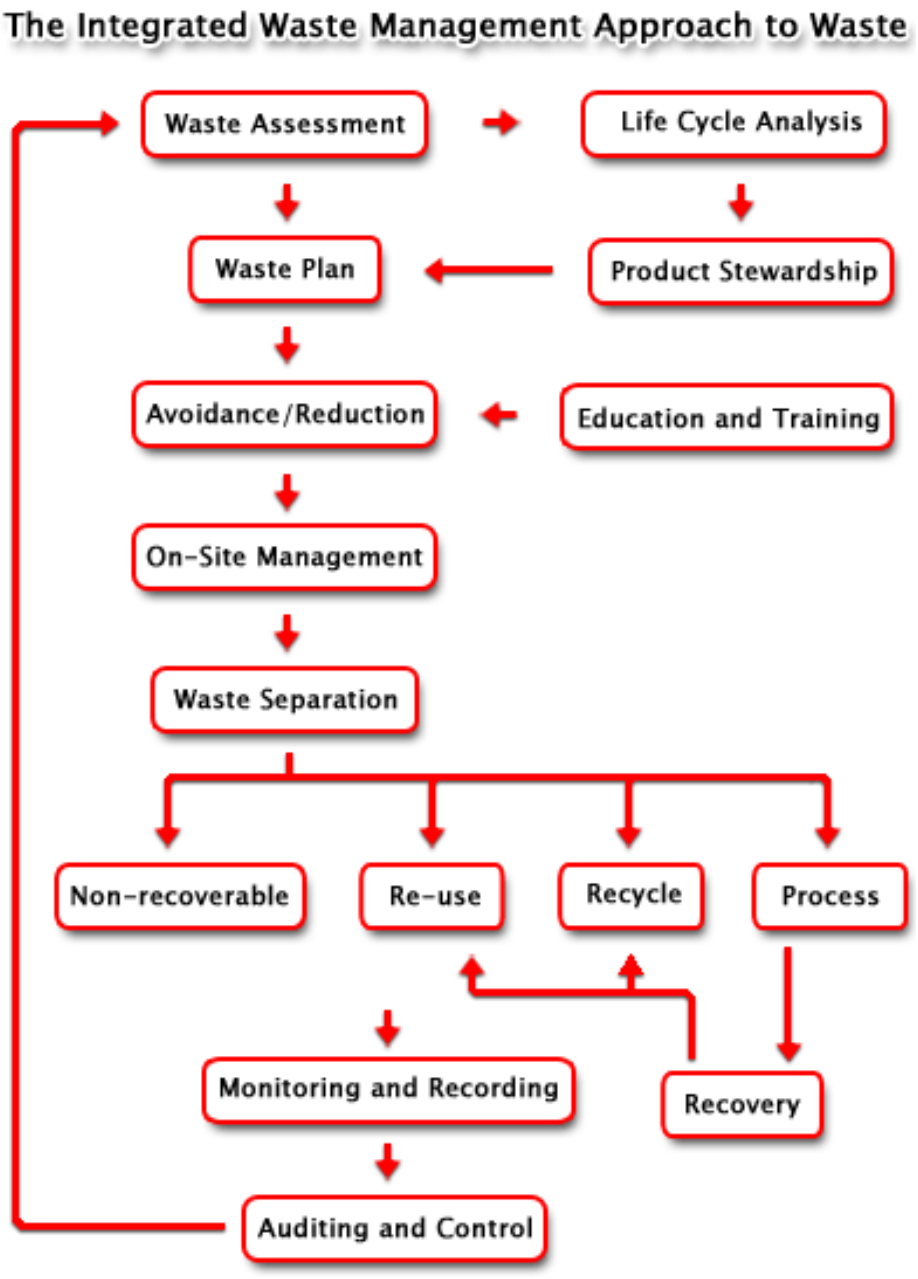
SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
Southern Double-collared Sunbird	*Cinnyris chalybeus*	-	Endemic		X			X
Greater Double-collared Sunbird	*Cinnyris afra*	-	Endemic		X			
Cape Sugarbird	*Promerops cafer*	-	Endemic		X			
Cape Weaver	***Ploceus capensis***	**-**	**Endemic**	**X**	**X**	**X**		**X**
Southern Masked-Weaver	*Ploceus velatus*	-	-	X	X	X		X
Southern Red Bishop	***Euplectes orix***	**-**	**-**	**X**	**X**	**X**		
Yellow Bishop	*Euplectes capensis*	-	-	X	X			
Swee Waxbill	*Coccopygia melanotis*	-	Endemic					
Common Waxbill	*Estrilda astrild*	-	-	X		X		
Pin-tailed Whydah	*Vidua macroura*	-	-	X		X		
House Sparrow	***Passer domesticus***	**-**	**-**				**X**	
Cape Sparrow	***Passer melanurus***	**-**	**Near-endemic**		**X**	**X**		
Southern Grey-headed Sparrow	***Passer diffusus***	**-**	**-**		**X**	**X**		**X**
African Pied Wagtail	*Motacilla aguimp*	-	-	X				
Cape Wagtail	***Motacilla capensis***	**-**	**-**	**X**				**X**
Cape Longclaw	*Macronyx capensis*	-	Endemic		X			

SPECIES	SCIENTIFIC NAME	CONSERVATION STATUS	ENDEMICITY	HABITAT				
				Farm dams, wetlands & surrounds	Natural vegetation fragments	Grain croplands or pasture	Towns, farmsteads, or out-buildings	Alien trees
African Pipit	***Anthus cinnamomeus***	**-**	**-**		**X**	**X**		
Plain-backed Pipit	*Anthus leucophrys*	-	-		X	X		
Long-billed Pipit	*Anthus similis*	-	-		X	X		
Cape Canary	***Serinus canicollis***	**-**	**Endemic**		**X**	**X**		**X**
Yellow Canary	***Crithagra flaviventris***	**-**	**Near-endemic**		**X**	**X**		**X**
Brimstone Canary	*Crithagra sulphuratus*	-	-		X			X
White-throated Canary	*Crithagra albogularis*	-	Near-endemic			X		X
Streaky-headed Seedeater	*Crithagra gularis*	-	-			X		
Cape Siskin	*Crithagra totta*	-	Endemic		X	X		
Cape Bunting	*Emberiza capensis*	-	Near-endemic		X			

Appendix B:
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
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Appendix C:
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.