SPREEUKLOOF WIND ENERGY FACILITY, EASTERN CAPE PROVINCE

ENVIRONMENTAL MANAGEMENT PROGRAMME

Revision 1
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Prepared for:
Spreeukloof Wind Farm (Pty) Ltd
P.O Box 163,
Newlands
7725

Prepared by:
Savannah Environmental (Pty) Ltd
First Floor, Block 2, 5 Woodlands Drive Office Park
Woodmead
Johannesburg, 2191
Tel: +27 (0)11 656 3237
Fax: +27 (0)86 684 0547
E-mail: info@savannahsa.com
www.savannahsa.com

PROJECT DETAILS

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Authors of EMPr	:	Savannah Environmental (Pty) Ltd Karen Jodas John von Mayer
Authors of Revision 1		Savannah Environmental (Pty) Ltd Gideon Raath Jo-Anne Thomas Rendani Rasivhetshele
Specialists	:	Ashlin Bodasing of Arcus Consulting Jon Smallie of Wildskies Jenna Lavin of CTS Heritage Lourens du Plessis of LOGIS Morné de Jager of Enviro Acoustic Research cc Brian Colloty
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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 plan: 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.

Natural properties of an ecosystem (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "...physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/).

Ramsar Convention on Wetlands: "The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution

towards achieving sustainable development throughout the world". As of March 2004, 138 nations have joined the Convention as Contracting Parties, and more than 1300 wetlands around the world, covering almost 120 million hectares, have been designated for inclusion in the Ramsar List of Wetlands of International Importance." (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/). South Africa is a Contracting Party to the Convention.

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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Appendices:

CHAPTER 1: INTRODUCTION

The Environmental Management Programme has been compiled for the Spreeukloof Wind Farm. The Spreeukloof Wind Farm Site is located between the towns of Sterkstroom and Molteno along the R397 main road, in the Enoch Mgijima Local Municipality, which falls within the jurisdiction of the Chris Hani District Municipality in the Eastern Cape Province. The project site including all associated infrastructure is wholly located within the Stormberg Renewable Energy Development Zone (REDZ 4) as determined by the Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (2015 – CSIR/DEA), and formally gazetted on 16 February 2018 (GN 114) and 26 February 2021(GN 142, 144 and 145). Spreeukloof Wind Farm received an Environmental Authorisation dated 02 November 2012 (DFFE ref: 12/12/20/1778/5), following a split from the larger Dorper Wind Farm (DFFE ref: 12/12/20/1778) authorised in May 2011.

An EMPr was submitted as part of the Dorper original EIA, the same EMPr was used following the application to amend the Dorper Wind Farm authorisation (i.e. splitting of the project into phases) for the broader facility. The project is intended to bid into the future rounds of the Department of Mineral Resources and Energy's (DMRE) Renewable Energy Independent Power Producers Procurement (REIPPP) Programme.

This EMPr has been developed based on the findings of the Environmental Impact Assessment (EIA) and subsequent amendments and must be implemented to protect sensitive on-site and off-site features through managing construction, operation and decommissioning activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts. This EMPr has been updated to include the additional mitigation recommended by specialists through the amendment application process. Changes made to this EMPr have been underlined for ease of reference.

In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, halted, or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts. While no permitting or licensing requirements arise directly by virtue of the Spreeukloof Wind Farm, this section will be applicable throughout the life cycle of the project.

This EMPr is applicable to all Spreeukloof Wind (Pty) Ltd employees and contractors working on the pre-construction, construction, and operation and maintenance phases of Spreeukloof Wind Farm.

CHAPTER 2: PROJECT DETAILS

Spreeukloof Wind Farm (Pty) Ltd received an Environmental Authorisation (EA) for the construction of the Spreeukloof Wind Energy Facility, including overhead power line and associated infrastructure on a site (the 'Property') near Molteno in the Eastern Cape Province (DFFE ref: 12/12/20/1778/5) on 02 November 2012. The facility is proposed within the Enoch Mgijima Local Municipality of the Chris Hani District Municipality on Portion 18 of the Farm Spreeukloof No. 59.

The original EIA (which received environmental authorisation in May 2011) and associated specialist studies considered five wind energy facilities collectively referred to as the Dorper Wind Farm (DFFE ref: 12/12/20/1778). The Dorper Wind Farm consisted of five phases: Dorper Wind Energy Facility, Loperberg Wind Energy Facility, Spreeukloof Wind Energy Facility, Spinning Head Wind Energy Facility and Spreeukloof Wind Energy Facility. The authorisation for the Spreeukloof Wind Energy Facility was received following the application to amend the Dorper Wind Farm authorisation (i.e. splitting of the project into phases) for the broader facility, although the project was initially known as the Penhoek Pass Wind Energy Facility. Subsequent amendments have been granted for the project as follows:

- DFFE Ref: 12/12/20/1778/5 (dated 20 May 2013): Amendment to the properties specified for the project, as well as turbine specification changes.
- DFFE Ref: 12/12/20/1778/5/AM3 (dated 13 June 2016): Amendment to the EA validity (extension)
- DFFE Ref: 12/12/20/1778/5/AM4 (dated 15 November 2018): Amendment to the EA validity (extension)

Spreeukloof Wind Energy is now considering an updated turbine model for the project due to advancements in wind turbine technology. In this regard, a further amendment application has been submitted to the DFFE. Amendments which have been applied for include:

i. Amendment of turbine specifications, to be as follows: Wind turbine generators (up to 12 turbines), comprising a hub height of 'up to 120m' and rotor diameter of 'up to 176m' from the currently authorised number of 21 turbines with hub height and rotor diameter of 120m and 125m, respectively.
ii. A reduction in the authorised number of turbines from the currently authorised 21 turbines, to reflect as 'up to 12' wind turbines. An updated layout will be provided for the amendment towards reflecting the removal of turbines from that currently authorised.
iii. Update of the project description to reflect the revised 132kV grid connection line routing and substation location, respectively.
iv. Amendment to the holder of the Environmental Authorisation
v. Amendment to the capacity of the Spreeukloof Wind Farm
vi. Extension of the Environmental Authorisation (EA) validity by an additional two years.

The proposed amendments to the Environmental Authorisation will result in the optimisation of the facility layout which was submitted to the Department of Forestry, Fisheries and Environment (DFFE) in the EIA process, and subsequent amendments thereto. The layout will however only be finalised during the final design phase, and will be submitted to DFFE at that

time for approval in accordance with the requirements of the EA. These amendments to the project are proposed to increase the efficiency of the facility and consequently the economic competitiveness thereof, as well as to avoid environmental sensitivities on the site.

2.1 Findings of the Environmental Impact Assessments

The motivation report together with the specialist studies contained within **Appendices A-F** provide a detailed assessment of the potential impacts that may result from the development of the Spreeukloof Wind Farm.

No environmental fatal flaws or unacceptable impacts were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures mainly include the avoidance of sensitive features within the development footprint and the undertaking of the construction and operational bird and bat monitoring, as specified by the specialists.

The potential environmental impacts associated with the Spreeukloof Wind Farm identified and assessed through the amendment process include:

» Impacts on ecology and freshwater.
» Impacts on avifauna.
» Impacts on bats.
» Impacts on heritage resources, including archaeology, palaeontology and the cultural landscape.
» Noise impacts due to the construction and operation of the wind farm.
» Visual impacts on the area imposed by the components of the facility.
» Visual impacts.
» Noise impacts, including increased pressure on the existing road network.

The development footprint, as assessed, has been overlain with the relevant environmental sensitivities in **Figure 1**.

2.1.1 Impacts on Ecology and Freshwater

The study area falls within the Karoo Escarpment Grassland and Tarkastad Montane Shrubland vegetation types. However, the majority of the proposed site falls within the Karoo Escarpment Grassland vegetation types which is classified as Least Threatened. According to the Eastern Cape Biodiversity Conservation Plan, a large portion of the site is classified as having high conservation value due to it being within an escarpment zone, which is described as an important ecological corridor. The ECBCP is, however, a broad-scale planning tool and does not necessarily take into account local conditions on site. This assessment evaluated sensitivity at a site-scale and is able to more accurately depict site-specific sensitivities.

Other factors that may lead to parts of the study area having high ecological sensitivity are the presence of wetlands within the shallow drainage lines on site, presence of steep slopes

in the escarpment and mountain zone and the potential presence of various plant and animal species of conservation concern.

Mountains and ridges are considered to have high ecological value due to the ecological processes that they support. Mountains, ridges and drainage lines (wetlands) represent particularly vital natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as biological corridors, providing for movement between habitat patches. Both functions are potentially critical to conservation of biological diversity as the landscape becomes increasingly fragmented into smaller, more isolated patches. Steep slopes can be problematic in constructing infrastructure due to the fact that any impact can have an effect downslope from that point. Depending on the steepness and the length of the slope, particular areas may be more sensitive to disturbance than others. Any steep slopes are therefore considered to have elevated Sensitivity. Potential issues that may arise from development of these areas includes erosion of substrates downslope and the impacts of stormwater runoff.

Other than protected ecosystems and threatened plant and animal species, forests and wetlands are both protected under national legislation (National Forests Act and National Wetlands Act respectively). Any impacts on these vegetation types would require a permit from the relevant National Department. There are three tree species that are protected under the National Forests Act that have a geographic distribution that includes this area. It has been evaluated that no habitat containing or suitable for these species occurs on site and it is therefore unlikely that they occur there.

There are no plant species of high conservation concern (threatened or near threatened) that could occur in available habitats in the study area. Due to the lower-level conservation status of other species, any impacts on them will not affect their conservation status, even if they occur on site. It is therefore concluded that impacts due to the proposed wind energy facility are highly unlikely to affect plant species of high conservation concern.

There are a number of animal species of conservation concern that may occur in habitats within the study area. This includes nineteen mammal species of conservation concern (including one species classified as Endangered and three near threatened bat species), one Near Threatened frog species and two Near-Threatened reptile species. The suitability of habitats for these species was evaluated during the field survey of the site during the EIA. It was evaluated that only the 3 bat species are potentially at risk of significant impacts due to the proposed wind energy facility. The other species are unlikely to occur on site or have the ability to move away during construction and return during operation of the wind energy facility.

Most of the study area appears to still be in natural condition, although some parts may be degraded due to commercial livestock farming, cultivation and alien plant invasions. Any degraded areas on site have been classified as having low sensitivity and conservation value. All other remaining natural vegetation on site, except for that classified as having high sensitivity, is classified as having medium Sensitivity. This indicates that it is natural but does not have high Sensitivity.

A risk assessment was undertaken which identified nine main potential negative impacts on the ecological receiving environment. The significance of these impacts was assessed during

the EIA phase after collection of relevant field data. The identified potential impacts are the following:

1. Impacts on bats
2. Impacts on threatened animals
3. Impacts on threatened plants
4. Impacts on protected tree species
5. Impacts on indigenous natural vegetation
6. Impacts on wetlands
7. Change in runoff and drainage patterns
8. Establishment and spread of declared weeds and alien invader plants
9. Increased risk of veld fires.

Impacts were assessed separately for wind turbines, substations, internal access roads and power lines. A summary of impacts, as evaluated, is provided in the table below.

It must be noted that the assessment of the impacts of the underground cabling was undertaken independently of any other infrastructure. The construction of the wind energy facility will, however, require the construction of internal access roads, which have similar impacts to the construction of underground cables. Taken in combination, the combined impact of the internal access roads and underground cabling will never be higher than the highest individual impact of either one of them.

All infrastructure could potentially have a significant impact on natural vegetation, although it was assessed that this impact would constitute only a small area. The conservation status of the vegetation is not high, and the amount of vegetation destroyed by construction of the wind energy facility will be relatively small (approximately 1-2% of the site).

Wind turbine construction is likely to have significant impacts on wetlands in the study area, since a number of the turbines are currently situated within designated wetland areas. Internal access roads and underground cables are also likely to affect various wetland systems. Due to the more extensive impact due to underground cables and internal access roads, these components of the infrastructure will lead to impacts of high significance on wetlands. Potential impacts will have to be carefully controlled to avoid degradation of downstream areas of wetland systems.

Disturbance due to construction of any infrastructure could lead to the spread of alien plants, but this impact can be effectively controlled with suggested measures.

2.1.2 Impacts on Avifauna

Although the development area does not impinge significantly on any major bird fly-ways, unique landscape features, it does affect threatened grassland habitat. Populations of regionally or nationally threatened (and impact susceptible) bird species are likely to occur within or close to the turbine arrays, and the proposed facility may have a detrimental effect on these birds, particularly during its operational phase, unless significant commitment is made to mitigating these effects. Careful and responsible implementation of the required mitigation measures should reduce construction and operational phase impacts to tolerable

and sustainable levels, especially if every effort is made to monitor impacts throughout, and to learn as much as possible about the impacts of wind energy developments on South Africa avifauna.

The proposed facility is likely to have a significant, long-term impact on the avifauna of the area, and may have a negative effect on key rare, Red-listed and/or endemic species. The most obvious and immediate negative impacts are likely to be on Cape Vulture and other soaring raptors, bustards species and crane species. These birds may be disturbed by construction of the facility, may lose foraging habitat to the construction footprint or be displaced from the area by the operating turbines (cranes), or may suffer mortalities in collisions with the turbine blades and power lines (vultures and cranes). These effects, which may also impact on other priority species, can probably be reduced to acceptable and sustainable levels by adherence to a proposed mitigation scheme, mainly involving careful and responsible development and management of the facility, with sensitivity to potential, negative impacts and a preparedness to adjust operating procedures in a sincere effort to mitigate such impacts.

2.1.3 Impacts on Bats

Bats have been found to be particularly vulnerable to being killed by wind turbines. It has long been a mystery why they should be so badly affected since bat echo-location allows them to detect moving objects very well. A recent study in America has found that the primary cause for mortality is a combination of direct strikes and barotrauma (bats are killed when suddenly passing through a low air pressure region surrounding the turbine blade tips causing low pressure damage the bat's lungs). The relative importance of this impact on bat populations depends on which species are likely to be affected, the importance of the site for those species and whether the site is within a migration corridor for particular bat species. The most vulnerable species are those that are already classified as threatened species, including those classified as critically endangered, endangered or vulnerable. For any other species, a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species unless the impact occurs across a wide area that coincides with their overall distribution range. Loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

- fragmentation of populations of affected species.
- reduction in area of occupancy of affected species; and
- loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances. There is one threatened species, the White-tailed Rat and two near threatened bats (Schreiber's long-fingered bat and Darling's horseshoe bat) that could potentially occur on site.

2.1.4 Impacts on Heritage Resources (archaeology, palaeontology and cultural landscape)

Archaeology Surface scatters of Middle Stone Age (MSA) stone artefacts were observed over most of the area surveyed. These occur between the surface and approximately 50 cm below the current surface level. Later Stone Age (LSA) stone artefacts were also observed as surface scatters, but mainly occurred in density around the koppies and rocky outcrops. Stone walling and remains thereof occur on the landscape, mainly as dam walls, but also as remaining foundations of buildings. Stone walling was also observed in some rock shelters on the koppies/rocky outcrops, which may either have been used as stock kraals/pens and to provide shelter from the wind as occupation areas. Historical buildings and abandoned farmhouses with outside rubbish dumping areas containing stoneware and porcelain ceramics as well as glass, iron and copper also occur within the proposed area for development. Graveyards and informal burials were also observed within the proposed area, most of the burials are deemed to be older than 60 years... No other associated archaeological materials were observed with the stone artefact scatters, and it is unlikely that the stone artefacts would be in primary context. No sites containing any depth of deposit or other archaeological material associated with the stone tool artefacts and archaeological material were observed within the proposed area for development.".

Palaeontology – The area proposed for the amended turbine layout is underlain by sediments of very high palaeontological sensitivity according to the SAHRIS Palaeosensitivity Map. The sediments underlying the development consist of Jurassic Dolerite (zero palaeontological sensitivity) and the Molteno Formation of the Karoo Supergroup (very high palaeontological sensitivity). As part of the original EA process, a desktop palaeontological assessment was conducted by Dr John Almond (2010, SAHRIS NID 92684) and a Phase 1 Palaeontology field assessment was completed by Fourie (2012, SAHRIS NID 92690). According to Fourie (2012), "Sporadic overlying Elliot Formation is mapped in the southern and north-eastern portions of the study area and minor underlying Burgersdorp Formation is mapped in the western and southern edges of the study area. The Molteno Formation is known to have the richest Triassic (*c.* 220-million-year-old) fossil floras recorded anywhere in the world, as well as some of the oldest known dinosaur trackways. Several key fossil sites are already recorded within the Molteno Formation in the Molteno-Sterkstroom outcrop area." According to Fourie (2012), "Fossils such as plants, insects and dinosaur trackways were not observed due to the thick layer of topsoil and subsoil. Small Molteno outcrops were observed but will not influence the placement of the wind turbines but may be considered in the placement of the internal access roads and underground cabling." Fourie (2012) recommends that any significant fossils identified during the course of construction are recorded, removed and that associated geological data is collected. This can take place through the implementation of a Chance Fossil Finds Procedure.

2.1.5 Noise impacts

The noise impact on surrounding areas (outside of the development footprint) are of low significance. The potential impact on sensitive receptors (e.g. homesteads) within the proposed wind energy facility footprint is potentially of high significance, but this will be dependent on final turbine placement and mitigation measures applied in order to reduce potential noise impacts on any receptors to a low significance. Care must be taken to

ensure that the operations at the wind farm do not unduly cause annoyance or otherwise interfere with the quality of life of the receptors.

Wind turbines produce sound, primarily due to mechanical operations and aerodynamics effects at the blades. Modern wind turbine manufacturers have virtually eliminated the noise impact caused by mechanical sources, and instituted measures to reduce the aerodynamic effects. But, as with many other activities, the wind turbines emit sound power levels at a level that does impact areas at some distance away. When potential sensitive receptors are nearby, care must be taken to ensure that the operations at the wind farm do not unduly cause annoyance or otherwise interfere with the quality of life of the receptors.

It should be noted that this does not suggest that the sound from the wind turbines should be inaudible under all circumstances - this is an unrealistic expectation that is not required or expected from any other agricultural, commercial, industrial or transportation related noise source – but rather that the sound due to the wind turbines should be at a reasonable level in relation to the ambient sound levels.

The current impact that the proposed wind energy facility could have on several surrounding potential receptors is considered of potentially high significance. It is critical that the developer consider the mitigation options as proposed in this document to reduce the significance of the impact to a more acceptable low. Should the layout change significantly, it is recommended that the new layout be remodelled/reviewed (if any turbines are within 1,000 meters from a potentially sensitive receptor) in terms of the potential noise impact by an independent acoustics specialist. This includes the situation when the existing layout is slightly modified, yet some of the potentially problematic turbines are still within a radius of 1,000 meters from a potentially sensitive receptor.

This report should also be made available to all potential sensitive receptors in the area, with the contents explained to them to ensure that they understand all the potential risks that the development of a wind energy facility may have on them and their families. With the implementation of the mitigation actions the significance of the impact could be reduced.

As part of the planning mitigation strategy, the applicant considered all the above-mentioned findings and sensitivities, and duly made the necessary amendments to the layout considered in the EIA to reduce impacts to an acceptable level. No environmental fatal flaws were identified to be associated with the proposed Spreeukloof Wind Energy Facility. Several issues requiring mitigation were however highlighted. Environmental specifications for the management of potential impacts were detailed within the Environmental Management Programme (EMPr) submitted as part of the split EIA.

2.1.6 Visual impacts

The construction and operation of the Dorper Wind Energy Facility and its associated infrastructure will have a visual impact on the natural scenic resources and rural character of this region. The rural and relatively unspoiled wide-open vistas surrounding the facility will be transformed for the entire operational lifespan of the plant. The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate. The functional design of the structures and the

dimensions of the facility cannot be changed in order to reduce visual impacts. In addition, no vegetation screening or landscaping would be able to hide structures of these dimensions. The facility and its surrounds should generally be maintained in a neat and appealing way. This also applies to the associated infrastructure (power lines, substations, access roads, etc.) of the facility. Where visual impacts are significantly exacerbated by their elevated location within the landscape, possible mitigation includes the placement of the wind turbines in relation to the topography (in cases where the turbine layout has not yet been finalised). The analysis of the potential visual exposure of the proposed turbine layout highlights the fact that the placement of the turbines on top of the ridge line (escarpment) tends to increase the frequency of exposure, while the valley surrounding the site and mountainous terrain to the north and south tends to break the frequency of exposure of receptors situated beyond these. Should the majority of the turbines be planned within the valley/central core of the development footprint, the potential visual impacts to the surrounding area could be reduced. 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.

2.2 Findings of the Comparative Specialists Assessments

The following are the conclusions and recommendations from the comparative assessments undertaken as part of the amendment process

2.2.1 Impacts on Ecology and Freshwater

The specialist study found that the refined layout related to the Spreeukloof WEF, has no material change on the assessment, findings, impacts (direct and cumulative) (including nature, significance category and mitigation measures) and recommendations of the specialist report included within the original EIA. From a terrestrial ecology and aquatic standpoint, the results are identical, and the proposed amendments have no material effect on the original specialist assessment conducted for the project and does not impact on an area of higher sensitivity than that originally authorised. The recommendations and findings of the original assessment report (Hoare, 2010) therefore apply without modification to the refined layout. It is further confirmed that the environment has not changed significantly from that during the original assessment and therefore the extension of the validity of the EA will not result in any additional impacts not considered and assessed before.

The amendments that are being proposed, have been proposed to avoid environmental sensitivities identified as confirmed in the June 2021 site survey & walkthrough. As the proposed amendments do not incur any change in impact (direct or cumulative) from that determined in the original assessment for the project, no additional mitigation measures are required. It is however recommended that a final assessment of the proposed layout with entire construction footprint, is evaluated to ensure all areas are micro-sited outside of the identified aquatic ecosystems.

The proposed amendments are therefore supported in terms of terrestrial ecology and aquatic biodiversity considerations, on the condition that all the proposed infrastructure:

» Will remain outside of the delineated freshwater feature footprints, except for roads which are considered acceptable.
» All works within the regulated area of a watercourse are suitably authorised under the National Water Act (No. 36 of 1998), as relevant and applicable, prior to the commencement of construction.

2.2.2 Impacts on Avifauna

In consideration of the avifaunal study, the following was concluded:

» The proposed amendment to the facility layout makes a slight positive difference to risk to birds, although not sufficient to alter the original impact assessment findings.
» The proposed amendment to the turbine model increases the per-turbine collision risk window but this is offset by the reduced number of turbines. The collision risk window of the wind farm as a whole is reduced slightly (by 12.8%).
» New information which has become available subsequent to the original assessment has made a significant difference to the rating of the impact of mortality of birds through collision with turbines. This impact has increased in significance from Medium-High to High under the amended scenario assessment. Two key species which were previously 'suspected' to potentially be susceptible to turbine collision (Verreaux's Eagle & Cape Vulture) have subsequently proven to actually be susceptible to turbine collision at operational wind farms and have also been upgraded in conservation status (Verreaux's Eagle from Least Concern to Vulnerable regionally; Cape Vulture from Vulnerable to Endangered regionally and globally), indicating that they require more protection than thought previously. This risk will need to be mitigated proactively from the start of operations (and earlier in some cases as described below).
» The cumulative impact of wind energy on birds in this area is now of High significance, mitigated to Medium if the recommendations of this report are adhered to.

The original mitigation recommendations made by Avisense (2010) and WildSkies (2014) are largely still applicable and relevant. However additional mitigation have been added due to the increase in significance of the risk of bird collision with turbines from Medium-High to High. If the mitigation measures provided are adhered to the proposed amendment is considered acceptable from an avifaunal perspective.

2.2.3 Impacts on Bats

Compared to the current turbine layout and dimensions of Spreeukloof WEF, it is likely that the change in turbine dimensions would (without mitigation) slightly increases mortality impacts on bats. This is primarily because of a potentially higher ground to lower tip height as well as the location of some turbines in bat sensitive areas – placing bats (particularly lower flying species using open spaces for commuting and foraging) at a higher risk. However, due

to the overall lower rotor swept area these impacts will only slightly increase the risk of bat mortality. As such, the significance of bat mortality will remain **medium-high before mitigation** and **low after mitigation** for mortality during foraging, and **medium before mitigation** and **low after mitigation** for mortality during migration. Cumulative impacts are likely to be of a **medium significance before mitigation** and **low after mitigation**.

The key initial mitigation measure that should be implemented at the Spreeukloof WEF would be adherence to the latest high sensitivity and medium-high sensitivity buffer distances in this report and in the Spreeukloof WEF pre-construction bat impact report. There are currently 2 turbines that need to be relocated. Should it not be possible to move these turbines, then more stringent mitigation measures set out in the original pre-construction bat impact assessment report, which would include curtailment, would need to be implemented as soon as turbines are erected. This would include a turbine cut-in speed of 8 m/s at hub-height for these turbines in February and March from sunset to sunrise and in January, April, September, October, November and December from sunset for 2.5 hours, and only when temperatures are 9 °C or higher. The sunset and sunrise times to be adjusted each month according to the seasonal changes in these times.

It is also recommended to maximise the ground clearance and minimise the tip height (i.e. the distance between the ground and the blade tip at its highest point) as much as possible. More specifically, it is not recommended for the lowest blade tips to encroach any lower than 30 m above ground, as turbines with a lower ground clearance run the risk of reaching the fatality thresholds sooner.

A full operational phase monitoring campaign, inclusive of fatality monitoring and estimates, is to commence as soon as the wind turbines are erected, and in accordance with latest version of the operational bat monitoring guidelines. Based on results from this operational monitoring campaign, should the estimated bat fatalities for the entire Spreeukloof WEF exceed the threshold of 31 bats per annum, then strict curtailment measures will need to be implemented – to be defined and monitored by an appropriate bat specialist. Blade feathering must also be implemented at the start of operation to prevent blade free-wheeling. This is to take place for the entire Spreeukloof WEF.

Based on the proposed amendments and the updated assessment, it is the opinion of the specialist that the amendment can be authorised, on condition that all recommendations are strictly adhered to.

2.2.4 Impacts on Heritage Resources (archaeology, palaeontology and cultural landscape)

The comparative specialist assessment concluded that based on the information available and due to the reduced number of turbines in the amendment layout, the impact has reduced in significance as compared to the original assessment. The proposed amendments including the powerline rerouting and the extension of validity amendment will have zero effect on the significance of impacts identified in the original EIA process. On condition that the recommendations from SAHRA articulated above are implemented. From a heritage perspective the proposed amendments are therefore supported on condition that the recommendation from SAHRA are implemented. In addition, no novel mitigation measures are required or recommended from a heritage perspective.

2.2.5 Noise impacts

When compared to the 2012 Noise Study, the significance of the noise impact did change, and the changes due to the amendment will result in a change in the mitigation measures. The 2012 Noise Study recommended the relocation of a number of receptors (or the relocation of a number of wind turbines), as well as a potential setback distance of 750 m. The following mitigation measures replace the mitigation measures highlighted in the 2012 noise report.

For the amendment it is recommended that night-time construction activities (at the closest WTG location from NSD03) be minimized where possible. If night-time construction activities must take place at night (such as the pouring of concrete), the receptor staying at NSD03 should be notified of the required night-time activities.

Additional mitigation measures are not required or recommended for the operational phase.

Specific additional, novel mitigation measures have been provided based on the remodelled noise findings as per the amendment layout provided, and are to be included into the project Environmental Management Program report, namely:

- The developer should evaluate the potential noise impact should the layout be revised where any wind turbines are located closer than 1,000 m from a confirmed NSD.
- The developer should evaluate the potential noise impact should the developer make use of a wind turbine with a maximum sound power emission level exceeding 107.2 dBA (re 1 pW).
- The developer should investigate any reasonable and valid noise complaint if registered by a receptor staying within 2,000 m from the location where construction or decommissioning activities are taking place, or from an operational wind turbine.

Considering the **low** significance of the potential noise impacts (with mitigation, inclusive of cumulative impacts) for the proposed WEF and associated infrastructure, it is recommended that the Part II Amendment for the proposed Spreeukloof WF be authorized.

2.2.6 Visual impacts

In consideration of the proposed amendments, cumulative impact is deemed to be of an acceptable level and there is no (zero) change to the significance rating compared with that of impacts identified in the original VIA Report (dated 2010). In addition to this, no new mitigation measures are required. The reduced number of wind turbines (12 turbines), together with the proposed changes in turbine specifications would result in similar overall visual impact significance ratings to that determined in the original VIA and subsequent amendments. The proposed amendments would result in no change in the overall visual impact significance ratings and no new visual mitigation measures are deemed necessary.

It is suggested that the proposed amendment to the turbine dimensions and layout be supported, subject to the conditions and recommendations as stipulated in the original Environmental Authorisation, and according to the Environmental Management Programme

and suggested mitigation measures, as provided in the original Visual Impact Assessment report.

2.2 Activities and Components associated with the Wind Energy Facility

The main activities/components associated with the Spreeukloof Wind Energy Facility comprise the following:

Main Activity/Project Component	Components of Activity	Details
Planning		
Conduct surveys	» Geotechnical survey by geotechnical engineer » Site survey and confirmation of the turbine micro-siting footprints » Survey of substation sites and power line routes	» All surveys are to be undertaken prior to initiating construction.
Construction		
Establishment of access roads to the site	» Upgrade access/haul roads to the site » Establish internal access roads: 3-6 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 up to 11m in width for use by the crane during construction phase only.	» Access roads will be constructed in advance of any components being delivered to site and will remain in place after completion for future access and possibly access for replacement of parts if necessary. » Existing access roads to the site will be utilised and upgraded where required. Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. » The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines (as well as heritage & paleontological specialists surveys). To accommodate the large crawler crane required for turbine assembly, a track of approximately 11m in width is required to be established on the site to accommodate the passage of the fully rigged crawler crane.
Undertake site preparation	» Site 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 stockpiled, backfilled and/or spread on site.

Main Activity/Project Component	Components of Activity	Details
Establishment of lay down areas on site	» Lay down areas (temporary footprint 25m x 50m) at each turbine position for the storage of wind turbine components and accommodation of construction and crane lifting equipment. » Temporary lay down area (80m x 100m wide). » Interim construction facilities (max 5000m^2)	» 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. » Such areas to make use of already compacted areas as far as possible, such as roadways or other laydown areas. » An area for interim construction facilities (batching plant, civil & electrical storage, site offices and parking) of approximately 5000 m^2 would be required during construction of the facility
Construct wind turbine foundations	» Concrete foundations of approximately of up to 20 x 20m x 2m depth at each turbine location	» Foundation holes will be mechanically excavated. » Shoring and safety barriers will be erected.
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 4 segments, a nacelle, and three rotor blades (each of up to 50 m in length). * 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	» Turbine units consist of a tower comprised of 4 segments, a nacelle, and three rotor blades. Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. 200 ton mobile assembly crane and a 750 ton main lift crawler crane) to erect the wind turbines. Other components include components required for the establishment of the substations (including transformers) and those required for the establishment of the power lines (including towers and cabling). » The wind turbine, including 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),

Main Activity/Project Component	Components of Activity	Details
	mixers, etc.). * The components required for the establishment of the substations (including transformers) * Components required for the establishment of the power lines (including towers and cabling) * Ready-mix cement trucks for turbine, substations and visitors centre foundations	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. The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself. 10 trucks will be used for the shipment of each turbine.
Erect turbines	» Large lifting crane used for lifting of large, heavy components » A small crane for the assembly of the rotor.	» The large lifting crane will lift the tower sections into place. » The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower. » The rotor (i.e. the blades of the turbine) will then be assembled or partially assembled on the ground. 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	» 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 substations will be constructed with a high-voltage (HV) yard footprint of up to 150m x 250m. » 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 sites * Step 3: Construction of terrace and foundations

Main Activity/Project Component	Components of Activity	Details
		* Step 4: Assembly, erection and installation of equipment * Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.
Connection of wind turbines to the on-site 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 would follow the internal access roads as far as reasonably possible.
Connect substations to power grid	» 132 kV distribution power lines are proposed to connect the substations in the facility to the electricity distribution network/grid.	» Routes for the power lines will be assessed, surveyed and pegged prior to construction.
Commissioning of the facility	» Wind energy facility commissioning	» Prior to the start-up of a wind turbine, a series of checks and tests will be carried out, including both static and dynamic tests to make sure the turbine is working within appropriate limits. » Grid interconnection and unit synchronisation will be undertaken to confirm the turbine and unit performance. Physical adjustments may be needed such as changing the pitch of the blades.
Undertake site remediation	» Remove all construction equipment from the site » Rehabilitation of temporarily disturbed areas where practical and reasonable	» On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.
Operation		
Operation	» Operation of turbines within the wind energy facility	» Once operational, the wind energy facility will be monitored remotely. It is estimated that the operational phase of the project will provide employment for approximately 30 skilled staff members, who will be responsible for monitoring and maintenance when required. » No permanent staff will be required on site for any extended period of time. » Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather

Main Activity/Project Component	Components of Activity	Details
		conditions or maintenance activities.
Maintenance	» Oil and grease – turbines » Transformer oil – substations » Waste product disposal	» The wind turbines will be subject to periodic maintenance and inspection. Periodic oil changes will be required and any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation. » The turbine infrastructure is expected to have a lifespan of approximately 20 - 30 years, with maintenance.
Decommissioning		
Site preparation	» Confirming the integrity of the access to the site to accommodate required equipment and lifting cranes. » Preparation of the site (e.g. lay down areas, construction platform) » Mobilisation of 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 discussed in this EIA 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.

In terms of the findings of the EIA Report and subsequent amendments, various planning, construction and operation-related environmental impacts were identified, including the disturbance of ecological environment (flora and fauna,) avifauna Impacts on avifauna (birds), disturbance to sense of place, visual aesthetics, noise pollution, socio-economic impacts, soil erosion and degradation, impacts on heritage and fossil resources, storage and utilisation of hazardous substances on-site and impacts on wetlands and drainage lines The EMPr has been developed and must be implemented to protect sensitive on-site and off-site features through controlling construction and operation activities that could have a detrimental effect on the environment and avoiding or minimising potential impacts.

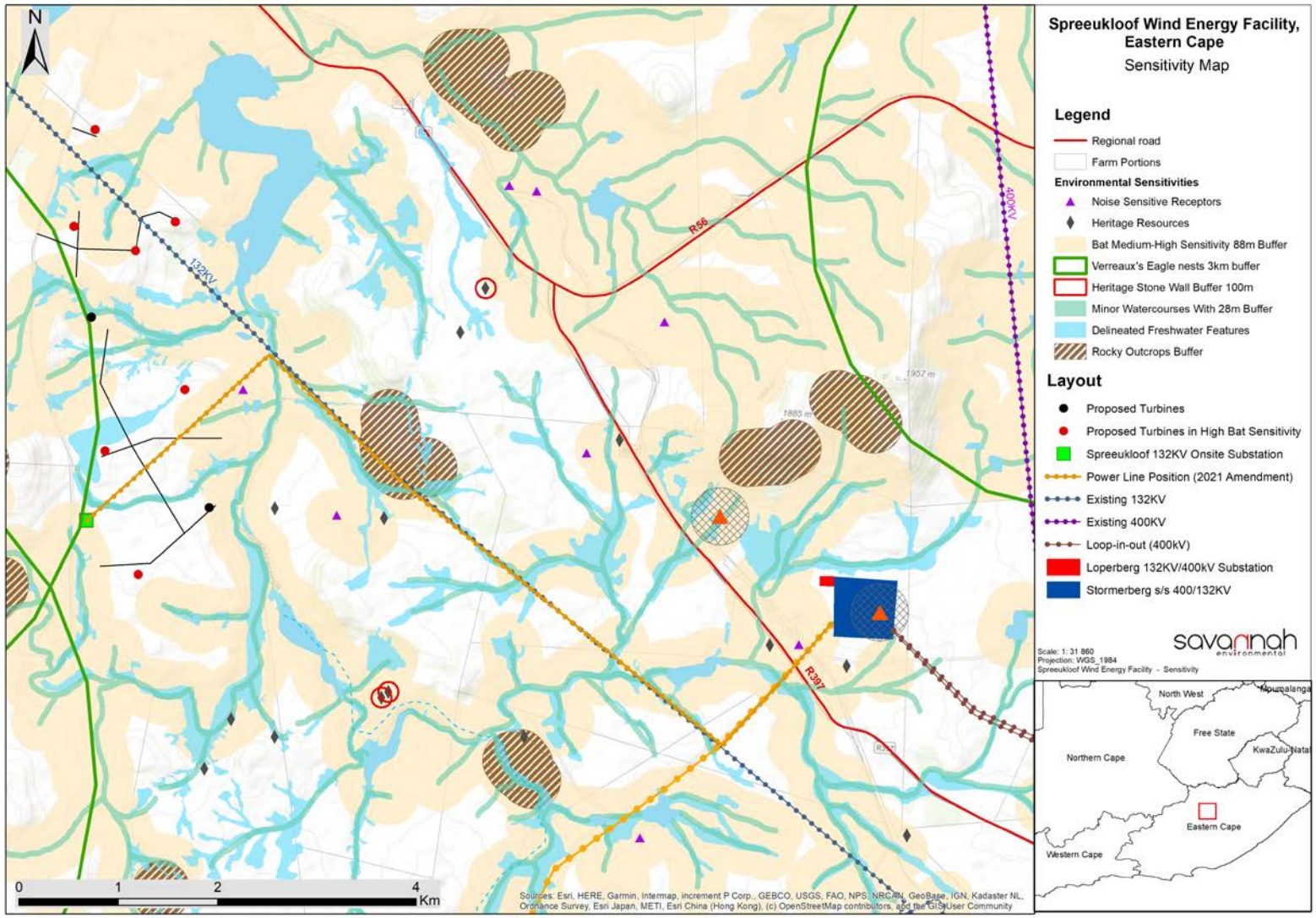


Figure 1: Spreeukloof Wind Farm Footprint with specialist sensitivities

CHAPTER 3: PURPOSE AND OBJECTIVES OF THE EMPR

An Environmental Management Programme (EMPr) 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". The objective of this EMPr 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 EMPr 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 EMPr is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMPr 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 to those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site rehabilitation (soil stabilisation, re-vegetation) and operation. The EMPr also defines monitoring requirements to ensure that the specified objectives are met.

This EMPr is applicable to all employees and contractors working on the pre-construction, construction, and operation and maintenance phases of the Spreeukloof Wind Farm. The document must be adhered to and updated as relevant throughout the project life cycle.

This EMPr has been compiled in accordance with Appendix 4 of the EIA Regulations, 2014 (as amended). This is a dynamic document and will be further developed in terms of specific requirements listed in any authorisations issued for the Spreeukloof Wind Farm and/or as the project develops. The EMPr has been developed as a set of environmental specifications (i.e. principles of environmental management). The specifications have been developed on the basis of the findings of the Environmental Impact Assessment (EIA), and must be implemented to protect sensitive on-site and off-site features through controlling construction, operation and decommissioning activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts.

The EMPr has the following objectives:

- 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 Spreeukloof Wind Farm.
- 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.
- Identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.

» Propose mechanisms and frequency for monitoring compliance, and prevent long-term or permanent environmental degradation.
» Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that were not considered in the Part II amendment process.

The mitigation measures identified within the Part II amendment process are systematically addressed in the EMPr, ensuring the minimisation of adverse environmental impacts to an acceptable level.

Spreeukloof Wind Farm (Pty) Ltd must ensure that the implementation of the project complies with the requirements of all environmental authorisations, permits, and obligations emanating from relevant environmental legislation. This obligation is partly met through the development and the implementation of this EMPr, and through its integration into the relevant contract documentation provided to parties responsible for construction and/or operation activities on the site. The adequacy and efficacy of implementation is to be monitored by an independent Environmental Control Officer (ECO). Since this EMPr is part of the Part II amendment process for the Spreeukloof Wind Farm, it is important that this document be read in conjunction with the BA report compiled for this project. This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. Should there be a conflict of interpretation between this EMPr and the Environmental Authorisation, the stipulations in the Environmental Authorisation shall prevail over that of the EMPr, unless otherwise agreed by the authorities in writing. Similarly, any provisions in legislation overrule any provisions or interpretations within this EMPr.

This EMPr shall be binding on all the parties involved in the planning, construction and operational phases of the project, and shall be enforceable at all levels of contract and operational management within the project. The document must be adhered to and updated as relevant throughout the project life cycle.

CHAPTER 4: STRUCTURE OF THIS EMPR

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

» Planning and design activities
» Construction activities
» Rehabilitation activities
» Decommissioning activities

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

4.1 Project Team

This draft EMP was compiled by:

EMPr Revision 1 Compilers	
Rendani Rasivhetshele	Savannah Environmental
Gideon Raath	Savannah Environmental
Jo-Anne Thomas	Savannah Environmental
Input from Specialist EMPr Revision	
Ecology and freshwater	Brian Colloty
Avifauna	Jon Smallie of Wildskies
Bats	Mark Hodgson and Ashlin Bodasing of arcus Consulting
Noise	Morné de Jager of Enviro Acoustic Research cc
Visual	Lourens du Plessis of LOGIS
Heritage	Jenna Lavin of CTS Heritage
EMPr Compilers	
John von Mayer	Savannah Environmental
Karen Jodas	Savannah Environmental
Input from Specialist Consultants	
Ecology: flora, fauna and wetlands	David Hoare of David Hoare Consulting cc
Avifauna	Andrew Jenkins of Avisense Consulting cc
Geology and erosion potential	Iain Paton of Outeniqua Geotechnical Services cc
Visual	Lourens du Plessis of MetroGIS
Heritage	Celeste Booth of the Albany Museum
Palaeontology	John Almond of Natura Viva cc
Noise	Morne de Jager of MENCO (M2 Environmental Connections cc)
Social Impact	Tony Barbour (Environmental Consultant and Researcher)

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, having been involved in EIA processes over the past ten (15) years. They have managed and drafted environmental management plans for other power generation projects throughout South Africa. In addition, they have been involved in compliance monitoring of major construction projects in South Africa.

CHAPTER 5: ROLES AND RESPONSIBILITIES

OBJECTIVE: Establish clear reporting, communication, and responsibilities during construction in relation to the overall implementation of the EMPr

For the purposes of the EMPr, the generic roles that need to be defined are those of the:

» Project Developer;
» Project Manager/Site Manager;
» Environmental Control Officer;
» Contractors; and
» Contractor's Safety, Health and Environment Representative/Environmental Officer.

It is acknowledged that the specific titles for these functions may vary once the project is implemented. The purpose of this section of the EMPr is to give a generic outline of what these roles typically entail. It is expected that this will be further defined during project implementation.

i) The Developer

As the Proponent, Spreeukloof Wind Farm (Pty) Ltd must ensure that the implementation of the project complies with the requirements of all environmental authorisations and all other permits, and obligations emanating from other relevant environmental legislation.

ii) Project Manager/Site Manager

The Project Manager/Site Manager is responsible for overall management of project and EMPr implementation. The following tasks will fall within his/her responsibilities:

» Be fully conversant with the BA for the project, the EMPr, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.
» Be fully knowledgeable with the contents of all relevant licences and permits.
» Be familiar with the recommendations and mitigation measures of this EMP and implement these measures.
» Ensure all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these.
» Monitor site activities on a daily basis for compliance.
» Ensure that the EMPr is correctly implemented throughout the project by means of site inspections and meetings. This must be documented as part of the site meeting minutes.
» Conduct internal audits of the construction site against the EMPr.
» Confine the construction site to the demarcated area.
» Rectify transgressions through the implementation of corrective action.

iii) Environmental Control Officer

A suitably qualified Environmental Control Officer (ECO)[1] must be appointed by the project proponent prior to the commencement of any authorised activities and will be responsible for monitoring, reviewing and verifying compliance by the Contractor with the environmental specifications of the EMPr and the conditions of the Environmental Authorisation. Accordingly, the ECO will:

- Be fully knowledgeable of the contents of the BA.
- Be fully knowledgeable of the contents of the conditions of the EA (once issued).
- Be fully knowledgeable of the contents of the EMPr.
- Be fully knowledgeable of all the licences and permits issued to the site.
- Be fully knowledgeable of the contents of all relevant environmental legislation.
- Ensure that the contents of the EMPr are communicated to the Contractors site staff and that the Site Manager and Contractors are constantly made aware of the contents through ongoing discussion.
- Ensure that the compliance of the EMPr, EA and the legislation is monitored through regular and comprehensive inspection of the site and surrounding areas.
- Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements or site-specific plans.
- Ensure that if the EMPr, EA and/or the legislation conditions, regulations or specifications are not followed then appropriate measures are undertaken to address any non-compliances (for example an ECO may cease construction or an activity to prevent a non-compliance from continuing).
- Ensure that any non-compliance or remedial measures that need to be applied are reported.
- Keep records of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.
- Independently report to the DFFE in terms of compliance with the specifications of the EMPr and conditions of the EA (once issued).
- Keep records of all reports submitted to DFFE.

The ECO must be present full-time on site for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, to facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing (i.e. during site establishment, and excavation of foundations). Thereafter, monthly compliance audits can be undertaken, provided that adequate compliance with the EA, environmental permits and EMPr is achieved. The developer should appoint a designated Environmental Officer (EO) to be present on-site to deal with any environmental issues as the arise. The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site handed over for operation.

[1] The ECO should have a relevant degree or technical diploma in environmental management and at least 2 years experience in the field

iv) **Contractors**

The Lead Contractor is responsible for the following:

» Ensure compliance with the EA, environmental permits and the EMPr at all times during construction.
» Have the overall responsibility of the EMPr and its implementation.
» Ensure that all appointed contractors and sub-contractors are aware of the EMPr and their respective responsibilities.
» Provide all necessary supervision during the execution of the project.
» Comply with any special conditions as stipulated by landowners.
» Inform and educate all employees about the environmental risks associated with the various activities to be undertaken, and highlight those activities which should be avoided during the construction process in order to minimise significant impacts to the environment.
» Maintain an environmental register which keeps a record of all incidents which occur on the site during construction. These incidents include:
    * Public involvement / complaints
    * Health and safety incidents
    * Hazardous materials stored on site
    * Non-compliance incidents
    * 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.
» Where construction activities are undertaken is close to any inhabited area, the necessary precautions shall be taken by the Contractor to safeguard the lives and property of the inhabitants.
» Conduct audits to ensure compliance to the EMPr.
» Ensure there is communication with the Project Manager, the ECO, and relevant discipline engineers on matters concerning the environment.
» Should the Contractor require clarity on any aspect of the EMPr the Contractor must contact the Environmental Consultant/Officer for advice.

Contractors and Service Providers must be aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. 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:

» Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
» A copy of the EMPr must be easily accessible to all on-site staff members.
» Employees must be familiar with the requirements of this EMPr and the environmental specifications as they apply to the construction of the wind farm.
» Prior to commencing any site works, all employees and sub-contractors must have attended an environmental awareness training course which must provide staff with an appreciation of the project's environmental requirements, and how they are to be implemented.

» Staff will be informed of environmental issues as deemed necessary by the ECO.

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 the above will be considered as non-compliance to the specifications of the EMPr
» 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 EMPr (i.e. ensure their staff are appropriately trained as to the environmental obligations)

v) Contractor's Safety, Health and Environment Representative/Environmental Officer

The Contractor's Safety, Health and Environment (SHE) Representative/Environmental Officer (EO), employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the SHE/EO must act as liaison and advisor on all environmental and related issues and ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor.

The Contractor's SHE/EO should:
» Be well versed in environmental matters.
» Understand the relevant environmental legislation and processes.
» Understand the hierarchy of Environmental Compliance Reporting, and the implications of Non-Compliance.
» Know the background of the project and understand the implementation programme.
» Be able to resolve conflicts and make recommendations on site in terms of the requirements of this Specification.
» Keep accurate and detailed records of all EMPr-related activities on site.

OBJECTIVE: Establish clear reporting, communication, and responsibilities during construction in relation to the overall implementation of the EMPr

Formal responsibilities are necessary to ensure that key procedures are executed during operation. Several professionals will form part of the operation team. For the purposes of the EMPr, the generic roles that need to be defined are those of the:

» Operations Manager; and
» Environmental Manager

It is acknowledged that the specific titles for these functions may vary once the project is implemented. The purpose of this section of the EMPr is to give a generic outline of what these roles typically entail. It is expected that this will be further defined during project implementation.

i) Operations Manager

The Plant Manager will:
» Ensure that adequate resources (human, financial, technology) are made available and appropriately managed for the successful implementation of the operational EMPr.
» Conduct annual basis reviews of the EMPr to evaluate its effectiveness.
» Take appropriate action as a result of findings and recommendations in management reviews and audits.
» Provide forums to communicate matters regarding environmental management.

ii) Environmental Manager

The Environmental Manager will:

» Develop and implement an Environmental Management System (EMS) for the wind farm and associated infrastructure.
» Manage and report on the wind farm's environmental performance.
» Maintain a register of all known environmental impacts and manage the monitoring thereof.
» Conduct internal environmental audits and co-ordinate external environmental audits.
» Liaise with statutory bodies (such as the National and Provincial Department of Environmental Affairs and conservation authorities) on environmental performance and other issues.
» Conduct environmental training and awareness for the employees who operate and maintain the wind farm.
» Compile environmental policies and procedures.
» Liaise with interested and affected parties on environmental issues of common concern.
» Track and control the lodging of any complaints regarding environmental matters.

The Environmental Manager must provide fourteen (14) days written notification to the DFFE that the Spreeukloof Wind Farm operation phase will commence.

CHAPTER 6: MANAGEMENT PLAN FOR WIND ENERGY FACILITY: PLANNING & DESIGN

6.1 Planning and Design

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

The most sensitive landscape features for planning purposes in the study area will be the presence of dams, wetlands and drainage lines. These features and an associated 30 m buffer should be excluded from any development footprint wherever possible.

A stormwater management plan must be compiled (usually done by an engineering company) that details how storm water off hard surfaces will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces.

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

Mitigation: Action/control	Responsibility	Timeframe
Consider design level mitigation measures recommended by the specialists, especially with respect to visual aesthetics, noise, flora, aquatic ecology (i.e. wetlands and pans), avifauna, and heritage, as detailed within the EIA report and relevant appendices.	Engineering Design Consultant / turbine supplier Spreeukloof Wind Farm	Tender Design & Design Review Stage
A 3km radius circular no-go buffer must be implemented around each of the known Verreaux's Eagle nests. No new overhead infrastructure may be constructed within these areas.	Engineering Design Consultant / Spreeukloof Wind Farm	Design phase
An avifaunal walk-through must be conducted by a suitably qualified and independent ornithologist for all components of the final facility layout to ensure that all avifaunal aspects have been adequately catered for.	Avifaunal Specialist and Spreeukloof Wind Farm	Design phase
None of the low voltage line connecting turbines should be above ground. Only the grid connection power line may be above ground. The internal cables should be buried in trenches following roads (i.e. not on their own	Engineering Design Consultant / Spreeukloof Wind Farm	Design phase

Mitigation: Action/control	Responsibility	Timeframe
servitude through the veld). Any above ground power line must be fitted with bird flight diverters to mitigate collision risk and pylons must be built on Eskom approved vulture friendly designs.		
The lower blade tip height must not be lowered below 30m above ground.	Spreeukloof Wind Farm and appointed contractors	Design phase
Turbines that intrude into high sensitivity buffers must be repositioned. These buffers are regarded as high sensitivity areas for turbine components only, and other infrastructure (roads, cables etc) are permissible. These areas include 200m around all cliff lines potential roosts and all other important bat features. Should important features, including wind pumps and water reservoirs be removed or covered, these buffers would not apply and can be removed. Should it not be possible to move these turbines, then more stringent mitigation measures set out in the original pre-construction bat impact assessment report, which would include curtailment, would need to be implemented as soon as turbines are erected.	Spreeukloof Wind Farm	Design phase
In the event that turbines can be micro-sited, then a bat specialist must map the final turbine layout before micro-siting and assess whether all turbines are appropriately sited in such a way that their blades do not encroach into any bat sensitive buffers.	Spreeukloof Wind Farm and bat specialist	Design phase
Access roads to be carefully planned to minimise the impacted area and prevent unnecessary over compaction of soil.	Spreeukloof Wind Farm	Design phase
A comprehensive stormwater management plan must be compiled those details how stormwater off hard surfaces will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces.	Spreeukloof Wind Farm	Design phase
The noise emission specifications of wind turbine generators should be considered when selecting the equipment.	Spreeukloof Wind Farm	Design phase
A detailed geotechnical investigation is required for the design phase.	Spreeukloof Wind Farm	Design phase

Performance Indicator	» Design meets objectives and does not degrade the environment » Design and layouts etc 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, SHE representative and Environmental Control Officer (ECO) prior to the commencement of construction.

OBJECTIVE: Protection of Heritage & Paleontological Resources

The potential for paleontological resources to be present within the study area has been identified through the EIA process. It is, therefore, recommended that a qualified palaeontologist be commissioned to carry out a field scoping study of the entire study area before construction commences. The main purpose of the field scoping study would be to identify any areas within the development footprint where specialist paleontological mitigation during the construction phase might be required. Relocation of wind turbines, roads or other developments would not be necessary on paleontological grounds, provided that appropriate mitigation is ensured. Mitigation would involve the recording and judicious collection of fossil material and associated geological data. Should substantial fossils (such as vertebrate remains or any sort or plant-rich beds) be exposed at any time during construction, the ECO should safeguard these in situ, where feasible. SAHRA and/or a professional palaeontologist should then be alerted as soon as possible so that appropriate mitigation measures can be implemented.

In terms of potential heritage resources: once the exact coordinates for the wind turbines are established an archaeologist should be appointed to inspect the exact and immediate surrounding area for possible sites. The grave and burial areas must be identified and cordoned off prior to the commencement of development so that no negative impact and vandalism occurs.

Project component/s	List of project components affecting the objective » power lines » access roads » substations » wind turbines
Potential Impact	» Destruction of potential fossil / paleontological resources
Activity/risk source	» Excavations to install wind turbines and associated infrastructure
Mitigation: Target/Objective	» No impacts on valuable fossil heritage. » Avoidance areas to be identified in the field prior to construction phase.

Mitigation: Action/control	Responsibility	Timeframe
Before any major construction commences a thorough field scoping survey of natural and artificial rock exposures within the study region as a whole should be undertaken by a qualified palaeontologist to identify specific areas or horizons of paleontological sensitivity on the ground.	Spreeukloof Wind Farm & Specialist	Pre-Construction
If any of the existing buildings are planned to be demolished during the course of development, a built-environment heritage specialist or historian must be appointed to assess the significance of the built environment and historical buildings.	Spreeukloof Wind Farm	Pre-Construction
Grave and burial areas must be identified and cordoned off prior to the commencement of development so that no negative impact and vandalism occurs.	Spreeukloof Wind Farm	Pre-Construction

Road alignments must be planned in such a way that the minimum of cut, and fill operations are required. Existing farms tracks should be re-used or upgraded to minimise the amount of change to un-transformed landscape.	Spreeukloof Wind Farm	Pre-Construction

Performance Indicator	» No impacts on valuable fossil heritage. » No impacts on valuable heritage resources.
Monitoring	» Construction schedule to be supplied to heritage practitioner » Monitoring of selected bedrock excavations by the palaeontologist should be carried out during the construction phase of the wind energy facility.

OBJECTIVE: Initiate Bird Monitoring Program

A monitoring programme should be implemented by Spreeukloof Wind Farm (in consultation with an avifauna specialist) to document the effect of the wind energy facility on birds. This should take place before construction (to provide a benchmark), during construction and during operation. Further details are included in Appendix A of this EMP. The developer should exercise further caution in the high sensitivity avifaunal areas (indicated in Figure 1) which require further monitoring during all four seasons to provide more certainty regarding bird movements within these areas. Comprehensive monitoring for all seasons should take place in order to demarcate exclusion zones, if necessary, within these areas before development occurs there.

Project component/s	List of project components affecting the objective » power lines » substations » wind turbines
Potential Impact	» Mortality of birds due to collision with turbines and power line infrastructure.
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- and post-construction monitoring	Spreeukloof Wind Farm	Pre-construction
A bird fatality threshold and adaptive management policy must be designed by an ornithologist for the site prior to COD.	Scientist specialist and Spreeukloof Wind Farm	Prior to operation
Start pre-construction monitoring	Monitoring agency	1 year before construction is due to start

Mitigation: Action/control	Responsibility	Timeframe
Periodically collate and analyse pre-construction monitoring data	Advising scientist	Every 3 months of monitoring
Review report on the full year of pre-construction monitoring, and integrate findings into construction EMP and broader mitigation scheme	Advising scientist, monitoring agency in negotiation with Spreeukloof Wind Farm	After a year of pre-construction monitoring

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	» Report on slope lift patterns on key ridges and implications for management of turbine operation of turbine positions in areas of caution.

CHAPTER 7: MANAGEMENT PLAN FOR WIND ENERGY FACILITY: CONSTRUCTION

7.1. Overall Goal for Construction

The construction phase of the wind energy facility should be undertaken in such a way that ensures the construction activities are properly managed in respect of environmental aspects and impacts and enables the wind energy facility construction activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to noise impacts, traffic and road use, and effects on local residents. The construction phase of the facility should also be undertaken in such a way as to minimise the impact on the vegetation and fauna / avifauna on the site as well as on any archaeological and historical value the site may have.

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

OBJECTIVE: Securing the site and site establishment

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 indigenous languages, all to the approval of the Site Manager. All unattended open excavations shall be adequately demarcated and/or fenced (fencing shall consist of a minimum of three strands of wire wrapped with danger tape). Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.

Project component/s	Project components affecting the objective: » wind energy turbines » access roads » substations » power lines
Potential Impact	» Hazards to landowners and public » Security of materials » Substantially increased damage to adjacent sensitive vegetation
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 SHE Representative.	Contractor	Erection: during site establishment Maintenance: for duration of

Mitigation: Action/control	Responsibility	Timeframe
		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
All development footprints for roads, buildings, underground cables, laydown areas and turbine footings should be fenced off with two strand wire and clearly indicated with flags and/or danger tape strips. There is to be no disturbance outside these demarcated areas, at least not without the permission of the ECO.	Contractor	Erection: during site establishment Maintenance: for duration of Contract

Performance Indicator	» Site is secure and there is no unauthorised entry » No members of the public/ landowners injured
Monitoring	» Regular visual inspection of fence for signs of deterioration/forced access » An incident reporting system will be used to record non-conformances to the EMP » ECO to monitor all construction areas on a weekly and monthly basis until all construction is completed; immediate report backs to site manager. » ECO to speak to contractors responsible for any infringements.

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

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

Mitigation: Action/control	Responsibility	Timeframe
Aim for a minimum of 80% of the low-skilled workers sourced from the local area.	Spreeukloof Wind Farm and contractors	Where required, training and skills development programmes to be initiated prior to the initiation of the construction phase.
Where required, implement appropriate training and skills development programmes prior to the initiation of the construction phase to ensure that 80% target is met.	Spreeukloof Wind Farm	Where required, training and skills development programmes to be initiated prior to the initiation of the construction phase.
Develop a database of local BEE service providers and ensure that they are informed of tenders and job opportunities.	Spreeukloof Wind Farm	Database of potential local BEE services providers to be completed before construction phase commences.
Identify potential opportunities for local businesses	Spreeukloof Wind Farm	Tender Design and Review stage

Performance Indicator	» 80% of semi and unskilled labour locally sourced. » Database of potential local BEE services providers in place before construction phase commences.
Monitoring	» Spreeukloof Wind Farm or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

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

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

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

Project component/s	Project components affecting the objective: » Construction and establishment activities associated with the establishment of the wind energy facility, including all 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. » Presence of construction workers on site may result loss of livestock due to stock theft and damage to farm infrastructure, such as gates and fences. Poaching of wild animals may also occur. » Due the relatively small number of workers the risk of impacts is likely to be low.
Activities/risk sources	» The presence of construction workers can impact negatively on family structures and social networks, especially in small, rural communities. » The presence of construction workers on the site can result in stock thefts and damage to farm infrastructure.
Mitigation: Target/Objective	» Avoid and or minimise the potential impact of construction workers on the local community and livelihoods.

Mitigation: Action/control	Responsibility	Timeframe
Aim for a minimum of 80% of the semi and low-skilled workers to be sourced from the local area. This should be included in the tender documents. Construction workers should be able to provide proof of having lived in the area for five years or longer.	Spreeukloof Wind Farm	Identify suitable local contractors prior to the tender process for the construction phase.
Establish contact with the adjacent farmers and develop a Code of Conduct for construction workers. 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. Ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct.	Spreeukloof Wind Farm	Briefing session for construction workers held before they commence work on site.
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.	Spreeukloof Wind Farm and contractors	Construction
Provide opportunities for workers to go home over weekends. The cost of transporting workers home over weekends and back to the site should be borne by the contractors.	Contractors	Construction
The housing of construction workers on the site should be limited to security personnel	Spreeukloof Wind Farm and contractors	Construction
On completion of the construction phase all construction workers must be transported back to their place of origin within two days of their contract ending. The costs of transportation must be borne by the contractor.	Contractors	Construction
Identify local contractors who are qualified to undertaken the required work	Spreeukloof Wind Farm	Tender Design and Review stage

Mitigation: Action/control	Responsibility	Timeframe
Compensate farmers / community members at full market related replacement cost for any losses, such as livestock, damage to infrastructure etc.	Contractors	Compensate Farmers / community members within 1 month of claim being verified by Spreeukloof Wind Farm or Contractors.

Performance Indicator	» Employment policy and tender documents that set out local employment and targets completed before construction phase commences. » Code of Conduct developed and approved prior to commencement of construction phase. » 80 % of semi and unskilled labour locally sourced where possible. » Construction workers employed have proof that they have lived in the area for five years or longer. » Tender documents for contractors include recommendations for construction camp. » All construction workers made aware of Code of Conduct within first week of being employed. » Briefing session with construction workers held at outset of construction phase. » Compensation claims settled within 1 month of claim being verified by Spreeukloof Wind Farm and affected farmers.
Monitoring	» Spreeukloof Wind Farm or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE: Noise control

Construction noise as well as traffic movement to and from the wind energy facility site (particularly the use of heavy-duty vehicles), could potentially result in a noise impact on the residents near the proposed facility during construction.

Project component/s	List of project components affecting the objective: » wind energy turbines » access roads » substations » power lines
Potential Impact	» Nuisance noise from construction affecting the surrounding community
Activity/risk source	» Any construction activities taking place within 500 m from potentially sensitive receptors (PSR)
Mitigation: Target/Objective	» Ensure equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors. » Ensure that maximum noise levels at potentially sensitive receptors be less than 65 dBA. » Prevent the generation of a disturbing or nuisance noises » Ensure acceptable noise levels at surrounding stakeholders and

	potentially sensitive receptors. » Ensuring compliance with the Noise Control Regulations

Mitigation: Action/control	Responsibility	Timeframe
Where possible, on-site construction activities will be limited to 6:00am to 6:00pm Monday – Saturday (excluding public holidays) (in terms of the Environment Conservation Act). Should construction activities need to be undertaken outside of these times, the surrounding communities will be notified, and appropriate approval will be obtained from DFFE.	Contractor	Construction
Night-time construction activities should be minimized where possible.	Contractor	Construction
Night-time construction activities (at the closest WTG location from NSD03) are not recommended and it should be minimized where possible. If night-time construction activities must take place at night (such as the pouring of concrete), the receptor staying at NSD03 should be notified of the required night-time activities. (Enviro Arcoustic Research, 2021).	Contractor	Construction
Roads must not be constructed within 150 m from occupied dwellings used for residential purposes (to reduce noise levels below 42 dBA if construction traffic may use the road at night).	Spreeukloof Wind Farm and Contractor	Construction
The developer should evaluate the potential noise impact should the layout be revised where any wind turbines are located closer than 1,000 m from a confirmed NSD.	Spreeukloof Wind Farm	Pre-Construction
The developer should investigate any reasonable and valid noise complaint if registered by a receptor staying within 2,000 m from the location where construction or decommissioning activities are taking place, or from an operational wind turbine.	Spreeukloof Wind Farm	Construction
The developer should evaluate the potential noise impact should the developer make use of a wind turbine with a maximum sound power emission level exceeding 107.2 dBA (re 1 pW).	Spreeukloof Wind Farm	Construction
Construction noise will be managed according to the Noise Control Regulations and SANS 10103.	Contractor	Construction
All construction equipment, including vehicles, will be properly and appropriately maintained in order to minimise noise generation.	Contractor	Construction
Establish a line of communication and notify all stakeholders and 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 in the vicinity (within 500 m) of the PSR 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	At least 2 days, but not more than 5 days before activity is to commence

Mitigation: Action/control	Responsibility	Timeframe
Measure the peak noise levels of equipment used when operational and keep database of noise levels	Acoustical Consultant / Approved Noise Inspection Authority	Start of project Quarterly during construction phase
When any noise complaints are received noise monitoring should be conducted at the complainant, followed by feedback regarding noise levels measured	Acoustical Consultant / Approved Noise Inspection Authority	Within 7 days after complaint was registered

Performance Indicator	» No complaints received concerning noise » Equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors. » Ensure that maximum noise levels at potentially sensitive receptors are less than 65 dBA.
Monitoring	» Quarterly noise monitoring by an Approved Noise Inspection Authority. Noise monitoring to be conducted 500 m downwind from all noisy activities or at PSRs when work is taking place within 500 m from a potentially sensitive receptor. » Monitoring to take place every time that a noise complaint is registered.

OBJECTIVE: Management of dust and emissions and damage to roads

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

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

Mitigation: Action/control	Responsibility	Timeframe
Implement dust suppression measures for heavy vehicles such as wetting roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.	Contractor	Construction
Haul vehicles moving outside the construction site carrying material that can be wind-blown will be covered with tarpaulins.	Contractor	Duration of contract
Vehicles should be fitted with recorders to record when vehicles exceed the speed limit.	Contractor	Duration of contract
Disturbed areas will be re-vegetated as soon as practicable.	Contractor	At completion of the construction phase
Vehicles and equipment will be maintained in a road-worthy condition at all times.	Contractor	Prior to construction phase
Ensure that damage to roads is repaired before completion of construction phase.	Contractor	Before completion of construction phase

Performance Indicator	» Dust suppression measures implemented for all heavy vehicles that require such measures during the construction phase commences. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed. » All heavy vehicles equipped with speed monitors before they are used in the construction phase. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up dated on a monthly basis.
Monitoring	» Spreeukloof Wind Farm or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager or SHE Representative. » An incident reporting system will be used to record non-conformances to the EMP.

OBJECTIVE: Soil and rock degradation and erosion control, water quality management

Any disturbed areas should be immediately rehabilitated in order to stabilise landscapes and prevent exposed surfaces from becoming susceptible to erosion. Water velocity off hard surfaces must be reduced and diffused before water is returned to natural systems in order to minimize the risk of creating erosion channels. If any erosion features develop, they should be stabilised using typical measures, such as gabions, weirs, rock-packing, etc.

The natural soil on the site needs to be preserved as far as possible to minimise impacts on the environment. Soil degradation including erosion (by wind and water) and subsequent

deposition elsewhere is of a concern in areas underlain by fine grained soil which can be mobilised when disturbed, even on relatively low slope gradients (accelerated erosion). Uncontrolled run-off relating to construction activity (excessive wetting, etc.) will also lead to accelerated erosion. Degradation of the natural soil profile due to excavation, stockpiling, compaction, pollution and other construction activities will affect soil forming processes and associated ecosystems. Degradation of parent rock is unlikely as there are no deep excavations or deep road cutting/filling.

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

Project component/s	Project components affecting the objective: » wind energy turbines » access roads » substations » power lines » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas). » All other infrastructure
Potential Impact	» Erosion and soil loss » Negative impacts on wetlands » Disturbance to or loss of wetland/pan habitat » Sedimentation of watercourses/wetland areas » A loss of indigenous vegetation cover. » Increased runoff into drainage lines can potentially be associated with accelerated erosion.
Activities/risk sources	» Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Concentrated discharge of water from construction activity » Stormwater run-off from sealed surfaces » Mobile construction equipment movement on site » Power line construction activities » River/stream/drainage line road crossings. » Roadside drainage ditches. » Project related infrastructure, such as buildings, turbines and fences.
Mitigation: Target/Objective	» To minimise erosion of soil from site during construction » To minimise deposition of soil into drainage lines » To minimise damage to vegetation by erosion or deposition » To minimise damage to rock, soil and vegetation by construction activity » No accelerated overland flow related surface erosion as a result of a loss of vegetation cover. » No reduction in the surface area of wetlands (drainage lines and other wetland areas) as a result of the establishment of infrastructure. » Minimal loss of vegetation cover due to construction related activities. » No or insignificant loss of wetland area in the specialist study area. » No increase in runoff into drainage lines as a result of construction of project related infrastructure. » No increase in runoff into drainage lines as a result of road construction.

Mitigation: Action/control	**Responsibility**	**Timeframe**

Mitigation: Action/control	Responsibility	Timeframe
Identify disturbance areas and restrict construction activity to these areas.	ECO/Contractor	Before and during construction
Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned away from drainage lines. Limit the height of stockpiles to reduce compaction.	Contractor	During site establishment and any activity related to earthworks as well as the duration of construction
Any excavation, including those for cables, must be supervised by the ECO.	Contractor	Duration of construction
All cable trenches, etc, through sensitive area should be dug carefully in order to minimise damage to surrounding areas.	Contractor	Duration of construction
Disturbance of vegetation and topsoil must be kept to a practical minimum.	Contractor	Duration of contract
Access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement and compaction of soil.	Engineer / ECO / Contractor	Before and during construction
Dust control on construction site: Wetting of denuded areas.	Contractor	Construction
Any stockpiles will be protected against wind erosion (e.g. surrounded by shadecloth fences or damped down on a regular basis).	Contractor	Construction
Rehabilitate disturbance areas as soon as construction in an area is completed.	Contractor	During and after construction
Soil conservation: Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and size and protect from erosion.	Contractor	Before and during construction
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	Erection: Before construction Maintenance: Duration of contract
Particular care should be taken in the design of road drainage line crossings in order to ensure there is no step in the channel bed, substrate continuity is maintained and no undue constriction of flow takes place.	Contractor	Erection: during site establishment Maintenance: for duration of contract
As far as possible, access to the wind energy facility construction site should be restricted to a single access point.	Contractor	Duration of contract
Internal access roads should be kept to a minimum.	Contractor / ECO	During site establishment
Where access roads cross natural drainage lines, culverts must be designed to allow free flow. Regular maintenance must be carried out	Engineer / ECO / Contractor	Before construction and
Control depth of excavations and stability of cut faces/sidewalls	Engineer / ECO / Contractor	maintenance over duration of

Mitigation: Action/control	Responsibility	Timeframe
		contract
Capture runoff from roofs in rainwater tanks or disperse runoff from impervious surfaces onto adjacent areas.	Contractor	Pre-construction (avoidance planning) and operational phases of the project.
Use mitre drains to deflect water from roads onto adjacent slopes.	Contractor	Pre-construction (avoidance planning) and operational phases of the project.
Compile a comprehensive stormwater management plan as part of the final design of the project	Construction team, management, environmental control officer	Construction & operation
Water velocity from precipitation and runoff must be reduced and diffused before water is returned to natural systems. Erosion features must be immediately stabilized, if they develop.	Construction team, management, environmental control officer	Construction & operation

Performance Indicator	» Acceptable level of soil erosion and degradation around site (refer to EIA report – September 2010) » Acceptable level of increased siltation in drainage lines » Minimal loss of indigenous vegetation cover during the construction phase of the project. » No increase in runoff into drainage lines as a result of construction of project related infrastructure.
Monitoring	» Regular inspections of the site » Weekly monitoring during the construction phase to ensure mitre drains or similar runoff management structures are properly constructed » 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 » An incident reporting system will be used to record non-conformances to the EMP.

OBJECTIVE: Minimisation of development footprint and disturbance to topsoil

In order to minimise impacts on flora, fauna and ecological processes, the development footprint should be limited.

Project component/s	List of project components affecting the objective: » wind energy turbines » access roads » substations » power lines
Potential Impact	» Impacts on natural vegetation » Impacts on soil » Loss of topsoil
Activity/risk source	» Site preparation and earthworks » Trenching activities for cable laying » Excavation for tower base foundations » Construction of site access road » Site preparation for lay-down area and site office/visitors centre (e.g. compaction) » Foundations or plant equipment installation » Track for crane movement on-site » Power line construction activities » Stockpiling of topsoil, subsoil and spoil material
Mitigation: Target/Objective	» To minimise footprints of disturbance of vegetation/habitats on-site » Remove and store all topsoil on areas that are to be excavated; and use this topsoil in subsequent rehabilitation of disturbed areas. » Fill material is to be sourced from tower base excavations; spoil material to be minimised.

Mitigation: Action/control	Responsibility	Timeframe
Construction activities must be restricted to demarcated areas so that impact on flora and fauna is restricted.	Contractor	Site establishment & duration of contract
Rehabilitate any disturbed areas immediately after construction in that area is complete in order to stabilise landscapes	Construction team, management, environmental control officer	Construction & operation

Performance Indicator	» Zero disturbance outside of designated work areas » Minimise clearing of existing vegetation
Monitoring	» Observation of vegetation clearing and soil management activities by ECO throughout construction phase. » Supervision of all clearing and earthworks. » An incident reporting system will be used to record non-conformances to the EMP.

OBJECTIVE: Limit Damage to wetland areas and drainage lines

Project component/s	List of project components affecting the objective: » wind energy turbines » access roads » substations » power lines
Potential Impact	» Damage to wetland 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.
Activity/risk source	» Construction and operation of facility
Mitigation: Target/Objective	» No damage to drainage lines within project area

Mitigation: Action/control	Responsibility	Timeframe
Align underground cables and internal access roads as much as possible along existing infrastructure & disturbances.	Spreeukloof Wind Farm, Construction team, ECO	Construction & Operation
For any new construction, cross watercourses perpendicularly to minimise disturbance footprints	Spreeukloof Wind Farm, Construction team, ECO	Construction & Operation
Rehabilitate any disturbed areas as quickly as possible	Spreeukloof Wind Farm, Construction team, ECO	Construction & Operation
Control stormwater and runoff water	Spreeukloof Wind Farm, Construction team, ECO	Construction & Operation
Obtain a permit as required in terms of the National Water Act from DWA to impact on any wetland or water resource.	Spreeukloof Wind Farm, Construction team, ECO	Construction & Operation
Appoint an independent environmental control officer during construction and an environmental manager during operation whose duty it will be to minimise impacts on surrounding sensitive habitats	Spreeukloof Wind Farm, Construction team, ECO	Construction & Operation

Performance Indicator	» No impacts on water quality, water quantity, wetland vegetation, natural status of wetland
Monitoring	» Water quality monitoring to take place on a regular basis. This should include the water quality and quantity leaving the project area through the watercourses (should be monitored within main drainage systems that exit site). » Habitat loss in watercourses should be monitored before and after construction. » The environmental manager should be responsible for driving this process. » Reporting frequency depends on legal compliance framework.

OBJECTIVE: Protection of vegetation / control alien invasive plants

Impacts on vegetation at the construction stage are expected to be mainly as a result of direct permanent loss of vegetation in development footprint areas. The development footprints will not impact on any botanical "no go" habitats or areas.

Project component/s	List of project components affecting the objective: » wind energy turbines » access roads » substations » power lines
Potential Impact	» Clearing of construction footprints » Construction activities » Traffic to and from site
Activity/risk source	» Site preparation and earthworks » Construction-related traffic » Foundations or plant equipment installation » Mobile construction equipment » Power line construction activities » Dumping or damage by construction equipment outside of demarcated construction areas.
Mitigation: Target/Objective	» To retain natural vegetation in the highly sensitive areas the site » To minimise footprints of disturbance of vegetation/habitats on-site » No alien plants within project control area » No loss of species of conservation concern

Mitigation: Action/control	Responsibility	Timeframe
Unnecessary impacts on surrounding natural vegetation must be avoided, e.g. driving around in the veld.	Construction team, management (ECO)	Construction
Avoid creating conditions in which alien plants may become established: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible » Do not import soil from areas with alien plants	Construction team, management (environmental officer)	Construction & Operation
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, Act 43 of 1983)	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
Internal access roads and underground cables should be aligned as much as possible along existing linear disturbances, e.g. roads on site, or the edges of cultivated lands, and away from steep slopes and drainage lines as	Construction team, management (ECO)	Construction

Mitigation: Action/control	Responsibility	Timeframe
much as possible.		
A site rehabilitation programme must be developed and implemented.	Contractor in consultation with Specialist	Duration of contract

Performance Indicator	» Zero disturbance outside of designated work areas » Minimised clearing of existing/natural vegetation » Number of plants and aerial cover of plants within project area and immediate surroundings
Monitoring	» Observation of vegetation clearing activities by ECO throughout construction phase » Annual audit of project area and immediate surroundings by qualified botanist. If no species alien are detected, then this can be stated. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants. The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. The environmental manager should be responsible for driving this process. Reporting frequency depends on legal compliance framework. » Supervision of all clearing and earthworks » An incident reporting system will be used to record non-conformances to the EMP.

OBJECTIVE: Protection of fauna & avifauna

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

Project component/s	List of project components affecting the objective: » wind energy turbines » access roads » substations » power lines
Potential Impact	» Vegetation clearance and associated impacts on faunal habitats » Traffic to and from site » Disturbance of birds
Activity/risk source	» Site preparation and earthworks » Construction-related traffic » Foundations or plant equipment installation » Mobile construction equipment » Power line construction activities
Mitigation: Target/Objective	» To minimise footprints of habitat destruction » To minimise disturbance to resident and visitor faunal and avifaunal species

Mitigation: Action/control	Responsibility	Timeframe
Areas to be cleared will be clearly marked in the field to eliminate unnecessary clearing/disturbance.	Contractor in consultation with Specialist	Pre-construction
Avifaunal survey of the construction area immediately before work commences. Such a survey would form part of the avifaunal monitoring programme proposed for the facility.	Spreeukloof Wind Farm in consultation with Specialist	Pre-construction
An avifaunal walk-through must be conducted by a suitably qualified and independent ornithologist for all components of the final facility layout to ensure that all avifaunal aspects have been adequately catered for.	Spreeukloof Wind Farm in consultation with Specialist	Pre-construction
A bird fatality threshold and adaptive management policy must be designed by an ornithologist for the site.	Spreeukloof Wind Farm in consultation with Specialist	Pre-construction
Ensure construction EMP is applied	Relevant Environmental Control Officer	During construction
The extent of clearing and disturbance to the native vegetation will be kept to a minimum so that impact on fauna and their habitats is restricted.	Contractor	Site establishment & duration of contract
A site rehabilitation programme should be compiled and implemented.	Contractor in consultation with Specialist	Duration of contract

Performance Indicator	» Zero disturbance outside of designated work areas » Minimised clearing of existing/natural vegetation and habitats for fauna and avifauna » Limited impacts on faunal species (i.e. noted/recorded fatalities) especially those of conservation concern.
Monitoring	» Observation of vegetation clearing activities by ECO throughout construction phase » Environmental manager to monitor the substation sites for electrocutions. » Supervision of all clearing and earthworks by ECO » An incident reporting system will be used to record non-conformances to the EMP.

OBJECTIVE: Protection of fossils and sites of heritage value

The main cause of impacts to archaeological sites is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. Large-scale excavations for foundations will damage archaeological sites, as will road construction activities.

Sensitive sites must be physically identified and cordoned to prevent any accidental incursion and damage during the construction and operational phases.

Before any major construction commences a thorough field scoping survey of natural and artificial rock exposures within the study region as a whole should be undertaken by a qualified palaeontologist to identify specific areas or horizons of paleontological sensitivity on the ground. On the basis of the initial scoping, a realistic, collaborative monitoring programme and protocol should be drawn up by the palaeontologist in conjunction with the developer. Note that the palaeontologist involved will be required to obtain a paleontological collection permit from SAHRA and to arrange a suitable repository for any fossils collected. An ECO should be appointed during the construction phases to observe whether any depth of deposit and in situ archaeological material remains is uncovered.

A list of identified and potential archaeological resources in the area is included in Appendix B of this EMP.

Project component/s	List of project components affecting the objective: » wind energy turbines » access roads » substations » power lines
Potential Impact	» Heritage objects or artefacts found on site are inappropriately managed or destroyed » Loss of fossil resources
Activity/risk source	» Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site » Power line construction activities
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
Areas required to be cleared during construction must be clearly marked in the field to avoid unnecessary disturbance of sensitive areas.	Contractor in consultation with Specialist	Pre-construction
Grave and burial areas must be identified and cordoned off prior to the commencement of development so that no negative impact and vandalism occurs.	Spreeukloof Wind Farm	Pre-construction
Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.	Spreeukloof Wind Farm	Pre-construction
A field scoping survey of natural and artificial rock exposures within the study region as a whole should be undertaken by a qualified palaeontologist to identify specific areas or horizons of paleontological sensitivity on the ground.	Contractor in consultation with Specialist	Pre-construction
Monitoring of selected bedrock excavations by the palaeontologist should be carried out during the construction phase of the wind energy facility.	Contractor in consultation with Specialist	Construction
If a heritage object is found, work in that area must be stopped immediately, and appropriate specialists brought	Spreeukloof Wind Farm /Contractor in	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
in to assess to site, notify the administering authority of the item/site, and undertake due/required processes.	consultation with Specialist	

Performance Indicator	» Zero disturbance outside of designated work areas » All heritage items located are dealt with as per the legislative guidelines
Monitoring	» Observation of excavation activities by ECO throughout construction phase » Supervision of all clearing and earthworks » An incident reporting system will be used to record non-conformances to the EMP.

OBJECTIVE: Minimisation of visual impacts associated with construction

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

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

Mitigation: Action/control	Responsibility	Timeframe
The activities and movement of construction workers and construction site vehicles will be restricted to the immediate construction site.	Contractor	Construction
The general appearance of construction activities, construction equipment camps and lay-down areas will be maintained by means of the timely removal of rubble and disused construction materials.	Contractor	Construction
Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas thereby limiting the removal of natural vegetation to the minimum.	Contractor	Construction
Use of proper topsoil removal and storage techniques when installing power lines. Implementation of controlled trenching procedures and insertion of correct erosion control measures.	Contractor/ Spreeukloof Wind Farm	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
Aviation warning lights must be mounted on turbine	Contractor	Erection of

Mitigation: Action/control	Responsibility	Timeframe
housing or such measures required by the Civil Aviation Authority.		turbines
Limit access to the construction sites (during both construction and operational phases) along existing access roads.	Contractor	Duration of contract

Performance Indicator	» Vegetation cover that remains intact with no new access roads or erosion scarring in close proximity of the facility.
Monitoring	» Monitoring of vegetation clearing during the construction phase. » 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 » 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 and avoidance of veld fires

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 C of this EMP.

Comprehensive fire and emergency procedures must be established for use during construction and operational phases of the project. Personnel must be trained to respond to veld fires in order to control them as quickly as possible.

Project component/s	List of project components affecting the objective: » wind energy turbines » substations » power lines
Potential Impact	» Release of contaminated water from contact with spilled chemicals » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
Activity/risk source	» Vehicles associated with site preparation and earthworks » Power line construction activities » 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 » To minimise production of waste » To ensure appropriate waste storage and disposal » To avoid environmental harm from waste disposal

Mitigation: Action/control	Responsibility	Timeframe
The storage of flammable and combustible liquids such as oils will be in designated areas which are appropriately bunded, and stored in compliance with MSDS files, as defined by the SHE Representative.	Contractor	Duration of contract
Any spills will receive the necessary clean-up action. Bioremediation kits are to be kept on-site and used to remediate any spills that may occur. Appropriate arrangements to be made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils (in accordance with a waste management plan).	Contractor	Duration of contract
Any storage and disposal permits/approvals which may be required will be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles will not to take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place, an appropriate drip tray will be used to contain any fuel or oils.	Contractor	Duration of contract
Transport of all hazardous substances will be in accordance with the relevant legislation and regulations.	Contractor	Duration of contract
Waste disposal records will be available for review at any time.	Contractor	Duration of contract
Construction contractors will provide specific detailed waste management plans to deal with all waste streams.	Contractor	Duration of contract
Specific areas will 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 will 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 will be reused or recycled. Bins and skips will 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 will be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract
Hydrocarbon waste will be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract
Waste and surplus dangerous goods will be kept to a minimum and will be transported by approved waste transporters to sites designated for their disposal.	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
Documentation (waste manifest) will be maintained detailing the quantity, nature and fate of any regulated waste.	Contractor	Duration of contract
An incident/complaints register will be established and maintained on-site.	Contractor	Duration of contract
Ensure that open fires on the site for cooking or heating are not allowed except in designated areas.	Contractor / ECO	Construction phase Ensure that designated areas for fires are identified on site at the outset of the construction phase.
Provide adequate fire fighting equipment onsite.	Spreeukloof Wind Farm / Contractor	Ensure that fire fighting equipment is provided before the construction phase commences.
Provide fire-fighting training to selected construction staff.	Spreeukloof Wind Farm / Contractor	Ensure that fire fighting training is provided before the construction phase commences.
Hazardous and non-hazardous waste shall be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered.	Contractors	Erection: during site establishment Maintenance: for duration of Contract within a particular area
All solid waste collected shall be disposed of at a registered waste disposal site. A certificate of disposal shall be obtained and kept on file. The disposal of waste shall be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt on site.	Contractors	Erection: during site establishment Maintenance: for duration of Contract within a particular area
Supply waste collection bins at construction equipment and construction crew camps.	Contractors	Erection: during site establishment Maintenance: for duration of

Mitigation: Action/control	Responsibility	Timeframe
		Contract within a particular area
Construction equipment will be refuelled within designated refuelling locations, or where remote refuelling is required, appropriate drip trays will be utilised.	Contractor	Duration of contract
All stored fuels to be maintained within a bund and on a sealed surface.	Contractor	Duration of contract
Fuel storage areas will be inspected regularly to ensure bund stability, integrity and function.	Contractor	Duration of contract
Construction machinery will be stored in an appropriately sealed area.	Contractor	Duration of contract
Oily water from bunds at the substations will be removed from site by licensed contractors.	Contractor	Duration of contract
Spilled cement will be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures.	Contractor	Duration of contract
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.	Contractor	Duration of contract
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of contract
Upon the completion of construction, the area will be cleared of potentially polluting materials.	Contractor	Completion of construction
Areas required to be cleared during construction will be clearly marked in the field to avoid unnecessary disturbance of adjacent areas.	Contractor in consultation with Specialist	Pre-construction
Avoid constructing infrastructure in wetland areas, wherever possible. Where unavoidable, ideally bridge a drainage line or wetland area, alternatively place box culverts the width of the affected area. Crossings must result in minimum disruption of surface flow patterns, ensure substrate continuity between areas up and downstream of the structure and must not result in a step in the bed profile.	Contractor	Pre-construction (avoidance planning) and construction phase.

Performance Indicator	» No chemical spills outside of designated storage areas » No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately » Provision of all appropriate waste manifests for all waste streams » 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
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance 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 » Observation and supervision of waste management practices throughout construction phase » Waste collection will 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 » Spreeukloof Wind Farm or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase

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

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

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

Mitigation: Action/control	Responsibility	Timeframe
This EMP and the Environmental Authorisation will be included in all tender documentation and Contractors contracts.	Spreeukloof Wind Farm	Tender process
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.	Spreeukloof Wind Farm	Duration of construction
Contractors will use chemical toilets/ablution facilities situated at designated areas of the site; no abluting will be permitted outside the designated area. These facilities will be regularly serviced by appropriate contractors.	Contractor (and sub-contractor/s)	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
Cooking/meals will 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 will be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.	Contractor (and sub-contractor/s)	Duration of contract
No one other than the ECO or personnel authorised by the ECO, will disturb flora or fauna outside of the demarcated construction area/s.	Contractor (and sub-contractor/s)	Duration of contract

Performance Indicator	» Compliance with specified conditions of Environmental Authorisation, EIA report and EMP » 80% of semi and unskilled labour locally sourced; » No complaints regarding contractor behaviour or habits » Fire fighting equipment and training provided before the construction phase commences. » Code of Conduct drafted before commencement of construction phase. » Briefing session with construction workers held at outset of construction phase
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

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

As the Proponent, Spreeukloof Wind Farm 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. Spreeukloof Wind Farm 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 Spreeukloof Wind Farm 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** (Spreeukloof Wind Farm'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).

7.3 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 will 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. Where this is not clearly dictated, Spreeukloof Wind Farm will

determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is conducted and reported.

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

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

The Environmental Control Officer 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 Environmental Control Officer 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.

CHAPTER 8: MANAGEMENT PLAN FOR WIND ENERGY FACILITY: REHABILITATION OF DISTURBED AREAS

8.1. Overall Goal for the Rehabilitation of Disturbed Areas

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

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

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

OBJECTIVE: To ensure rehabilitation of disturbed areas

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular maintenance operations.

Project component/s	List of project components affecting the objective: » wind energy facility (including temporary access roads and laydown areas) » power line servitude and service road for power line servitude
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 will be removed from site.	Contractor	Following execution of the works
All temporary fencing and danger tape should 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 will be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following completion of construction activities in an

Mitigation: Action/control	Responsibility	Timeframe
		area
Disturbed areas will be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-use 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.	Spreeukloof Wind Farm in consultation with rehabilitation specialist	Post-rehabilitation
On-going alien plant monitoring and removal should be undertaken on all areas of natural vegetation on an annual basis.	Spreeukloof Wind Farm in consultation with rehabilitation specialist	Post-rehabilitation

Performance Indicator	» All portions of site, including construction 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 » Closed site free of erosion and alien invasive plants
Monitoring	» On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented » On-going alien plant monitoring and removal should be undertaken on an annual basis

CHAPTER 9: MANAGEMENT PLAN FOR WIND ENERGY FACILITY: OPERATION

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

Comprehensive fire and emergency procedures must be established for use not only during construction, but also for the operational phases of the project. Personnel must be trained to respond to veld fires in order to control them as quickly as possible.

9.1. 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 and enables the wind energy facility operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to noise impacts, farming practices, traffic and road use, and effects on local residents as well as minimising impacts on birds and other fauna using the site.

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

OBJECTIVE: Limit impacts on bats due to turbine blades

Bats have been found to be particularly vulnerable to being killed by wind turbines. It has long been a mystery why they should be so badly affected since bat echo-location allows them to detect moving objects very well. A recent study in America has found that the primary cause for mortality is a combination of direct strikes and barotrauma (bats are killed when suddenly passing through a low air pressure region surrounding the turbine blade tips causing low pressure damage the bat's lungs).

Bats are most vulnerable when leaving and returning to their roosts, usually at sunset and sunrise. This is also the time of the day (usually) when there is the least wind. The bat monitoring programme will identify whether threatened / near threatened species occur on site or not and when they are most active.

The most vulnerable species are those that are already classified as threatened species, including those classified as critically endangered, endangered or vulnerable.

Project component/s	» Wind turbines
Potential Impact	Loss of individuals of the near threatened bat species, Schreiber's Long-fingered Bat
Activity/risk source	Operation
Mitigation: Target/Objective	Limited bat mortalities within project control area

Mitigation: Action/control	Responsibility	Timeframe
Implement an environmental monitoring programme to monitor the impact on bat species.	Spreeukloof Wind Farm in consultation with ECO	Operation
Consider stopping operation at key times when bats are vulnerable as determined through the monitoring programme.	Spreeukloof Wind Farm	Operation
Apply blade feathering to prevent unnecessary free-wheeling of blades below generation cut-in speed at operation commencement.	Spreeukloof Wind Farm	Operation
Additionally, a full operational phase monitoring campaign, inclusive of fatality monitoring and estimates is to commence as soon as the wind turbines are erected, and in accordance with latest version of the bat monitoring guidelines. This is to take place based on result from this monitoring campaign, should the estimated bat fatalities for the entire WEF exceed the threshold of 69 bats per annum, then strict curtailment measures will need to be implemented by an appropriate bat specialist.	Bat specialist and Spreeukloof Wind Farm	Operation

Performance Indicator	Number of individual mortalities from collision with wind turbines
Monitoring	» Determine densities of Schreiber's Long-fingered Bat within the area before and after construction » Document patterns of bat movement in the vicinity » Record bat mortalities and, as far as possible, the circumstances surrounding collisions. Standard protocols should be used when undertaking such surveys

OBJECTIVE: Protection of avifauna and determine the impact of the operating facility on priority bird species

During operation of the facility, the threat of collision of avifauna with the turbine blades is the most concerning issue. However, the real extent of this threat is not currently well understood within the South African context due to the limited numbers of turbines in South Africa with which bird interactions have been monitored. Lighting of turbines and other infrastructure has the potential to attract birds, thereby increasing the risk of collisions with turbines. Infrastructure associated with the facility often also impacts on birds. A monitoring programme should be implemented to document the effect on birds (Refer to EMP Appendix A).

Painting of the blades as a mitigation measure for bird collisions is not proven to be successful. In addition, blade painting will increase the visual impact and is not supported.

Project component/s	List of project components affecting the objective: » wind energy facility (turbines) » power lines
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 turbines » Electrocution
Activity/risk source	» Spinning turbine blades
Mitigation: Target/Objective	» More accurately determine the impact of the operating wind energy facility on priority bird species

Mitigation: Action/control	Responsibility	Timeframe
A site monitoring programme will be implemented for surveying bird movements in relation to the wind energy facility and fully documenting all collision / electrocution casualties.	Spreeukloof Wind Farm / environmental manager	Operation
An observer led turbine Shutdown on Demand (SDOD) programme must be implemented at the facility from the start of operations (COD). This programme must consist of a suitably qualified, trained, and resourced team of observers present on site for all daylight hours 365 days of the year. This team must be stationed at vantage points with full visible coverage of all turbine locations. The observers must detect incoming priority bird species (Cape Vulture, Verreaux's Eagle & others to be identified when the programme is fully designed), track their flights, judge when they enter a turbine proximity threshold, and alert the control room to shut down the relevant turbine. A full detailed method statement or protocol must be designed by an ornithologist prior to COD.	Specialist (ornithologist)	Prior to commencement of operation
Start post-construction avifaunal monitoring	Monitoring agency	6 months after construction is completed
The facility must be monitored once operational in accordance with the most recent version of the best practice guidelines available at the time (Jenkins et al, 2015). A minimum of two years of monitoring must be completed, although if significant impacts are detected this will need to be extended. Fatality estimates should continue for the full life span of the facility. The results of this monitoring should feed into the adaptive management plan for the facility.	Monitoring agency	Operation
The local population of Verreaux's Eagle must be monitored for the full lifespan of the wind farm to ensure that any population level impacts are measured. This will require 2-3 visits to each of the 9 known nests (and any new ones subsequently found) during breeding season each year by a suitably	Monitoring agency	Operation

Mitigation: Action/control	Responsibility	Timeframe
qualified independent ornithologist. This will measure breeding status and productivity and the overall health of this local population.		
The Donkerhoek Cape Vulture roost must be surveyed monthly once the wind farm is operational, in order to better understand trends in vulture numbers at the roost and how this relates to collision risk at the wind farm.	Spreeukloof Wind Farm / Avifaunal Specialist	Operation
Periodically collate and analyse post-construction monitoring data	Advising scientist	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 in negotiation with Spreeukloof Wind Farm	1-year post-construction
Review the need for further post-construction monitoring	Advising scientist, monitoring agency in negotiation with Spreeukloof Wind Farm	1-year post-construction
Ensure all dead stock are removed from the land (and perhaps relocated to safe 'restaurant' area for vultures at least 20 km from the site, and that all landowners within a wide radius (>10 km) of the facility are asked to do the same. This should reduce the numbers of vultures attracted to the area and lower collision risk.	Specialist & Spreeukloof Wind Farm	Duration of contract
A 'Cape Vulture Food Management Programme' must be implemented on site to ensure all dead livestock/wildlife on site are removed as soon as possible and made unavailable to vultures for feeding. This will also need to be implemented at any nearby operational facilities, so that a larger area is covered. This programme will reduce the amount of available vulture food on site and reduce vulture-turbine collision risk. This programme will require the deployment of a dedicated (i.e. no other tasks) and adequately resourced (transport, binoculars, GPS, cameras, training) team of staff to patrol the full site during all daylight hours. The co-operation of landowners will also be essential to ensure that reported carcasses are disposed of effectively. This programme must be operational by the time the first turbine blades are turning on site and should not wait for COD. A full detailed method statement or protocol must be designed by an ornithologist prior to COD.	Specialist & Spreeukloof Wind Farm	

Performance Indicator	» No additional disturbance to avifaunal populations on the wind energy facility site » Continued improvement of avifaunal protection efforts » Quantifiable reductions in avian impacts once the facility is operational » 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 to operational phase
Monitoring	» Observation of avifaunal populations and incidence of injuries/death from collisions from turbine blades » Environmental manager to monitor turbine field for fatalities.

OBJECTIVE: Minimisation of visual & noise 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.

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

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

In terms of potential noise impacts it is recommended that the developer consider the various mitigation options as proposed in this document to reduce the significance of the impact to a more acceptable low.

Project component/s	List of project components affecting the objective: » Wind energy facility (including access roads) » Substations
Potential Impact	» Risk to aircraft in terms of the potential for collision » Enhanced visual intrusion » Increased noise levels at potentially sensitive receptors

Activity/risk source	» Substations and associated lighting » Wind turbines and other infrastructure
Mitigation: Target/Objective	» To minimise potential for visual impact » To ensure that the facility complies with Civil Aviation Authority requirements for turbine visibility to aircraft » Minimise contrast with surrounding environment and visibility of the turbines to humans » The containment of light emitted from the substations in order to eliminate the risk of additional night-time visual impacts. » Prevent the generation of a nuisance noises » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors.

Mitigation: Action/control	Responsibility	Timeframe
Aviation warning lights will 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.	Spreeukloof Wind Farm	Duration of contract
Maintain the general appearance of the facility in an aesthetically pleasing way.	Spreeukloof Wind Farm	Operation 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 sites.	Spreeukloof Wind Farm	Operation and maintenance
Undertake regular maintenance of light fixtures.	Spreeukloof Wind Farm	Operation and maintenance
Add additional noise monitoring points at any complainants that registered a noise complaint relating to the operation of the facility.	Acoustical Consultant / Approved Noise Inspection Authority	With quarterly monitoring

Performance Indicator	» Appropriate visibility of infrastructure to aircraft » The effective containment of the light to the substation sites. » Ensure that the change in ambient sound levels as experienced by Potentially Sensitive Receptors is less than 7 dBA
Monitoring	» Ensure that aviation warning lights or other measures are installed before construction is completed and are fully functional at all times. » The monitoring of the condition and functioning of the light fixtures during the operational phase of the project. » Quarterly noise monitoring by an Acoustic Consultant or Approved Noise Inspection Authority for the first year of operation. Noise monitoring programme to be developed and implemented at the start of operation.

OBJECTIVE: Appropriate handling and management of hazardous substances and waste

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

Project component/s	List of project components affecting the objective: » wind energy turbines » 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 » Fuel and oil storage
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.	Spreeukloof Wind Farm	Operation
Storage areas for hazardous substances must be appropriately sealed and bunded.	Spreeukloof Wind Farm	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.	Spreeukloof Wind Farm	Operation
Care will 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.	Spreeukloof Wind Farm	Operation and maintenance
Waste handling, collection and disposal operations will be managed and controlled by a waste management contractor.	Spreeukloof Wind Farm /waste management contractor	Operation
Used oils and chemicals: » Appropriate disposal will be arranged with a licensed facility in consultation with the administering authority. » Waste will be stored and handled according to the relevant legislation and regulations.	Spreeukloof Wind Farm	Operation
General waste will be recycled where possible or disposed of at an appropriately licensed landfill.	Spreeukloof Wind Farm	Operation
Hazardous waste (including hydrocarbons) and general waste will be stored and disposed of separately.	Spreeukloof Wind Farm	Operation
Disposal of waste will be in accordance with relevant legislative requirements, including the use of licensed contractors.	Spreeukloof Wind Farm	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: Benefit for tourism in the area. Maximise local employment and business opportunities during operation

The establishment of the proposed facility may create an attraction and in so doing benefit local tourism in the area. However, this benefit is likely to be limited.

Project component/s	List of project components affecting the objective: » Wind energy facility » Day to day operational activities associated with the wind energy facility including maintenance etc.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised. » The proposed wind energy facility has the potential to provide the Inkwanca 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 operational phase of the wind energy facility will create approximately 4 full time employment opportunities. » 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	» Benefit to local tourism by providing area with a potential tourist attraction. » In the medium to long term employ as many locals as possible to fill the 4 full time employment opportunities.

Mitigation: Action/control	Responsibility	Timeframe
Identify local members of the community who are suitably qualified or who have the potential to be employed full time.	Spreeukloof Wind Farm	Identify members during construction
After 5 years the objective is to have all the employment opportunities taken up by locals.	Spreeukloof Wind Farm	Develop training and skills programme during construction

Mitigation: Action/control	Responsibility	Timeframe
		phase
Liaise with representatives from the Inkwanca Municipality and tourism organisations to raise awareness of the proposed wind energy facility	Spreeukloof Wind Farm	Set up meeting with municipality and local tourism organisations during the construction phase.

Performance Indicator	» Public exposure to the project. » Meeting with Mgijima Municipality and local tourism organisations during the construction phase. » 5-year training and skills development programme developed and designed before construction phase completed » Potential locals identified before construction phase completed
Monitoring	» Indicators listed above must be met for the operational phase.

CHAPTER 10: MANAGEMENT PLAN FOR WIND ENERGY FACILITY: DECOMMISSIONING

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.

10.1. 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.

10.2 Disassemble and Replace Existing Turbines

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

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

Project component/s	» Decommissioning phase of the wind energy facility.
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 (4) is 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.	Spreeukloof Wind Farm	At decommissioning.

Performance Indicator	South African Labour legislation at the relevant time.
Monitoring	Spreeukloof Wind Farm and Department of Labour.

APPENDIX A: BIRD MONITORING

MONITORING PROGRAMME

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

(i) Determine the densities of birds 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) 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 REF is commissioned.

(iv) 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. 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. The bulk of the work involved should be done by an expert ornithologist or under the supervision of such.

7.1 Monitoring protocols

7.1.1 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 the six months 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 within the development area should surveyed for cliff-nesting raptors at least every six months using documented protocols, and all sightings of key species (Refer to Table 6.1 of Avifauna EIA study) 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.

7.1.2 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 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.

7.1.3 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 ofeach count.

7.2 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.

7.2.1 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. 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 surveymethod.

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. 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.

7.2.2 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. The frequency of these surveys should be informed by assessments of scavenge and decomposition rates conducted in the initial stages of the monitoring period (see above), 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 shouldbe 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).

APPENDIX B: HERITAGE ON SITE

EMP APPENDIX B: IDENTIFICATION OF ARCHAEOLOGICAL FEATURES AND MATERIAL FROM INLAND AREAS: guidelines and procedures for developers

1. Human Skeletal material

Human remains, whether the complete remains of an individual buried during the past, or scattered human remains resulting from disturbance of the grave, should be reported. In general, the remains are buried in a flexed position on their sides but are also found buried in a sitting position with a flat stone capping and developers are requested to be on the alert for this.

2. Freshwater mussel middens

Freshwater mussels are found in the muddy banks of rivers and streams and were collected by people in the past as a food resource. Freshwater mussel shell middens are accumulations of mussel shell and are usually found close to rivers and streams. These shell middens frequently contain stone tools, pottery, bone, and occasionally human remains. Shell middens may be of various sizes and depths, but an accumulation which exceeds 1 m^2
in extent, should be reported to an archaeologist.

3. Stone artefacts

These are difficult for the layman to identify. However, large accumulations of flaked stones which do not appear to have been distributed naturally should be reported. If the stone tools are associated with bone remains, development should be halted immediately, and archaeologists notified

4. Fossil bone

Fossil bones may be found embedded in geological deposits. Any concentrations of bones, whether fossilized or not, should be reported.

5. Large stone features

They come in different forms and sizes but are easy to identify. The most common are roughly circular stone walls (mostly collapsed) and may represent stock enclosures, remains of wind breaks or cooking shelters. Others consist of large piles of stones of different sizes and heights and are known as *isisivane.* They are usually near river and mountain crossings. Their purpose and meaning is not fully understood, however, some are thought to represent burial cairns while others may have symbolic value.

6. Historical artefacts or features

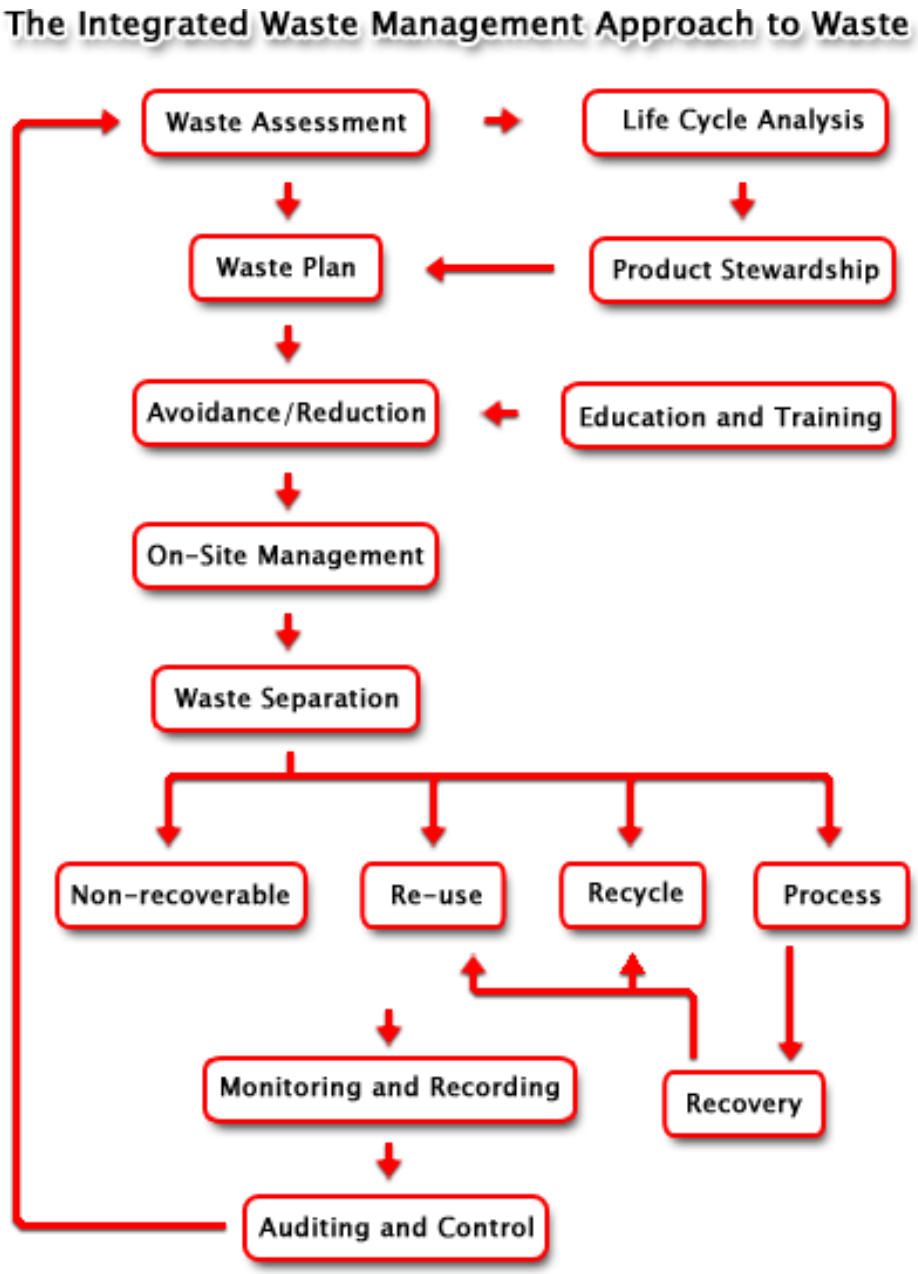
These are easy to be identified and include foundations of buildings or other construction features and items from domestic and military activities.

Reference	Description	GPS point
Site 1	Middle Stone Age stone artefact scatter	31˚28'29.22"S; 26˚20'44.40"E
Site 2	Later and Middle Stone Age artefact scatter near historical farmhouse	31˚26'19.56"S; 26˚21'52.20"E
Site 3	Middle Stone Age stone artefact scatter	31˚25'44.16"S; 26˚23'29.52"E
Site 4	Stone walling and foundations	31˚25'29.40"S; 26˚23'38.28"E
Site 5	Middle Stone Artefact scatter	31˚26'16.74"S; 26˚24'32.10"E
Site 6	Historical graves	31˚26'45.96"S; 26˚23'04.02"E
Site 7	Stone walling	31˚27'42.60"S; 26˚23'08.88"E
Site 8	Later Stone Age stone artefact scatter and stone walling	31˚27'44.58"S; 26˚23'06.36"E
Site 9	Middle Stone Age artefact scatter and circular stone feature	31˚26'49.38"S; 26˚23'07.56"E
Site 10	Middle and Later Stone artefact scatters and historical graves	31˚26'44.52"S; 26˚22'22.38"E
Site 11	Middle Stone Age artefact scatter	31˚27'21.24"S; 26˚25'33.00"E
Site 12	Middle Stone Age artefact scatter	31˚27'22.92"S; 26˚25'31.86"E
Site 13	Middle Stone Age artefact scatter	31˚27'22.32"S; 26˚25'30.30"E
Site 14	Middle Stone Age artefact scatter	31˚27'14.46"S; 26˚25'27.24"E
Site 15	Middle Stone Age artefact scatter	31˚27'22.20"S; 26˚25'29.82"E
Site 16	Middle Stone Age artefact scatter	31˚27'23.52"S; 26˚25'29.22"E
Site 17	Middle Stone Age artefact scatter	31˚27'24.12"S; 26˚25'27.96"E
Site 18	Middle Stone Age artefact scatter	31˚27'38.04"S; 26˚25'20.10"E
Site 19	Middle and Later Stone Age artefact scatter	31˚27'35.64"S; 26˚25'18.36"E
Site 20	Later Stone Age artefact scatter	31˚27'38.64"S; 26˚24'54.42"E
Site 21	Middle Stone Age artefact scatter	31˚27'49.32"S; 26˚24'50.64"E
Site 22	Middle Stone Age artefact scatter	31˚27'50.10"S; 26˚25'42.12"E
Site 23	Middle Stone Age artefact scatter	31˚28'14.10"S; 26˚24'25.62"E
Site 24	Middle Stone Age artefact scatter and historical rubbish dump near historical farmhouses	31˚27'55.08"S; 26˚24'01.32"E
Site 25	Middle Stone Age artefact scatter	31˚29'16.44"S; 26˚23'30.35"E
Site 26	Middle Stone Age artefact scatter	31˚28'21.18"S; 26˚22'33.36"E
Site 27	Middle Stone Age artefact scatter	31˚28'05.46"S; 26˚22'30.18"E
Site 28	Middle Stone Age artefact scatter	31˚27'59.04"S; 26˚22'26.52"E
Site 29	Historical stone walling farmhouse	31˚27'54.00"S; 26˚22'09.66"E
Site 30	Middle Stone Age artefact scatter	31˚28'10.28"S; 26˚22'00.42"E
Site 31	Middle Stone Age artefact scatter	31˚30'07.86"S; 26˚25'50.64"E
Site 32	Middle Stone Age artefact scatter	31˚27'10.44"S; 26˚27'32.40"E
Site 33	Historical graveyard	31˚27'26.76"S; 26˚26'02.58"E
GPS 33	Cyphergat Railway Station and houses	31˚27'19.02"S; 26˚25'46.08"E
Site 34	Rock shelter with rock paintings	31˚28'04.14"S; 26˚27'01.02"E
Site 35	Middle Stone Age artefact scatter	31˚28'21.06"S; 26˚26'28.68"E

APPENDIX C: CONSTRUCTION WASTE GUIDELINES

GUIDELINE FOR INTEGRATED MANAGEMENT OF CONSTRUCTION WASTE

Waste is broadly defined by the Department of Human Settlements Water and Sanitation 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 theplastics and packaging industries, conducts plastic reclamation and recycling.

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

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

Information Sources:

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

APPENDIX D: EARTH WORKS

Earthworks and foundations for structures

A basic assessment of the geotechnical nature of the study area affords the opportunity to identify any potential fatal flaws with the proposed site, in terms of the suitability of the site for development. A basic assessment of the main geotechnical constraints that may impact on the civil engineering design are tabulated as follows:

Geotechnical Constraint	Effect on the proposed development	Severity	Comment & recommendations
Collapsible & compressible soil	Soil horizons with a potentially collapsible or compressible fabric unsuitable for foundations.	Low-medium	Unconsolidated transported soils are potentially compressible and collapsible under load. Dynamic compaction of soil will be necessary or found on rock.
Differential settlement (DS)	Foundations placed across different soil types or rock may settle differentially.	Medium-High	Depth to bedrock or dense soil horizons (residual or consolidated) will vary across the site. Recommend found individual structures on adequately dense soil or rock.
Bearing capacity	Soils with low in situ bearing capacity resulting in high settlements of structures if not compacted or engineered properly	Medium	Transported sands: 50-80kPa, depending on level of consolidation. Residual soils: 50-250kPa, depending on moisture, structure and consistency. Rock: >250kPa, depending on lithology, structure and state of weathering.
Saturated soils, groundwater problems, perched or permanent water tables	Seepage from sidewalls of excavations affecting stability or dewatering of trenches necessary.	Low	Groundwater problems are unlikely to affect shallow excavations. Perched water tables may exist on residual soils or underlying rock in low-lying areas.
Active soil	Heaving clays affecting foundation stability	Low-Medium	Active clay anticipated in residual weathered mudstones or dolerite. Found all turbines below clay on rock or very dense soil.
Excavations	Boulders or rock affecting excavations	Medium	Difficult excavations expected below 1m in most upland areas.
	Unstable excavations requiring shoring	Low-medium	Sidewalls of excavations exceeding 1m in unconsolidated sandy soils will be unstable. Temporary slopes to be battered to 1:2.
Slope stability	Geological instability causing damage to structures founded on slopes	Low	No unstable slopes in development footprint.

Geotechnical Constraint	Effect on the proposed development	Severity	Comment & recommendations
Seismic activity	Structures at risk of damage due to seismicity	Low-Medium	Eastern Cape is a potentially active seismic area. Seismic intensity of VI (MMS) and peak ground acceleration of less than 50cm/s^2 with a 90% chance of not being exceeded within 50 years.
Flood potential or storm water damage	Low lying areas affected by poor drainage.	Low	Most of the site is well drained.
	Steep slopes affected by uncontrolled run-off	Low	No natural steep slopes within development footprint
Unconsolidated fill	Unconsolidated fill material affecting foundations	Low	Minor fill associated with existing farm buildings and dams
Availability of local construction material	Large distances to nearest quarry for sources of suitable construction material negatively affect construction costs	High	Nearest major centre is Queenstown (100km). Potential local sources of construction material are restricted to selected fill (Sabunga-weathered dolerite).
Mining Activity	Past, present or future mining activity which may affect development of the site	Low	No known mining activity (developer should confirm this withland owner)

The above classification highlights some basic potential constraints, none of which are considered insurmountable. A detailed geotechnical investigation should be undertaken before the engineering design phase to provide more information.

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 ofthe 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 enteringthe 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 aresult 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 approvedby 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 theEngineer'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.