GUNSTFONTEIN WIND ENERGY FACILITY, NEAR SUTHERLAND, NORTHERN CAPE PROVINCE

CONSTRUCTION & OPERATION ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

DEA REFERENCE: 14/12/16/3/3/2/826

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Prepared for

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PROJECT DETAILS

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Title	:	Environmental Impact Assessment Process Environmental Management Programme: Gunstfontein Wind Energy Facility, Northern Cape Province
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DEFINITIONS AND TERMINOLOGY

Alien species: A species that is not indigenous to the area or out of its natural distribution range.

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: means the background noise level already present in the environment (in the absence of noise generated by any other proposed development).

Assessment: The process of collecting, organising, analysing, interpreting and communicating information which is relevant.

Biological diversity: The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.

Commencement: The start of any physical activity, including site preparation and any other activity on site resulting in the furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Commercial Operation date: The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

Commissioning: Commissioning commences once construction is completed. Commissioning covers all activities including testing after all components of the power station are installed.

Construction: Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

Cumulative impacts: Impacts that result from the incremental impact of a 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.

Decommissioning: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

Department/ the competent authority: Refers to the Department of Environmental Affairs or any other relevant authority responsible for administering environmental laws.

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. A disturbing noise would be a noise that increase the rating level with more than 7 dBA. Therefore, for this area the rating level is 35 dBA, and if the operation of the wind energy facility results in a noise level higher than 42 dBA, and that change can be attributed to the wind energy facility that would be a disturbing noise.

'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.

Ecosystem: A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

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 assessment practitioner: An individual responsible for the planning, management and coordinating of environmental management plan or any other appropriate environmental instruments introduced by legislation.

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 inspector: A person designated as an environmental management inspector in terms of Section 31B or 31C on the National Environmental Management Act 107 of 1998.

Environmental Management Programme: A plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

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

Habitat: The place in which a species or ecological community occurs naturally.

Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment (Van der Linde and Feris, 2010; pg 185).

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000

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.

Method statement: A method statement is a written submission to the ECO and the Proponent's Representative by the Contractor(s) in collaboration with his/her EO.

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/).

Perennial and non-perennial: Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Pre-construction: The period prior to the commencement of construction, which may include activities (e.g. geotechnical surveys) which do not require Environmental Authorisation.

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

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

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at 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 and/or concrete. It is approximately 80 – 120 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 120 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.

Waste: Any substance, whether or not that substance can be reduced re-used, recycled and recovered; that is surplus, unwanted, rejected, discarded, abandoned or disposed of which the generator has no further use for the purposes of production. Any product which must be treated and disposed of, that is identified as waste by the minister of Environmental affairs (by notice in the Gazette) and includes waste generated by the mining, medical or other sectors, but: A by-product is not considered waste, and portion of waste, once re-used, recycled and recovered, ceases to be waste.

Watercourse: as per the National Water Act means -
(a) a river or spring;

(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

Wetland: Wetlands are defined in the National Water Act as 'land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

» **Intermittent or seasonal wetlands:** are vleis or larger drainage lines where water tends to accumulate during the rainy season, and may persist for a week or longer, usually several months. In this case there is enough seasonal moisture accumulation to ensure that surface soils remain waterlogged for a longer period, hence also supporting specially adapted flora that will grow in (seasonally) saturated soils.
» **Perennial[1] wetlands:** are all dams, rivers and other water bodies that carry water permanently, and will only have severely reduced flows or water during periods of prolonged severe droughts.

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.

[1] Perennial: from Latin per, "through", annus, "year", lasting or active through the year or through many years, indefinitely.

ABBREVIATIONS AND ACRONYMS

DEA	National Department of Environmental Affairs
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EO	Environmental Officer (employed by the Contractor)
GG	Government Gazette
GN	Government Notice
Ha	Hectare
I&AP	Interested and Affected Party
km^2	Square kilometres
kV	Kilovolt
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
PM	Project Manager
SHE	Safety, Health and Environment
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited

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PURPOSE & OBJECTIVES OF THE EMPR CHAPTER 1

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"[2]. The objective of this Environmental Management Programme is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMPr is to help ensure compliance with recommendations and conditions specified through an EIA process, as well as to ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective 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, operational and decommissioning phases of a project, and is intended to manage and mitigate construction and operational activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (site clearing and site establishment) through those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site rehabilitation (soil stabilisation, re-vegetation) and operation. The EMPr also defines monitoring requirements in order to ensure that the specified objectives are met.

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

The EMPr has the following objectives:

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

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

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

The mitigation measures identified within the EIA process as well as from the walk-through surveys are systematically addressed in the EMPr, ensuring the minimisation of adverse environmental impacts to an acceptable level.

Gunstfontein Wind Energy Facility (Pty) Ltd must ensure that the implementation of the project complies with the requirements of any and all Environmental Authorisations and permits (once issued), as well as with obligations emanating from all relevant environmental legislation. This obligation is partly met through the development of the EMPr, and the implementation of the EMPr through its integration into the contract documentation for activities associated with both construction and operation. Since this EMPr is part of the EIA process undertaken for the proposed wind energy facility, it is important that this guideline document be read in conjunction with the Final Scoping Report (October 2015) and EIA Report (February 2016). This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental process. This EMPr for pre-construction, construction, operational and decommissioning activities has been compiled in accordance with Appendix 4 of the EIA Regulations (2014) and in terms of specific requirements listed in any authorisations issued for the proposed project.

To achieve effective environmental management, it is important that Contractors are aware of their 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 Contractors obligations in this regard include the following:

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

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

The EMPr is a dynamic document, which must be updated when required. It is considered critical that this final EMPr be updated to include site-specific information and specifications as required throughout the life-cycle of the facility. This will ensure that the project activities are planned and implemented taking sensitive environmental features into account.

PROJECT DETAILS *CHAPTER 2*

Gunstfontein Wind Energy Facility (Pty) Ltd **(herein referred to as the Proponent)** is proposing to establish a commercial wind energy facility and associated infrastructure on a site located within the Karoo Hoogland Local Municipality (approximately 20 km south of Sutherland in the Northern Cape Province). This project is referred to as the Gunstfontein Wind Energy Facility. The facility will be powered by wind. No other fuels will be used as a generating fuel during the operational phase of the project. The optimised final layout of the wind turbines and associated infrastructure (i.e. after implementing suggested mitigation) are shown on **Figure 2.1** (also refer to **Appendix A**).

The potentially sensitive areas already identified through the scoping study and the results from the bird and bat pre-construction monitoring provided No-Go areas (i.e. avoidance of identified avifaunal, bat and ecologically sensitive areas). These areas were excluded from the developable area. The proposed area for the development of the Gunstfontein Wind Energy Facility (~12 000 ha in extent) included four farm portions: Portion 1 and the Remainder of the farm Gunstfontein 131, Boschmans Hoek 177, and the Remainder of the farm Wolven Hoek 182. However, based on the specialist findings and identified sensitivities it was recommended that limited wind farm infrastructure (i.e. turbines) should be placed on the following farm portions (which include the escarpment edge, the face of the escarpment and the lower lying terrain):

» Boschmans Hoek 177; and
» The Remainder of the Farm Wolven Hoek 182.

Therefore, through the micro-siting exercise, turbine positions have been confined to the remainder of the Farm Gunsfontein 131. The number of turbines has also been reduced from up to 100 (as indicated in the Scoping Report) to up to 68 turbines in response to the avifaunal and bat specialist recommendation based on the 12 months bird and bat pre-construction monitoring.

In order to assess the impacts associated with the proposed Gunstfontein Wind Energy Facility, it is necessary to understand the extent of the affected area. The development footprint area for the Gunstfontein Wind Farm site to be occupied by turbines and associated infrastructure considered in the EIA is Portion 1 and the Remainder of the Farm Gunstfontein 131.

The project will include the following infrastructure:

» Up to 68 wind turbines, each up to 4MW in capacity, subject to a 200MW cap on contracted capacity. The hub height of each turbine will be up to 120 metres, and the rotor diameter up to 140 metres.

- Permanent concrete foundations (22 m x 22 m x 25 m) to support the turbines, and crane pad/laydown areas (50 m x 25 m);
- Cabling between the turbines, to be laid underground where practical and generally alongside the internal access roads, to connect to an on-site substation;
- An on-site substation (120 m x 120 m)to facilitate the connection between the wind energy facility and the electricity grid;
- Internal access roads (35 km in extent and 8 m wide) to each turbine linking the wind turbines and other infrastructure on the site;
- Buildings and dedicated areas for administration, workshops, control systems, maintenance and storage with parking areas where required; and
- Temporary construction compound and temporary site offices.

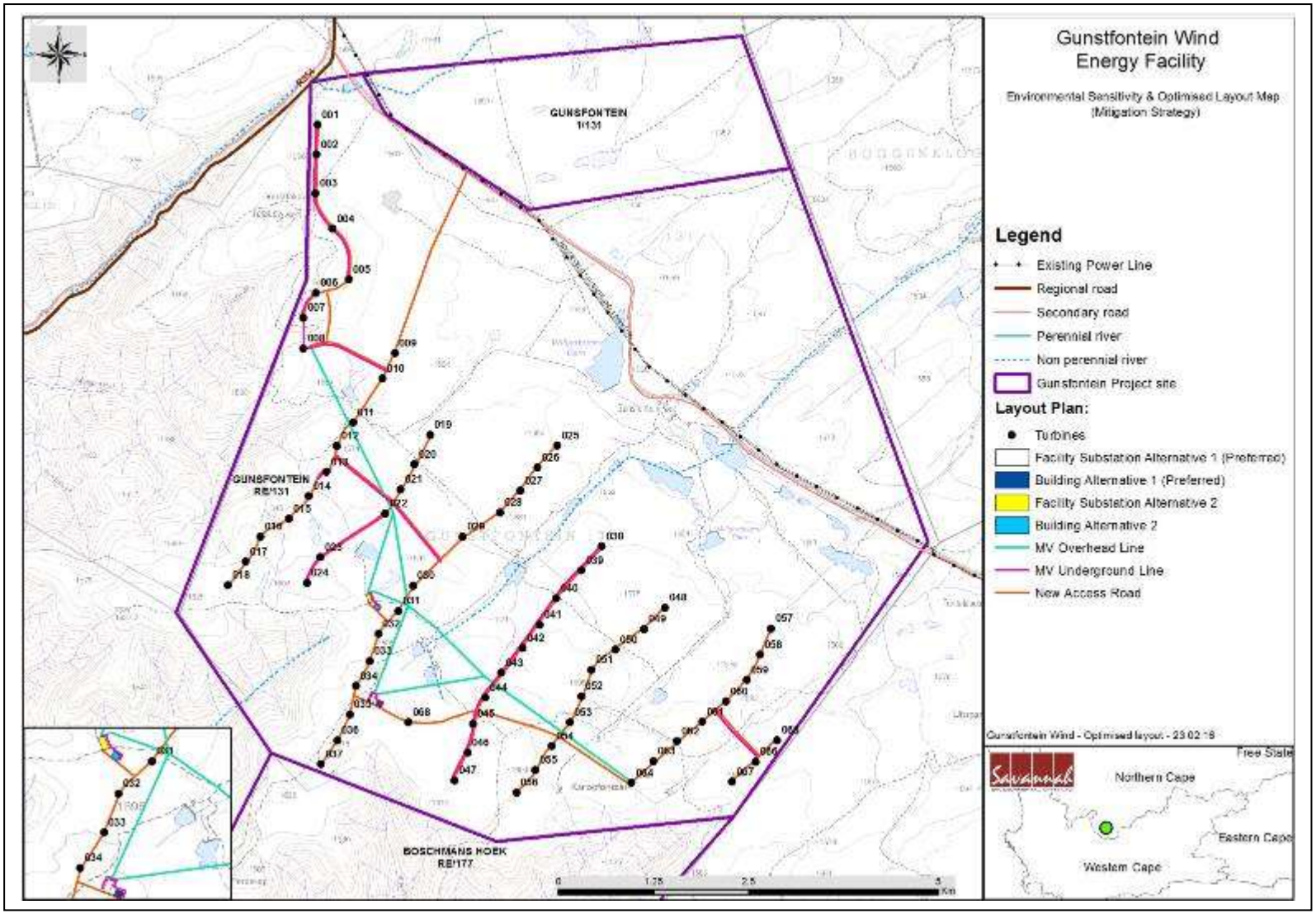

Figure 2.1: **Optimised** Layout for the Wind Energy Facility (Refer to **Appendix A** for A3 Maps)

2.1 Activities and Components associated with the Wind Energy Facility

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

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

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 selected MV underground and overhead power line routes between the turbines » Survey of internal access routes and watercourse crossings » Environmental walk-through surveys	» Surveys to be undertaken prior to initiating construction.
	Construction	
Establishment of access roads to and within the site	» Upgrade access/haul roads to the site Establish internal access roads: up to 8 m wide permanent roadway within the site between the turbines for use during construction and operation phase.	» Access roads will be constructed in advance of any large scale components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary, i.e. maintenance activities. » Existing access roads to the site will be utilised, and upgraded where required. Special haul roads may need to be constructed 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 by surveys undertaken by ecological, heritage and avifaunal specialists).
Undertake site preparation	» Site establishment of offices/	» These activities will require the stripping of topsoil, which will need

Main Activity/Project Component	Components of Activity	Details
	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	to be stockpiled, backfilled, where necessary, and/or spread on site and where necessary used latter for rehabilitation.
Establishment of lay down areas on site	» Permanent lay down areas (footprint 50m x 25m) at each turbine position for the storage and assembly of wind turbine components and accommodation of construction and crane lifting equipment. » Construction site office	» The permanent lay down area will need to accommodate the cranes required in tower/turbine assembly during construction and for maintenance if and when required. » Temporary storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site. » A large permanent lay down area will be required at each position where the main lifting crane may be required to be erected and/or disassembled. This area would be required to be levelled, compacted, with foundations in part, to accommodate the assembly crane and tower segments, which would need to access the main crane from all sides. These areas have also been surveyed by the ecologist, archaeologist and palaeontologist during the walkthrough surveys.
Construct wind turbine foundations	» Turbine foundations will be up to 22m x 22m. Foundation holes will be excavated to a depth of approximately 4m-6m, depending on the underlying geotechnical conditions on site	» Foundation holes will be mechanically excavated and might use explosives where necessary, e.g. where the subsurface conditions don't allow for mechanical excavation (permits would be required for the latter – to be obtained by the Contractor(s)). » Safety barriers will be erected around open excavations where necessary.
Establishment of onsite batching plants	» A batching plant will be required for construction covering approximately 50m x 50m	» Batching plant equipment will need to be installed » A small office may be necessary » A lay down area will need to accommodate aggregate material for

Main Activity/Project Component	Components of Activity	Details
		batching.
Transport of components and equipment to site	» Trucks will be used to transport all components to site: * Components of various specialised construction equipment, 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/concrete mixers, etc.). * Components required for the establishment of the MV overheard power line (including towers and cabling). * Ready-mix concrete trucks for, *inter alia,* turbine and building foundations.	» Turbine units consist of a tower comprised of a number of segments, a nacelle, rotor and three blades. » The wind turbine, including tower, will be brought to site by the supplier in sections/segments. The individual components are defined as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.) and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc.) as a result of abnormal loading. The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself. » It is estimated that approximately 10-14 trucks will be used for the transport of each turbine.
Construct Substation and ancillary infrastructure.	» A 132 kV substation complex (120m x 120m) will be required to facilitate grid connection to the Soetwater Switching Substation » Substation components » Security fencing around high-voltage (HV) Yard » Workshop » Temporary site offices » Operation and Maintenance building(s)	» 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 substation will be constructed within a high-voltage (HV) yard footprint of up to 14 400 m^2. A further up to 12 000m^2 may be needed for associated buildings and parking. » The substation would be constructed in the following simplified sequence:

Main Activity/Project Component	Components of Activity	Details
		* Step 1: Survey of the site * Step 2: Site clearing and levelling and construction of access road to substation sites * Step 3: Construction of terrace and foundations * Step 4: Assembly, erection and installation of equipment * Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.
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, assisted by the smaller crane. » The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower. » The rotor (i.e. the blades of the turbine) will then be assembled or partially assembled on the ground by the smaller crane. It will then be lifted to the nacelle by the large crane, and bolted in place. Alternatively the blades may be lifted into position on the nacelle individually by the main crane. » It mayl take 2-5 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.
Medium voltage cabling between the turbines to the on-site substation	» Wind turbines » Medium Voltage (MV) underground and overhead power lines connecting each turbine to the substation	» The installation of underground cables will require the excavation of trenches, approximately 1m – 2m in depth within which these cables can then be laid. » The underground cables would follow the internal access roads as far as reasonably possible. » The MV overhead power lines will be constructed by placing pylons in more disturbed areas and avoiding any sensitive areas identified in the walkthrough surveys. » Where underground cabling is not practical or environmentally

Main Activity/Project Component	Components of Activity	Details
		sensible (e.g. in rocky area where blasting would be required), cabling would be above ground, suspended between ~8m high pylons at ~60m centres.
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 rehabilitation	» 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, access roads and laydown areas within 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. Based on information provided by the Proponent, the project will employ between 12 and 17 permanent employment opportunities as well as provide for further shorter term contract work. The operational phase is expected to last 20 years. It is anticipated that there will be full time security, maintenance and control room staff required on site. » Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities.
Maintenance	» Oil and grease – turbines » Transformer oil – substation » 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

Main Activity/Project Component	Components of Activity	Details
		approximately 20 - 25 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. This may be longer than the 20 year envisaged life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.
Disassemble and remove existing turbines	» A large crane will be used to disassemble the turbine and tower sections.	» Turbine components would be reused, recycled or disposed of in accordance with regulatory requirements. » 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 (if applicable).

2.2 Findings of the Environmental Impact Assessment

In terms of the findings of the EIA Report, various potential planning, construction and operation-related potential environmental impacts were identified all within acceptable limits, as having to be managed, including:

» Disturbance of the ecological environment;
» Potential impacts on drainage lines and other sensitive habitats, mainly from access roads;
» Potential impacts on avifauna (birds), although no turbines are in high risk areas;
» Potential impacts on bats, although no turbines are in high risk areas;
» Potential disturbance to sense of place, visual aesthetics;
» Noise during construction;
» Socio-economic impacts;
» Potential soil erosion and degradation; and
» Potential impacts on heritage and/ fossil resources (if disturbed).

From the specialist investigations undertaken for the proposed wind energy facility development site, a number of potentially sensitive areas were identified (refer to Figure 2.2):

The following 'no go' areas and sensitive areas have been identified on the site:

» **Ecological sensitivities:** The greater project development site for the Gunstfontein wind farm project comprises three distinctive and ecologically different areas: the high-lying plateau, the low-lying plains and the intervening rugged or steep escarpment. The facility itself is restricted to the plateau and the margin of the escarpment, with no wind turbine closer than 500m from the edge of the escarpment. This development footprint area is considered moderately sensitive overall with some areas of high sensitivity related to the confirmed presence of a variety of listed and endemic species concentrated along drainage lines and seasonally wet lowlands. Identified specific areas of sensitivity include the:
  * the area in the vicinity of drainage lines and pans, where there are areas of sandy soils and moister conditions;
  * the edge of the escarpment; and
  * areas of exposed bedrock and rock pavement.

  Based on the layout assessed (Layout Alternative 1), 9 turbines (turbines 2, 4, 11, 28, 39, 40, 41, 42 and 49) were to be located within the drainage areas and lowlands and hence needed to be relocated to less sensitive areas; and 2 turbines (turbines 5 and 6) were to be located within other high sensitivity areas which impact on plant species and habitats of concern and hence also needed to be relocated. Provided that these turbines were relocated and access roads through the very high sensitivity areas minimised, then the impacts of the development

were assessed as reduced to an acceptable level. As part of the mitigation strategy, these turbines have been relocated out of the high sensitive areas.

» **Avifaunal sensitivities:** The no-go areas already identified for the bird community should be excluded from development. The following sensitive areas should be noted:

- The renosterveld area on the northern farm portion of the proposed development site which has a double importance due to its utilization by Falcons and Bustards, as well as an entryway to the study area used by Waterbirds and "Ciconids". This area is considered the higher routes flux observed in the area and is intended to safeguard these movements;
- The area of the main waterbodies and main valley are associated to the activity of Waterbirds (particularly the main waterbodies), "Ciconids" (in the main valley especially) and Bustards. These include the Waterbirds highlighted which presented the highest activity of the general waterbird community, as well as the occurrence of sensitive species (to which a buffer of 500m was considered) or high activity levels though not of sensitive species (where a buffer of 200 m was considered). Additionally the analysis of the Waterbirds and "Ciconids" activity showed an increased movement frequency between the main valley and a waterbody located east which led to the selection of this particular section as sensitive due to collision risk during such movements. These corridors were selected based on the routes flux observed and are intended to safeguard any collision risk regarding such movements;
- The escarpment area was especially important for Raptor and Falcon species. For that reason a 500m buffer was selected around the escarpment edges. Rock Hyrax colonies were abundantly observed in the escarpment area, especially in the rocky outcrops. These are prey of several raptor species, including Verreauxs' Eagle for which Rock Hyrax is considered its main prey. Additionally a potential Verreauxs' Eagle nest was discovered in the escarpment area. Though breeding of the species was not confirmed, pairs were regularly observed in the surrounding areas which indicate that it may be a possibility in the next breeding seasons. Therefore a 2000 m buffer was highlighted around this potential breeding location;
- The valley thickets south of the central escarpment area which were important for "Ciconids", some Raptors and passerine species. A 200 m buffer was considered around this feature;
- Additionally a buffer area was considered around the potential breeding locations of Secretary bird (1500 m buffer area) and Martial Eagle (2000 m buffer area). However due to their large distance from the proposed WEF farm boundaries (approximately 3 km) these buffers do not affect any farm portions proposed for development; and
- The main routes of arrival and utilization of the central waterbodies present on the site were also highlighted and are considered no-go areas for turbine placement due to habitat loss and disturbance impacts.

The buffers defined are indicative boundaries of areas/environmental features considered to pose higher collision risk for the avifaunal community with confirmed and potential occurrence within the proposed development area. These buffers are proposed to be respected in terms of the placement of wind turbines construction footprint.

» **Heritage sensitivities:** Eight heritage features were recorded. The heritage features that were recorded consisted of Anglo Boer War (South African War) fortifications, rock art, stone cairns and farm labourer ruins). The rock art site (Feature 1), the stone cairn (Feature 4), the ruin (Feature 6) and four fortifications (Feature 2, 3,7 & 8) are all located well away from any development footprint and will not be impacted on by the proposed wind farm development. However, the third fortification (Feature 5) would have been indirectly impacted on by tower 14 located 48 m to the north and the proposed access road that is located 20 m to the North West (Layout Alternative 1). It was accordingly recommended that the tower and access roads are micro adjusted to have a no development buffer zone of at least 60 m from feature 5 which was done. The site must also be demarcated during construction to prevent accidental damage to the site during the construction phase.

» **Paleontological Heritage sensitivities:** Due to the potential economic as well as geoscientific interest (including possible association with fossil plants), the five uranium anomalies identified on the Remainder of the Farm Gunstfontein 131 should be protected by buffer zones of 30 m radius. The GPS locations of these five anomalies are as follows:

* Anomaly 169 (Gunstfontein 131): 32 33 20 S, 20 38 20 E
* Anomaly 170 (Gunstfontein 131): 32 35 09 S, 20 37 29 E
* Anomaly 171 (Gunstfontein 131): 32 36 07 S, 20 38 08 E
* Anomaly 172 (Gunstfontein 131): 32 34 02 S, 20 41 40 E
* Anomaly 173 (Gunstfontein 131): 32 34 56 S, 20 42 21 E

A similar 30m radius buffer zone be established to safeguard the association of abundant fossilised plant material with a sizeable body of koffieklip (rusty-brown ferruginised sandstone) recorded at Loc. 114 (32°33'16.97"S, 20°38'0.73"E) on the western margins of Gunstfontein 131. Please note that the identified anomalies and fossilised plant material are all located well away from any wind farm infrastructure and will not be impacted on by the proposed wind farm development.

» **Bat sensitivities:** Areas of high bat sensitivity areas defined by a 200 m buffer around temporary water bodies. It was recommended that Turbine 11 (Layout Alternative 1) should be relocated as it wass located in a no go zone – this was done. The following no-go areas must be considered:

* The 500 m buffer surrounding all confirmed bat roosts;
* A 200 m buffer surrounding potential roosting sites;

- A 500 m buffer surrounding permanent water bodies and lines where high activity levels have been recorded; a 200 m buffer surrounding other permanent water bodies and lines;
- A 200 m buffer surrounding linear features with potential to be used by bats as navigation corridors and commuting pathways within or across the site (mountain gorges and water lines/ waterbodies that are arranged in a linear way and that may form a corridor); and
- Habitats where high bat activity of sensitive species have been recorded during the surveys: all escarpment area where many rock crevices hold high roosting potential and an additional 500m buffer around the upper ridge line, as this may be an approaching route of bat roosting in the escarpment that may travel to the area above the escarpment to forage.

As part of the mitigation strategy, turbine 11 has been relocated out of high sensitive and no-go areas.

The buffers defined are indicative boundaries of areas/environmental features considered to pose higher collision risk for the bat community with confirmed and potential occurrence within the proposed development area. These buffers are proposed to be respected in terms of the placement of wind turbines construction footprint.

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 were possible.

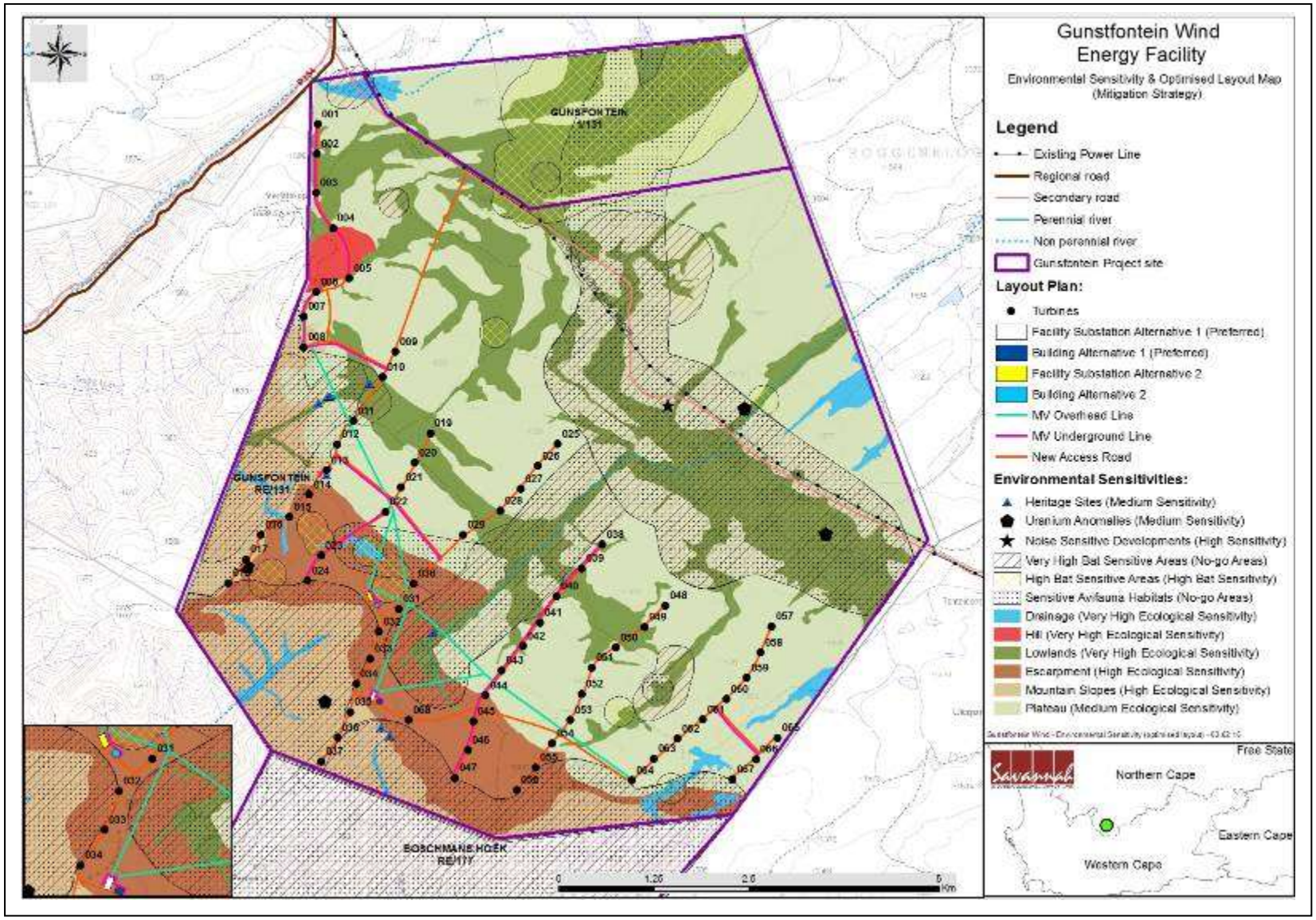

Figure 2.2: Environmental sensitivity map for the project study area illustrating sensitive areas in relation to the Optimised Gunstfontein Wind Facility layout refer to **Appendix A** for A3 maps)

2.3 Applicable Legislation

The following legislation and guidelines have informed the scope and content of this EMPr:

- National Environmental Management Act (Act No 107 of 1998);
- EIA Regulations, published under Chapter 5 of the NEMA (GN 982, GNR 983, GNR 984 and GNR 985 in Government Gazette 38282 of 4 December 2014).
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010).
  - Public Participation in the EIA Process (DEA, 2010).
  - Integrated Environmental Management Information Series (published by DEA).
- International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007).

Several other Acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed for the project. A review of legislative requirements applicable to the proposed project is provided in **Table 2.2**.

Table 2.2: Relevant legislative permitting requirements applicable to the Wind Energy Facility Project EIA

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. In terms of GN R543, R544, R545 and R546 of June 2010, a scoping and EIA process was required to be undertaken for the proposed project.	» National Department of Environmental Affairs » Department of Environmental and Nature Conservation (DENC) – commenting authority	The listed activities triggered by the proposed Project has been identified and assessed in the EIA process being undertaken. This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	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, stopped or minimised. In terms of NEMA, it has become the legal	Department of Environmental Affairs (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.

	duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.		
National Environmental Management: Waste Act (Act No 59 of 2008)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 912 of November 2013), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste.	DEA (hazardous waste) Provincial Department of Environmental Affairs (general waste)	As no waste disposal site is to be associated with the project. In terms of GNR921, no permit is required for this project. Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, as detailed in this EMPr.

	» Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.		
Environment Conservation Act (Act No 73 of 1989)	In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces, but the Northern Cape province have not yet adopted provincial regulations in this regard. Allows the Minister of Environmental Affairs to make regulations regarding noise, among other concerns	DEA NC DENC Local Municipality	Noise impacts are expected to be associated with the construction phase of the project and are not likely to present a significant intrusion to the local community. There is no requirement for a noise permit in terms of the legislation.

National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under general authorisation in terms of S39 and GN 1191 of GG 20526 October 1999. In terms of Section 19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	Department of Water and Sanitation (DWS)	A Water Use Licence (WUL) or General Authorisation (GA) is required as some drainage lines on the site will be impacted upon by road crossings. Application for a WUL or GA will be made with the DWS in terms of Section 21 of the Act. Water will be extracted from groundwater (borehole on site) for use within the facility and during construction.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act.	Department of Mineral Resources (DMR)	Should material not be sourced from a commercial source and a borrow pit(s) be considered necessary, the Contractor shall source and apply for the relevant permit from the DMR.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Measures in respect of dust control (S32) and National Dust Control Regulations of November 2013. Measures to control noise (S34) - no regulations promulgated yet.	DEA Karoo Hoogland Local Municipality	No permitting or licensing requirements arise from this legislation. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with

			the Act. The air quality officer may require a dust monitoring programme as per the Regulations for dust control. This EMPr however makes provision for managing and mitigating potential dust impacts.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided.	South African Heritage Resources Agency (SAHRA) Northern Cape Heritage Resources Authority	A Heritage and Paleontological Impact Assessment (HIA) was undertaken as part of the EIA Process to identify heritage sites. The overall area is considered as having a low archaeological significance. The relevant mitigation measures are included in this EMPr.

	Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened & protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process	National Department of Environmental Affairs DENC	As the applicant will not carry out any restricted activity, as is defined in Section 1 of the Act, no permit is required to be obtained in this regard. A Specialist Ecological Assessment was undertaken as part of the Environmental Impact Assessment process (refer to Appendix D). As such the potential occurrence of critically endangered, endangered, vulnerable, and protected species, as well as critically endangered (CR), endangered (EN), vulnerable (VU) or protected ecosystems and species and the potential for them to be affected has been considered.

	including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). » This Act also regulates alien and invader species. » Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. The Proponent has a responsibility for: » The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). » Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development		

	within the area are in line with ecological sustainable development and protection of biodiversity. » Limit further loss of biodiversity and conserve endangered ecosystems.		
National Environmental Management: Biodiversity Act 10 of 2004	GNR 598: The Alien and Invasive Species (AIS) Regulations provides for the declaration of weeds and invader plants.	Department of Agriculture, Forestry and Fisheries (DAFF)	This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies are included in this EMPr. In addition, weed control and management has also been included in this EMPr.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S13 the landowner would be required to burn firebreaks to ensure that should a veldfire occur on the property, that it does not spread to adjoining land. In terms of S13 the landowner must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. » In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Agriculture, Forestry and Fisheries (DAFF)	While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operational phase of the project The relevant management and mitigation measures has been included in this EMPr.
Conservation of	» Prohibition of the spreading of weeds	Department of Agriculture,	An Ecology study was undertaken

Agricultural Resources Act (CARA) (Act No 43 of 1983)	(S5). » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).	Forestry and Fisheries (DAFF)	(refer to Appendix D of the EIA Report). The relevant mitigations measures were identified and are included in this EMPr.
National Forests Act (Act No 84 of 1998)	Protected trees: According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that ' no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence.	» Department of Agriculture, Forestry and Fisheries (DAFF) » NC DENC	A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest. No Protected tree species or indigenous tree species were identified on site.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km radius around such structure. Structures lower than 45m, which are considered as a danger to aviation shall be	Civil Aviation Authority (CAA)	While no permitting or licence requirements arise from the legislation, this act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in the CAR Part 139.01.33.

	marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft. Section 14 of Obstacle limitations and marking outside aerodrome or heliport – CAR Part 139.01.33 relates specifically to appropriate marking of wind energy facilities.		
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature	Department of Health Karoo Hoogland Local Municipality	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

	or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts. The general conditions, limitations and escort requirements for abnormally	Provincial Department of Transport (provincial roads) South African National Roads Agency Limited (national roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).

	dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		
Astronomy Geographic Advantage Act (Act 21 of 2007)	» Preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy. » Regulations promulgated in terms of AGA in 2009 require all developments in the Sutherland area that entail external night lighting, to be fully cut-off, with no light emitted in the upward direction. This is aimed at protecting the observational integrity of SALT (Southern African Large Telescope), the largest telescope in the Southern Hemisphere, located approximately 20 km east of Sutherland. » In terms of section 7(1) and 7(2) of this Act, the Minister declared core astronomy advantage areas on 20 August 2010 under Regulation No. 723 of Government Notice No. 33462. In this regard, all land within a 3 kilometres radius of the centre of the	Department of Science and Technology	The study area falls within the Sutherland Central Astronomy Advantage Area gazetted in GN R140 of 28 February 2015, the 75km circular buffer centred on the SALT. While no regulations (draft or final) have yet been gazetted for this area, SAAO should be consulted as a key stakeholder. It should be noted that the entire project falls outside of the Karoo Central Astronomy Advantage Areas which were gazetted for the protection of the SKA.

	Southern African large Telescope dome falls under the Sutherland Core Astronomy Advantage Area. The declaration also applies to the core astronomy advantage area containing the MeerKAT radio telescope and the core of the planned Square Kilometre Array (SKA) radio telescope. The study area does not fall within the 3 km radius of SALT or within an area which could affect the MeerKAT and SKA developments. » Under Section 22(1) of the Act the Minister has the authority to protect the radio frequency spectrum for astronomy observations within a core or central astronomy advantage area. As such, the Minister may still under section 23(1) of the Act, declare that no person may undertake certain activities within a core or central astronomy advantage area. These activities include the construction, expansion or operation of any fixed radio frequency interference source, facilities for the generation, transmission or distribution of electricity, or any activity capable of causing radio frequency interference or which may detrimentally influence the astronomy and scientific endeavour.		

Provincial Legislation/ Policies / Plans			
Northern Cape Nature Conservation Act, 2009	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: » Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property; » Aquatic habitats may not be destroyed or damaged; » The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species. The Act provides lists of protected species for the Province.	NC DENC	A permit is required for any activities which involve species listed under schedule 1 or 2. The NC DENC permit office provides an integrated permit which can be used for all provincial and Threatened or Protected Species (TOPS)-related permit requirements. Provincially protected plant species were found within the study area. Therefore, a permit could be required for removal of such species. A permit could be required NC DENC to relocate protected plants and to clear natural vegetation within the development area.
Local Legislation / Policies / Plans			
Karoo Hoogland Local	» The IDP notes that the Karoo Hoogland	Karoo Hoogland Local	New developments in the

Municipality Integrated Development Plan (IDP)	is primarily an agricultural community. Conservation of the environment and sustainable development are identified as primary points of departure in policy. » The main socio-economic developmental issues are identified as widespread poverty, the lack of employment opportunities, low adult literacy levels, and general the lack of diversified skills amongst the bulk of the population. School dropout rates are pronounced. The IDP describes general living conditions in the LM as "some of the worst in the country".	Municipality	municipality to be in line with the IDP.

Table 2.3: **Standards applicable to the Gunstfontein Wind Energy Facility**

Theme	Standard	Summary
Air	South African National Standard (SANS) 69	Framework for setting and implementing national ambient air quality standards
	SANS 1929: Ambient Air Quality	Sets limits for common pollutants
Noise	SANS 10328:2003: Methods for Environmental Noise Impact Assessments	General procedure used to determine the noise impact
	SANS 10103:2008: The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication	Provides noise impact criteria
	National Noise Control Regulations	Provides noise impact criteria
	SANS 10210: Calculating and Predicting Road Traffic Noise	Provides guidelines for traffic noise levels
Waste	DWAF (1998) Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste	DWAF Minimum Requirements
	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) – National norms and standard for the storage of waste.	» Provides uniform national approach relating the management of waste facilities » Ensure best practice in management of waste storage » Provides minimum standards for the design and operation of new and existing waste storage
Water	Best Practise Guideline (G1) Storm Water Management DWA 2006	Provides guidelines to the management of storm water
	South African Water Quality Guidelines	Provides water quality guidelines
Economical, Environmental and Social	Equator Principles 2013	Determines, assesses and manages environmental and social risk in projects

STRUCTURE OF THIS EMPR *CHAPTER 3*

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

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

These chapters set out the procedures necessary for Gunstfontein Wind Energy Facility (Pty) Ltd, as the Proponent to achieve environmental compliance. For each of the phases for the wind energy facility project, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The management plan has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions monitoring requirements and performance indicators. A specific Environmental Management Programme table has been established for each environmental objective. The information provided within the EMPr 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, e.g.: » wind turbines; » Substation » access roads; and » Associated infrastructures.
Potential Impact	Brief description of potential environmental impact if objective is not met.
Activity/risk source	Description of activities which could impact on achieving objective.
Mitigation: Target/Objective	Description of the target; include quantitative measures and/or dates of completion.

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

		measures.

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

The objectives and EMPr tables are required to be reviewed and possibly modified whenever changes, e.g. the following, occur:

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

3.1 Project Team

This EMPr was compiled by:

EMP Compilers	
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Karen Jodas	Savannah Environmental
Input from Specialists	
Ecology	Simon Todd Consulting
Avifauna	Bioinsight South Africa
Bats	Bioinsight South Africa
Soils and Land-Use, Land Capacity and Agricultural Potential	Garry Paterson of Arc-Institute for soil, climate and water
Visual	Jon Marshall of Afzelia
Heritage	Jaco van der Walt of Heritage Contracts
Palaeontology	John Almond of Natura Viva
Noise	Morne de Jager of EAR- Enviro Acoustic Research
Social Impact	Tony Barbour and Schalk van der Merwe (Environmental Consultant and Researcher)

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, and have managed

and drafted Environmental Management Programmes for other wind energy facility projects throughout South Africa. In addition, they have been involved in compliance monitoring of major construction projects in South Africa.

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

4.1 Goal for Pre-Construction

Overall Goal for Pre-Construction (Planning and Design): Undertake the pre-construction (planning and design) phase of the wind farm in a way that:

» Ensures that the design of the wind farm responds to the identified environmental constraints and opportunities.
» Ensures that pre-construction activities are undertaken in accordance with all relevant legislative requirements and avoids sensitive environmental areas as far as practically possible.
» Ensures that adequate regard has been taken of any landowner and community concerns and that these are appropriately addressed through design and planning (where appropriate).
» Ensures that the best environmental options are selected for the wind farm.
» Enables the wind farm construction activities to be undertaken without significant disruption to other land uses in the area.

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

4.2 Planning and Design

OBJECTIVE 1 : To ensure that the design of the facility responds to the identified environmental constraints and opportunities

Subject to final turbine micro-siting and subsequent acceptance from DEA, the layout and preferred grid connection option must be implemented.

Project component/s	» wind turbines; » cabling between turbines; » substation; » access roads and crane hard standings; » service building(s); and » associated infrastructure.
Potential Impact	» Design fails to respond optimally to the environmental considerations.
Activities/risk sources	» Positioning of turbines and alignment of access roads and underground cabling » Positioning of substation

	» Positioning of buildings » Construction and design of watercourse crossings » Pre-construction activities, e.g. geotechnical investigations
Mitigation: Target/Objective	» To ensure that the design of the facility responds to the identified environmental constraints and opportunities. » To ensure that pre-construction activities are undertaken in an environmentally friendly manner by e.g. avoiding identified sensitive areas. » To ensure that the design of the facility responds to the identified constraints identified through pre-construction bird and bat monitoring.

Mitigation: Action/control	Responsibility	Timeframe
The developer to finalise layout of all components, and submit to DEA for approval as might be required by the EA.	Proponent / Contractor(s)	Prior to construction
Bridge design must be such that it minimises impact to riparian areas with minimal alterations to water flow and must allow the movement of fauna and flora.	Contractor(s)	Design phase
All buffers and no-go areas stipulated in the Avifaunal and Bat Reports must be adhered to for the facility	Contractor(s)	Design phase
A comprehensive stormwater management must be compiled and detail how stormwater will be managed to reduce velocities and volumes of water that could lead to erosion of surfaces (refer to **Appendix H**).	Contractor(s)	Design phase
The EMPr should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.	Proponent / Contractor(s)	Tender Design & Design Review Stage
Preconstruction ecological walk-through of the final approved layout and suitable micrositing of the turbines and access roads must be conducted prior to construction activities.	Proponent	Design phase
Water use license/ General Authorisation to be obtained for any impacts on wetlands / drainage lines (if applicable).	Proponent/Contractor(s)	Design phase
Water use license or General Authorisation to be	Proponent/Contractor(s)	Design phase

Mitigation: Action/control	Responsibility	Timeframe
obtained for abstraction of water from on-site borehole/s for construction or operation purposes.		
Mining permit/license to be obtained for any borrow pits to be established for the project (if applicable).	Contractor(s)	Design phase
Obtain required abnormal load permits for transportation of project components to site.	Contractor(s)/ Transport Contractor	Design phase
Determine an appropriate location for onsite batching outside of identified sensitive areas.	Contractor(s)	Design phase
A detailed geotechnical investigation is required for the design phase.	Contractor(s)	Design phase
The facility must be designed to discourage the use of infrastructure components as perching or roosting substrates by birds.	Contractor(s)	Design phase
Develop an alien invasive and open space management plan for the site (refer to **Appendix C**).	Proponent	Pre-construction
Develop a plant rescue and protection plan for the site (refer to **Appendix D**).	Proponent	Pre-construction
Develop a re-vegetation and habitat rehabilitation plan for the site (refer to **Appendix E**).	Proponent	Pre-construction
Develop a traffic management plan for the site (refer to **Appendix F**).	Proponent	Pre-construction
Develop a storm water management plan for the site (refer to **Appendix H**).	Proponent	Pre-construction
Develop an erosion management plan for the site (refer to **Appendix J**).	Proponent	Pre-construction
Develop an effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	Proponent	Pre-construction

Performance Indicator	» Design meets objectives and does not unnecessarily degrade the environment. » Design and layouts etc. respond to the mitigation measures and recommendations in the EIA and walkthrough reports.

Monitoring and Reporting	» Ensure that the design implemented meets the objectives and mitigation measures in the EIA Report through review of the design by the Project Manager, ECO, Contractor and the Environmental Officer (EO) prior to the commencement of construction.

OBJECTIVE 2: To ensure effective communication mechanisms

On-going communication with affected and surrounding landowners is important to maintain during the construction and operational phases of the wind farm. Any issues and concerns raised should be addressed as far as possible in as short a timeframe as possible.

Project component/s	» wind turbines; » cabling between turbines; » substation; » access roads; » watercourse crossing, i.e. access roads and culverts; » buildings; and » all other infrastructure.
Potential Impact	» Impacts on affected and surrounding landowners and land uses
Activity/risk source	» Activities associated with pre-construction activities » Activities associated with construction of the wind farm » Activities associated with construction of watercourse crossings » Activities associated with operation
Mitigation: Target/Objective	» Effective communication with affected and surrounding landowners » Addressing of any issues and concerns raised as far as possible in as short a timeframe as possible

Mitigation: Action/control	Responsibility	Timeframe
Compile and implement a grievance mechanism procedure for the public (using **Appendix B**) to be implemented during both the construction and operational phases of the facility and if applicable during decommissioning. This procedure should include details of the contact person who will be receiving issues raised by interested and affected parties, and the process that will be followed to address issues. A Project Specific Grievance Mechanism will be developed and implemented prior to construction.	Proponent and/or Contractor(s)	Pre-construction (construction procedure) Pre-operation (operation procedure)
Develop and implement a grievance mechanism for the construction, operational	Proponent and/or Contractor(s)	Pre-construction (construction

Mitigation: Action/control	Responsibility	Timeframe
and closure phases of the project for all employees, contractors, subcontractors and site personnel. This procedure should be in line with the South African Labour Law.		procedure) Pre-operation (operation procedure)
Liaison with landowners is to be undertaken prior to the commencement of construction in order to agree on landowner-specific conditions during construction and maintenance.	Proponent and/or Contractor(s)	Pre-construction
An incident reporting system must be developed and used to record non-conformances to the EMPr.	Contractor(s)/ ECO	Pre-construction Duration of construction
Public complaints register must be developed and maintained on site in line with the Grievance mechanism (**Appendix B**).	Contractor(s)	Pre-construction Duration of construction

Performance Indicator	» Effective communication procedures in place for all phases as required.
Monitoring	» An incident reporting system should be used to record non-conformances to the EMPr. Grievance mechanism procedures should be implemented. » Public complaints register must be developed and maintained.

OBJECTIVE 3: Protection of Heritage and Palaeontological Resources

Project component/s	» Wind turbines; » Cabling between turbines; » Substation; » Access roads; » Buildings; and » All other infrastructure.
Potential Impact	» Destruction of potential heritage and fossil/palaeontological resources
Activity/risk source	» Activities associated with construction of the wind farm » Activities associated with construction of watercourse crossings » Activities associated with operation
Mitigation: Target/Objective	» Protection of identified heritage sites and fossils » Protection of potential heritage artefacts uncovered during construction

Mitigation: Action/control	Responsibility	Timeframe
All palaeontological specialist work should conform to international best practice for	Proponent and Specialist	Pre-Construction

Mitigation: Action/control	Responsibility	Timeframe
palaeontological fieldwork and (e.g. data recording fossil collection and curation) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013).		
On-site investigation to identify and cordon off sensitive heritage sites/areas must be undertaken prior to commencement of construction.	Contractor(s) in conjunction with the ECO/ EO	Pre-construction
A realistic, collaborative monitoring programme and protocol should be drawn up by the palaeontologist in conjunction with the proponent.	Proponent and Specialist	Pre-construction
A 30m radius buffer zone must be established to safeguard the association of abundant fossilised plant material with a sizeable body of koffieklip (rusty-brown ferruginised sandstone) recorded at Loc. 114 (32°33'16.97"S, 20°38'0.73"E) on the western margins of Remainder of the Farm Gunstfontein 131.	Proponent and Specialist	Pre-Construction
The five uranium anomalies identified on the Remainder of the Farm Gunstfontein 131 must be protected by buffer zones of 30 m radius. The GPS locations of these five anomalies are as follows: » Anomaly 169 (Gunstfontein 131): 32 33 20 S, 20 38 20 E » Anomaly 170 (Gunstfontein 131): 32 35 09 S, 20 37 29 E » Anomaly 171 (Gunstfontein 131): 32 36 07 S, 20 38 08 E » Anomaly 172 (Gunstfontein 131): 32 34 02 S, 20 41 40 E Anomaly 173 (Gunstfontein 131): 32 34 56 S, 20 42 21 E	Proponent and Specialist	Pre-Construction

Performance Indicator	» No impacts on valuable fossil heritage. » No impacts on valuable heritage resources.
Monitoring	» Contractor to cordon off sensitive sites

MANAGEMENT PROGRAMME FOR THE WIND ENERGY FACILITY: CONSTRUCTION CHAPTER 5

5.1. Overall Goal for Construction

The construction phase of the wind energy facility should be undertaken in such a way that ensures the construction activities are properly managed in respect of environmental aspects and impacts 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 watercourses, vegetation, fauna and avifauna on the site as well as on any archaeological and historical value the site may have, as determined by the EIA.

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

The Proponent must ensure that the implementation of the 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 EMPr, and the implementation of the EMPr through its integration into the contract documentation. These are outlined below. The Proponent will retain various key and facilitation roles and responsibilities during the construction of the wind energy facility, however, the Contractor(s) will be responsible for implementing the conditions of the EMPr.

a) OBJECTIVE 1: Establish clear reporting, communication, and responsibilities in relation to overall implementation of the EMPr

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager, Site Manager, Contractor's Environmental Officer (EO), ECO and Contractor for the construction phase of this project are as detailed below. Formal responsibilities are necessary to ensure that key procedures are executed.

Project Manager/ Coordinator will:

» 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.
» Ensure that the project Contractor(s) are made aware of all stipulations within the EMPr.
» Coordinate the correct implementation of the EMPr throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
» Be fully knowledgeable with the EIA Report (including amendments) for the project, the EMPr, the conditions of the Environmental Authorisation, and all relevant licences and permits.
» Be fully knowledgeable with the contents of all relevant licences and permits.

Site Manager (Contractor(s)'s on-site Representative) will:

» Be fully knowledgeable with the contents of the EIA Report and risk management.
» Be fully knowledgeable with the contents and conditions of the Environmental Authorisation and related amendments.
» Be fully knowledgeable with the contents of the EMPr.
» Have overall responsibility of the EMPr and its implementation.
» Ensure that audits are conducted to ensure compliance to the EMPr.
» Ensure there is communication with the Project Manager, the ECO, the EO, and relevant discipline engineers on matters concerning the environmental compliance.
» Be fully knowledgeable with the contents of all project licences and permits.
» 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.

An independent **Environmental Control Officer (ECO)** 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(s) with the environmental specifications of the EMP and the conditions of the Environmental Authorisation. Accordingly, the ECO will:

» Be fully knowledgeable with the contents of the EIA Report.
» Be fully knowledgeable with the contents and with the conditions of the Environmental Authorisation including all subsequent amendments.
» Be fully knowledgeable with the contents of the EMPr.
» Be fully knowledgeable of all the project licences and permits issued to the site and ensure communication to the relevant personnel on the conditions contained therein.
» Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with them.

- » Ensure that the contents of this document are communicated to the Contractor(s) site staff and that the Site Manager and Contractors are constantly made aware of the contents through regular discussion.
- » Ensure that the compliance of the EMPr, EA and legislative is monitored through regular and comprehensive inspection of the site and surrounding areas.
- » 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 an activity to prevent a non-compliance from continuing, if reasonable (i.e. if all other options have been exhausted)).
- » 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.
- » Visit the site sufficient regularly so as to ensure that activities on site comply with all relevant environmental legislation.
- » Ensure that appropriate measures are undertaken to address any non-compliances recorded. The Method Statements must include the timelines to close out the identified non-conformances.
- » Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMPr and/or project permits.
- » Keep record of all environmental activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.
- » Ensure that the compilation of progress reports for submission to the Proponent, with input from the Site Manager, takes place on a regular basis, weekly, Monthly Reports including Final Post-Construction Audit Reports.
- » Ensure that there is regular 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 and recorded.
- » Independently report to the Department of Environment (National & Provincial) in terms of compliance with the specifications of the EMPr and conditions of the EA (once issued) if and when requested.
- » Submit independent reports to the DEA and other regulating authorities regarding compliance with the requirements of the EMPr, EA and other environmental permits.

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.

Contractor(s) and their Service Providers/ Sub-Contractors: The Contractor(s) is responsible for the overall execution of the activities envisioned in the construction phase including the implementation and compliance with recommendations and conditions of the EMPr. It is important that the Contractor(s) is fully aware of the

responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The Contractor(s) 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)'s obligations in this regard include the following:

» Ensure implementation and compliance with the EMPr at all times during construction activities.
» Responsible for the implementation of corrective actions enforced by the ECO/ EO for non-conformances recorded within a reasonable period of time. The Method Statement must indicate the turn-around time for closing out the non-conformances.
» 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.
» Employees must be provided with a basic understanding of the key environmental features of the construction site and the surrounding environment by the Contractor's Environmental Officer.
» 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 proposed facility.
» 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. The training is to be conducted by the Environmental Officer.
» Staff will be informed of environmental issues as deemed necessary by the ECO/ EO.

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

» Ensuring adherence to the Environmental management programme.
» Ensuring that Method Statements are submitted to the Site Manager and ECO for approval/acceptance 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 register is kept in the site office, which lists all transgressions issued by the ECO/ EO.
» 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).

Contractor's EO and Environment Representative[3]: The EO will be responsible for implementation of this EMPr and should be appointed prior to any commencement of the activities.

The Contractor's EO/ Environmental Representative should:

» Be well versed with all the project documentation and general environmental matters.
» Understand the relevant environmental legislation and processes and the implementation thereof.
» 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. The EO shall keep a daily diary for monitoring the site specific activities as per project schedule.
» As a general mitigation strategy, the EO should 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) and therefore needs the relevant training/ experience. The EO will have overall responsibility for environmental management and implementation of mitigations in absence of the ECO.
» The EO is responsible for managing the day-to-day on-site implementation of this EMPr and other Project Permits/Authorisations,
» Ensure or otherwise train and induct all contractor's employees prior to commencement of any works;
» Compilation of Weekly and Monthly Monitoring Reports to be submitted to the ECO and Site Manager.
» In addition, the EO/ Environmental Representative must act as project 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, ECO and Contractor(s).

5.3. Objectives for the Construction EMPr

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

[3] This refers to the Contractor's designated environmental site representative. The person might have a different title, e.g. Safety, Health and Environmental officer, but their core mandate will be as is described in this EMPr.

OBJECTIVE 2 : Securing the site and site establishment

The Contractor(s) 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(s) must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English 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	» Wind energy turbines » Cabling between turbines » Substation » Access roads » Buildings » MV Overhead power line(s) » Operation and maintenance buildings » Laydown areas and hardstands
Potential Impact	» Hazards to landowners and public » Security of materials » Substantially increased damage to natural vegetation and sensitive environmental areas, due largely to unawareness of where such areas are located. » Potential impact on fauna and avifauna
Activities/risk sources	» Open excavations (foundations and cable trenches) » Movement of construction employees, vehicles and plant 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.	Contractor(s)/ ECO/ EO	During site establishment Maintenance: for duration of Contract.
Where necessary to control access, fence and secure area using appropriate means, and implement access control procedures – fencing should take cognisance of farming activities, e.g. not limiting game and/or sheep and other animals from accessing water/ food (fencing	Contractor(s)	During site establishment Maintenance: for duration of Contract.

Mitigation: Action/control	Responsibility	Timeframe
should be discussed and planned in conjunction with the landowners prior to construction).		
Fence and secure Contractor's equipment camp.	Contractor(s)	Erection: during site establishment Maintenance: for duration of Contract.
Develop and implement an efficient access control system which allows for the identification of all people on site.	Contractor(s)	During site establishment Implement for duration of contract
Concrete batching plant/s to be located in areas of low sensitivity within the approved development area or an area approved by the ECO.	Contractor(s)	During site establishment
All unattended open excavations must be adequately demarcated and/or fenced (fencing shall consist of a minimum of three strands of wire wrapped with danger tape).	Contractor(s)	During site establishment
Establish appropriately bunded areas for storage of hazardous materials (i.e. fuel to be required during construction). Bunds must be constructed in order to accommodate 110% of the volume of the substance stored.	Contractor(s)	During site establishment and during construction
Establish the necessary ablution facilities with chemical toilets and provide adequate sanitation facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site.	Contractor(s)	During site establishment and during construction
Ablution or sanitation facilities should not be located within 100 m from a 1:100 year flood line or within 32m of a watercourse if the 1:100 year flood line is unknown/uncertain.	Contractor(s)	Site establishment, and duration of construction

Performance Indicator	» Site is secure and there is no unauthorised entry. » No members of the public/ landowners injured as a result of construction activities. » Fauna and flora is protected as far as practically possible » Appropriate and adequate waste management and sanitation facilities provided at construction site.
Monitoring and Reporting	» Regular visual inspection of fence for signs of deterioration/forced access. » An incident reporting system used to record non-conformances to the EMPr. » Public complaints register used to record complaints received.

	» ECO/ EO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager. » ECO/ EO to address any infringements with responsible contractors as soon as these are recorded.

OBJECTIVE 3 : Maximise local employment and business opportunities associated with the construction phase

It is acknowledged that skilled personnel are required for the construction of the wind turbines and associated infrastructure. However, where semi-skilled and unskilled labour is required, opportunities for local employment should be maximised as far as possible. Employment of locals and the involvement of local Small, Micro and Medium Enterprises (SMMEs) would enhance the social benefits associated with the project, even if the opportunities are only temporary. The procurement of local goods could furthermore result in positive economic spin-offs. It is acknowledged that socio-economic development forms a major part of the REIPPPP and the Project therefore has various targets to meet.

Project component/s	» Construction activities associated with the establishment of the wind farm, including associated infrastructure.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised. However, due to the relatively small size of the facility the number of employment and business opportunities for locals will be limited.
Activities/risk sources	» The employment of outside contractors to undertake the work and who make use of their own labour will reduce the employment and business opportunities for locals. Employment of local labour will maximise local employment opportunities.
Mitigation: Target/Objective	» The Proponent, in discussions with the local municipality, should aim to employ as many workers (skilled, semi-skilled / low-skilled) from the local areas/ towns, as possible. » The proponent should also develop a database of local BBBEE service providers

Mitigation: Action/control	Responsibility	Timeframe
Employ as many workers (skilled, semi-skilled / low-skilled) from the local area/ nearby towns as possible.	Contractor(s)	Project duration
Where required, implement appropriate training and skills development programmes prior to the initiation of the construction phase to ensure that local employment target is met.	Proponent/ Contractor(s)	Project duration

Mitigation: Action/control	Responsibility	Timeframe
Develop a database of local Broad Based Black Economic Empowerment (BBBEE) service providers and ensure that they are informed of relevant tenders and job opportunities.	Contractor(s)	Project duration
Skills audit to be undertaken as per the Renewable Energy Independent Power Producer Procurement Process (REIPPPP) Enterprise Development (ED) and Socio-Economic Development (SED) Requirements to determine training and skills development requirements.	Contractor(s)	Project duration
Identify potential opportunities for local businesses.	Proponent/ Contractor(s)	Project duration

Performance Indicator	» Source as many local labourers as possible. » Database of potential local BBBEEE services providers in place before construction phase commences. » Skills audit to determine need for training and skills development programme undertaken within 1 month of commencement of construction phase.
Monitoring and Reporting	» Contractors and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register used to record complaints received. » A Site Specific Grievance Mechanism must be communicated and implemented prior to construction.

OBJECTIVE 4 : Avoid the negative social impacts on family structures and social networks due to the presence of construction workers from outside the area, including potential loss of livestock, game, other fauna and damage to farm infrastructure

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 (including stock theft), 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	» Construction and establishment activities associated with the establishment of the wind farm, including associated infrastructure. » Construction work force
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. » Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities. » Impact on safety of farmers and communities (increased crime etc.) by construction workers and also damage to farm infrastructure such as gates and fences.
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 or illegal hunting/ trapping of fauna and or game and damage to farm infrastructure.
Mitigation: Target/Objective	» Avoid and or minimise the potential impact of construction workers on the local community and livelihoods. » To minimise impacts on the social and biophysical environment.

Mitigation: Action/control	Responsibility	Timeframe
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.	Proponent/ Contractor(s)	Pre-construction/ construction
Ensure that construction workers who are found guilty of breaching the Code of Conduct are disciplined accordingly. All disciplinary hearings and/or dismissals must be in accordance with South African labour legislation.	Proponent/ Contractor(s)	Pre-construction/ construction
The housing of construction workers on the site should be limited to security personnel, if required.	Contractor(s)	Pre-construction/ construction
Compensate farmers / community members for any proven cost for any losses, such as livestock, damage	Proponent/ Contractor(s)	Construction

Mitigation: Action/control	Responsibility	Timeframe
to infrastructure etc.		
Inform the landowner of activity on their land as per agreed landowner construction requirements or at least two (2) days in advance of planned activities	Contractor(s)	Duration of contract
Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners.	Contractor(s)	Pre- construction and when required
Contact details of emergency and police services should be prominently displayed on site.	Contractor(s)	Construction
Appropriate fire-fighting equipment must be present on site and members of the workforce should be appropriately trained in using this equipment in the fighting of veld fires.	Contractor(s)	Construction
Employees, visitors and/or subcontractors should be made well aware of the consequences of any damage to private property and/or loss of livestock, game and/or other fauna.	Proponent/ Contractor(s)	Duration of contract
Should there be any damage to private property and/or loss of livestock, game and/or other fauna that can be linked to the Contractor, or any subcontractor, the landowner shall be compensated accordingly upon sufficient proof thereof.	Proponent/ Contractor(s)	Duration of contract
Reasonable site access control should be implemented.	Contractor(s)	Duration of contract

Performance Indicator	» Employment policy and tender documents that set out requirement for local employment and targets completed before construction phase commences. » Code of Conduct developed and approved prior to commencement of construction phase. » Labour locally sourced, where possible. » 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. » Documentation of Landowner Requirements to be agreed with the contractor prior to commencement of construction. » Appropriate waste and wastewater management. » Community Monitoring Forum in place before construction phase commences. » No criminal activities and theft of livestock, illegal hunting or trapping of game and/or other fauna attributable to the construction workers are reported. » No complaints received from landowners or the general public.

	» No fires or on-site accidents occur.
Monitoring and Reporting	» The Proponent, Contractor(s) and/or the appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register used to record complaints received.

OBJECTIVE 5 : 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	» Wind Energy turbines » Cabling between turbines » Substation » Access roads » Buildings » Watercourse crossing, i.e. access roads and culverts
Potential Impact	» Nuisance noise from construction activities affecting the surrounding community.
Activity/risk source	» Any construction activities taking place within 500 m from potentially sensitive receptors (PSR). » Site preparation and earthworks » Construction-related transport » Foundations or plant equipment installation » Building activities » Power line construction activities
Mitigation: Target/Objective	» Ensure equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors. » Ensure as far as possible 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
On-site construction activities should be limited to daylight hours as far as possible. No construction activities after 13:00 on Saturdays, Sundays and public holidays. Should construction activities need to be undertaken outside of these times, landowners need to	Contractor(s)	Construction

Mitigation: Action/control	Responsibility	Timeframe
be consulted. Where work takes place outside of normal working hours, the relevant legislation should be adhered to.		
Construction staff working in areas where the 8-hour ambient noise levels exceed 75dBA must wear ear protection equipment.	Contractor(s)	Construction
Construction noise must be managed according to the Noise Control Regulations and SANS 10103	Contractor(s)	Construction
The construction crew must abide by the national standards and local by-laws, if any, regarding noise.	Contractor(s)	Construction
All construction equipment, including vehicles, must be properly and appropriately maintained in order to minimise noise generation.	Contractor(s)	Construction
Establish a line of communication and notify all stakeholders and sensitive receptors of the means of registering any issues, complaints or comments.	Contractor(s)	All phases of project.
Notify potentially noise sensitive receptors about work to take place at least 2 days before the activity in the vicinity (within 500 m) of the Potentially Sensitive Receptors (PSR) is to start. The following information to be presented in writing: » Description of activity to take place; » Estimated duration of activity; » Working hours; and » Contact details of responsible party.	Contractor(s)	At least 2 days, but not more than 5 days before activity is to commence.

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 as far as possible.
Monitoring and Reporting	» Should a complaint about noise be reported, the Proponent and/or Contractor(s) is to look into the matter and determine steps to deal with the complaint An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register used to record complaints received.

OBJECTIVE 6 : Management of dust and emissions and damage to roads

During the construction phase, limited gaseous or particulate emissions (and dust) 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	» Wind Energy turbines » Cabling between turbines » Substation » Access roads » Buildings » Watercourse crossing, i.e. access roads and culverts » Batching Plant
Potential Impact	» Heavy vehicles can generate noise and dust impacts. Movement of heavy vehicles can also damage roads. » Dust and particulates from vehicle movement to and on-site, foundation excavation, road construction activities, road maintenance activities, temporary stockpiles, and vegetation clearing affecting the surrounding residents (dust nuisance) and visibility. » Release of minor amounts of air pollutants (for example NO_2, CO and SO_2) from vehicles and construction equipment
Activities/risk sources	» The movement of heavy vehicles and their activities on the site can result in noise and dust impacts and damage roads. » Clearing of vegetation and topsoil. » Excavation, grading and scraping. » Transport of materials, equipment and components on internal access roads. » Re-entrainment of deposited dust by vehicle movements. » Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces. » Fuel burning from construction vehicles with combustion engines.
Mitigation: Target/Objective	» To avoid and or minimise the potential noise and dust impacts associated with heavy vehicles, and also minimise damage to roads. » To ensure emissions from all vehicles are minimised, where possible, for the duration of the construction phase. » To minimise nuisance to the community and adjacent landowners from dust emissions and to comply with workplace health and safety requirements for the duration of the construction phase.

Mitigation: Action/control	Responsibility	Timeframe
Implement appropriate dust suppression measures on site such as wetting roads on a regular basis including during site clearing and periods of high winds (by using non-potable water as far as practically possible).	Contractor(s)	Construction
Haul vehicles moving outside the construction site carrying material that can be wind-blown should be covered with tarpaulins.	Contractor(s)	Duration of contract
Ensure vehicles adhere to speed limits on public roads and speed limits set within the site.	Contractor(s) / transportation contractor	Duration of contract
Disturbed areas must be re-vegetated as soon as practicable after construction is complete in an area.	Contractor(s)	At completion of the construction phase.

Mitigation: Action/control	Responsibility	Timeframe
Vehicles and equipment must be maintained in a road-worthy condition at all times.	Contractor(s)	Prior to construction phase.
Ensure that damage to gravel public roads and access roads attributable to construction vehicles use for the construction of the Project is repaired before completion of construction phase.	Contractor(s)	Before completion of construction phase.
Regular dust control of materials (sand, soil, concrete) must be used at concrete batching plants on site.	Contractor(s)	Construction
Strictly control vibration pollution from compaction plant or excavation plant as far as practically possible	Contractor(s)	Construction
Disturbed areas must be re-vegetated as soon as practicable.	Contractor(s)	At completion of the construction phase.
If monitoring results or complaints indicate inadequate performance against the criteria indicated, then the source of the problem will be identified, and existing procedures or equipment modified to ensure the problem is rectified.	Contractor(s)	Duration of contract

Performance Indicator	» Appropriate dust suppression measures implemented on site during the construction phase. » Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed or before entering the site. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.
Monitoring and Reporting	» The Proponent and 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. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register used to record complaints received.

OBJECTIVE 7 : Soil degradation and erosion control

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.) could 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. Steep slopes are prone to soil erosion and good soil management must be undertaken during construction on these slopes.

A set of strictly adhered to mitigation measures are required to be implemented in order to effectively limit/ manage the potential impact on the environment. The disturbance areas where human impact is likely are the focus of the mitigation measures laid out below. Management of erosion will be required during the construction phase of the facility. The section below provides a guideline for the management of erosion on site and will need to be supplemented with the principles for erosion management contained in the Erosion Management Plan included in **Appendix H**.

Project component/s	» Wind turbines; » Substation; » Access roads; » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas); » Watercourse crossing, i.e. access roads and culverts; and » All other infrastructure (site camp, batching plant etc).
Potential Impact	» Erosion and soil loss; » Sedimentation of watercourses; » A loss of indigenous vegetation cover; and » 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; » River/stream/drainage line road crossings ; » Roadside drainage ditches; and » 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 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 drainage lines 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; and » No increase in runoff into drainage lines as a result of road

	construction.

Mitigation: Action/control	Responsibility	Timeframe
Stockpile topsoil separately from subsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 50 m away from drainage lines if practically possible. Limit the height of stockpiles as far as possible to reduce compaction.	Contractor(s)	During site establishment and any activity related to earthworks as well as the duration of construction.
Phased development and vegetation clearing must be implemented where possible so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time before construction commences.	Contractor(s)	During site establishment and any activity related to earthworks as well as the duration of construction.
New access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement and compaction of soil. (Allowance has been made for micro-siting of internal access roads)	Contractor(s)	Before and during construction
Identify and demarcate construction areas for general construction work and restrict construction activity to these areas.	Contractor(s)	Construction
Rehabilitate disturbance areas as soon as construction in an area is completed, if practically and logistically possible.	Contractor(s)	During and after construction
Stockpiles not used in three (3) months after stripping must be seeded or appropriately covered to prevent dust and erosion - only if natural seeding does not occur.	Contractor(s)	During and after construction
Erosion control measures: Implement run-off attenuation on slopes (sand bags, logs), silt fences, stormwater catch-pits, shade nets or temporary mulching over denuded areas.	Contractor(s)	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(s)	Erection: during site establishment Maintenance: for duration of contract.
Where access roads cross natural drainage lines,	Engineer /	Before and

Mitigation: Action/control	Responsibility	Timeframe
culverts (or other appropriate measures) must be designed to allow free flow. Regular maintenance of the culverts must be carried out.	Contractor(s)	during construction
Control depth of all excavations and stability of cut faces/sidewalls – this will also be covered by health and safety requirements.	Engineer / Contractor(s)	Maintenance over duration of contract
Compile a comprehensive stormwater management plan as part of the final design of the project and implement during construction and operation (refer to **Appendix H**).	Contractor(s)	Compile during design; implement during construction & operation
Cement/Concrete batching to take place in designated areas only, as detailed on the approved facility layout map (if applicable).	Contractor(s)	Construction.
Spillages of cement/concrete to be cleaned up immediately and disposed of.	Contractor(s)	Construction
Spill kits to be kept on active parts of the construction site & at site offices.	Contractor(s)	Construction
Soil erosion control measures (such as hessian mats and gabions) be used for in erosion prone areas such as steep slopes.	Contractor(s)	Construction
Storm water Management Plan to be updated and implemented as soon as the designs have been finalised.	Contractor(s)	Construction

Performance Indicator	» Acceptable level of activity within disturbance areas; » No activity outside of designated areas » Minimal level of soil erosion around site as a result of construction activities » No siltation in drainage lines as a result of construction activities » Minimal level of soil degradation as a result of construction activities » No accelerated erosion at drainage line road crossings (typical signs of accelerated erosion would be headcut development, channel incision or scour adjacent to the structure). » Limited soil erosion around site as a result of construction activities; » No increased siltation in drainage lines as a result of construction activities; » Impacts on drainage lines are minimised. » Only limited localised scour adjacent to culverts. » Acceptable state of excavations, as determined by ECO.
Monitoring and Reporting	» Continual inspections of the site by ECO/ EO; » Daily monitoring for the water crossing construction period. » Fortnightly inspections of sediment control devices by ECO/ EO; » On-going inspections of surroundings, including drainage lines by

	ECO/ EO; » Reporting of ineffective sediment control systems and rectification as soon as possible; » An incident reporting system must record non-conformances to the EMPr; and » Public complaints register used to record complaints received.

OBJECTIVE 8 : Limit disturbance and avoid damage to drainage lines/ watercourses

The layout for the wind energy facility avoids the placement of turbines and access roads within wetland areas. However, there are still some instances where roads and cables may cross watercourse areas. Mitigation measures are required to minimise impacts on those systems affected in this regard.

Project component/s	» Access roads » Cabling between turbines » Watercourse crossing, i.e. access roads and culverts » Wind turbines » Workshop area/ laydown areas
Potential Impact	» Damage to drainage line areas by any means that will result in hydrological changes (includes erosion, siltation, dust, and direct removal of soil or vegetation, contamination, dumping of material). The focus should be on the functioning of the drainage line as a natural system. » Increased runoff into drainage lines can potentially be associated with accelerated erosion.
Activity/risk source	» Construction of access roads and cabling.
Mitigation: Target/Objective	» Minimise damage to watercourse areas where crossing will be built. » 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
Align underground cables and internal access roads as far as possible along existing infrastructure and disturbances, e.g. within the internal access road construction corridor.	Proponent, Contractor(s)	Construction
For any new construction where direct impacts on drainage lines are unavoidable cross watercourses perpendicularly as far as practically possible to minimise disturbance footprints.	Contractor(s)	Construction

Rehabilitate any disturbed areas as soon as possible once construction is completed in an area.	Contractor(s)	Construction
Bridge design must be such that it minimises impact to riparian areas with minimal alterations to water flow and must allow the movement of fauna and flora	Contractor(s)	Construction
Obtain required water use license/ GA for impacting on drainage lines (if applicable).	Proponent	Pre-construction
Construction must not result in the width of the watercourse being narrowed.	Contractor(s)	Construction
Control storm water and runoff water through the implementation of a storm water management plan for the site (**refer to Appendix H**).	Contractor(s), ECO/ EO	Construction
Contaminated runoff from the construction site(s) should be prevented from entering the rivers/streams.	Contractor(s)	Construction
Ablution facilities at the construction sites, i.e. outside the construction camp must be located at least 100m away from drainage lines and must be regularly serviced.	Contractor(s)	Construction
Concrete batching plants and stockpiles to be located more than 50m away from drainage lines wherever practically possible. If not possible, the ECO/ EO must be consulted to ensure the relevant mitigation measures are implemented.	Contractor(s)/ ECO/ EO	Construction
Utilise erosion control measures on access roads, wetland areas and drainage lines.	Contractor(s)	Construction

Performance Indicator	» Limited impacts on water quality, water quantity, riparian or wetland vegetation, natural status of riparian or wetland areas. » No increase in runoff into drainage lines as a result of construction of project related infrastructure.
Monitoring and Reporting	» Habitat loss in watercourses should be monitored before and after construction by the ECO/ EO. » The ECO in conjunction with the EO, should be responsible for monitoring and reporting. » An incident reporting system must be used to record non-conformances to the EMPr. » Weekly monitoring by the ECO/ EO during the construction phase to ensure mitre drains or similar runoff management structures are properly constructed. » Public complaints register must be used to record complaints received.

OBJECTIVE 9 : Protection of indigenous vegetation, control of alien invasive plants and management of topsoil

Impacts on vegetation at the construction stage are expected to be mainly as a result of direct permanent loss of vegetation in development footprint areas. Due to disturbance of vegetation, there is a higher risk of alien species dominating disturbed areas. Therefore, control of alien invasive plants is required. An Alien Invasive Plant Management Plan is attached to **Appendix C**. Method for Plant Rescue and Habitat Rehabilitation (a Plant Rescue and Protection Plan and Re-Vegetation Management Plan and Rehabilitation Plan) is attached to **Appendix D** and **E**.

Project component/s	» wind turbines and associated laydown areas; » access roads and cabling; » substation; » workshop area; » site camp » batching plants; and » temporary laydown areas.
Potential Impact	» Proliferation of alien plants
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(s) and site office/visitor's centre (e.g. compaction) » Foundations or plant equipment installation » Stockpiling of topsoil, subsoil and spoil material
Mitigation: Target/Objective	» To retain natural vegetation in the highly sensitive areas of the site; » To minimise footprints of disturbance of vegetation/habitats on-site; » No alien plants within project control area; » Remove and store all topsoil on areas that are to be excavated wherever practically possible; and use this topsoil in subsequent rehabilitation of disturbed areas; and » Limited 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 where there are no existing roads or where there aren't new roads planned. The construction impacts must be contained to the footprint of the infrastructure.	Contractor(s)	Construction
Keep disturbance of indigenous vegetation to a minimum and rehabilitate disturbed areas as quickly as possible	Contractor(s)	Construction

Mitigation: Action/control	Responsibility	Timeframe
No importing of soil from areas with alien plants	Contractor(s)	Construction
Internal access roads and cables should be aligned as far as possible along existing linear disturbances, e.g. access road corridors on site and away from steep slopes and drainage lines as much as possible. Where new roads are to be constructed, these should follow existing tracks or disturbed areas or the edges of disturbed areas as far as possible.	Contractor(s)	Construction / design
Identify and demarcate areas within which activities are to be undertaken. Ensure that activities are restricted to these areas to ensure unnecessary impacts on surrounding natural vegetation are avoided.	Contractor(s)	Construction
Establish an on-going monitoring programme to detect, quantify and remove any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act, Act 43 of 1983 and NEM: Biodiversity Act).	Contractor(s)	Construction & Operation
Control any alien plants that become established using registered control methods.	Contractor(s)	Construction & Operation
Salvaging topsoil: » Topsoil must always be salvaged and stored separately from subsoil and lower-lying parent rock or other spoil material. o Topsoil stripping removes up to 30 cm or less of the upper soils. o In cultivated areas, depth of topsoil may increase and needs to be confirmed with the land owner » Prior to salvaging topsoil the depth, quality and characteristics of topsoil should be known for every management area. * This will give an indication of total volumes of topsoil that need to be stored to enable the proper planning and placement of topsoil storage. * Different types of topsoil – rocky soils and sands or loams must be stored separately Topsoil should be removed (and stored) under dry conditions to avoid excessive compaction whenever topsoil will have to be stored for longer than one year.	Contractor(s)	Before and during construction
Storing topsoil: » Viability of stored topsoil depends on moisture, temperature, oxygen, nutrients and time stored. » Rapid decomposition of organic material in warm, moist topsoil rapidly decreases microbial activity necessary for nutrient cycling, and reduces the	Contractor(s)	Before and during construction

Mitigation: Action/control	Responsibility	Timeframe
amount of beneficial micro-organisms in the soil. » Stockpile location, if not adjacent to a linear development: ∗ At least 50 m from any watering point ∗ Ideally a disturbed but weed-free area » *Topsoil is typically stored in berms with a width of 150 – 200 cm, and a maximum height of 2m:* ∗ Place berms along contours or perpendicular to the prevailing wind direction ∗ Adhere to the following general rule: the larger the pile of topsoil storage needs to be, the shorter should be the time it is stored » Topsoil handling should be reduced to stripping, piling (once), and re-application. Between the stockpiling and reapplication, stored topsoil should not undergo any further handling except control of erosion and (alien) invasive vegetation » Where topsoil can be reapplied within six months to one year after excavation, it will be useful to store the topsoil as close as possible to the area of excavation and re-application, e.g. next to cabling trenches ∗ In such case, use one side of the linear development for machinery and access only ∗ Place topsoil on the other/far side of this development, followed by the subsoil (e.g. on geotextile) » In cases where topsoil has to be stored longer than 6 months or during the rainy season, soils should be kept as dry as possible and protected from erosion and degradation by: ∗ Preventing puddling on or between heaps of topsoil ∗ Or covering topsoil berms ∗ Preventing all forms of contamination or pollution ∗ Preventing any form of compaction ∗ Monitoring establishment of all invasive vegetation and removing such if it appears ∗ Keeping slopes of topsoil at a maximal 2:1 ratio ∗ Monitoring and mitigating erosion where it appears ∗ Where topsoil needs to be stored in excess of more than 6 months, it is recommended to either cover the topsoil or allow an indigenous grass cover to grow on it – if this does not happen spontaneously, seeding should be		

Mitigation: Action/control	Responsibility	Timeframe
considered. This must be implemented only after consultation with the ECO.		
Reapplying topsoil: » Spoil materials and subsoil must be back-filled first, then covered with topsoil » Generally, topsoil should be re-applied to a depth equal to slightly greater than the topsoil horizon of a pre-selected undisturbed reference site » The minimum depth of topsoil needed for revegetation to be successful is approximately 20 cm » If the amount of topsoil available is limited, a strategy must be worked to out to optimise revegetation efforts with the topsoil available » Reapplied topsoil should be landscaped in a way that creates a variable microtopography of small ridges and valleys that run parallel to existing contours of the landscape. The valleys become catch-basins for seeds and act as run-on zones for rainfall, increasing moisture levels where the seeds are likely to be more concentrated. This greatly improves the success rate of revegetation efforts. » To stabilise reapplied topsoils and minimise raindrop impact and erosion: o Use organic material from cleared and shredded woody vegetation where possible o Alternatively, suitable geotextiles or organic erosion mats can be used as necessary Continued monitoring will be necessary to detect any sign of erosion early enough to allow timeous mitigation	Contractor(s)	Before and during construction
Re-applied topsoil needs to be re-vegetated as soon as possible, following the specifications of the revegetation and rehabilitation plan (**refer to Appendix E**)	Contractor(s)	Before and during construction, monitored during operational phase

Performance Indicator	» Limited disturbance outside of designated work areas. » Minimised clearing of existing/natural vegetation. » Limited loss of natural vegetation within "no-go" areas. Loss of other natural vegetation only within designated footprint of infrastructure. » Limited fragmentation of untransformed areas of natural vegetation. » Limited alien infestation within project control area.
Monitoring and Reporting	» Observation of vegetation clearing activities by ECO/ EO throughout construction phase.

	» Supervision of all clearing and earthworks. » Monitoring of alien plant establishment within the project control area on an on-going basis. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be used to record complaints received.

OBJECTIVE 10 : Protection of fauna & avifauna

Infrastructure associated with the facility often impacts on birds and animals. New roads constructed will also have a disturbance and habitat destruction impact.

Project component/s	» wind turbines and associated laydown areas; » access roads and cabling; » substation; » Overhead power lines; » workshop area; » batching plants; and » temporary laydown areas.
Potential Impact	» Vegetation clearance and associated impacts on faunal habitats; and » Disturbance of birds (e.g. destruction of habitat,)
Activity/risk source	» Site preparation and earthworks; » Construction-related traffic; » Foundations or plant equipment installation; and » Mobile construction equipment.
Mitigation: Target/Objective	» To minimise footprints of habitat destruction; and » To minimise disturbance to resident and visitor faunal and avifaunal species.

Mitigation: Action/control	Responsibility	Timeframe
The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on fauna and their habitats is restricted.	Contractor(s)	Site establishment & duration of contract.
Should any animals be found these should be relocated prior to construction, the ECO/ EO should first be consulted to ensure that no permits are required for relocation. If permits are required these must first be obtained.	Contractor(s)	Site establishment & duration of contract.
No poaching or illegal hunting of wildlife on site during construction	Contractor(s)	Site establishment & duration of contract.

Mitigation: Action/control	Responsibility	Timeframe
No animals are to be harmed or killed by the Proponent or Contractor(s). Employees should be trained (e.g. during toolbox talks) that poisonous animals should not be killed and if encountered the ECO/ EO should be informed.	Contractor(s)/ ECO/ EO/	Duration of contract
The ECO/ EO must have the required Competency Certificates, received from the attendance of a Reptile Husbandry and Handling Course as there may be many poisonous snakes to be moved. Alternatively, if any poisonous animals are encountered on site, they should either be allowed sufficient space and time to relocate, or a relevantly qualified person must be contacted to remove/relocate the animal.	Contractor(s)/ ECO/ EO/	Duration of contract
Employees must be prohibited from harvesting wild plants for any purpose	Contractor(s)	Duration of contract
Active breeding in the immediate surroundings must be monitored during construction by the ECO/EO. Should any bird nests be found that are likely to be disturbed by construction activities, these will not be relocated without first consulting an avifaunal specialist. If nests cannot be relocated, other mitigation measures will be investigated.	Contractor(s)/ ECO/ EO	Site establishment & duration on contract

Performance Indicator	» No disturbance outside of designated work areas. » Minimised clearing of existing/natural vegetation and habitats for fauna and avifauna. » Limited impacts on faunal species (including avifauna) (i.e. noted/recorded fatalities), especially those of conservation concern.
Monitoring and Reporting	» Observation of vegetation clearing activities by ECO/ EO throughout construction phase. » Supervision of all clearing and earthworks by ECO/ EO. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be used to record complaints received.

OBJECTIVE 11 : Protection of fossils and sites of heritage and archaeological value

The construction phase of the wind energy facility will entail excavations into the superficial sediment cover (soils etc.) and perhaps also into the underlying bedrock. Areas of potentially fossiliferous bedrock may be sealed-in or sterilised by infrastructure

such as hard standing areas for each wind turbine, lay down areas and internal access roads. These activities may adversely affect potential fossil heritage within the study area by potentially damaging, destroying, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good.

» **Heritage sensitivities:** Eight heritage features were recorded. The heritage features that were recorded consisted of Anglo Boer War (South African War) fortifications, rock art, stone cairns and farm labourer ruins). The rock art site (Feature 1), the stone cairn (Feature 4), the ruin (Feature 6) and four fortifications (Feature 2, 3,5,7 & 8) are all located well away from any development footprint and will not be impacted on by the proposed wind farm development. It is recommended that the tower and access roads are micro adjusted to have a no development buffer zone of at least 60 m from the heritage features identified. The site must also be demarcated during construction to prevent accidental damage to the site during the construction phase.

» **Paleontological Heritage sensitivities:** Due to the potential economic as well as geoscientific interest (including possible association with fossil plants), the five uranium anomalies identified on the Remainder of the Farm Gunstfontein 131 should be protected by buffer zones of 30 m radius. The GPS locations of these five anomalies are as follows:

* Anomaly 169 (Gunstfontein 131): 32 33 20 S, 20 38 20 E
* Anomaly 170 (Gunstfontein 131): 32 35 09 S, 20 37 29 E
* Anomaly 171 (Gunstfontein 131): 32 36 07 S, 20 38 08 E
* Anomaly 172 (Gunstfontein 131): 32 34 02 S, 20 41 40 E
* Anomaly 173 (Gunstfontein 131): 32 34 56 S, 20 42 21 E

A similar 30m radius buffer zone be established to safeguard the association of abundant fossilised plant material with a sizeable body of koffieklip (rusty-brown ferruginised sandstone) recorded at Loc. 114 (32°33'16.97"S, 20°38'0.73"E) on the western margins of Gunstfontein 131. Please note that the identified anomalies and fossilised plant material are all located well away from any wind farm infrastructure and will not be impacted on by the proposed wind farm development.

Project component/s	» wind turbines; » access roads and cabling; » Substation; and » Operations and service building area.
Potential Impact	» Heritage objects or artefacts found on site are inappropriately managed or destroyed; and » Loss of fossil resources.
Activity/risk source	» Site preparation and earthworks; » Foundations or plant equipment installation; » Mobile construction equipment movement on site; and

	» Access road 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
The ECO/ EO for the project should be well versed before construction starts on the possible types of heritage sites/materials they may encounter and the procedures to follow when they find sites. They should be trained by the Heritage Specialist to identify, follow the relevant procedure and report to the site manager if sites are found.	Contractor(s) and ECO/ EO	Pre-construction
If a heritage object is found, work in that area (the immediate area affecting the find) must be stopped immediately, and appropriate specialists brought in to assess the site, notify the administering authority of the item/site, and undertake due/required processes.	Proponent / Contractor(s) in consultation with Specialist	Duration of contract
Turbines, towers and access roads must have a no development buffer zone of at least 60 m from the heritage features identified. The sites must also be demarcated during construction to prevent accidental damage to the site during the construction phase.	Contractor(s) in consultation with Specialist	Duration of contract
If at any stage during the construction phase any semblance of a fossil were to be observed, it would be vital to recover the fossil and report the occurrence to the geological staff at the closest repository in the Northern Cape and/or the South African Heritage Resources Agency (SAHRA) (021 642 4502) so that systematic and professional investigation/ excavation can be undertaken.	Contractor(s)	Duration of contract
If concentrations of archaeological materials are exposed during construction then all work must stop for an archaeologist to investigate.	Contractor(s)	Construction
If any human remains (or any other concentrations of archaeological heritage material) are exposed during construction, all work in the immediate area affecting the find, must cease and it must be reported immediately to the nearest museum/archaeologist or to the South African Heritage Resources Agency, so that a systematic and professional investigation can be undertaken. Sufficient time should be allowed to investigate and to remove/collect such material.	Contractor(s)	Construction
The ECO/ EO for the project should be alerted to the potential for, and scientific significance of, new fossil finds during the construction phase of the development. They should familiarise themselves with the sort of fossils concerned through museum displays	Contractor(s) and ECO/ EO	Pre-construction/ Construction

Mitigation: Action/control	Responsibility	Timeframe
and accessible, well-illustrated literature.		

Performance Indicator	» Minimum disturbance outside of designated work areas. » All heritage items located are dealt with as per the legislative guidelines.
Monitoring and Reporting	» Observation of excavation activities by ECO/ EO throughout construction phase. » Supervision of all clearing and earthworks. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be used to record complaints received.

OBJECTIVE 12 : 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	» Construction site » Transportation of staff and equipment » Wind turbines
Potential Impact	» The potential scarring of the landscape due to the creation of new access roads/tracks or the unnecessary removal of vegetation; and » Construction traffic.
Activity/risk source	» The viewing of visual scarring by observers in the vicinity of the facility or from the roads traversing the site.
Mitigation: Target/Objective	» Minimal disturbance to vegetation cover in close vicinity to the proposed facility and its related infrastructure; and » Minimised construction traffic, where possible.

Mitigation: Action/control	Responsibility	Timeframe
The general appearance of construction activities, construction equipment camps and lay-down areas must be maintained and kept neat and tidy by means of the timely removal of rubble and disused construction materials.	Contractor(s)	Construction
Reduce visual disturbances by minimising areas of surface disturbance, controlling erosion, using dust suppression techniques and restoring exposed soil as close as possible to their original contour and vegetation	Contractor(s)	Construction

Mitigation: Action/control	Responsibility	Timeframe
Limit access to the construction sites (during both construction and operational phases) along existing access roads as far as possible.	Contractor(s)	Duration of contract
Vehicle movements on local roads must be limited to standard construction operating hours wherever possible to limit noise impacts and dust nuisance.	Contractor(s)	Duration of contract
Times for arrival and departure of heavy vehicles must be co-ordinated as far as possible in order to minimise congestion.	Contractor(s)	Duration of contract
The movement of all vehicles within the site must be on designated roadways.	Contractor(s)	Duration of contract
Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards and must be managed on an ongoing basis).	Contractor(s)	Duration of contract
All vehicles travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.	Contractor(s)	Duration of contract
Ensure all disturbed areas are appropriately rehabilitated once construction in an area is complete.	Contractor(s)	Duration of construction

Performance Indicator	» Construction site maintained in a neat and tidy condition. » Vegetation cover that remains intact with no erosion scarring in close proximity of the facility. » Site appropriately rehabilitated after construction is complete.
Monitoring	» Ensure that mitigation measures are implemented during construction to minimise visual impacts on surrounding communities. » Ensure that aviation warning lights or other measures are installed before construction is completed according to CAA requirements. » Ensure that aviation warning lights or other measures are functional at all times. » Monitoring of rehabilitation activities to ensure appropriate rehabilitation of the site. » An incident reporting system will be used to record non-conformances to the EMPr. » Public complaints register must be used to record complaints received.

OBJECTIVE 13 : Appropriate handling and storage of chemicals, hazardous substances and waste

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

Project component/s	» wind turbines; » Concrete batching plant; » Construction camp/ laydown areas; and » Associated infrastructure.
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; and » 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; » Packaging and other construction wastes; » Hydrocarbon use and storage ; and » Spoil material from excavation, earthworks and site preparation.
Mitigation: Target/Objective	» To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons; » To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons; » To comply with waste management legislation; » To minimise production of waste; » To ensure appropriate waste storage and disposal; and » To avoid environmental harm from waste disposal.

Mitigation: Action/control	Responsibility	Timeframe
An effective monitoring system must be implemented during the construction phase to detect any leakage or spillage of hazardous substances during their transportation, handling, use and storage.	Contractor(s)	Duration of contract
The storage of flammable and combustible liquids such as oils must be in designated areas which are appropriately bunded, and stored in compliance with Material Safety Data Sheets (MSDS) files.	Contractor(s)	Duration of contract
Any spills must receive the necessary clean-up action. Bioremediation kits must be kept on-site and used to	Contractor(s)	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
remediate any spills that may occur. Appropriate arrangements to be made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils.		
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be complied with.	Contractor(s)	Duration of contract
Routine servicing and maintenance of vehicles is not to take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, e.g. during emergencies, an appropriate drip tray must be used to contain any fuel or oils.	Contractor(s)	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	Contractor(s)	Duration of contract
Waste disposal records must be available for ECO review at all times.	Contractor(s)	Duration of contract
Construction contractors must provide specific detailed waste management plans/method statements to deal with all waste streams.	Contractor(s)	Duration of contract
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap) and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control.	Contractor(s)	Duration of contract
Where possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation and storage of waste streams (such as wood, metals, general refuse etc.).	Contractor(s)	Duration of contract
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors and licensed waste disposal sites.	Contractor(s)	Duration of contract
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	Contractor(s)	Duration of contract
Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor(s)	Duration of contract
Documentation (waste manifest) must be maintained detailing the quantity, nature and fate of any hazardous waste.	Contractor(s)	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
An incident/complaints register must be established and maintained on-site.	Contractor(s)	Duration of contract
Hazardous and non-hazardous waste must be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered.	Contractor(s)	Erection: during site establishment Maintenance: for duration of Contract within a particular area.
All solid waste collected must be disposed of at a registered waste disposal site. A certificate of disposal must be obtained and kept on file. The disposal of waste must be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site.	Contractor(s)	Erection: during site establishment Maintenance: for duration of Contract within a particular area.
Supply waste collection bins at construction equipment and construction crew camps.	Contractor(s)	Erection: during site establishment Maintenance: for duration of Contract within a particular area.
Construction equipment must be refuelled within designated refuelling locations, or where remote refuelling is required, appropriate drip trays must be utilised.	Contractor(s)	Duration of contract
All stored fuels to be maintained within a bund and on a sealed surface.	Contractor(s)	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function.	Contractor(s)	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor(s)	Duration of contract
Spilled cement/concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor(s)	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(s)	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents. Spill kits to be kept on-site.	Contractor(s)	Duration of contract
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor(s)	Duration of contract
Upon the completion of construction, the area will be cleared of potentially polluting materials.	Contractor(s)	Completion of construction
Supply adequate weather and vermin proof waste collection bins and skips (covered at minimum with secured netting or shadecloth) at site where construction is being undertaken. Separate labelled bins should be provided for general and hazardous waste. As far as possible, provision should be made for separation of waste for recycling.	Contractor(s)	Site establishment, and duration of construction
All work sites must be kept free of waste. No solid waste may be burned or buried on site or disposed of by any other method on site or within quarries or borrows pits. Solid waste (general waste) to be disposed of at the nearest municipal landfill site. Slips of disposal to be retained as proof of responsible disposal	Contractor(s)	Site establishment, and duration of construction
Liquid waste: No liquid waste, including grey water, may be discharged into any water body or drainage line. All sewage disposal to take place at a registered and operational wastewater treatment works. Slips of disposal to be retained as proof of responsible disposal Hazardous substances and hazardous waste: Ensure compliance with all national, regional and local legislation with regard to the storage, handling and disposal of hydrocarbons, chemicals, solvents and any other harmful and hazardous substances and materials. The onus is on the Contractor to identify and interpret the applicable legislation. Hazardous waste to be disposed of at a registered h:H or H:H landfill site. Depending on the classification of the waste, a registered service provider with the necessary permits is to collect, transport and dispose of hazardous waste. Proof of appropriate disposal to be provided to the ECO.	Contractor(s) O&M Contractor	During and post construction.
Keep a record of all hazardous substances stored on site for submission to the ECO. Clearly label all the containers storing hazardous waste.	Contractor(s)	Pre-Construction
An effective monitoring system must be put in place to detect any leakage or spillage of all hazardous	Contractor(s)	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
substances during their transportation, handling, installation and storage.		
Precautions must be in place to limit the possibility of oil and other toxic liquids from entering the soil or clean stormwater system.	Contractor(s)	Duration of contract
Implement an integrated waste management approach that is based on waste minimisation and incorporates reduction, recycling, re-use and disposal where appropriate.	Contractor(s)	Duration of contract
Upon the completion of construction, the area must be cleared of potentially polluting materials. Spoil stockpiles must also be removed and appropriately disposed of or the material re-used for an appropriate purpose.	Contractor(s)	Completion of construction

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

OBJECTIVE 14 : 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, the

EIA Report and this EMPr, as well as the requirements of all relevant environmental legislation.

Project component/s	» Wind energy facility; and » Associated infrastructure.
Potential Impact	» Pollution/contamination of the environment; and » Disturbance to the environment and surrounding communities.
Activity/risk source	» Contractors are not aware of the requirements of the EMPr, 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 EMPr and the Environmental Authorisation must be included in all tender documentation and Contractor(s) contracts.	Proponent	Tender process
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no abluting must be permitted outside the designated area. These facilities must be regularly serviced by appropriate contractors. Ablution facilities must not be placed within 50m from any river or drainage line.	Contractor(s) (and sub-contractor/s)	Duration of contract
Cooking must take place in a designated area. No firewood or kindling may be gathered from the site or surrounds.	Contractor(s) (and sub-contractor/s)	Duration of contract
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.	Contractor(s) (and sub-contractor/s)	Duration of contract
No one must disturb flora or fauna outside of the demarcated construction area/s.	Contractor(s) (and sub-contractor/s)	Duration of contract

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

OBJECTIVE 15 : To avoid and or minimise the potential risk of increased veld fires during the construction phase.

The increased presence of people on the site could increase the risk of veld fires, particularly in the dry season.

Project component/s	» wind turbines » construction camp
Potential Impact	» Fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences.
Activity/risk source	» Contractors are not aware of the requirements of the EMPr, 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
No open fires for cooking or heating must be allowed on site.	Contractor(s)	Construction
Provide adequate fire-fighting equipment on-site.	Contractor(s)	Construction
Provide fire-fighting training to selected construction staff.	Contractor(s)	Construction
Compensate farmers / community members at full market related replacement cost for any losses due to the wind energy facility project, such as livestock, damage to infrastructure etc. as a result of fires that can be directly attributed to construction activities.	Contractor(s)	Construction

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

OBJECTIVE 16 : Traffic management and transportation of equipment and materials to site (Traffic Management Plan)

The construction phase of the project will be the most significant in terms of generating traffic impacts resulting from the transport of equipment (including turbine components) and materials and construction crews to the site and the return of the vehicles after delivery of materials. Potential impacts associated with transportation and access relate mostly to works within the site boundary (i.e. the Wind Energy Facility and ancillary infrastructure) and external works outside the site boundary. This section should be read in conjunction with the Traffic and Transportation Plan attached as Appendix F.

Project component/s	» wind turbines; » substation; » access roads; » associated infrastructure; and » construction vehicles
Potential Impact	» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted; » Risk of accidents; » and » Deterioration of road pavement conditions (i.e. both surfaced and gravel road) due to abnormal loads.
Activity/risk source	» Transportation of project components to site.
Mitigation: Target/Objective	» To minimise impact of traffic associated with the construction of the facility on local traffic; » To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction; and » To ensure all vehicles are roadworthy and all materials/equipment are carried appropriately and within any imposed permit/licence conditions.

Mitigation: Action/control	Responsibility	Timeframe
Develop and implement a traffic management plan (Refer to **Appendix F**).	Contractor(s), (Transportation sub-contractor)	Duration of contract
Existing road infrastructure must be used as far as possible for providing access to the proposed turbine positions. Where no road infrastructure exists, new roads should be placed within existing disturbed areas or environmental conditions must be taken into account to ensure the minimum amount of damage is caused to natural habitats.	Contractor(s), (Transportation sub-contractor)	Duration of contract
Internal roads must be located to minimize stream crossings. All structures crossing streams must be located and constructed so that they do not decrease	Contractor(s), (Transportation sub-contractor)	Duration of contract

channel stability or increase water velocity.		
All relevant permits for abnormal loads must be applied for from the relevant authority.	Contractor(s), (Transportation sub-contractor)	Duration of contract
A designated access (or accesses) to the proposed site must be created to ensure safe entry and exit.	Contractor(s)	Duration of contract
Appropriate road management strategies must be Implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor(s), (Transportation sub-contractor)	Duration of contract
Any traffic delays because of construction traffic must be co-ordinated with the appropriate authorities.	Contractor(s)	Duration of contract
Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards). Signage must be maintained on an on-going basis.	Contractor(s)	Duration of contract
Appropriate maintenance of all vehicles must be ensured.	Contractor(s)	Duration of contract
Signs must be placed along construction roads to identify speed limits, travel restrictions, and other standard traffic control information. All vehicles travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.	Contractor(s)	Duration of contract
Keep hard road surfaces as narrow as possible.	Contractor(s)	Duration of contract
Construction vehicles carrying material to the site should avoid using roads through densely populated built-up areas.	Contractor(s), (Transportation sub-contractor)	Duration of contract
The movement of all vehicles within the site must be on designated roadways.	Contractor(s)	Duration of contract
All hazardous substances must be transported in accordance with the relevant legislation and regulations.	Contractor(s)	Duration of contract
Road borders should be regularly maintained to ensure that vegetation remains short and that they therefore serve as an effective firebreak (where required).	Contractor(s) in consultation with the ECO	Duration of contract
Roads must be designed so that changes to surface water runoff are avoided and erosion is not initiated.	Contractor(s)	Duration of contract

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

OBJECTIVE 17 : Effective management of concrete batching plants

Concrete is required during the construction of a wind energy facility. In this regard there could be a need to establish a batching plant within the site. Batching plants are facilities/installations that combine various ingredients to form concrete. Some of these inputs include sand, water, aggregate (rocks, gravel, etc.), fly ash, potash, and cement.

Turbid and highly alkaline wastewater, dust emissions and noise are the key potential impacts associated with concrete batching plants. Concrete batching plants, cement, sand and aggregates can produce dust. Potential pollutants in batching plant wastewater and stormwater include cement, sand, aggregates, chemical additive mixtures, fuels and lubricants.

Project component/s	» Concrete batching plant/s
Potential Impact	» Dust emissions » Release of contaminated water » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation
Activity/risk source	» Operation of the batching plant » Packaging and other construction wastes » Hydrocarbon use and storage » Spoil material from excavation, earthworks and site preparation
Mitigation: Target/Objective	» To ensure that the operation of the batching plant does not cause pollution to the environment or harm to persons

Mitigation: Action/control	Responsibility	Timeframe
Where possible concrete batching plants should be sited such that impacts on the environment or the amenity of the local community from noise, odour or polluting emissions are minimised	Contractor(s)	Construction phase
The provision of natural or artificial wind barriers such as trees, fences and landforms may help control the emission of dust from the plant.	Contractor(s)	Construction phase
Where there is a regular movement of vehicles. Access and exit routes for heavy transport vehicles should be planned to minimise noise and dust impacts on the environment	Contractor(s)	Construction phase
The concrete batching plant site should demonstrate good maintenance practices, including regular sweeping to prevent dust build-up	Contractor(s)	Construction phase
The prevailing wind direction should be considered to ensure that bunkers and conveyors are sited in a sheltered position to minimise the effects of the wind.	Contractor(s)	Construction phase
Aggregate material should be delivered in a damp condition, and water sprays or a dust suppression agent should be correctly applied to reduce dust emissions and reduce water usage	Contractor(s)	Construction phase
Conveyors must be designed and constructed to prevent fugitive dust emissions. This may include covering the conveyor with a roof, installing side protection barriers and equipping the conveyor with spill trays, which direct material to a collection point. Belt cleaning devices at the conveyor head may also assist to reduce spillage.	Contractor(s)	Construction phase
The site should be designed and constructed such that clean stormwater, including roof runoff, is diverted away from contaminated areas and directed to the stormwater discharge system.	Contractor(s)	Construction phase
Any liquids stored on site, including admixtures, fuels and lubricants, should be stored in accordance with applicable legislation	Contractor(s)	Construction phase
Contaminated stormwater and process wastewater should be captured and recycled where possible. A wastewater collection and recycling system should be designed to collect contaminated water.	Contractor(s)	Construction phase
Process wastewater and contaminated stormwater collected from the entire site should be diverted to a settling pond, or series of ponds, such that the water can be reused in the concrete batching process. The	Contractor(s)	Construction phase

Mitigation: Action/control	Responsibility	Timeframe
settling pond or series of ponds should be lined with an impervious liner capable of containing all contaminants found within the water they are designed to collect		
Areas where spills of oils and chemicals may occur should be equipped with easily accessible spill control kits to assist in prompt and effective spill control	Contractor(s)	Construction phase
Ensure that all practicable steps are taken to minimise the adverse effect of noise emissions. This responsibility includes not only the noise emitted from the plant and equipment but also associated noise sources, such as radios, loudspeakers and alarms	Contractor(s)	Construction phase
Where possible, waste concrete should be used for construction purposes at the batching plant or project site.	Contractor(s)	Construction phase
The batching plant should be monitored by the ECO/EO to ensure that the plant is operating according to its environmental objectives and within legislative requirements.	ECO/EO	Construction phase

Performance Indicator	» No complaints regarding dust » No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase » A complaints register must be maintained, in which any complaints from the community must be logged. Complaints will be investigated and, if appropriate, acted upon » An incident reporting system must be used to record non-conformances to the EMPr » Proponent or appointed ECO/EO must monitor indicators listed above to ensure that they have been met for the construction phase

5.4. Detailing Method Statements

OBJECTIVE 18 : Ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk

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

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

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

Method Statements must be compiled for all activities which affect any aspect of the environment and should be applied consistently to all activities. Specific areas to be addressed in the method statement: pre, during and post construction includes, *inter alia*:

» Site establishment (which explains all activities from induction training to offloading, construction sequence for site establishment and the different amenities to be established etc. Including a site camp plan indicating all of these).

- Preparation of the site (i.e. clearing vegetation, compacting soils and removing existing infrastructure and waste).
- Soil management/stockpiling and erosion control.
- Excavations and backfilling procedure.
- Batching procedures
- Stipulate norms and standards for water supply and usage (i.e.: comply strictly to licence and legislation requirements and restrictions)
- Stipulate the storm water management procedures recommended in the storm water management method statement (in accordance with the Storm Water Management Plan – Attached as **Appendix H**).
- Ablution facilities (placement, maintenance, management and servicing)
- Solid Waste Management:
  - Description of the waste storage facilities (on site and accumulative).
  - Placement of waste stored (on site and accumulative).
  - Management and collection of waste process.
  - Recycle, re-use and removal process and procedure.
- Liquid waste management:
  - The design, establish, maintain and operate suitable pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into rivers, streams or existing drainage systems.
  - Should grey water (i.e. water from basins, showers, baths, kitchen sinks etc.) need to be disposed of, link into an existing facilities where possible. Where no facilities are available, grey water runoff must be controlled to ensure there is no seepage into natural watercourses.
- Dust and noise pollution
  - Describe necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels.
  - Procedure to control dust at all times on the site, access roads, borrow pits and spoil sites (dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments). These impacts include visual pollution, decreased safety due to reduced visibility, negative effects on human health and the ecology due to dust particle accumulation.
- Hazardous substance storage (Ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, concrete, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply).
  - Lists of all potentially hazardous substances to be used.
  - Appropriate handling, storage and disposal procedures.
  - Prevention protocol of accidental contamination of soil at storage and handling areas.
  - All storage areas, (i.e.: for harmful substances appropriately bunded with a suitable collection point for accidental spills must be implemented and drip trays underneath dispensing mechanisms including leaking engines/machinery).
- Fire prevention and management measures on site.

» Fauna and flora protection process on and off site (i.e. removal to reintroduction or replanting, if necessary).
  * Rehabilitation and re-vegetation process.
» Incident and accident reporting protocol.
» General administration
» Designate access road and the protocol on while roads are in use.
» Requirements on gate control protocols.

The Contractor(s) may not commence the activity covered by the Method Statement until it has been provided to, reviewed and accepted by the Site Manager /Project Manager and/or ECO, except in the case of emergency activities and then only with the consent of the Site Manager. Review and accepted (or approval where required) of the Method Statement will not absolve the Contractor(s) from their obligations or responsibilities in terms of their contract. Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and accepted/approved.

The ECO and the EO must monitor the construction activities to ensure that these are undertaken in accordance with the approved Method Statement(s).

5.5 Awareness and Competence: Construction Phase of the Wind Energy Facility

OBJECTIVE 19 : To ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm

To achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this 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 Contractors obligations in this regard include the following:

» All employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment. This includes the discussion/explanation of site environmental matters during regular toolbox talks.
» The content and requirements of Method Statements are to be clearly explained to all plant operators and general workers. All staff acting in a supervisory capacity is to have copies of the relevant Method Statements and be aware of the content thereof.

- Ensuring that a copy of the EMPr is readily available on-site, and that all site staff are aware of the location and have access to the document.
- Senior site staff will be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the facility.
- Employees must undergo training for the operation and maintenance activities associated with a wind energy facility and have a basic knowledge of the potential environmental impacts that could occur and how they can be minimised and mitigated.
- Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course which can be done by the contractors environmental representative or the ECO.
- The course should be sufficient to provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- Awareness of any other environmental matters, which are deemed to be necessary by the ECO.
- Ensuring that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) are erected at prominent locations throughout the site.
- Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances, minimisation of disturbance to sensitive areas, management of waste, and prevention of water pollution.
- Records must be kept of those that have completed the relevant training.
- Training should be done either in a written or verbal format but must be in an appropriate format for the receiving audience.
- Refresher sessions must be held to ensure the contractor staff are aware of their environmental obligations as practically possible.
- All sub-contractors must have a copy of the EMPr and sign a declaration/acknowledgement that they are aware and familiar with the contents and requirements of the EMPr and that they will conduct work in such a manner as to ensure compliance with the requirements of the EMPr. All subcontractors performing the works should appoint a qualified Environmental Officer for the implementation of this EMPr and other project permits and authorisations.
- Contractors and main sub-contractors should have a basic training in the identification of archaeological sites/objects, and protected flora and fauna that may be encountered on the site.

Therefore, prior to the commencement of construction activities on site and before any person commences with work on site thereafter, adequate environmental awareness and responsibility are to be appropriately presented to all staff present onsite, clearly describing their obligations towards environmental controls and methodologies in terms of this EMPr.

5.5.1 Environmental Awareness Training

Environmental Awareness Training must take the form of an on-site talk and demonstration by the ECO before the commencement of site establishment and construction on site. The education/awareness programme should be aimed at all levels of management and construction workers within the contractor team. A record of attendance of this training must be maintained by the ECO on site.

5.5.2 Induction Training

Environmental induction training must be presented to all persons who are to work on the site – be it for short or long durations; Contractor's or Engineer's staff; administrative or site staff; sub-contractors or visitors to the site.

This induction training should include discussing the Proponent's environmental policy and values, the function of the EMPr and Contract Specifications and the importance and reasons for compliance to these. The induction training must highlight overall do's and don'ts on site and clarify the contractual and legal repercussions of non-compliance (penalty fees will be outlined in the service level agreement between the proponent and the contractor). The non-conformance reporting system must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the EO/ Environmental Representative on site.

5.5.3 Toolbox Talks

Toolbox talks should be held on a scheduled and regular basis (at least twice a month/ if necessary) where foremen, environmental and safety representatives of different components of the Works and sub-consultants hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and the prevention of reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

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

OBJECTIVE 20 : To monitor the performance of the control strategies employed against environmental objectives and standards

An environmental monitoring schedule should be developed and implemented not only to ensure conformance with the condition of the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. The independent ECO will be responsible for monitoring (on a monthly basis) for the most part on a monthly basis although will include others on a needs basis (also

refer to section 5.6.1 below). The Site Manager and Proponent's Environmental 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; and
» Aid communication and feedback to authorities and stakeholders.

The EO for the Contractor/s performing different aspects of activities on site must be appointed prior to site mobilisation and will be responsible for the day to day implementation of the EMPr and other project permits and authorisations. The EO will be responsible for weekly and monthly reporting to the ECO and Site Manager.

The ECO will ensure compliance with the EMPr during construction, and will conduct monitoring activities on a regular basis. An independent ECO must be appointed, and have the appropriate experience and qualifications to undertake the necessary tasks. The ECO will report any non-compliance or where corrective action is necessary to the Site Manager, DEA and/or any other monitoring body stipulated by the regulating authorities.

5.6.1 Non-Conformance Reports

All supervisory staff including Foremen, Resident Engineers, and the ECO/ EO must be provided the means to be able to submit non-conformance reports to the Site Manager. Non-conformance reports will describe, in detail, the cause, nature and effects of any environmental non-conformance by the Contractor. Records of penalties imposed may be required by the relevant authority.

The non-conformance report will be updated on completion of the corrective measures indicated on the finding sheet. The report must indicate that the remediation measures have been implemented timeously and that the non-conformance can be closed-out to the satisfaction of the Site Manager and ECO.

5.6.2 Monitoring Reports

A monitoring report will be compiled by the ECO on a monthly basis and must be submitted to DEA for their records (Director: Compliance Monitoring). This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents recorded, corrective action required, and details of those non-conformances or incidents which have been closed out. The ECO/EO will be responsible for the weekly and monthly reports which will be submitted internally which will aid the ECO in compiling the monitoring report. The monitoring report must be submitted to the DEA on the first week of the following month.

5.6.3 Audit Reports

The Proponent must ensure that project compliance with the conditions of the Environmental Authorisation (once issued) is audited, and that the audit reports re submitted to the Director: Compliance Monitoring at the DEA.

5.6.4 Final Audit Report

A final external audit should be conducted following the completion of rehabilitation after construction is completed. The audit report must be submitted to the DEA within 30 days of completion of the audit (i.e. within 30 days of site handover) and within 30 days of completion of rehabilitation activities.

The final environmental audit report must:

» Be compiled by an independent environmental auditor;
» Indicate the date of the audit, the name of the auditor and the outcome of the audit;
» Evaluate compliance with the requirements of the approved EMPr and the EA;
» Include measures to be implemented to attend to any non-compliances or degradation noted;
» Include copies of any approvals granted by other authorities relevant to the development for the reporting period;
» Highlight any outstanding environmental issues that must be addressed. Along with recommendations for ensuring these issues are appropriately addressed;
» Include a copy of the EA and the approved EMPr;
» Include all documentation such as waste disposal certificates, hazardous waste landfill site licenses etc. pertaining to the EA; and
» Include evidence of adherence to the conditions of this authorisation and the EMPr where relevant such as training records and attendance registers.

MANAGEMENT PROGRAMME FOR THE WIND ENERGY FACILITY
REHABILITATION OF DISTURBED AREAS CHAPTER 6

6.1. Overall Goal for the Rehabilitation of Disturbed Areas

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

» Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed (Refer to **Appendix E:** Revegetation and Rehabilitation Plan).

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

OBJECTIVE 1 : 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); » Temporary laydown areas; and » Watercourse crossing, i.e. access roads and culverts.
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	» Site preparation and earthworks » Excavation of foundations and trenches » Temporary laydown areas » Temporary access roads/tracks » Other disturbed areas/footprints
Mitigation: Target/Objective	» To ensure and encourage site rehabilitation of disturbed areas; and » 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
The site rehabilitation programme must be implemented (refer to **Appendix E**).	Contractor(s) and ECO/ EO in consultation with Specialist	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
All temporary facilities, equipment and waste materials must be removed from site and appropriately disposed of.	Contractor(s)	Following execution of the works.
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor(s)	Following completion of construction activities in an area.
Disturbed areas must 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 as far as practically possible.	Contractor(s) in consultation with rehabilitation specialist and the landowners.	Following completion of construction activities in an area.
No exotic plants may be used for rehabilitation purposes. Only indigenous plants of the area may be utilised.	Contractor(s)	Construction/ operation
Newly rehabilitated areas must be adequately demarcated and access restricted (specifically vehicular access) until vegetation is established. Appropriate signage must be established and maintained to ensure personnel are aware of these areas.	Contractor(s)	Construction/ operation
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Contractor(s) in consultation with rehabilitation specialist	Post-rehabilitation
On-going alien plant monitoring (as per the Alien invasive Management Plan- refer to **Appendix C**) and removal should be undertaken on all areas of natural vegetation on an annual basis.	Contractor(s) in consultation with rehabilitation specialist	Post-rehabilitation
All disturbed soil areas (including road and hard stand verges) should be compacted sufficiently to avoid increased burrowing of rodents (which in turn could attract raptors and result in turbine collisions). Disturbed areas should effectively rehabilitated with indigenous grass species as soon as possible.	Contractor(s) in consultation with the ECO/ EO	Following completion of construction activities in an area.

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 at least 50% plant cover achieved on rehabilitated sites; and » Closed site free of erosion and alien invasive plants.
Monitoring and Reporting	» 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. » An incident reporting system must be used to record non-conformances to the EMPr.

MANAGEMENT PROGRAMME FOR THE WIND ENERGY FACILITY: OPERATION CHAPTER 7

7.1. Overall Goal for Operation

Overall Goal for Operation: To ensure that the operation of the wind energy facility does not have unforeseen impacts on the environment and to ensure that all potential 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.

7.2. Roles and Responsibilities

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of wind energy facility's Operations Manager, and Environmental Manager for the operation phase of this project are detailed below.

The **O&M Operator** must:

» 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.

The **Environmental Manager** must:

» Develop and Implement an Environmental Management System (EMS) for the wind energy facility and associated infrastructure.
» Manage and report on the facility'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 if and when required.
» Liaise with statutory bodies such as the National and Provincial Department of Environmental Affairs (DEA) on environmental performance and other issues.

» Conduct environmental training and awareness for the employees who operate and maintain the wind energy facility.
» Compile environmental policies and procedures where required.
» Liaise with interested and affected parties on environmental issues of common concern.
» Track and control the lodging of any complaints regarding environmental matters.

7.3. Objectives

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

OBJECTIVE 1 : Securing the site

Safety issues may arise with public access to wind turbines (e.g. unauthorised entry to the site). Prevention and control measures to manage public access are therefore important.

Project component/s	» wind energy facility development footprint; » Access roads; and » Operations and service building.
Potential Impact	» Hazards to landowners and public
Activities/risk sources	» Uncontrolled access to the wind energy facility and associated infrastructure.
Mitigation: Target/Objective	» To secure the site against unauthorised entry; and » To protect members of the public/landowners/residents.

Mitigation: Action/control	Responsibility	Timeframe
Where necessary to control access, fence and secure access to the site and entrances to the site.	Proponent / O&M Operator	Operation
Post information boards about public safety hazards and emergency contact information.	Proponent / O&M Operator	Operation

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

OBJECTIVE 2 : Protection of indigenous natural vegetation, fauna and maintenance of rehabilitation

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

Project component/s	» Areas requiring regular maintenance » Route of the security team (if required) » Wind Energy Facility including access roads and laydown areas » Areas disturbed during the construction phase and subsequently rehabilitated at its completion » Watercourse crossings
Potential Impact	» Disturbance to or loss of vegetation and/or habitat. » Alien plant invasion. » Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention.
Activity/Risk Source	» Movement of employee vehicles within and around site.
Mitigation: Target/Objective	» Maintain minimised footprints of disturbance of vegetation/habitats on-site. » Ensure and encourage plant regrowth in non-operational areas of post-construction rehabilitation.

Mitigation: Action/Control	Responsibility	Timeframe
Vehicle movements must be restricted to designated roadways as far as practically possible.	Proponent / O&M Operator	Operation
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	O&M Operator	Operation
An on-going alien plant monitoring and eradication programme must be implemented, where necessary.	Proponent	Operation
A botanist familiar with the vegetation of the area should monitor the rehabilitation success and alien plant removal on an annual basis.	O&M Operator / Specialist	Annual monitoring until successful re-establishment of vegetation in an area
Fire breaks should be established, where appropriate	Proponent	Duration of

and as discussed with the landowners. Access roads could also act as fire breaks.	O&M Operator / Specialist	contract
Vegetation control within the facility should be by manual clearing and herbicides should not be used except to control alien plants in the prescribed manner if necessary.	Proponent O&M Operator / Specialist	Operation
An environmental manager / consultant should be appointed during operation whose duty it will be to minimise impacts on surrounding sensitive habitats	Contractor(s) and Proponent O&M Operator	Operation

Performance Indicator	» No further disturbance to vegetation or terrestrial faunal habitats. » Continued improvement of rehabilitation efforts.
Monitoring	» Observation of vegetation on-site by environmental manager / consultant. » Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas. » Annual monitoring with records of alien species presence and clearing actions » Annual monitoring with records of erosion problems and mitigation actions taken with photographs » If necessary, an on-going alien plant monitoring and removal should be undertaken on an annual basis or as deemed necessary by the Proponent Environmental Manager. This must be determined especially for the first 5 years of the operational phase where re-infestation is the highest, or until deemed unnecessary by a suitably qualified botanist/Proponent Environmental Management

OBJECTIVE 3 : Protection of avifauna and priority bird species

During operation of the facility, the threat of collision of birds and bats with the turbine blades and overhead power lines is considered to be of moderate to low significance for this facility. Four seasons of bird monitoring has been conducted and turbines have been removed from high risk areas. However, the real extent of this threat is not currently well understood within the South African context due to the limited numbers of wind turbines in South Africa with which bird interactions have been monitored. Bird monitoring must be undertaken during the operation of the facility.

Project component/s	» Wind energy facility (turbines); and » Associated infrastructure, i.e. overhead power lines
Potential Impact	» Disturbance to or loss of birds as a result of collision with the turbine blades;

	» Electrocution and collision with the power lines;
Activity/risk source	» Spinning turbine blades; » Unmarked overhead power lines;
Mitigation: Target/Objective	» More accurately determine the impact of the operating wind energy facility on priority bird species; and » Minimise impacts associated with the turbines, power lines

Mitigation: Action/control	Responsibility	Timeframe
Some mitigation options that can be employed if monitoring reveals significant numbers of collisions. Mitigation measures should be considered in detail at that time, if needs be.	Proponent O&M Operator / Suitably qualified specialist	Operation
A systematic bird monitoring programme should be implemented at this facility once operational, as per the current best practice guidelines.	Proponent O&M Operator in consultation with Specialist	Construction & operation
Review post-construction bird monitoring report on the full year of operational bird monitoring, and integrate findings into operational EMPr and broader mitigation scheme if and where considered necessary.	Advising scientist/biologist/ monitoring agency/avifauna specialist	1 year post-construction

Performance Indicator	» Limit additional disturbance to bird populations on the wind energy facility site. » Continued improvement of bird protection devices, if any. » 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 and Reporting	» Observation of avifaunal populations and incidence of injuries/death from collisions from turbine blades. » Environmental manager to monitor turbine field for fatalities. » Review of bird monitoring report on the full year of post-construction monitoring » Condition 43 and 44 of the EA

OBJECTIVE 4 : Protection of Bats

Bats have been found to be particularly vulnerable to being killed by wind turbines. Pre-construction bat monitoring has been completed for all 4 seasons for the project development site.

Project component/s	» access roads; » substation; » wind turbines; and » associated infrastructure
Potential Impact	» Bat mortality and destruction of habitat / roosts.
Activity/risk source	» Wind turbine placement
Mitigation: Target/Objective	» Reduce impacts on bat species

Mitigation: Action/control	Responsibility	Timeframe
A post-construction bat monitoring by an independent monitor should take place for at least two years after operation has commenced.	Proponent	Operational Phase
Implement any feasible mitigation measures for bats based on the operational phase bat monitoring if required. Further mitigation options that may be utilized include curtailment, blade feathering, blade lock, acoustic deterrents or light lures.	Proponent O&M Operator and specialist	Operational Phase

Performance Indicator	» No additional disturbance to bat populations on the wind energy facility site. » Continued improvement of bat protection devices, if any. » Regular provision of clearly worded, logical and objective information on the interface between the bat populations and the proposed/ operating wind energy facility. » Clear and logical recommendations on why, how and when to institute mitigation measures to reduce bat impacts of the development, from pre-construction to operational phase.
Monitoring and Reporting	» Environmental manager to monitor turbine field for fatalities.

OBJECTIVE 5 : Minimisation of visual impact - lighting

The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate to any significant extent within this landscape. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's Marking of Obstacles expressly states, "Wind turbines shall be painted 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. The Gunstfontein Wind Energy Facility will have synchronous flashing lights on the turbines representing the outer perimeter of the facility and Pilot Activated Lighting (PAL) is being investigated to further reduce impact. In this manner less warning lights is 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 Proponent 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. The operational, security and safety lighting fixtures of the proposed wind energy facility will have some impact on telescopic observations from the Southern African Large Telescope (SALT), located 25km from the closest Gunstfontein turbine. The SALT relies on keeping ambient lighting levels to a minimum in order to maximise its operational potential. SALT are being engaged with.

Project component/s	List of project components affecting the objective: » Wind energy facility (including access roads and turbines); and » Associated infrastructure
Potential Impact	» Risk to aircraft in terms of the potential for collision; and » Enhanced visual intrusion.
Activity/risk source	» Size/scale of turbines » Associated lighting » Wind turbines and other infrastructure » Access roads » Other associated infrastructure
Mitigation: Target/Objective	» To minimise potential for visual impact; » To ensure that the facility complies with Civil Aviation Authority requirements for turbine visibility to aircraft; and » Minimise contrast with surrounding environment and visibility of the turbines to humans.

Mitigation: Action/control	Responsibility	Timeframe
Aviation warning lights must be mounted on turbine hub	Proponent /	Operation and

Mitigation: Action/control	Responsibility	Timeframe
or such measures specified by the Civil Aviation Authority consent.	O&M Operator	maintenance
Ensure that proper planning is undertaken regarding the placement of lighting structures for the turbines and ancillary buildings.	Proponent / O&M Operator	Design
Maintain the general appearance of the facility in an aesthetically pleasing way.	Proponent / O&M Operator	Operation and maintenance
Undertake regular maintenance of light fixtures.	Proponent / O&M Operator	Operation and maintenance

Performance Indicator	» Minimised visual intrusion on surrounding areas. » Appropriate visibility of infrastructure to aircraft.
Monitoring and Reporting	» Ensure that aviation warning lights or other measures are installed before construction is completed and are fully functional at all times. » The monitoring of the condition and functioning of the light fixtures during the operational phase of the project.

OBJECTIVE 6 : Minimisation of noise impacts from turbines

From the results of the EIA studies undertaken, noise impacts associated with the wind energy facility are expected to be of low significance. However, mitigation measures are proposed in order to further reduce any potential for noise impact. The rating level in the area for the wind energy facility is likely to be 35 dBA at night. That would also be the "lower limit". Due to the limited noise receptors in and around the site (as identified in the noise impact assessment report), noise from the turbine is unlikely to negatively affect any residents in the broader study area.

Project component/s	» Wind energy facility (including access roads).
Potential Impact	» Increased noise levels at potentially sensitive receptors; » Changing ambient sound levels could change the acceptable land use capability; and » Disturbing character of sound.
Activity/risk source	» Operation of wind turbines
Mitigation: Target/Objective	» Ensure that the change in ambient sound levels (measured in L_{Aeq}) as experienced by Potentially Sensitive Receptors is less than 5 dBA; (change from the measured and calculated ambient sound levels for the corresponding wind speed); » Prevent the generation of disturbing noise from the wind turbines; and

	» Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors

Mitigation: Action/control	Responsibility	Timeframe
If required, additional noise monitoring points at a complainant that registered a valid and reasonable noise complaint relating to the operation of the facility	Proponent/ O&M Operator / Acoustical Consultant / Approved Noise Inspection Authority	Operation

Performance Indicator	» Ensure that the change in ambient sound levels (L_{Aeq}) as experienced by Potentially Sensitive Receptors is less than 7 dBA.
Monitoring and Reporting	» A complaints register must be maintained, in which any complaints from the community are to be logged. Complaints must be investigated and, if appropriate, acted upon.

OBJECTIVE 7 : 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 turbines; and » Associated infrastructure.
Potential Impact	» Inefficient use of resources resulting in excessive waste generation; and » Litter or contamination of the site or water through poor waste management practices.
Activity/risk source	» Generators and gearbox – turbines; and » Fuel and oil storage.
Mitigation: Target/Objective	» To comply with waste management legislation; » To minimise production of waste; » To ensure appropriate waste disposal; and » 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	Proponent	Operation

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

Performance Indicator	» No complaints received regarding waste on site or dumping; » Internal site audits identifying that waste segregation, recycling and reuse is occurring appropriately; » Provision of all appropriate waste manifests; and » No contamination of soil or water.
Monitoring and Reporting	» Waste collection must be monitored internally 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; and » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the environmental manager. All appropriate waste disposal certificates must accompany the monthly reports.

OBJECTIVE 8 : Maximise local employment and business opportunities during operation

A limited number of permanent employment opportunities will be created during the operational phase of the project. The operational phase is expected to last for 20 - 25 years.

Project component/s	» Wind energy facility; and » 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 as far as possible.
Activity/risk source	» The operational phase of the wind energy facility will create permanent 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	» Create medium- to long-term full time employment for locals.

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.	Proponent / O&M Operator	Identify members during construction
Develop a training and skills transfer programme for the operational phase for local personnel.	Proponent / O&M Operator	Operations

Performance Indicator	» Public exposure to the project. » Meeting with Local Municipality; and » Training and skills development programme developed and designed before construction phase completed.
Monitoring and Reporting	» Indicators listed above must be met for the operational phase.

OBJECTIVE 9 : Ensure the implementation of an appropriate fire management plan during the operation phase

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

Project Component/s	» Operation and maintenance of the wind energy facility and associated infrastructure.
Potential Impact	» Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences. In addition, fire can pose a very minor risk to the wind energy facility infrastructure.
Activities/Risk Sources	» The presence of operation and maintenance personnel and their activities on the site can increase the risk of veld fires.
Mitigation: Target/Objective	» To avoid and or minimise the potential risk of veld fires on local communities and their livelihoods.

Mitigation: Action/Control	Responsibility	Timeframe
Provide adequate fire-fighting equipment on site.	Proponent / O&M Operator	Operation
Join local Fire Protection Association, should there be one in existence.	Proponent / O&M Operator	Operation
Provide fire-fighting training to selected operation and maintenance staff.	Proponent / O&M Operator	Operation
Ensure that appropriate communication channels are established to be implemented in the event of a fire.	Proponent / O&M Operator	Operation
Fire breaks should be established where and when required in consultation with the landowners. Cognisance must be taken of the relevant legislation when planning and burning firebreaks (in terms of timing, etc.). Access roads may also act as fire breaks.	Proponent / O&M Operator	Operation
Upon completion of the construction phase, an emergency evacuation plan must be drawn up to ensure the safety of the staff and surrounding land users in the case of an emergency.	Proponent / O&M Operator	Operation
Contact details of emergency services should be prominently displayed on site.	Proponent / O&M Operator	Operation

Performance Indicator	» Fire-fighting equipment and training provided before the construction phase commences. » Appropriate fire breaks in place.
Monitoring and Reporting	» Proponent must monitor indicators listed above to ensure that they have been met.

OBJECTIVE 10 : Minimise the potential negative impact on farming activities and on the surrounding landowners

Once operational, the negative impact on the daily living and movement patterns of neighbouring residents is expected to be minimal and intermittent (i.e. the increase in traffic to and from site, possible dust creation of vehicle movement on gravel roads on site and possible increase in criminal activities). The number of workers on site on a daily basis is anticipated to have minimal negative social impacts in this regard.

Some positive impacts will be experienced with farmers gaining more access to land through the high quality site roads. Farmers involved with the project will also receive income which can be invested into farming activities. Once construction is completed, negative impacts on farming activities on the site must be limited as far as possible.

Project Component/s	» Possible negative impacts of activities undertaken on site on the activities of surrounding property owners; and » Impact on farming activities on site.
Potential Impact	» Limited intrusion impact on surrounding land owners; and » Interference with farming activities on site.
Activities/Risk Sources	» Increase in traffic to and from site could affect daily living and movement patterns of surrounding residents, and » Operational activities on site could interfere with farming activities of landowner.
Mitigation: Target/Objective	» Effective management of the facility; » Mitigation of intrusion impacts on property owners; and » Mitigation of impact on farming activities.

Mitigation: Action/Control	Responsibility	Timeframe
Effective management of the facility and accommodation facility to avoid any environmental pollution focusing on water, waste and sanitation infrastructure and services.	Proponent / O&M Operator	Operation
Vehicle movement to and from the site should be minimised as far as possible.	Proponent / O&M Operator	Operation
Local roads should be maintained to keep the road surface up to a reasonable standard.	O&M Operator	Operation
Limit the development of new access roads on site.	O&M Operator	Operation
Ensure on-going communication with the landowners of the site in order to ensure minimal impact on farming activities.	Proponent / O&M Operator	Operation

Performance Indicator	» No environmental pollution occurs (i.e. waste, water and sanitation); » No intrusion on private properties and on the activities undertaken on the surrounding properties; and » Continuation of farming activities on site.

Monitoring and reporting	» Proponent should be able to demonstrate that facility is well managed without environmental pollution and that the above requirements have been met.

MANAGEMENT PLAN FOR THE WIND ENERGY FACILITY: DECOMMISSIONING CHAPTER 8

The turbine infrastructures which will be utilised for the proposed wind energy facility are expected to have a lifespan of 20 - 25 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. The relevant mitigation measures contained under the construction section should be applied during decommissioning and therefore is not repeated in this section. It must be noted that decommissioning activities will need to be undertaken in accordance with the relevant legislation applicable at that time, which may require this section of the EMPr to be revisited and amended.

8.1. Site Preparation

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

8.2 Disassemble Turbines

The wind (turbine and tower sections) of the proposed facility will be disassembled once it reaches the end of its economic lifespan. A large crane would be required for disassembling the turbine and tower sections. Once disassembled, the components will be reused, recycled, or disposed of in accordance with regulatory requirements (NEMA / NEM:WA). All parts of the turbine would be considered reusable or recyclable except for the blades.

8.3 Rehabilitation of the Site

In order to minimise the extent of rehabilitation activities required during the decommissioning phase, the project Proponent must ensure that constant effort is applied to rehabilitation activities throughout the construction, operation and maintenance phases of the project.

In decommissioning of the facility the Proponent must ensure that:

- All sites not already vegetated are vegetated as soon as possible after operation ceases with species appropriate to the area.
- Any fauna encountered during decommission should be removed to safety by a suitably qualified person.
- All structures, foundations (to at least 750mm below ground level) and sealed areas are demolished, removed and waste material disposed of at an appropriately licensed waste disposal site.
- All access/service roads not required to be retained by landowners are closed and fully rehabilitated.
- All vehicles to adhere to low speed limits (40km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust.
- All disturbed areas are compacted, sloped and contoured to ensure drainage and runoff and to minimise the risk of erosion.
- All rehabilitated areas are monitored for erosion.
- Components of the facility are removed from the site and disposed of appropriately.
- Retrenchments should comply with South African Labour legislation of the day.

The section on Rehabilitation (Chapter 6) is also relevant to the decommissioning of sections of the proposed Project and must be adhered to.

OBJECTIVE 1 : To avoid and or minimise the potential environmental and social impacts associated with the decommissioning phase

Project component/s	» wind turbines; » substation; and » associated infrastructure.
Potential Impact	» Impacts on people, flora, fauna, soils etc.
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.	O&M Operator	Decommissioning.
Proponent must ensure that all relevant regulations, national and local legislation are adhered to and that the relevant authorities are informed and involved in the process as much as possible.	Proponent	Decommissioning
Rehabilitation should start immediately after	Proponent / O&M	Decommissioning

Mitigation: Action/control	Responsibility	Timeframe
decommissioning is completed.	Operator / Contractor	
Re-vegetation specifications to be developed.	Proponent / O&M Operator / contractor	Decommissioning
All excavations must be rehabilitated with soil and topsoil, which should not contain invasive plant species (in compliance with the CARA, as amended), to the satisfaction of the ECO.	O&M Operator / Contractor	Decommissioning
All building materials must be removed from the site. All compacted surfaces must be ripped and re-vegetated as per the re-vegetation specifications.	O&M Operator / Contractor	Decommissioning
The most suitable seed mix for disturbed areas to be used in rehabilitation would include indigenous species.	O&M Operator / Contractor	Decommissioning
Rehabilitation to be conducted in a progressive manner (i.e. once decommissioning in an area has been completed the area will be rehabilitated). The rehabilitation of the area with indigenous vegetation must coincide with the rainfall events and all alien invasive vegetation shall be removed.	O&M Operator / Contractor	Decommissioning
Rehabilitation measures for the site are to include the following: » Re-contouring Subsoil stockpiles should be used to re-contour construction affected areas. The Contractor shall restore the profile, soil condition and landform to as close as possible state to the pre-construction state. » Scarification and ripping All areas where rehabilitation interventions are required shall be cross-ripped before topsoil placement. Topsoil and fertile soil shall be uniformly scarified to allow for vegetation growth » Fertilising The Contractor shall be required to perform soil analysis tests on the top 75mm of prepared surface prior to re-vegetation/seeding to determine the required fertiliser levels for permanent cover. » Seed acquisition The Contractor shall purchase seed from a South African National Seed Organisation (SANSOR) accredited dealer. Seed used for rehabilitation shall not be older than one season. Purchased seed must be of the correct species and of known origin, dried and packed, conforming to all legal requirements for seed. Proof of compliance must be provided to Proponent	Proponent and O&M Operator / Contractor	Decommissioning

Mitigation: Action/control	Responsibility	Timeframe
prior decommissioning of works.		
The Contractor shall schedule works for placing of topsoil once all infrastructure has been successfully decommissioned. Seeding can then take place after the first rains of the season and should be concluded by one month before the end of the growing season.	O&M Operator / Contractor	Decommissioning
The seed mix for use in rehabilitation must be an approved mix of indigenous grass species common to the area.	O&M Operator / Contractor	Decommissioning
The Contractor shall maintain rehabilitated areas free of weeds and invader plants until the end of the Defects Notification Period applicable to rehabilitation. Control of weeds and invader plants must be done in accordance with the specifications stipulated in the CARA.	O&M Operator / Contractor	Decommissioning
The Contractor shall be responsible for the prevention of erosion in areas impacted upon by their activities. All erosion repairs must be implemented at the first signs thereof and no erosion shall be allowed to develop on a large scale.	O&M Operator / Contractor	Decommissioning
All recyclable rubble and solid waste (e.g. scrap metal, cables, bottles, cans, and plastic residues) shall be collected and disposed of through a registered recycling company. Waste manifests will be kept by the Contractor and shown to the ECO on request. All non-recyclable rubble and solid waste shall be collected and disposed of at an approved waste disposal site. Waste manifests will be shown to the ECO on request.	O&M Operator / Contractor	Decommissioning

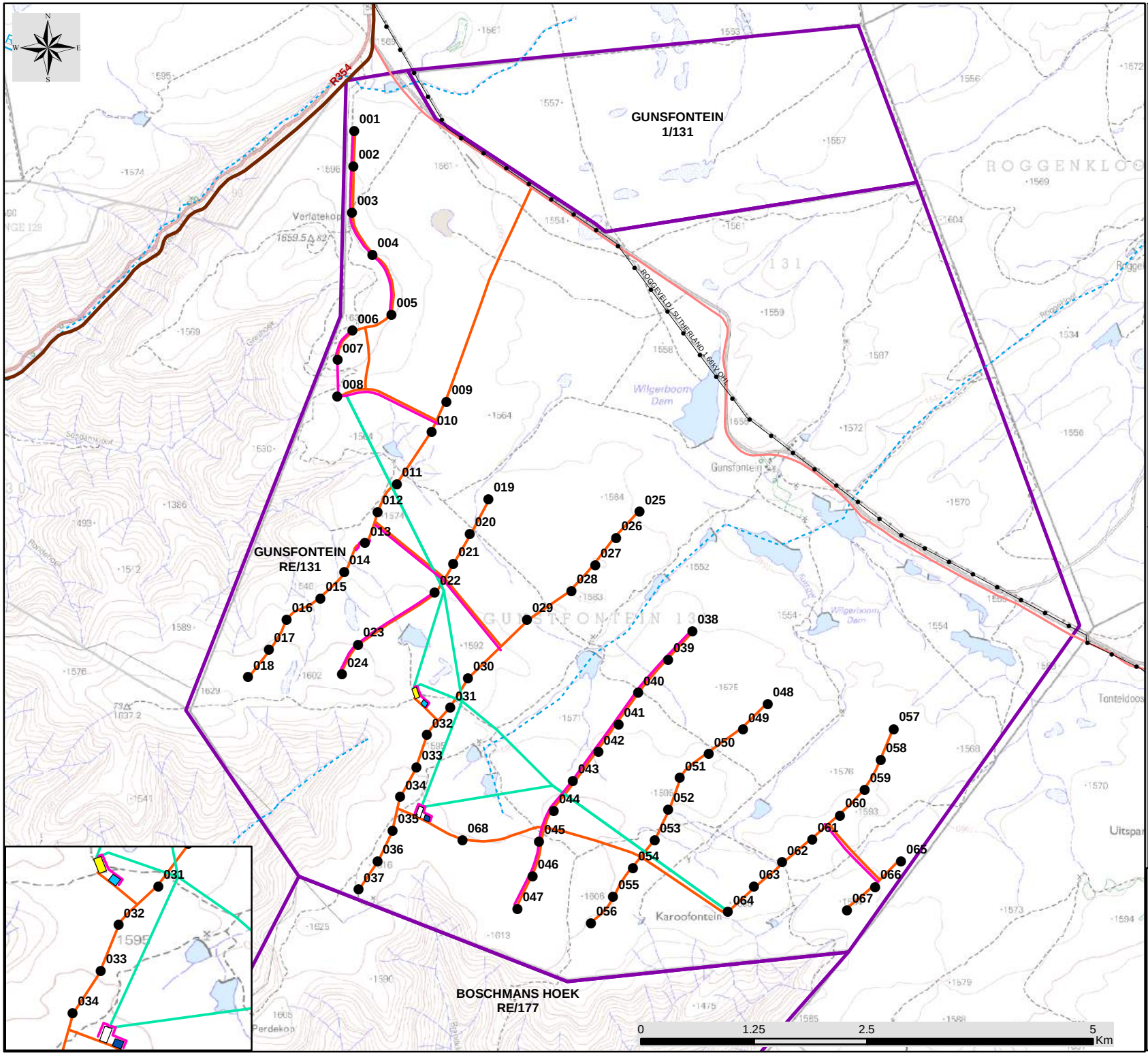
Performance Indicator	» South African Labour legislation at the relevant time; and » Successful re-vegetation and rehabilitation of the site
Monitoring	Monitoring of Rehabilitation by Project Proponent & Rehabilitation Close-Out Report.

FINALISATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME CHAPTER 9

The EMPr is a dynamic document, which must be updated when required. It is considered critical that this draft EMPr be updated to include site-specific information and specifications following the final walk-through surveys (flora, fauna, avifauna, bats, and heritage) and site development footprint, including the access roads and power line routes. This will ensure that the construction and operation activities are planned and implemented taking sensitive environmental features into account.

Appendix A:

A3 Layout and Sensitivity Maps



Gunstfontein Wind Energy Facility

Environmental Sensitivity & Optimised Layout Map (Mitigation Strategy)

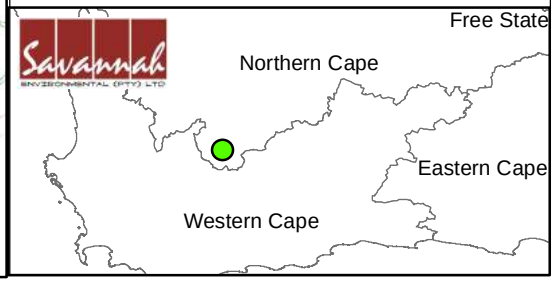
Legend

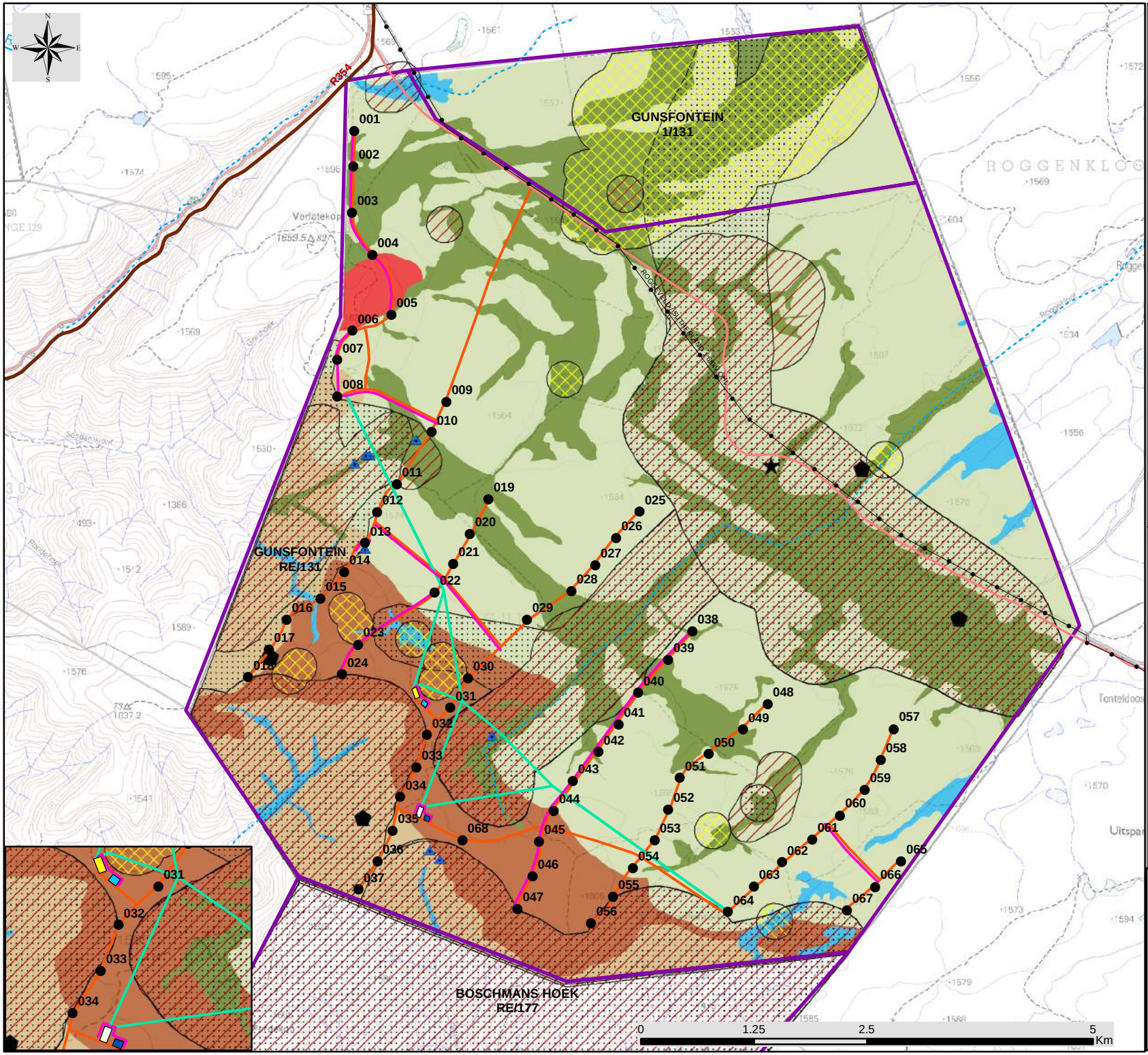
- Existing Power Line
- Regional road
- Secondary road
- Perennial river
- Non perennial river
- Gunsfontein Project site

Layout Plan:

- Turbines
- Facility Substation Alternative 1 (Preferred)
- Building Alternative 1 (Preferred)
- Facility Substation Alternative 2
- Building Alternative 2
- MV Overhead Line
- MV Underground Line
- New Access Road

Gunstfontein Wind - Optimised layout - 23.02.16





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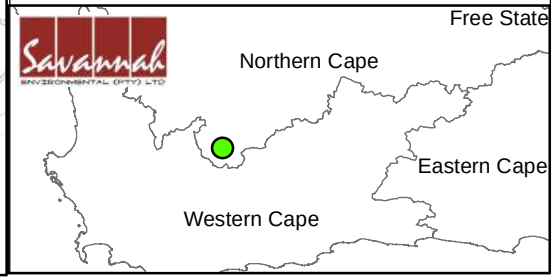
- MV Underground Line
- New Access Road

Environmental Sensitivities:

- Heritage Sites (Medium Sensitivity)
- Uranium Anomalies (Medium Sensitivity)
- Noise Sensitive Developments (High Sensitivity)
- Very High Bat Sensitive Areas (No-go Areas)
- High Bat Sensitive Areas (High Bat Sensitivity)
- Sensitive Avifauna Habitats (No-go Areas)
- Drainage (Very High Ecological Sensitivity)
- Hill (Very High Ecological Sensitivity)
- Lowlands (Very High Ecological Sensitivity)
- Escarpment (High Ecological Sensitivity)
- Mountain Slopes (High Ecological Sensitivity)
- Plateau (Medium Ecological Sensitivity)

Gunstfontein Wind - Environmental Sensitivity (optimised layout) - 03.02.16



Appendix B:

Grievance Mechanism for Public Complaints and Issues

GRIEVANCE MECHANISM / PROCESS

PURPOSE

This Grievance Mechanism has been developed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The aim of the grievance mechanism is to ensure that grievances or concerns raised by local landowners and or communities are addressed in a manner that:

» Provides a predictable, transparent, and credible process to all parties, resulting in outcomes that are seen as fair, effective, and lasting.
» Builds trust as an integral component of broader community relations activities.
» Enables more systematic identification of emerging issues and trends, facilitating corrective action and pre-emptive engagement.

The aim of this Grievance Mechanism is to address grievances in a manner that does not require a potentially costly and time consuming legal process.

PROCEDURE FOR RECEIVING AND RESOLVING GRIEVANCES

» Local landowners, communities and authorities must be informed in writing by the Proponent of the grievance mechanism and the process by which grievances can be brought to the attention of the Proponent through its designated representative.
» A company representative must be appointed as the contact person for grievances to be addressed to. The name and contact details of the contact person must be provided to local landowners, communities and authorities.
» Project related grievances relating to the construction, operational and or decommissioning phase must be addressed in writing to the contact person. The contact person should assist local landowners and or communities who may lack resources to submit/prepare written grievances.
» The grievance must be registered with the contact person who, within 5 working days of receipt of the grievance, must contact the Complainant to discuss the grievance and agree on suitable date and venue for a meeting in order to discuss the grievances raised. Unless otherwise agreed, the meeting should be held within 3 weeks of receipt of the grievance.
» The contact person must draft a letter to be sent to the Complainant acknowledging receipt of the grievance, the name and contact details of Complainant, the nature of the grievance, the date that the grievance was raised, and the date and venue for the meeting (once agreed).
» Prior to the meeting being held the contact person must contact the Complainant to discuss and agree on the parties who should attend the

meeting. The people who will be required to attend the meeting will depend on the nature of the grievance. While the Complainant and or proponent are entitled to invite their legal representatives to attend the meeting/s, it should be made clear that to all the parties involved in the process that the grievance mechanism process is not a legal process. It is therefore recommended that the involvement of legal representatives be limited.

» The meeting should be chaired by the Proponent's representative appointed to address grievances. The Proponent must provide a person to take minutes of and record the meeting/s. Any costs associated with hiring venues must be covered by the Proponent.

» Draft copies of the minutes must be made available to the Complainant and the Proponent within 4 working days of the meeting being held. Unless otherwise agreed, comments on the Draft Minutes must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days of receipt of the draft minutes.

» In the event of the grievance being resolved to the satisfaction of all the parties concerned, the outcome must recorded and signed off by the relevant parties. The record should provide details of the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.

» In the event of a dispute between the Complainant and the Proponent regarding the grievance, the option of appointing an independent mediator to assist with resolving the issue should be discussed. The record of the meeting/s must note that a dispute has arisen and that the grievance has not been resolved to the satisfaction of all the parties concerned.

» In the event that the parties agree to appoint a mediator, the Proponent will be required to identify three (3) mediators and forward the names and CVs to the Complainant within 2 weeks of such agreement being reached. The Complainant, in consultation with the Proponent, must identify the preferred mediator and agree on a date for the next meeting. The cost of the mediator must be borne by the Proponent however the mediator may rule that the Complainant must re-imburse the Proponent a proportion of these costs. The Proponent must provide a person to take minutes of and record the meeting/s.

» In the event of the grievance, with the assistance of the mediator, being resolved to the satisfaction of all the parties concerned, the outcome must be recorded and signed off by the relevant parties, including the mediator. The record should provide details on the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.

» In the event of the dispute not being resolved, the mediator must prepare a draft report that summaries the nature of the grievance and the dispute. The report should include a recommendation by the mediator on the proposed way forward with regard to the addressing the grievance.
» The draft report must be made available to the Complainant and the Proponent for comment before being finalised and signed by all parties. Unless otherwise agreed, comments on the draft report must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days. The way forward will be informed by the recommendations of the mediator and the nature of the grievance.

A Complaint is closed out when no further action can be or needs to be taken. Closure status will be classified in the Complaints Register as follows:

» Resolved. Complaints where a resolution has been agreed and implemented and the Complainant has signed the Confirmation Form.
» Unresolved. Complaints where it has not been possible to reach an agreed resolution and the case has been authorised for close out by the Appeals Committee.
» Abandoned. Complaints where the Complainant is not contactable after one month following receipt of a Complaint and efforts to trace his or her whereabouts have been unsuccessful.

The grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. In the event of the grievance not being resolved to the satisfaction of Complainant and or the Proponent, either party may be of the opinion that legal action may be the most appropriate option.

Appendix C:

Alien Invasive and Open Space Management Plan

ALIEN INVASIVE AND OPEN SPACE MANAGEMENT PLAN

1. PURPOSE

Invasive alien species pose the second largest threat to biodiversity after direct habitat destruction. The purpose of this Alien Invasive and Open Space Management Plan is to provide a framework for the management of alien and invasive plant species and the integrated management of the natural and semi-natural areas within the development area during the construction and operation of the Gunstfontein Wind Energy Facility. The broad objectives of the plan includes the following:

» Ensure alien plants do not become dominant in parts or throughout the whole site through the control and management of alien and invasive species presence, dispersal and encroachment.
» Managing and maintaining the ecosystem in a near-natural state and restoring and/or rehabilitating the ecosystems to such a state.
» Develop and implement a monitoring and eradication programme for alien and invasive species.
» Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

2. RELEVANT ASPECTS OF THE SITE

The disturbance associated with the construction of the facility will encourage the invasion of alien species into areas with very low current levels of invasion. Some alien invasion is inevitable and regular alien clearing activities would be required to limit the extent of this problem. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion, however, the roadsides and turbine service areas are likely to remain foci of alien plant invasion. This impact is highly likely to occur during the operational phase of the development. The construction phase is considered too short for significant alien plant invasion to occur despite the fact that many alien species are likely to be imported at this point. Species observed to be problematic in the area include:

» *Bromus spp.*
» *Avena fatua*
» *Erodium cicutarium*
» *Salsola kali*
» *Malva parviflora*
» *Prosopis glandulosa*
» *Atriplex inflata*

Although the presence of these species within the development area are not directly of concern to the development of the wind energy facility, these are the species that are likely to become a problem within the disturbed areas of the site on account of seed input from these adjacent areas.

3. LEGISLATIVE CONTEXT

Conservation of Agricultural Resources Act (Act No. 43 of 1983)

In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act (Act No. 43 of 1983), all declared aliens must be effectively controlled. Landowners are legally responsible for the control of invasive alien plants on their properties. In terms of this Act, 198 alien species were listed as declared weeds and invaders and ascribed to one of the following categories:

» Category 1: Prohibited and must be controlled.
» Category 2 (commercially used plants): May be grown in demarcated areas provided that there is a permit and that steps are taken to prevent their spread.
» Category 3 (ornamentally used plants): May no longer be planted. Existing plants may be retained as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)

The National Environmental Management: Biodiversity Act (NEM:BA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Regulations have been published in Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEMBA. According to this Act and the regulations, any species designated under Section 70 cannot be propagated, grown, bought or sold without a permit. Below is an explanation of the three categories:

» Category 1a: Invasive species requiring compulsory control. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
» Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
» Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Cat 2 plants to exist in riparian zones.

» Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Cat 3 plants to exist in riparian zones.

Plants listed under the categories above are detailed within Notice 1 of the Alien and Invasive Species published in GNR599 of 01 August 2014. The following guide is a useful starting point for the identification of alien species: Bromilow, C. 2010. Problem Plants and Alien Weeds of South Africa. Briza, Pretoria.

It is important to note that alien species that are regulated in terms of the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) as weeds and invader plants are exempted from NEM:BA. This implies that the provisions of the CARA in respect of listed weed and invader plants supersede those of NEM:BA.

4. ALIEN PLANT MANAGEMENT PRINCIPLES

4.1. Prevention and early eradication

A prevention strategy should be considered and established, including regular surveys and monitoring for the presence of invasive alien plants, effective rehabilitation of disturbed areas and prevention of unnecessary disturbance of natural areas.

Monitoring plans should be developed which are designed to identify Invasive Alien Plant Species shortly after they establish in the project area. Keeping up to date on which weeds are an immediate threat to the site is important, but efforts should be planned to update this information on a regular basis. When new Invasive Alien Plant Species are recorded on site, an immediate response of identifying the area for future monitoring and either hand-pulling the weeds or an application of a suitable herbicide should be planned. It is, however, better to monitor regularly and act swiftly than to allow invasive alien plants to become established on site.

4.2. Containment and control

If any alien invasive plants are found to become established on site, action plans for their control should be developed, depending on the size of the infestations, budgets, manpower considerations and time. Separate plans and control actions should be developed for each location and/or each species. Appropriate registered chemicals and other possible control agents should be considered in the action plans for each site/species. The key is to ensure that no invasions get out of control. Effective containment and control will ensure that the least energy and resources are required to maintain this status over the long-term. This will also be an indicator that natural systems are impacted to the smallest degree possible.

4.3. General Clearing and Guiding Principles

Alien control programs are long-term management projects and should include a clearing plan which includes follow up actions for rehabilitation of the cleared area. The lighter infested areas should be cleared first to prevent the build-up of seed banks. Pre-existing dense mature stands ideally should be left for last, as they probably will not increase in density or pose a greater threat than they are currently. Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of aliens are easily dispersed across boundaries by wind or watercourses. All clearing actions should be monitored and documented to keep records of which areas are due for follow-up clearing.

i. Clearing Methods

Different species require different clearing methods such as manual, chemical or biological methods or a combination of both. Care should however be taken that the clearing methods used do not encourage further invasion. As such, regardless of the methods used, disturbance to the soil should be kept to a minimum.

Fire shall not be used for alien control or vegetation management at the site. The best-practice clearing method for each species identified should be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water

» **Mechanical control**

This entails damaging or removing the plant by physical action. Different techniques could be used, e.g. uprooting, felling, slashing, mowing, ringbarking or bark stripping. This control option is only really feasible in sparse infestations or on small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice, need to have the cut stumps or coppice growth treated with herbicides following the mechanical treatment. Mechanical control is labour intensive and therefore expensive, and could cause severe soil disturbance and erosion.

» **Chemical Control**

Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance which stimulates alien invasion and may also be ineffective for many woody species which re-sprout. Where herbicides are to be used, the impact of the operation on the natural environment should be minimised by observing the following:

* Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control.

- All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.
- Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of at a suitable site.
- To avoid damage to indigenous or other desirable vegetation, products should be selected that will have the least effect on non-target vegetation.
- Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation.
- The appropriate health and safety procedures should also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the following Regulations and guidelines should be followed:

- Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.
- Pesticide Management Policy for South Africa published in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947) – GNR 1120 of 2010.
- South African Bureau of Standards, Standard SANS 10206 (2010)

According to Government Notice No. 13424 dated 26 July 1992, it is an offence to "*acquire, dispose, sell or use an agricultural or stock remedy for a purpose or in a manner other than that specified on the label on a container thereof or on such a container*".

Contractors using herbicides need to have a valid Pest Control Operators License (limited weeds controller) according to the Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947). This is regulated by the Department of Agriculture, Forestry and Fisheries (DAFF).

» **Biological control**

Biological weed control consists in the use of natural enemies to reduce the vigour or reproductive potential of an invasive alien plant. Biological control agents include insects, mites, and micro-organisms such as fungi or bacteria. They usually attack specific parts of the plant, either the reproductive organs directly (flower buds, flowers or fruit) or the seeds after they have dropped. The stress caused by the biological control agent may kill a plant outright or it might impact on the plants reproductive capacity. In certain instances, the reproductive capacity is reduced to zero and the population is effectively sterilised. All of these outcomes will help to reduce the spread of the species.

To obtain biocontrol agents, provincial representatives of the Working for Water Programme or the Directorate: Land Use and Soil Management (LUSM), Department of Agriculture, Forestry and Fisheries (DAFF) can be contacted.

4.4. General management practices

The following general management practices should be encouraged or strived for:

- Establish an ongoing monitoring programme for the construction phase to detect and quantify any alien species that may become established and identify the problem species.
- Alien vegetation regrowth on areas disturbed by construction must be immediately controlled once recorded - throughout the entire site during construction and operation.
- Care must be taken to avoid the introduction of alien invasive plant species to the site. Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment. Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.
- Cleared areas that have become invaded by alien species can be sprayed with appropriate herbicides provided that these are such that they break down on contact with the soil. Residual herbicides should not be used. Mechanical/ manual method should however also be considered as an option.
- The effectiveness of vegetation control varies seasonally and this is also likely to impact alien species. Control early in the wet season will allow species to re-grow and follow-up control is likely to be required. It is tempting to leave control until late in the wet season to avoid follow-up control. However, this may allow alien species to set seed before control and hence will not contribute towards reducing alien species abundance. Therefore, vegetation control should be aimed at the middle of the wet season, with a follow-up event towards the end of the wet season. There are no exact dates that can be specified here as each season is unique and management must therefore respond according to the state and progression of the vegetation.
- Alien management is an iterative process and it may require repeated control efforts to significantly reduce the abundance of a species. This is often due to the presence of large and persistent seed banks. However, repeated control usually results in rapid decline once seed banks become depleted.
- Some alien species are best individually pulled by hand and removed from the site.
- Regular vegetation control to reduce plant biomass within the site should be conducted. This should be timed so as to coincide with the critical growth phases of the most important alien species on site. This will significantly reduce the cost of alien management as this should contribute towards the control of the dominant alien species and additional targeted control will be required only for a limited number of species.

» No alien species should be cultivated on-site. If vegetation is required for aesthetic purposes, then non-invasive, water-wise locally-occurring species should be used.
» During operation, surveys for alien species should be conducted regularly. It is recommended that this be undertaken every 6 months for the first two years after construction and annually thereafter. All aliens identified should be cleared using appropriate means.

4.5. Monitoring

In order to monitor the impact of clearing activities, follow-ups and rehabilitation efforts, monitoring must be undertaken. This section provides a description of a possible monitoring programme that will provide an assessment of the magnitude of alien invasion on site as well as an assessment of the success of the management programme.

In general, the following principles apply for monitoring:
» Photographic records must be kept of areas to be cleared prior to work starting and at regular intervals during initial clearing activities. Similarly, photographic records should be kept of the area from immediately before and after follow-up clearing activities. Rehabilitation processes must also be recorded.
» Simple records must be kept of daily operations, e.g. area/location cleared, labour units and, if ever used, the amount of herbicide used.
» It is important that, if monitoring results in detection of invasive alien plants, that this leads to immediate action.

The following monitoring could be used as a baseline to ensure management of alien invasive plant species.

Construction Phase

Monitoring Action	Indicator	Timeframe
Document alien species present at the site	List of alien species	Preconstruction & monthly thereafter
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannually

Operation Phase

Monitoring Action	Indicator	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually (first 2 years) / Annually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Biannually (first 2 years) / Annually
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually(first 2 years) / Annually

5. OPEN SPACE MANAGEMENT PRINCIPLES

The following elements are considered part of the Open Space Management Plan. The principles contained within the Alien Invasive Management Plan should also be considered to form part of the Open Space Management Plan.

Access Control:

» Access to the facility should be strictly controlled.
» All visitors and contractors should be required to sign-in.
» Signage at the entrance should indicate that disturbance to fauna and flora is strictly prohibited.

Prohibited Activities:

The following activities should not be permitted by anyone except the landowner or his representatives:

» No fires within the site.
» No hunting, collecting or disturbance of fauna and flora, except where required for the safe operation of the facility and only by the Environmental Officer on duty and with the appropriate permits and landowner permission.
» No driving off of demarcated roads.
» No interfering with livestock.

Fire Risk Management:

Although fires are not a regular occurrence at the site, fires may occasionally occur under the right circumstances. Ignition risk sources in the area include the following:

» Lightning strikes
» Personnel within the facility
» Infrastructure such as transmission lines

The National Veld and Forest Fires Act places responsibility on the landowner to ensure that the appropriate equipment as well as trained personnel are available to combat

fires. Therefore, the management of the facility should ensure that they have suitable equipment as well as trained personnel available to assist in the event of fire.

Firebreaks

Extensive firebreaks are not recommended as a fire-risk management strategy at the site. The site is very large compared to the extent of the infrastructure and the maintenance of firebreaks would impose a large management burden on the operation of the facility. In addition, the risk of fires is not distributed equally across the site and within many of the lowlands of the site, there is not sufficient biomass to carry fires and the risk of fires within these areas is very low. Rather targeted risk management should be implemented around vulnerable or sensitive elements of the facility such as substations or other high-risk components. Within such areas, the extent over which management action needs to be applied is relatively limited and it is recommended that firebreaks are created by mowing and that burning to create firebreaks is not used as this in itself poses a risk of runaway fires. Where such firebreaks need to be built such as around substation, a strip of vegetation 5-10 m wide can be cleared manually and maintained relatively free of vegetation through manual clearing on an annual basis. However if alien species colonise these areas, more regular clearing should be implemented.

Appendix D:

Plant Rescue and Protection Plan

PLANT RESCUE AND PROTECTION PLAN

1. PURPOSE

The purpose of the plant rescue and protection plan is to implement avoidance and mitigation measures, in addition to the mitigation measures included in the Environmental Management Programme (EMPr) to reduce the impact of the development of the Gunstfontein Wind Energy Facility on listed and protected plant species and their habitats, and to provide guidance on search and rescue of species of conservation concern.

2. RELEVANT ASPECTS OF THE SITE

According to the SANBI SIBIS database, 692 plant species have been recorded from the quarter degree squares 3220 CB, DA, CD, DC (Table 1). This includes 11 species of high conservation concern and 22 species of moderate conservation concern. Several listed species were observed at the site including *Brunsvigia josephinae*, *Eriocephalus grandiflorus*, *Adromischus phillipsiae*, *Lachenalia congesta*, *Delosperma sphalmanthoides*, *Cliffortia arborea* and *Romulea komsbergensis*. Areas of high listed species density include the low-lying areas on sandy soils along drainage lines, gravel outcrops and rock pavements especially along the escarpment.

Table 1: Numbers of the species within the different conservation status categories as indicated below, data derived from the SANBI SIBIS database. Species not evaluated are largely alien species and species no longer recognised as valid.

Status/ IUCN Red List Category	No. Species
Critically Endangered (CR)	**2**
Endangered (EN)	**0**
Vulnerable (VU)	**9**
Near Threatened (NT)	**4**
Critically Rare	**0**
Rare	**13**
Declining	**2**
Data Deficient - Insufficient Information (DDD)	**3**
Data Deficient - Taxonomically Problematic (DDT)	**8**
Least Concern	**547**
Not Evaluated	**104**
Total	**692**

A preliminary walk-through of the final layout should be conducted to assess the presence of listed plant species within the development footprint which will need to be rescued or relocated. Such a walk-through should be conducted at the

favourable time of year when the probability of recognizing species of conservation concern is high.

3. PRINCIPLES FOR SEARCH AND RESCUE

Successful plant rescue can only be achieved if:

» Species can be removed from their original habitat with minimal damage to the plant, especially the roots.
» All plants removed are safely stored and treated according to their specific requirements prior to being transplanted again.
» They are relocated into a suitable habitat and protected from further damage and all disturbances to aid their re-establishment.
» Timing of planting activities is planned with the onset of the growing season.
» Steps are taken where necessary to aid the initial establishment of vegetation, including occasional watering.

The following principles apply in terms of plant rescue and protection:

» A permit is required from the Northern Cape Department of Economic Development and Nature Conservation (DENC) to translocate or destroy any listed and protected species, even if they do not leave the property. This permit should be obtained prior to any search and rescue operations being undertaken.
» Where suitable species are identified, a search and rescue operation of these species should be undertaken within the development footprint, where these species would be affected, and prior to the commencement of construction.
» As far as possible, timing of search and rescue activities should be planned with the onset of the growing season.
» Affected individuals should be translocated to a similar habitat outside of the development footprint and marked and recorded for monitoring purposes. For each individual plant that is rescued, the plant must be photographed before removal, tagged with a unique number or code and a latitude longitude position recorded using a hand-held GPS device.
» The rescued plants must be planted into a container to be housed within a temporary nursery on site or immediately planted into the target habitat.
» Rescued plants, if re-planted back in the wild, should be placed as close as possible to where they were originally removed. Re-planting into the wild must cause as little disturbance as possible to existing natural ecosystems. The position of he rescued individual/s must be recorded to aid in future monitoring of that plant as noted earlier.
» During construction, the Environmental Control Officer (ECO)/ Environmental Officer (EO) must monitor vegetation clearing at the site. Any deviations from the plans that may be required should first be checked for listed species by

the ECO/EO and any listed species present which are able to survive translocation should be translocated to a safe site.

» Any listed species suitable for translocation observed within the development footprint, and that would be affected, that were not previously observed be translocated to a safe site.
» The collecting of plants or their parts should be strictly forbidden (as per the mitigations included in the EMPr). Staff should be informed of the legal and conservation aspects of harvesting plants from the wild as part of the environmental induction training as per the mitigations including the EMPr.
» Sensitive habitats and areas outside of the project development area should be clearly demarcated as no go areas during the construction and operational phase to avoid accidental impacts.

Appendix E:

Revegetation and Rehabilitation Plan

REVEGETATION AND REHABILITATION PLAN

1. PURPOSE

The purpose of the rehabilitation plan is to ensure that areas cleared or impacted during construction activities of the Gunstfontein Wind Energy Facility are rehabilitated with a plant cover that reduces the risk or erosion from these areas as well as restores some ecosystem function. The purpose of the rehabilitation plan for the site can be summarised as follows:

» Achieve long-term stabilisation of all disturbed areas to minimise erosion potential.
» Re-vegetate all disturbed areas with suitable local plant species.
» Minimise visual impact of disturbed areas.
» Ensure that disturbed areas are safe for future uses.

This Revegetation and Rehabilitation Plan should be closely aligned with other site-specific plans, including the Erosion Management Plan, Alien Invasive and Open Space Management Plan, and Plant Rescue and Protection Plan.

2. RELEVANT ASPECTS OF THE SITE

The site occurs within a semi-arid environment and a fundamentally different approach to rehabilitation efforts in such areas is required as compared to traditional rehabilitation approaches within more mesic areas. In addition, rehabilitation techniques which rely on agricultural techniques such as the application of fertilizer and the planting of annual grasses or other alien species are not appropriate. The major implication of the semi-arid nature of the site is that the use of appropriate species and techniques is key in order to achieve long-term success.

3. IDENTIFICATION OF TARGET AREAS

The construction activities required for the development will result in significant disturbance at the site. Rehabilitation is costly and time-consuming and therefore priority areas where rehabilitation should be focused must be identified. Priority areas include areas vulnerable to erosion such as on steep slopes as well as areas near to important ecosystems such as areas near to drainage lines.

4. TOPSOIL MANAGEMENT

Effective topsoil management is a critical element of rehabilitation, particularly in arid and semi-arid areas where soil properties are a fundamental determinant of vegetation composition and abundance. Although some parts of the site consist of exposed bedrock, most parts of the site have at least some topsoil. Where any excavation or topsoil clearing is required, the topsoil should stockpiled and later used to cover cleared and disturbed areas once construction activity has ceased.

» Topsoil is the top-most layer (0-25cm) of the soil in undisturbed areas. This soil layer is important as it contains nutrients, organic matter, seeds, micro-organisms fungi and soil fauna. All these elements are necessary for soil processes such as nutrient cycling and the growth of new plants. The biologically active upper layer of the soil is fundamental in the maintenance of the entire ecosystem;
» Topsoil should be retained on site in order to be used for site rehabilitation. The correct handling of the topsoil is a key element to rehabilitation success. Firstly it is important that the correct depth of topsoil is excavated. If the excavation is too deep, the topsoil will be mixed with sterile deeper soil, leading to reduction in nutrient levels and a decline in plant performance on the soil;
» Wherever possible, stripped topsoil should be placed directly onto an area being rehabilitated. This avoids stockpiling and double handling of the soil. Topsoil placed directly onto rehabilitation areas contains viable seed, nutrients and microbes that allow it to revegetate more rapidly than topsoil that has been in stockpile for long periods;
» If direct transfer is not possible, the topsoil should be stored separately from other soil heaps until construction in an area is complete. The soil should not be stored for a long time and should be used as soon as possible. The longer the topsoil is stored, the more seeds, micro-organisms and soil biota become sterile;
» Ideally stored topsoil should be used within a month and should not be stored for longer than three months. In addition, topsoil stores should not be too deep, a maximum depth of 1m is recommended to avoid compaction and the development of anaerobic conditions within the soil;
» If topsoil is stored on a slope then sediment fencing should be used downslope of the stockpile in order to intercept any sediment and runoff should be directed away from the stockpiles upslope.
» Reduced activity at the site after large rainfall events when the soils are wet is encouraged. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.
» Any topsoil, waste rock or other material dumps should be protected from erosion with silt traps and other suitable prevention measures.

» Gabions and other stabilisation features should be used during construction activities on steep slopes in order to prevent erosion.

5. GENERAL PRINCIPLES FOR REHABILITATION

5.1. Mulching

Mulching is the covering of the soil with a layer of organic matter of leaves, twigs bark or wood chips, usually chopped quite finely. The main purpose of mulching is to protect and cover the soil surface as well as serve as a source of seed for revegetation purposes.

» During site clearing the standing vegetation should not be cleared and mixed with the soil, but should be cleared separately, either mechanically or by hand using a brush-cutter. The cleared vegetation should be stockpiled and used whole or shredded by hand or machine to protect the soil in disturbed areas and promote the return of indigenous species;
» Mulch is to be harvested from areas that are to be denuded of vegetation during construction activities, provided that they are free of seed-bearing alien invasive plants;
» No harvesting of vegetation may be done outside the area to be disturbed by construction activities; and
» Brush-cut mulch shall be stored for as short a period as possible, and seed released from stockpiles shall be collected for use in the rehabilitation process.

5.2 Seeding

In some areas the natural regeneration of the vegetation may be poor and the application of seed to enhance vegetation recovery may be required. Seed should be collected from plants present at the site and should be used immediately or stored appropriately and used at the start of the following wet season. Seed can be broadcast onto the soil, but should preferably be applied in conjunction with measures to improve seedling survival such as scarification of the soil surface or simultaneous application of mulch.

» Indigenous seeds may be harvested for purposes of re-vegetation in areas that are free of alien / invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites;
» Seed may be harvested by hand and if necessary dried or treated appropriately;
» Seed gathered by vacuum harvester, or other approved mass collection method, from suitable shrubs or from the plant litter surrounding the shrubs must be kept apart from individually harvested seed; and
» No seed of alien or foreign species should be used or brought onto the site.

5.3 Transplants

Where succulent plants are available or other species which may survive translocation are present, individual plants can be dug out from areas about to be cleared and planted into areas which require revegetation. This can be an effective means of establishing indigenous species quickly.

» Plants for transplant should only be removed from areas that are going to be cleared;
» Perennial grasses, shrubs, succulents and geophytes are all potentially suitable candidates for transplant;
» Transplants should be nearby and should not be transported around the site to distant areas; and
» Transplants must remain within the site and may not be transported off the site. Therefore, it is recommended that before construction commences individuals of listed species within the development footprint should be marked and translocated to similar habitat outside the development footprint under the supervision of an ecologist or someone with experience in plant translocation. Permits from the relevant provincial authorities will be required to relocate listed plant species.

5.4 Use of soil savers

On steep slopes and areas where seed and organic matter retention is low, it is recommended that soil savers are used to stabilise the soil surface. Soil savers are man-made materials, usually constructed of organic material such as hemp or jute and are usually applied in areas where traditional rehabilitation techniques are not likely to succeed.

» In areas where soil saver is used, it should be pegged down to ensure that is captures soil and organic matter flowing over the surface; and
» Soil saver may be seeded directly once applied as the holes in the material catch seeds and provide suitable microsites for germination.

5.6. General

» Progressive rehabilitation is an important element of the rehabilitation strategy and should be implemented where feasible;
» Once revegetated, areas should be protected to prevent trampling and erosion;
» No construction equipment, vehicles or unauthorised personnel should be allowed onto areas that have been vegetated;
» Where rehabilitation sites are located within actively grazed areas, they should be fenced;

» Fencing should be removed once a sound vegetative cover has been achieved; and
» Any runnels, erosion channels or wash aways developing after revegetation should be backfilled and consolidated and the areas restored to a proper stable condition.

6. MONITORING REQUIREMENTS

As rehabilitation success, particularly in arid areas is unpredictable, monitoring and follow-up actions are important to achieve the desired cover and soil protection.

» Re-vegetated areas should be monitored every 3 months for the first 12 months and every 6 months thereafter for the next year.
» Re-vegetated areas showing inadequate surface coverage (less than 30% within 12 months after re-vegetation) should be prepared and re-vegetated.
» Where transplants have been used the survival rate of the different species used should be monitored every 3 months for the first 12 months and every 6 months thereafter for the next year. The results should be used to inform the choice of species for transplant and other factors which may influence survival.

Appendix F:

Traffic Management Plan

PRINCIPLES FOR TRAFFIC MANAGEMENT

1. PURPOSE

The purpose of this Traffic Management Plan (TMP) is to address regulatory compliance, traffic management practices, and protection measures to help reduce impacts related to transportation and the construction of temporary and long-term access within the vicinity of the Gunstfontein Wind farm project site. The objectives of this plan include the following:

» To ensure compliance with all legislation regulating traffic and transportation within South Africa (National, Provincial, Local & associated guidelines).
» To avoid incidents and accidents while vehicles are being driven and while transporting personnel, materials, and equipment to and from the project site.
» To raise greater safety awareness in each driver and to ensure the compliance of all safe driving provisions for all the vehicles.
» To raise awareness to ensure drivers respect and follow traffic regulations.
» To avoid the deterioration of access roads and the pollution that can be created due to noise and emissions produced by equipment, machinery, and vehicles.

2. RELEVANT ASPECTS OF THE PROJECT

The general freight for the wind farm comprise of building material, blades, nacelles, towers, rotors and a transformer. The route for transportation of imported equipment is either from Saldanha, Cape Town or Port Elizabeth, although Saldanha is the preferred port with a route length of 426km.

The northern section of the study area (above the escarpment) can be accessed via a gravel road which branches off of the R354. The internal access roads will need to be established. As far as possible, existing access roads to the site would be utilised, and upgraded where required.

The traffic volumes and movements for the construction, operation and decommissioning phases of the project will have varying patterns:

<u>Construction Phase</u>
The anticipated traffic during the construction phase per turbine are as follows:

» Abnormal vehicles: 10 (turbine components)
» Heavy vehicles: 60 (reinforcement and concrete)
» Heavy vehicles: 5 (road layer works)

Therefore 150/10 (heavy/abnormal) vehicles will be required per turbine.

The total trips for the preferred heavy vehicles during the construction phase of the project for the alternative layout of 68 turbines will be 680 abnormal and 10200 heavy vehicles during the construction phase of the project over an estimated period of 24 months.

The personnel required during installation is estimated to be 300 persons. The personnel will likely be transported to and from the site by means of busses. This personnel transportation will likely comprise between 15 to 20 trips per day.

The current traffic volume on the N1 near Matjiesfontein (between Laingsburg and Touwsrivier) is estimated from the most recent SANRAL yearbook at 3834 average daily traffic, 1497 average daily truck traffic (both directions with a 50/50 split) and a maximum hourly flow of about 800 veh/h for this section of the road.

The current traffic volumes on the R354 (Western Cape Province Road: Trunk Road 20/1) is in the order of 140 vehicles per day with a 13% heavy vehicle component.

In the worst case, the number of heavy vehicle trips per day would be in order of 15-25 round trips for the construction of the wind farm. Based on the expected number of construction trips to be generated by the Gunstfontein wind farm development, the existing road network has sufficient capacity to accommodate the additional trips from an operational perspective.

Operations Phase

The operations phase of this project is not expected to generate significant traffic volumes as the generated site traffic would be limited to maintenance support, with only a few light vehicles per day. It is estimated that the number of external light trips will vary between 5 and 10 light vehicles per day to transport operational personnel to and from the site. There is also a possibility that certain turbine elements such as blades, gearbox or nacelle hub will need to be replaced over the life of the project, which would require ad hoc abnormal trips and the movement of a crane to the site.

There will be nominal construction equipment necessary for the maintenance of the roads if required. This would be infrequent and negligible.

Decommissioning Phase

The anticipated traffic during the decommissioning phase per turbine are estimated as follows:

- Abnormal vehicles for removal of turbines: 10 (turbine components)
- Heavy vehicles for transportation of debris: 5 (demolished concrete bases)

» Heavy vehicles for transporting construction equipment: 5 (road works)

Therefore 10/10 (heavy/abnormal) vehicles will be required per turbine.

This traffic is expected over a 12 month period. The personnel required at this stage would be in the order of 100 persons which would generate 5 to 10 trips daily. The traffic volume on the National and Provincial roads would be in the order of 1.5 to 2.0 times the existing traffic depending on the actual growth rates and the additional trips due to the decommissioning of the windfarm will contribute less than 5%.

It can therefore be stated that the installation traffic, the operational traffic and the decommissioning traffic would be low without out any significant impact on the existing traffic flows on the N1 or Provincial Roads and it will have a negligible impact on pavement structures. Furthermore the traffic impact on the provincial gravel road will also be negligible with respect to service levels.

3. TRAFFIC AND TRANSPORTATION MANAGEMENT PRINCIPLES

» Prior to the commencement of construction the contractors must develop their own detailed Transport Management Plan (TMP) based on traffic volumes and road carrying capacity.
» The transport contractor must ensure that all required permits for the transportation of abnormal loads are in place prior to the transportation of equipment and project components to the site. Specific abnormal load routes must be developed with environmental factors taken into consideration.
» Before construction commences, authorised access routes must be clearly marked in the field with signs or flagging. The Construction Contractor must review the location of designated access and will be responsible for ensuring construction travel is limited to designated routes. The entrance off the main access road must not be constructed before a blind rise or on a bend of the public road.
» All employees must attend an environmental training program (e.g. toolbox talks) by the Environmental Officer (EO). Through this program, employees will be instructed to use only approved access roads, drive within the delineated road limits, and obey jurisdictional and posted speed limits to minimise potential impacts to the environment and other road users.
» The contractor will be responsible for making sure that their suppliers, vendors, and subcontractors strictly comply with the principles of this TMP and the contractor's TMP.
» Adjacent landowners must be notified of the construction schedule.
» Access roads and entrances to the site should be carefully planned to limit any intrusion on the neighbouring property owners and road users.

» Signs must be posted in the project area to notify landowners and others of the construction activity.
» Flagging must be provided at access points to the site and must be maintained until construction is completed on the site.
» Speed limits must be established prior to commencement of construction and enforced over all construction traffic.
» Speed controls and implementation of appropriate dust suppression measures must be enforced to minimise dust pollution.
» Throughout construction the contractor will be responsible for monitoring the condition of roads used by project traffic and for ensuring that roads are maintained in a condition that is comparable to the condition they were in before the construction began.
» Drivers must have an appropriate valid driver's license and other operational licences required by applicable legislation.
» All vehicles must be maintained in good mechanical, electrical, and electronic condition, including but not limited to the brake systems, steering, tires, windshield wipers, side mirrors and rear view mirror, safety belts, signal indicators, and lenses.
» Any traffic delays attributable to construction traffic must be co-ordinated with the appropriate authorities.
» No deviation from approved transportation routes must be allowed, unless roads are closed for reasons outside the control of the contractor.
» Impacts on local communities must be minimised. Consideration should be given to limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time.

4. MONITORING

» The principal contractor must ensure that all vehicles adhere to the speed limits.
» A speeding register must be kept with details of the offending driver.
» Repeat offenders must be penalised.
» Where traffic signs are not being adhered to, engineering structures must be used to ensure speeds are reduced.

Appendix G:

Transportation Assessment

GUNSTFONTEIN WIND ENERGY FACILITY
TRANSPORT ASSESSMENT

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Title		Title	

GUNSTFONTEIN WIND ENERGY FACILITY

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Revision 4

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Contents

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EXECUTIVE SUMMARY

The transport needs for the proposed Gunstfontein WEF, which is located on the remainder of the farm portions Gunstfontein 131, Wolven Hoek 182, Portion 1 of the farm Gunstfontein 131 and Farm Boschmans Hoek 177, were investigated to confirm access route and site access for the development of a Wind Energy Facility (WEF).

The general requirements are:

- Available and established access routes
- Legal limits for normal heavy vehicle freight
- Abnormal Permits required for transport of Abnormal Loads (transformers and turbine components)
- Maximum vertical clearance on most routes is 5,2m for Abnormal Loads but should preferably be limited to 4,8m.

The general freight for a wind farm comprises of building materials including stone and aggregate, turbine components, power transformers and other minor electrical and mechanical equipment. The imported freight will be transported from South African ports to the respective sites. Building materials will be transported from sources in surrounding towns while certain elements will be transported from various manufacturing centres in South Africa.

The preferred landing port for the imported elements to the proposed Gunstfontein WEF will be from the Saldanha port. The route distance of 426 kilometres km via Moorreesburg comprises of surfaced roads the full way.

No toll fees are required on the preferred or alternative routes. Abnormal Permits will be required for transport of the abnormal wind turbine components and power transformers but such permits are common and easily attained.

The preferred route is predominantly on National or Provincial Roads with suitable standards for transport of container freight and is suitable for abnormal loads with permits. There is limited risk of delays for normal routine maintenance works (repairs and reseals) depending on the time of transport and scheduling of road contracts. However, there is an alternative route available which largely mitigates this risk.

The transport of elements from manufacturing centres within South Africa is predominantly on National and Provincial roads, which presents no limitations for normal freight.

The traffic impact on the National and Provincial road network during the installation, commissioning and decommissioning phases of the facility is low without any significant impact.

The final access locations are evaluated in the Site Access Roads section 3.3.7

The preferred access position to the site is proposed off the gravel road leading to Klein Roggeveld and is expected to be at an acceptable safe point and is an extension of an existing road, which should be acceptable to the Northern Cape Provincial Government as the road authority. The preferred access route is predominantly on an existing road and will require the upgrade of the gravel road to a suitable standard in order to accommodate the freight traffic. In general no obvious problems are expected with freight transport along the proposed routes to the site and also for accesses necessary for the construction and maintenance of the site.

1 INTRODUCTION

Gunstfontein Wind Farm (Pty) Ltd., has engaged Aurecon to prepare a Transport Assessment with particular focus on the access to the site for the proposed Gunstfontein WEF on a site located approximately 20km south of Sutherland in the Northern Cape Province on the remainder of the farm portions Gunstfontein 131, Wolven Hoek 182, Portion 1 of the farm Gunstfontein 131 and Farm Boschmans Hoek 177 in support of the environmental approval application.

The site location is indicated on the Key Plan below:

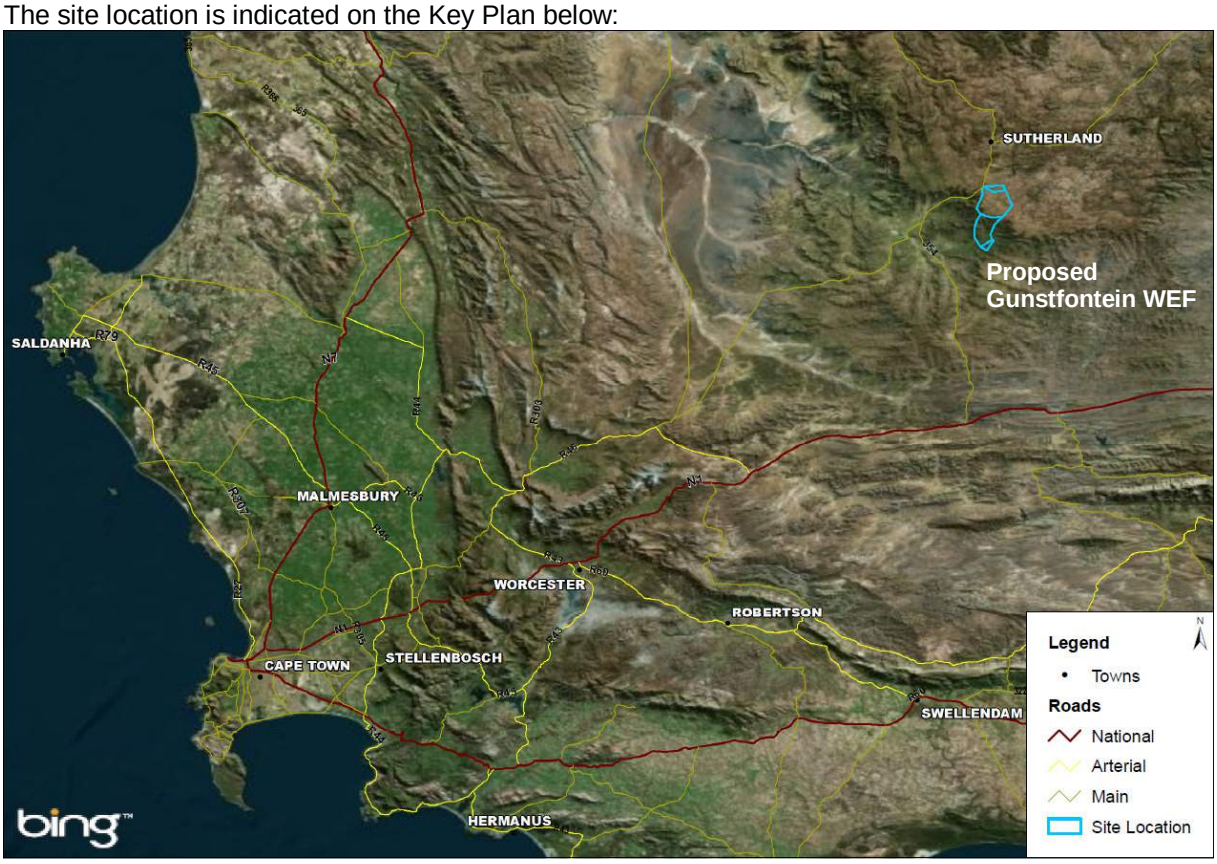


Figure 1: Key Plan detail

The proposed development is a Wind Electricity Generating Farm with the following parameters:

- Up to 100 Wind Turbine Generators (with smaller WTG's) or 68 WTG's (with larger WTG's).
- Up to 4MW per WTG
- Hub height up to 120m
- Rotor diameter of up to 140m
- Capacity of up to 200MW

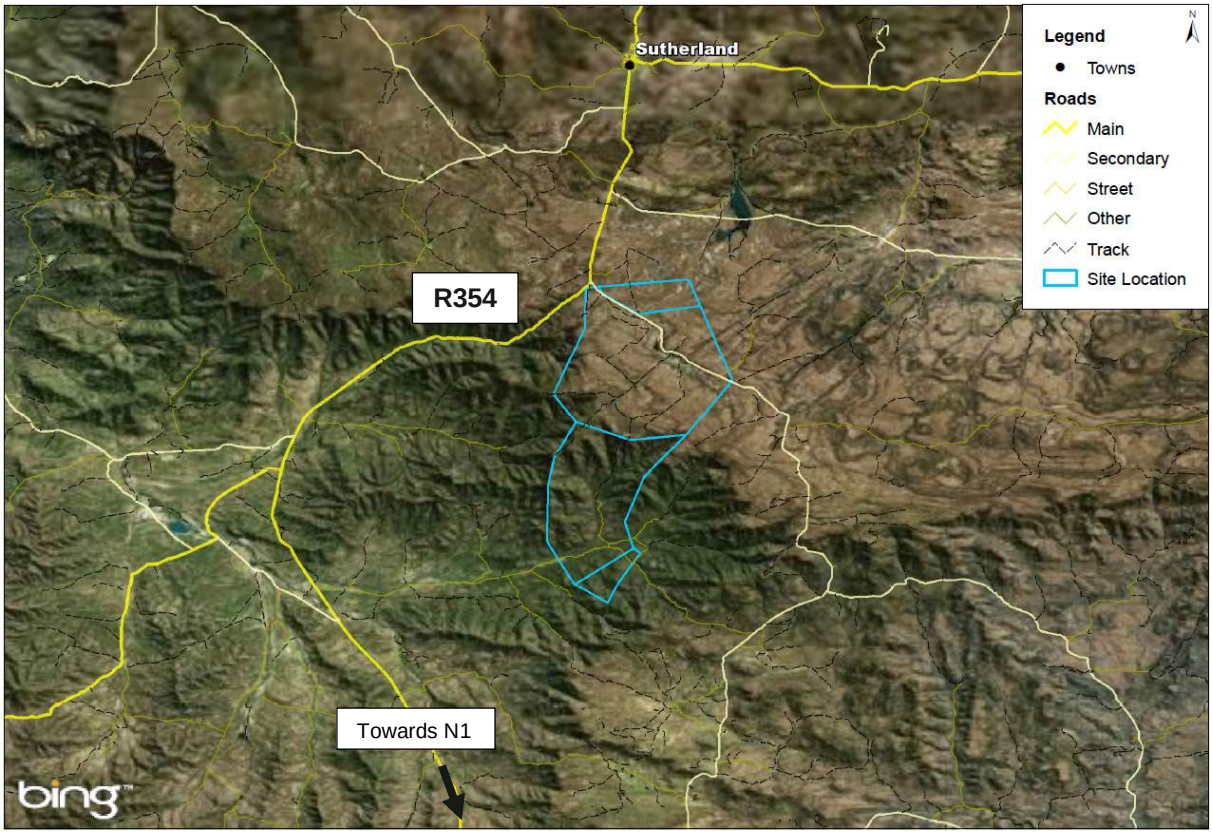


Figure 2: Site Location

The scope of the study is to evaluate the transport requirements to support the development of the Gunstfontein WEF with particular focus on the access to site from the N1.

The scope of the Transport Assessment Study includes inter alia:

- Determine the access freight routes between points of delivery and departure for the components.
- Confirm the associated clearances required for the necessary equipment to be transported from the point of delivery to the various sites.
- Confirm freight requirements.
- Determine (Abnormal) Permit requirements if any.
- Consider feasibility of alternative accesses to the site from the N1
- Propose traffic accommodation measures during potential upgrading of the access on the Provincial or National Roads.

2 BASIS AND ASSUMPTIONS

The following parameters have been defined / assumed based on Aurecon's domain knowledge and relevant experience:

- Imported elements, including major turbine components, are shipped to and transported from the nearest or most practical South African Port to the site.
- Certain elements are transported from manufacturing centres within South Africa.
- Materials for concrete foundation structures and road construction are obtained locally from closest available commercial source but could also be sourced from new borrow pits and quarries on the site to limit carting of materials over long distances and at steep grades.
- The largest potential loads with respect to weight will be:
  - Transformer(s) with a payload of approximately 85t
  - Nacelle for each turbine – up to approx. 100t
- Long distance freight will be transported predominantly on surfaced roads.
- Foundations will ultimately be dictated by site geotechnical conditions but generally comprise of large diameter (in the order of 15m to 22m) concrete bases supported on rock or suitable soils.
- The standard vehicle size for the transportation of turbine blades was assumed to be for a blade length of 70m.
- Geometric standards applied were such that blades up to 70m in length could be accommodated on the access roads to the proposed development.
- A minimum road width of 4.5m with 0.25m rounding each side was assumed.
- The preliminary alignments are based on satellite imagery information as the only available information.
- The turbines will be removed off site during the de-commissioning stage but the turbine bases will only be demolished to 1m below normal ground level.

3 ASSESSMENT

3.1 General Freight Requirements

3.1.1 Legislation

The general limitations on road freight transport are currently:

- Axle load limitation of 7,7t on front axle, 9,0t on single rear axles.
- Axle unit limitations are 18t for dual axle unit and 24t for 3 axle unit.
- Bridge formula requirements to limit concentration of loads and to regulate load distribution on the vehicle.
- Gross vehicle mass of 56t. This means a typical payload of about 30t.
- Maximum vehicle length of 22m for an interlink, 18,5m for horse and trailer and 13,5m for a single unit.
- Width limit of 2,6m.
- Height limit 4,3m with a 0,3m tolerance.

Abnormal permits are required for vehicles exceeding these limits.

3.1.2 Facility Freight

Materials and equipment transported to the site comprise of:

- Building materials (concrete aggregates, cement, reinforcement and gravel).
- Construction equipment such as road building equipment, excavators and cranes.
- Turbine components (blades, towers and nacelles).
- Transformers and cables.

The following is also anticipated for the project:

1. **<u>During the Installation phase:</u>**
    a) Building materials comprising of reinforced concrete materials for turbine foundations and road layerworks. These will be transported using conventional trucks which should adhere to legal limits.
    b) Turbine Components will most likely be transported by abnormal vehicles from the nearest suitable South African port which is Saldanha. The number of loads will be a function of the number of turbines to be constructed.
    c) Wind Turbine Towers will be manufactured locally, with steel towers shipped from Atlantis or Port Elizabeth and concrete towers manufactured on site or in Cape Town and transported in segments.
    d) Power Transformers will most probably be transported by abnormal vehicles from manufacturing centres in Johannesburg.

2. **During the Operational Phase:**

   a) Potential replacement of turbine elements which would require employment of cranes and transport equipment. This is however expected to have a low probability incidence.

3. **During the De-commissioning Phase:**

   a) The removal of turbine components from the site to a suitable spoil / recovery / recycling site which could potentially imply shipping it out of the country and which would require abnormal transport to the approved recovery sites. The location if these sites is unknown at this stage but would be accessible from the mayor routes.

   b) Re-instatement of the disturbed areas such as ripping of access roads and reinstating of vegetation by using suitable construction equipment which will have to be employed on site.

   c) The turbine bases will have to be demolished partially which will require heavy demolishing equipment and debris transported to suitable spoil sites.

Examples of the abnormal loads which are most pertinent to the wind farm logistics are illustrated below.

Figure 3: Abnormal freight (Tower section, in low-load configuration, in top picture and blade in bottom picture)

Figure 4: Minor wind farm components delivered to a wind farm site with normal freight

3.2 Traffic Statement

The traffic volumes will have three different patterns for the construction, operational and de-commissioning stages of the project respectively.

a) <u>Traffic during the Installation Phase</u>

Based on Aurecon's experience with similar projects, it is estimated that the number of expected trips per turbine would be:

- Abnormal vehicles: 10 (turbine components)
- Heavy vehicles: 60 (reinforcement and concrete)
- Heavy Vehicles 90 (road layer works)

TOTAL 150 / 10 (Heavy / Abnormal) per turbine

The total trips for the 100 turbine (Smaller WTG's) facility layout would be 1000 abnormal and 15000 heavy vehicle trips. However the total trips for the preferred alternative layout of 68 turbines (Larger WTG's) will be 680 abnormal and 10200 heavy vehicle during the construction stage of the project over an estimated period of 24 months. Should concrete towers be used, then the number of abnormal loads would decrease but heavy loads would increase.

If the concrete and road building materials could be sourced from newly developed sources in close vicinity to the site, the number of heavy vehicles on the access roads could reduce substantially.

From previous experience, the personnel during installation is estimated to be 300. The personnel will most likely reside in Sutherland as the closest community or alternatively a compound on site or close by. It is recommended that the majority of construction personnel is transported to and from site by means of busses.

This personnel transport will contribute the majority of the estimate daily trips of between 15 to 20 trips. The impact of this on the general traffic would therefore also be considered negligible as the additional peak hour traffic would be at most 10 trips.

Current traffic volumes on N1 near Matjiesfontein (Between Laingsburg and Touwsrivier) are estimated from the most recent SANRAL yearbook at about 3834 ADT (Average Daily Traffic), 1497 ADTT (Average Daily Truck Traffic) (both directions with a 50/50 split) and a maximum hourly flow of about 800 veh/h for this section of road.

The current traffic volumes on the R354 (Western Cape Provincial Road: Trunk Road 20/1) is in the order of 140 vehicles per day with a 13% heavy vehicle component.

In the worst case, the number of heavy vehicle trips per day would be in the order of 15-25 round trips. The impact of this on the general traffic would therefore be negligible as the additional peak hour traffic would be at most 5 - 10 trips.

b) Traffic during the Operational Phase

After construction, the generated site traffic would be limited to maintenance support, with only a few light vehicles per day. It is estimated that the number of external light trips will vary between 5 and 10 light vehicles per day to transport operational personnel to and from the site.

Secondly there is also a possibility of replacement of certain turbine elements such as a blade, gearbox or nacelle hub which would require abnormal trips and establishment of cranes. However this is considered negligible

Finally, there will be nominal construction equipment necessary for the maintenance of the roads if required, although this would most probably only be internal traffic except for re-gravelling from external sources. This would also be infrequent and negligible.

c) Traffic during the Decommissioning Phase

The anticipated traffic during the decommissioning phase per turbine are:

• Abnormal vehicles for removal of turbines:	10 (turbine components)
• Heavy vehicles for transporting debris:	5 (Demolished concrete bases)
• Heavy Vehicles for transporting construction equipment	5 (road works)
TOTAL	**10 / 10 (Heavy / Abnormal) per turbine**

This traffic is expected over a 12 month period. The personnel during this phase would be in the order of 100 persons which would generate 5 to 10 trips daily.

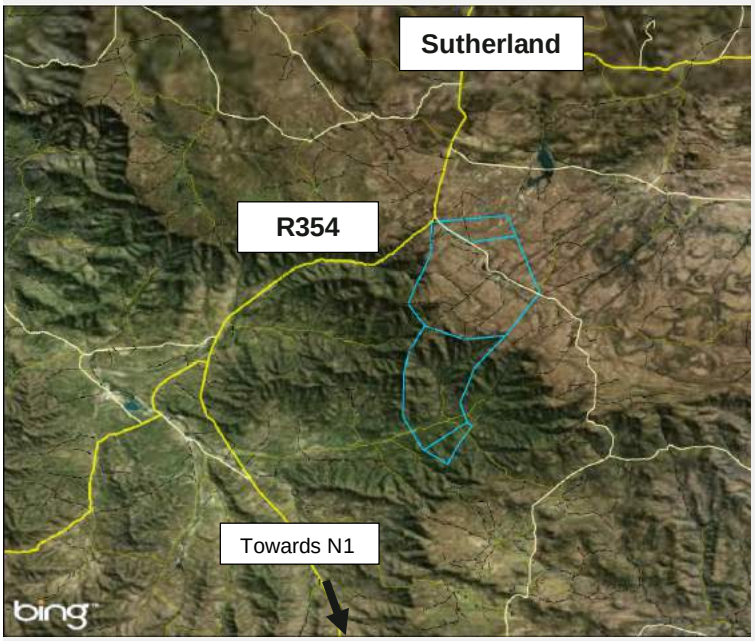
The traffic volumes on the National and Provincial roads would be in the order of 1,5 to 2,0 times the existing traffic depending on the actual growth rates. The upgrading of the roads by the respective authorities would be dictated by the service levels experienced. As stated in the assumptions, the authorities should upgrade the roads to maintain reasonable service levels which will render the impact due to decommissioning negligible.

It can therefore be stated that the installation traffic, the operational traffic and the decommissioning traffic would be low without any significant impact on the existing traffic flows on the N1 or Provincial Roads and it will also have a negligible impact on the pavement structure. Furthermore, the traffic impact on the Provincial gravel access roads will also be negligible with respect to service levels.

3.3 Access Route

3.3.1 Site Description

The site description is as follows:



Location (Centre Point)	32°38'02"S 20°38'30"E
Distance S from Sutherland	20 km
Generation Capacity	200MW
Distance from Ports	
Saldanha	426 km
Cape Town	331 km
Port Elizabeth	662 km
Farm(s)	Gunstfontein 131, Portion 1 of Gunstfontein 131, Wolven Hoek 182, and Farm Boschmans Hoek 177

Figure 5: Site Description

3.3.2 Preferred Route from Port

The route for transportation of imported equipment is either from Saldanha, Cape Town or Port Elizabeth. Saldanha is the preferred port with a route length of 426 kilometres as indicated in Figure 6: Preferred Freight Route below.

It should be noted that the Ports Authority also has preferences on freight imports which should be respected.

Certain alternatives to the preferred route also exist and are shown in Figure 7: Alternative Freight Routes from Port. Section views of the roads are shown in Appendix A, while urban section views along the preferred route are shown in Appendix B.

Figure 6: Preferred Freight Route

The route from the alternative port of Port Elizabeth is about 622km and is the least preferred route, but also offers an alternative should Saldanha port not be available for any reason. Cape Town port would most probably not be able to accommodate the imported turbine elements due to current activities, even though it is closer to the site than Saldanha port.

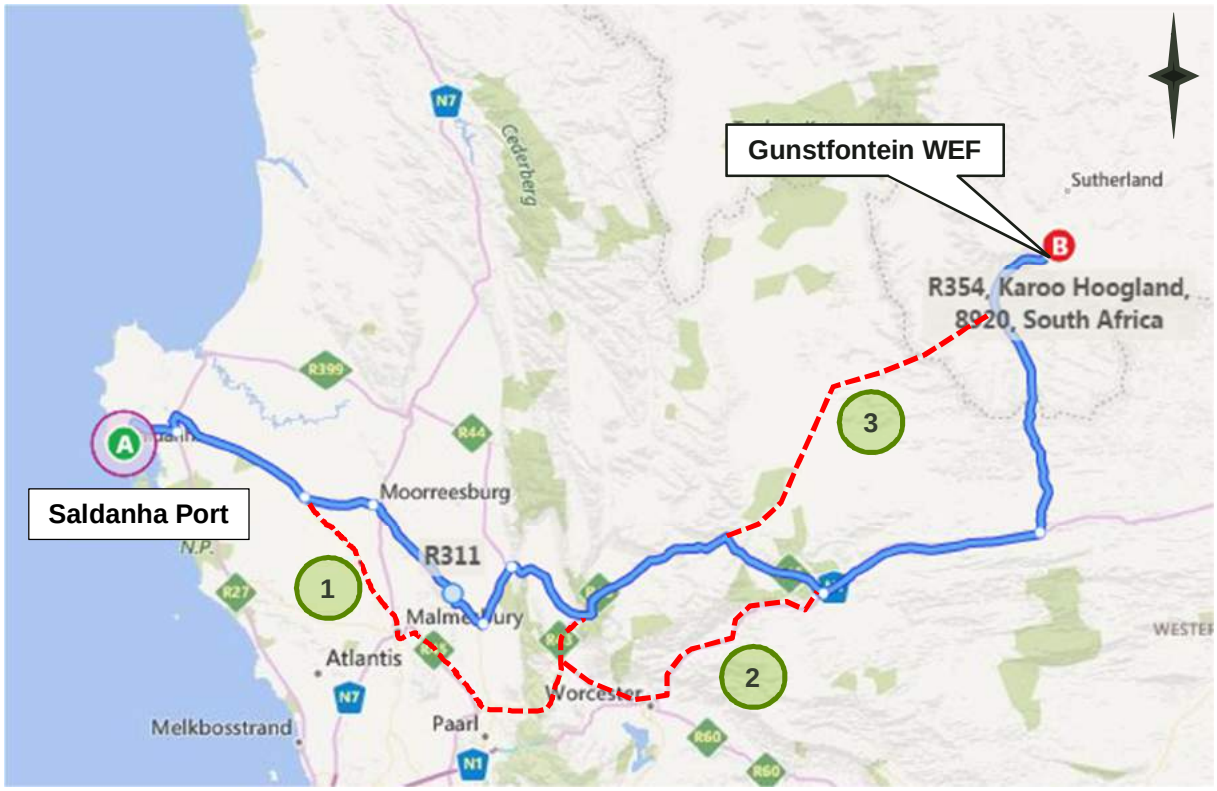


Figure 7: Alternative Freight Routes from Port

The following is noted regarding deviations from the preferred route:

1. This alternative passes through the town of Malmesbury, where an urban intersection limits the maximum turning radius. This alternative will be restricted for abnormal loads that require a large turning radius (e.g. vehicles transporting the blades).
2. This alternative passes through Worcester and De Doorns along the National Route N1. One of the bridges over the N1, between Worcester and De Doorns is however of concern. It is estimated that the bridge is lower than 5m meaning that the maximum height of freight is limited.
3. This alternative follows a more direct route to the project sites, by using a Provincial gravel road (R356) between Ceres and Sutherland. Following this route increases the distance travelled on gravel roads by approximately 100km. This gravel road may require some upgrades to accommodate the abnormal vehicles and will need routine maintenance during the construction period. This deviation is therefore not recommended.

The alternatives shown in Figure 7: Alternative Freight Routes from Port are presented for the cases where the preferred route of travel is unavailable due to maintenance or any other reasons. The alternatives that are presented have certain constraints (as mentioned) and may not be able to accommodate all of the abnormal loads.

It is suggested that the transporting contractor executes a more detailed study before transporting any of the components to confirm the preferred and alternative routes for each type of load configuration and also a combination of routes if required, should any of the preferred section be unavailable for items such as maintenance, etc.

3.3.3 Route for Construction Materials

Material sources for road building and concrete works is available in Worcester and all material will most likely be transported from this town on the National Road N1 and the R354. As stated earlier, to reduce traffic on access roads, consideration could be given to sourcing material for road building and concrete aggregate from new quarries/sources in the vicinity of the site, if it is feasible with respect to the target implementation programme. (The approval period for such quarries/sources is typically 18 months.)

The closest manufacturing centre will most likely be Cape Town which is situated 331 km from the site. For most part of the route, the National Route N1 will be utilised, which is surfaced all the way. There are however toll fees present on this specific route, but can be avoided if an alternative route is used.

3.3.4 Authority and Permit Requirements

The following is noted:

a) No toll fees required on the routes from the Saldanha port. On the routes from the other manufacturing centres certain portions of the national routes are tolled which will required toll fees, but can be avoided if an alternative route is taken.

b) Abnormal permits will be required for the transport of the transformer and the turbine elements by the logistics contractor. The estimated permit value will be a function of the actual vehicle configuration but is estimated at R9000 – R15000 per trip dependent on the weight of the load and escorting requirements by Provincial Traffic. In extreme cases permits could be as high as R50 000 per trip. The abnormal application process would take approximately a month to complete and should be applied for once the project is awarded preferred bidder status, by the logistics contractor.

3.3.5 Route Limitations of the Preferred Route from the Port

The identified routes have possible limitations that will require more detailed investigations to determine the level of upgrading that will be required (if any) to accommodate the abnormal loads. All the possible limitations (apart from the capacity of the bridges on the R354) will potentially be encountered on the gravel roads from the R354 intersection to the prospective site. Possible limitations other than capacity of the bridges on the R354 that require investigation might include: motor grid gates with loading constraints, overhead power and telecommunication lines with an insufficient ground clearance, substandard geometry and drainage issues.

3.3.6 Capacity of bridges

The section of the preferred route along the R354 between Matjiesfontein (N1) and Sutherland does not form part of a heavy freight route. Several bridges exist along this route that will have to be crossed by abnormal loads. Elevation and approach views of a typical bridge on the R354 are shown in Figure 8 and Figure 9 below.

A high order investigation was done to confirm the loading capacity of the existing bridges along this section of road. Aurecon believes it is unlikely that there would be any problems with the loading capacity of these bridges with regards to the delivery of abnormal loads (provided the requirements of the Bridge

Formula are met) however a detailed investigation should be undertaken by the transport contractor to confirm that the vehicle configuration is suited to the maximum axle loading for the bridges.

Figure 8: Elevation view of typical bridge on R354

Figure 9: Approach view of typical bridge on R354

3.3.7 Site Access Road

The access to the site is proposed off the gravel road leading to Klein Roggeveld. Internal access roads also needs to be established.

The access position for the northern section of the study area is proposed to be located approximately 2.5km from the R354 turnoff to Klein Roggeveld, which should be approved by Northern Cape Provincial Government as sufficient sight distances (stopping and shoulder) are available.

Existing roads will be utilised as far as possible and upgrades done where necessary. Access roads between the turbines will be required for construction purposes and later for maintenance purposes. The internal access roads will be confirmed once the final positioning of the wind turbines are available and a more detailed design is required. These roads will obviously have to be constructed before any components are delivered to site.

The access roads to the Northern part of the study area are depicted in Figure 10.

The access option is indicated in the following figure:

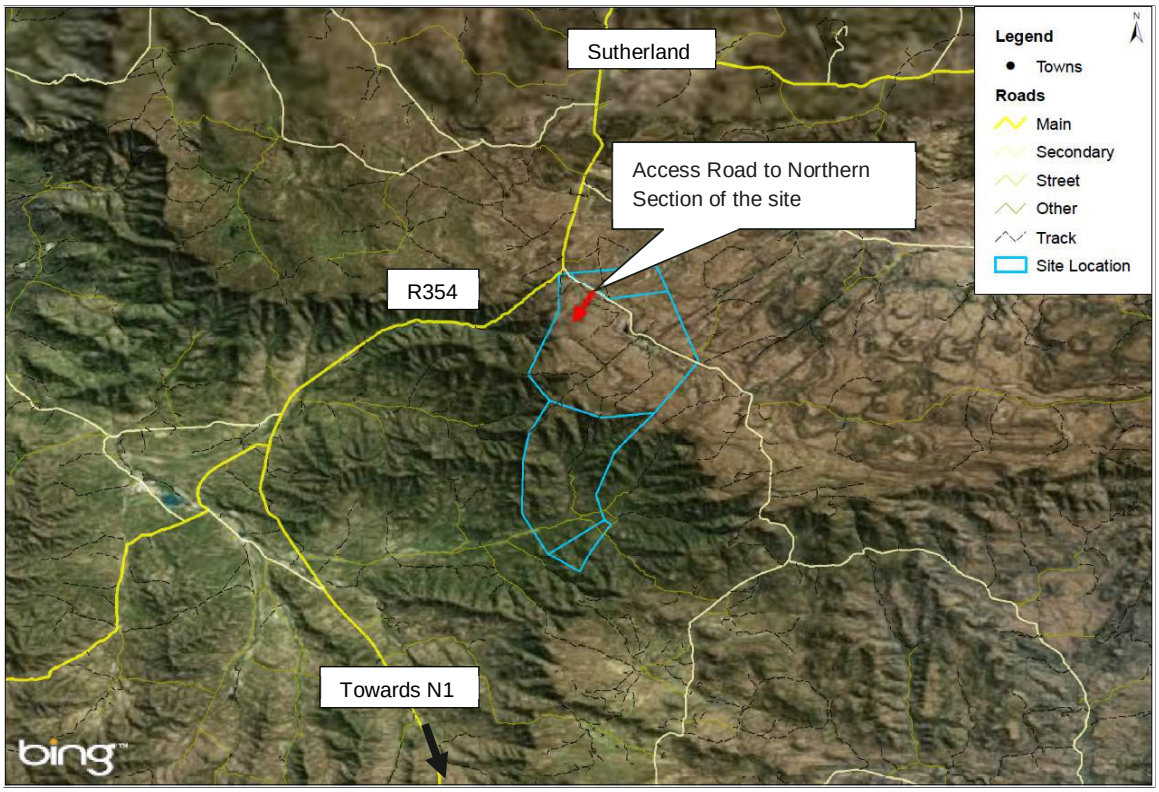


Figure 10: Access Position to Site

Below is an image from the turnoff on the R354 to Klein Roggeveld.

Figure 11: Klein Roggeveld Turnoff

3.3.8 Accommodation of Traffic during Construction

SANRAL and Provincial Authority may require upgrading of the access intersection to the site from National or Provincial roads. During upgrading of the access, traffic will have to be accommodated as per SADC Road Traffic Signs Manual requirements. The typical minimum signage requirements shown below will have to be implemented to ensure safety if the road needs closure during construction.

The accommodation of traffic on the potential access road from the gravel road leading to Klein Roggeveld to the site would require consultation with the farm users as only one-way traffic will be possible at best which means that the roads will be closed at times for local traffic.

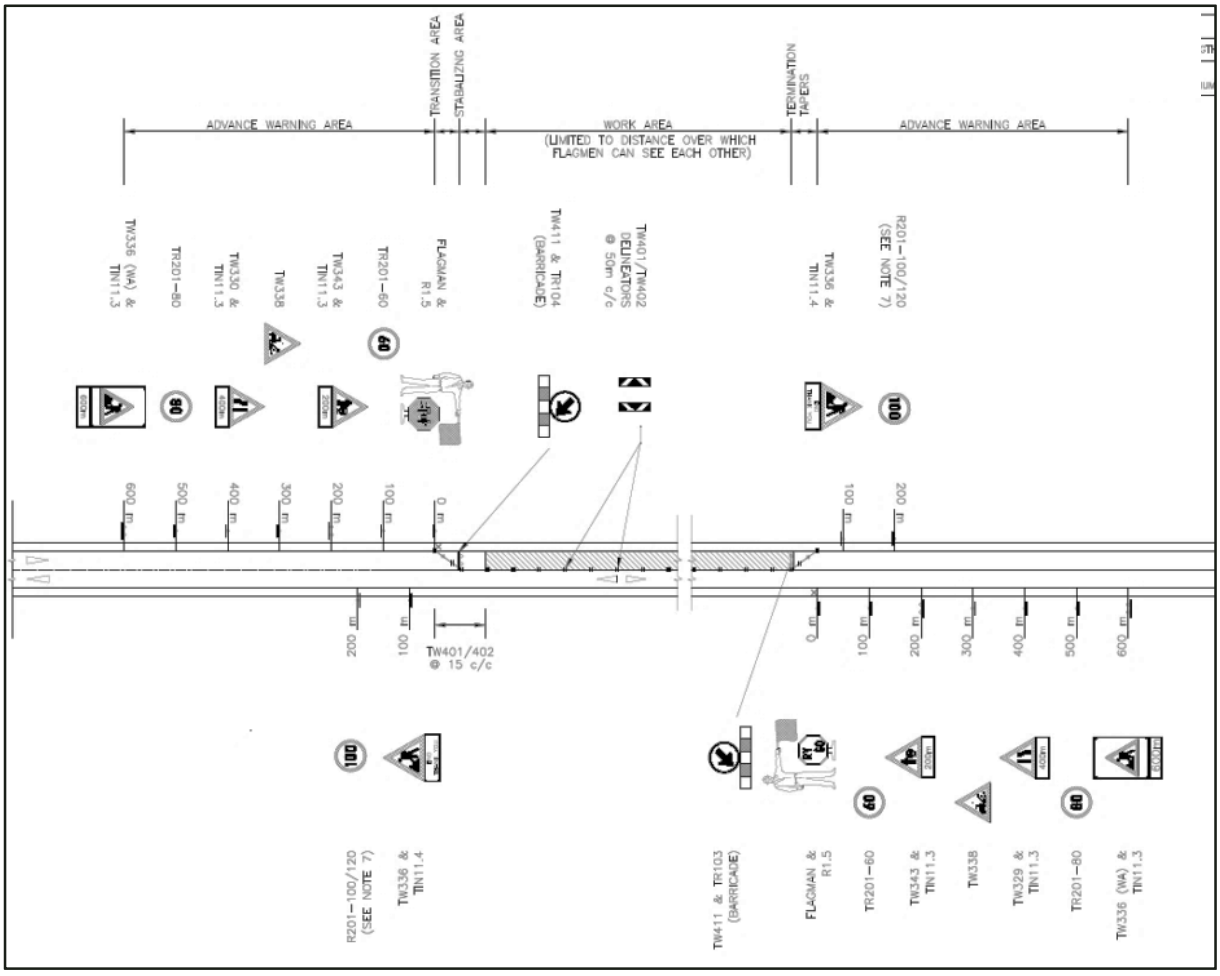


Figure 12: Accommodation of Traffic - Typical Layout

4 CONCLUSION

The transport needs for the proposed Gunstfontein WEF on the remainder of the farm portions Gunstfontein 131, Wolven Hoek 182, Portion 1 of the farm Gunstfontein 131 and Farm Boschmans Hoek 177 was investigated to confirm access route and site access for the development of a Wind Farm.

The general requirements are:

- Legal limits for normal heavy vehicle freight
- Legal limits for normal length vehicle freight
- Abnormal Permits required for transport of transformers
- Maximum vertical clearance on most routes is 5,2m for Abnormal Load but should preferably be limited to 4,8m.

The general freight for the wind farms comprise of building materials, blades, nacelles, towers, rotors and a transformer. The imported freight will be transported from South African ports to the respective sites. Building materials will be transported from sources in surrounding towns while certain elements will be transported from various manufacturing centres in South Africa. It could be beneficial to source road building materials and concrete aggregate from new quarries or borrow pits.

The preferred import origin of the imported elements to the proposed Gunstfontein WEF will be from the Saldanha port.

The route distance of 426 kilometres via Moorreesburg comprises of surfaced roads the full way. No toll fees are required. Abnormal Permits will be required for transport of the transformer and turbine components in any event.

The route is predominantly on National or Provincial Roads with suitable standards for transport of normal freight or abnormal loads with permits. There is a possibility of limited risk of delays for normal routine maintenance works (repairs and reseals) depending of the time of transport and scheduling of roads contracts.

The transport of elements from manufacturing centres within South Africa is predominantly on National and Provincial roads, which presents no limitations for normal freight.

The traffic impact on the National and Provincial road network during the installation, commissioning and decommissioning phases of the facility is low without any significant impact.

The preferred access road for abnormal loads is the road accessing the northern section of the study area, due to its current condition and short length.

It is recommended that as much as possible of the materials needed for construction be sourced within a close vicinity of the study area. As transporting close to 60 vehicles on the access route per WTG foundation opens the drivers to unnecessary risk.

In general no obvious problems are expected with freight transport along the proposed routes to the site and also for accesses necessary for the installation, operation and decommissioning of the site. It will however be necessary to confirm certain aspects (clearances, bridge capacity, etc.) dependent on the actual vehicle configuration used by the freight haulier.

Appendix A: Elements of Preferred Route

Table 1: Elements of preferred route

Element	Route Name	From	To	Distance [km]	Type
1	R45	Saldanha	Moorreesburg	84.9	Surfaced Provincial Road
				The R45 is a single carriageway two lane road with surfaced shoulders.	
2	R311	Moorreesburg	Riebeeck Kasteel	35.4	Surfaced Provincial Road
				The R311 is a single carriageway two lane road with surfaced shoulders.	
3	R46	Riebeeck Kasteel	Hermon	9.9	Surfaced Provincial Road
				The R46 is a single carriageway two lane road with surfaced shoulders.	

Element	Route Name	From	To	Distance [km]	Type
4	R46	Hermon	Wolseley	42.6	Surfaced Provincial Road
				The R46 is a single carriageway two lane road with surfaced shoulders. There are passes along this section of the route.	
5	R46	Wolseley	Ceres	16.6	Surfaced Provincial Road
				The R46 is a single carriageway two lane road with surfaced shoulders. There are mountain passes along this section of the route.	
6	R46	Ceres	Touwsrivier	80.6	Surfaced Provincial Road
				The R46 is a single carriageway two lane road with gravel shoulders. There are mountain passes along this section of the route.	

Element	Route Name	From	To	Distance [km]	Type
7	N1	Touwsrivier	Matjiesfontein	56.7	Surfaced National Road
				The N1 is a single carriageway two lane road with surfaced shoulders.	
8	R356	Matjiesfontein	Klein Roggeveld Turn-Off	96.2	Surfaced Provincial Road
				The R356 is a single carriageway two lane road with gravel shoulders (surfaced shoulders in places). There are mountain passes along this section of the route.	
9	N/A	Klein Roggeveld Turn-Off	Junction	2.5	Gravel Road
				Provincial gravel road potentially requiring minor upgrades (improvement of vertical alignment) and routine maintenance	

Appendix B: Urban Sections along the Preferred Route

Table 2: Urban sections on preferred route

Element	Route Name	Town	Type
2	R311	Moorreesburg	Surfaced Provincial Road
			
3	R46	Riebeeck Kasteel	Surfaced Provincial Road
			

Element	Route Name	Town	Type
6	R46	Ceres	Surfaced Provincial Road

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Appendix H:

Storm Water Management Plan

STORMWATER MANAGEMENT PLAN

1. PURPOSE

It is understood that activities associated with developments can impact negatively on drainage systems. By taking greater cognisance of natural hydrological patterns and processes it is possible to develop stormwater management systems in a manner that reduces these potentially negative impacts and mimic nature. The main risks associated with inappropriate stormwater management are increased erosion risk and risks associated with flooding. Therefore, this Stormwater Management Plan and the Erosion Management Plan are closely linked to one another and should be managed together.

This Stormwater Management Plan addresses the management of stormwater runoff from the development site and significant impacts relating to resultant impacts such as soil erosion and downstream sedimentation. The main factors influencing the planning of storm water management measures and infrastructure are:

» Topography and slope gradients;
» Placing of infrastructure and infrastructure design;
» Annual average rainfall;and
» Rainfall intensities;

The objective of the plan is therefore to provide measures to address runoff from disturbed portions of the site, such that they:

» do not result in concentrated flows into natural watercourses i.e. provision should be made for temporary or permanent measures that allow for attenuation, control of velocities and capturing of sediment upstream of natural watercourses.
» do not result in any necessity for concrete or other lining of natural watercourses to protect them from concentrated flows off the development if not necessary.
» do not divert flows out of their natural flow pathways, thus depriving downstream watercourses of water.

This Stormwater Management Plan must be updated and refined once the construction/ civil engineering plans have been finalised following detailed design.

2. RELEVANT ASPECTS OF THE SITE

The most prominent hydrological features within the study area, mainly located on top of the plateau, are a number of non-perennial pans and farm dams. Other smaller pans and farm dams occur throughout the study area. There are no major perennial rivers in close proximity to the proposed development site, but a number of non-perennial rivers and streams traverse the study area. The most notable of these is the Tankwa River and its tributaries that have their origin within this region.

The proposed development occurs at the intersection of the following catchments within the Nama Karoo Ecoregion:

- E23A – Tankwa;
- E23B - Knoffelhoeks River catchment; and
- D56C – Unknown tributary of the Riet River catchment

These catchments are characterised by several perennial and non-perennial rivers associated with these mainstream systems, several of which contain the following:

- Seeps with no wetland habitat, only rock outcrops colonised by grasses;
- Seep wetlands, rock and clay soils colonised by *Juncus* and other sedge species;
- Channelled valley bottom wetlands (Plate 3), with *Juncus* and other sedge species;
- Unchannelled valley bottom wetland areas, similar to the above but without a visible channel; and
- Depressions / endorheic pans, some of which have been converted into dams.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all of drainage lines within the site have been assigned a condition score of AB (Nel *et al.* 2012), indicating that they largely intact watercourses of biological significance. This is largely due to this catchments falling with the headwaters of large systems such as the Tankwa and Buffels River. This is especially true for those systems flowing in a westerly direction forming part of the Tankwa River catchment, as these are largely natural systems.

It should be noted that there is a potential impact on riparian systems through the possible increase in surface water runoff on downstream riparian form and function, i.e. although no water courses are present, impacts to the hydrological regime such as alteration of surface run-off patterns may be altered.

3. STORMWATER MANAGEMENT PRINCIPLES

In the design phase, various stormwater management principles should be considered including:

- Prevent concentration of stormwater flow at any point where the ground is susceptible to erosion.
- Reduce stormwater flows as far as possible by the effective use of attenuating devices (such as swales, berms, silt fences). As construction progresses, the stormwater control measures are to be monitored and adjusted to ensure complete erosion and pollution control at all times.
- Minimse the area of exposure of bare soils to minimse the erosive forces of wind, water and all forms of traffic.

- Ensure that development does not increase the rate of stormwater flow above that which the natural ground can safely accommodate at any point in the sub-catchments.
- Ensure that all stormwater control works are constructed in a safe and aesthetic manner in keeping with the overall development.
- Plan and construct stormwater management systems to remove contaminants before they pollute surface waters or groundwater resources. Implement the principle of separating clean and dirty run-off streams (typically from bunded areas or those areas associated with hydrocarbon storage or the facility substation).
- Contain soil erosion, whether induced by wind or water forces, by constructing protective works to trap sediment at appropriate locations. This applies particularly during construction.
- Avoid situations where natural or artificial slopes may become saturated and unstable, both during and after the construction process.
- Design and construct roads to avoid concentration of flow along and off the road. Where flow concentration is unavoidable, measures to incorporate the road into the pre-development stormwater flow should not exceed the capacity of the culvert. To assist with the stormwater run-off, gravel roads should typically be graded and shaped with a 2-3% crossfall back into the slope, allowing stormwater to be channelled in a controlled manor towards the natural drainage lines and to assist with any sheet flow on the site.
- Design culvert inlet structures to ensure that the capacity of the culvert does not exceed the pre-development stormwater flow at that point. Provide detention storage on the road and/or upstream of the stormwater culvert.
- Design outlet culvert structures to dissipate flow energy. Any unlined downstream channel must be adequately protected against soil erosion.
- Where the construction of a building causes a change in the vegetative cover of the site that might result in soil erosion, the risk of soil erosion by stormwater must be minimised by the provision of appropriate artificial soil stabilisation mechanisms or revegetation of the area. Any inlet to a piped system should be fitted with a screen, or grating to prevent debris and refuse from entering the stormwater system.
- Preferably all drainage channels on site and contained within the larger area of the property (i.e. including buffer zone) should remain in the natural state so that the existing hydrology is not disturbed.

3.1. Engineering Specifications

A detailed Stormwater Management Plan with engineering specifications describing and illustrating the proposed stormwater control measures must be prepared by the Civil Engineers during the detailed design phase and should be based on the underlying principles of this Stormwater Management Plan. This should include erosion control measures. Requirements for project design include:

» Erosion control measures to be implemented before and during the construction period, including the final stormwater control measures (post construction).
» All temporary and permanent water management structures or stabilisation methods must be indicated within the detailed comprehensive Stormwater Management Plan.
» The drainage system for the site should be designed to specifications that can adequately deal with a 1:50 year intensity rainfall event or more to ensure sufficient capacity for carrying storm waters around and away from infrastructure.
» Procedures for stormwater flow through a project site need to take into consideration both normal operating practice and special circumstances. Special circumstances in this case typically include severe rainfall events.
» An on-site Engineer or Environmental Officer must be responsible for ensuring implementation of the erosion control measures on site during the construction period.
» The EPC Contractor holds ultimate responsibility for remedial action in the event that the approved stormwater plan is not correctly or appropriately implemented and damage to the environment is caused.

During the construction phase, the contractor must prepare a Stormwater Control Method Statement to ensure that all construction methods adopted on site do not cause, or precipitate soil erosion and shall take adequate steps to ensure that the requirements of the Stormwater Management Plan are met before, during and after construction. The designated responsible person on site, must be indicated in the Stormwater Control Method Statement and shall ensure that no construction work takes place before the relevant stormwater control measures are in place.

An operation phase Stormwater Management Plan should be designed and implemented if not already addressed by the mitigations implemented as part of construction, with a view to preventing the passage of concentrated flows off hardened surfaces and onto natural areas.

Appendix I:

Emergency preparedness and Response Plan

EMERGENCY PREPAREDNESS AND RESPONSE PLAN

1. PURPOSE

The purpose of the Emergency Preparedness and Response Plan is:

- To assist contractor personnel to prepare for and respond quickly and safely to emergency incidents, and to establish a state of readiness which will enable prompt and effective response to possible events.
- To control or limit any effect that an emergency or potential emergency may have on site or on neighbouring areas;
- To facilitate emergency response and to provide such assistance on the site as is appropriate to the occasion;
- To ensure communication of all vital information as soon as possible;
- To facilitate the reorganisation and reconstruction activities so that normal operations can be resumed;
- To provide for training so that a high level of preparedness can be continually maintained.

This plan outlines response actions for potential incidents of any size. It details response procedures that will minimise potential health and safety hazards, environmental damage, and clean-up efforts. The plan has been prepared to ensure quick access to all the information required in responding to an emergency event. The plan will enable an effective, comprehensive response to prevent injury or damage to the construction personnel, public, and environment during the project. Contractors are expected to comply with all procedures described in this document. A Method Statement should be prepared at the commencement of construction detailing how this plan is to be implemented as well as details of relevant responsible parties for the implementation. The method statement must also reflect conditions of the IFC PS1 and include the following:

- » Identification of areas where accidents and emergency situations may occur;
- » Communities and individuals that may be impacted;
- » Response procedure;
- » Provisions of equipment and resources;
- » Designation of responsibilities;
- » Communication; and
- » Periodic training to ensure effective response to potentially affected communities.

2. PROJECT-SPECIFIC DETAILS

The Gunstfontein Wind Farm (Pty) Ltd proposes to construct and operate a wind energy facility, known as the Gunstfontein Wind Energy Facility, on the Remaining Extent of the Farm Gunstfontein 131, located approximately 20km south of Sutherland in the Northern Cape Province. Due to the scale and nature of this development, it is anticipated that the following risks could potentially arises during the construction and operation phases:

- Fires;
- Leakage of hazardous substances;
- Storage of flammable materials and substances;
- Accidents; and
- Natural disasters.

3. EMERGENCY RESPONSE PLAN

There are three levels of emergency as follows:

- Local Emergency: An alert confined to a specific locality.
- Site Emergency: An alert that cannot be localised and which presents danger to other areas within the site boundary or outside the site boundary.
- Evacuation: An alert when all personnel are required to leave the affected area and assemble in a safe location.

If there is any doubt as to whether any hazardous situation constitutes an emergency, then it must be treated as an Evacuation.

Every effort must be made to control, reduce or stop the cause of any emergency provided it is safe to do so. For example, in the event of a fire, isolate the fuel supply and limit the propagation of the fire by wetting the adjacent areas. Then confine and extinguish the fire (where appropriate) making sure that re-ignition cannot occur; for a gas fire it is usually appropriate to isolate the fuel and let it burn itself out but keep everything around the fire cold.

3.1. Emergency Scenario Contingency Planning

3.1.1. Scenario: Spill which would result in the contamination of land, surface or groundwater

i. Spill Prevention Measures

Preventing spills must be the top priority at all operations which have the potential of endangering the environment. The responsibility to effectively prevent and mitigate any scenario lies with the Contractor and the ECO. In order to reduce the risk of spills and associated contamination, the following principles should be considered during construction and operation activities:

» All equipment refuelling, servicing and maintenance activities should only be undertaken within appropriately sealed designated areas.
» All maintenance materials, oils, grease, lubricants, etc. should be stored in a designated area in an appropriate storage container.
» No refuelling, storage, servicing, or maintenance of equipment should take place within 50m of drainage lines or sensitive environmental resources in order to reduce the risk of contamination by spills.
» No refuelling or servicing should be undertaken without absorbent material or drip pans properly placed to contain spilled fuel.
» Any fluids drained from the machinery during servicing should be collected in leak-proof containers and taken to an appropriate disposal or recycling facility.
» If these activities result in damage or accumulation of product on the soil, the contaminated soil must be disposed of as hazardous waste. Under no circumstances shall contaminated soil be added to a spoils pile and transported to a regular disposal site.
» Chemical toilets used during construction must be regularly cleaned. Chemicals used in toilets are also hazardous to the environment and must be controlled. Portable chemical toilets could overflow if not pumped regularly or they could spill if dropped or overturned during moving. Care and due diligence should be taken at all times.
» Contact details of emergency services and HazMat Response Contractors are to be clearly displayed on the site. All staff are to be made aware of these details and must be familiar with the procedures for notification in the event of an emergency (as well as the possible time delay in emergency services arriving due to the remote location of the site).

ii. Procedures

The following action plan is proposed in the event of a spill:

1. Spill or release identified.

2. Assess person safety, safety of others and environment.
3. Stop the spill if safely possible.
4. Contain spill to limit entering water bodies and surrounding areas.
5. Identify substance spilled.
6. Quantify spill (under or over guideline/threshold levels).
7. Notify Site Manager and emergency response crew and authorities (in event of major spill).
8. Inform users (and downstream users) of potential risk.
9. Clean up of spill using on-site spill kit or by HazMat team (if required).
10. Record of spill incident on company database.

a) Procedures for containing and controlling the spill (i.e. on land or in water)

Measures can be taken to prepare for quick and effective containment of any potential spills. Each contractor must keep sufficient supplies of spill containment equipment at the construction sites, at all times during and after the construction phase. These should include specialised spill kits or spill containment equipment. Other spill containment measures include using drip pans underneath vehicles and equipment every time refuelling, servicing, or maintenance activities are undertaken.

Specific spill containment methods for land and water contamination are outlined below.

Containment of Spills on Land

Spills on land include spills on rock, gravel, soil and/or vegetation. It is important to note that soil is a natural sorbent, and therefore spills on soil are generally less serious than spills on water as contaminated soil can be more easily recovered. It is important that all measures be undertaken to avoid spills reaching open water bodies. The following methods could be used:

» *Dykes*

Dykes can be created using soil surrounding a spill on land. These dykes are constructed around the perimeter or down slope of the spilled substance. A dyke needs to be built up to a size that will ensure containment of the maximum quantity of contaminant that may reach it. A plastic tarp can be placed on and at the base of the dyke such that the contaminant can pool up and subsequently be removed with sorbent materials or by pump into barrels or bags. If the spill is migrating very slowly, a dyke may not be necessary and sorbents can be used to soak up contaminants before they migrate away from the source of the spill.

» *Trenches*
Trenches can be dug out to contain spills. Spades, pick axes or a front-end loader can be used depending on the size of trench required. Spilled substances can then be recovered using a pump or sorbent materials.

Containment of Spills on or in Water (including water resource features)

Spills in water can negatively impact water quality and aquatic life. All measures need to be undertaken to contain spills to drainage lines or open water. The following methods could be used:

» *Temporary weirs*
Temporary weir structures can be used to contain spills in streams and to prevent further migration downstream. Plywood or other materials found on site can be placed into and across the width of the stream, such that water can still flow under the weir. Weirs are however only effective for spilled substances which float on the water surface, and also only for a limited time period.

» *Barriers*
In some situations barriers made of netting or fence material can be installed across a stream, and sorbent materials placed at the base to absorb spilled substance. Sorbents will need to be replaced as soon as they are saturated. Water will be allowed to flow through.

b) Procedures for transferring, storing, and managing spill related wastes

Used sorbent materials are to be placed in plastic bags for future disposal. All materials mentioned in this section are to be available in the spill kits. Following clean up, any tools or equipment used must be properly washed and decontaminated, or replaced if this is not possible.

Spilled substances and materials used for containment must be placed into empty waste oil containers and sealed for proper disposal at an approved disposal facility.

c) Procedures for restoring affected areas

Criteria that may be considered include natural biodegradation of oil, replacement of soil and revegetation. Once a spill of reportable size has been contained, the ECO and the relevant Authority must be consulted to confirm that the appropriate clean up levels are met.

3.1.2. Scenario: Fire (and fire water handling)

i. Action Plan

The following action plan is proposed in the event of a fire:

1. Quantify risk
2. Assess person safety, safety of others and environment
3. If safe – attempt to extinguish fire using appropriate equipment
4. If not safe to extinguish, contain fire
5. Notify Site Manager and emergency response crew and authorities
6. Inform users (and downstream users) of potential risk of fire
7. Record of incident on company database

ii. Procedures

Because large scale fires may spread very quickly in the environment it is most advisable that the employee/contractor not put his/her life in danger in the case of an uncontrolled fire.

Portable firefighting equipment must be provided in line with the Building Code of South Africa and the relevant provincial building code. All emergency equipment including portable fire extinguisher, hose reels, hydrants must be maintained and inspected by a qualified contractor in accordance with the relevant legislation and National standards.

Current evacuation signs and diagrams for the building or site that are compliant to relevant state legislation must be provided in a conspicuous position, on each evacuation route. Contact details for the relevant emergency services should be clearly displayed on site and all employees should be aware of procedures to follow in the case of an emergency.

a) Procedures for initial actions

Persons should not fight the fire if any of the following conditions exist:

» They have not been trained or instructed in use of a fire extinguisher.
» They do not know what is burning.
» The fire is spreading rapidly.
» They do not have the proper equipment.
» They cannot do so without a means of escape.
» They may inhale toxic smoke.

b) Reporting procedures

» Report fire immediately to the site manager, who will determine if it is to be reported to the relevant emergency services and authorities.
» The site manager must have copies of the Report form to be completed.

SUMMARY: RESPONSE PROCEDURE

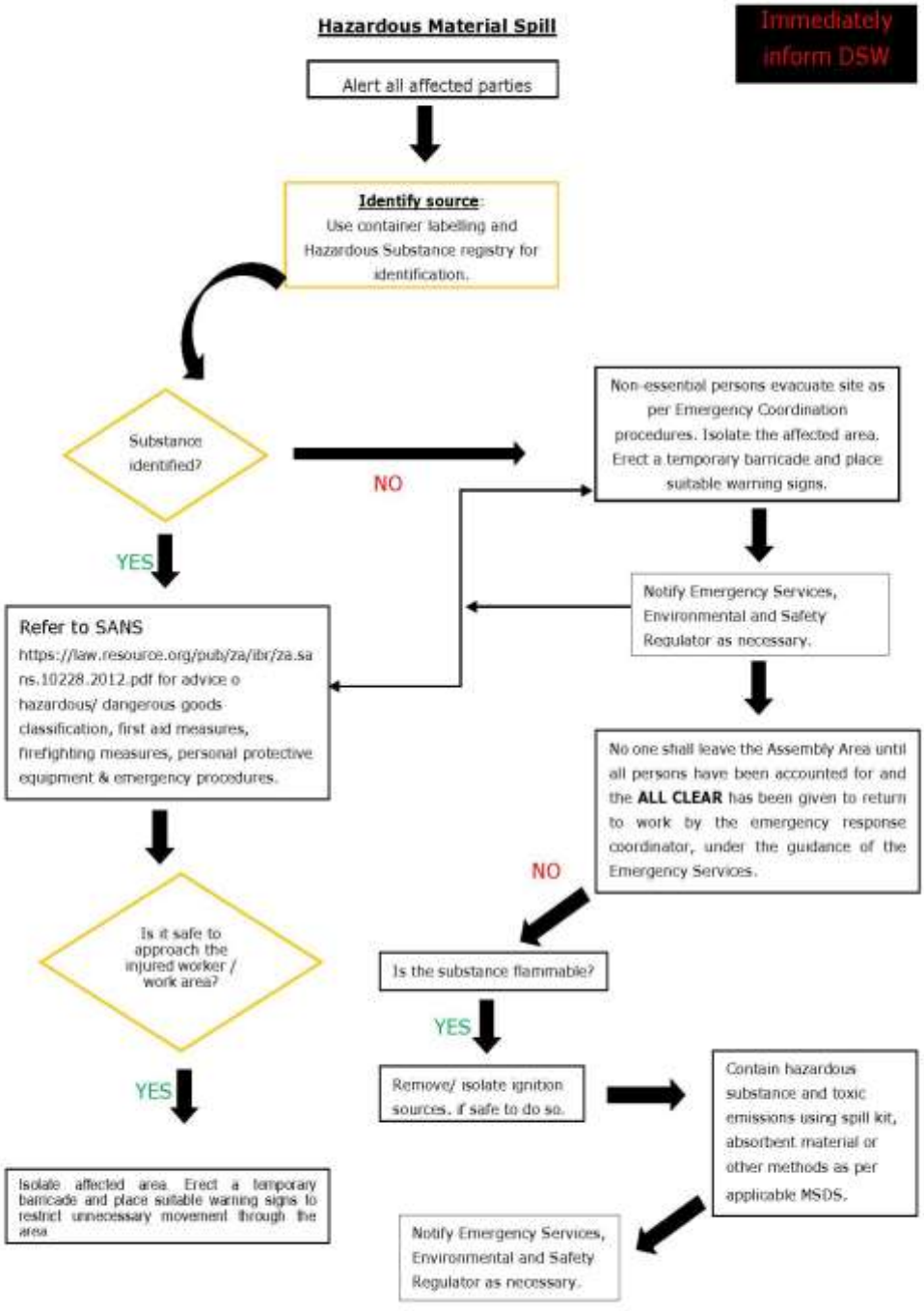

Figure 1: Hazardous Material Spill

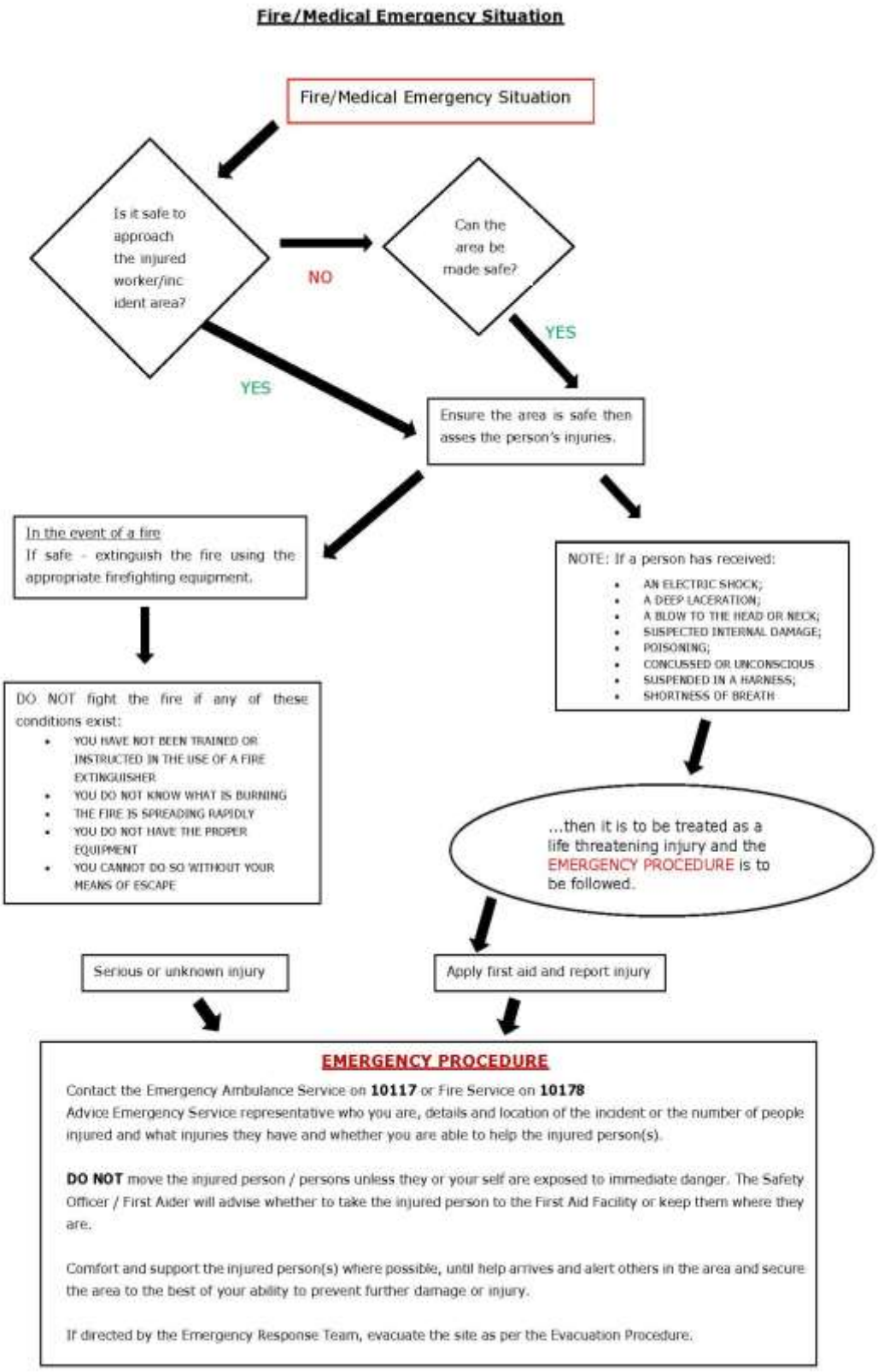

Figure 2: Emergency Fire/Medical

Appendix J:

Erosion Management Plan

PRINCIPLES FOR EROSION MANAGEMENT

1. PURPOSE

Exposed and unprotected soils are the main cause of erosion in most situations. Therefore, this erosion management plan and the revegetation and rehabilitation plan are closely linked to one another and should not operate independently, but should rather be seen as complementary activities within the broader environmental management of the site and should therefore be managed together.

This Erosion Management Plan addresses the management and mitigation of potential impacts relating to soil erosion. The objective of the plan is to provide:

- A general framework for soil erosion and sediment control, which enables the contractor to identify areas where erosion can occur and is likely to be accelerated by construction related activities.
- An outline of general methods to monitor, manage and rehabilitate erosion prone areas, ensuring that all erosion resulting from all phases of the development is addressed.

2. RELEVANT ASPECTS OF THE SITE

The soils in most of the Gunstfontein study area are not considered to be highly erodible. This is due to several factors, including the shallow soil depth to underlying rock, as well as the presence of surface rock outcrops. This will lead to a relatively stable soil surface, although in areas with steeper slopes, virtually all soils will erode to some extent if disturbed.

However, in land type **Db6**, there is a significant occurrence (74%) of duplex soils, which are deeper, with a sandy topsoil abruptly overlying a clay subsoil, so that if the topsoil becomes exposed (by such actions as overgrazing, or man-made processes such as construction), it can be washed away, resulting in the subsoil forming a crust, which is very difficult to re-vegetate. Therefore, great care should be taken in this area wherever construction activities are planned.

The only planned infrastructure that traverses land type Db6 is a single length of access road.

3. EROSION AND SEDIMENT CONTROL PRINCIPLES

The goals of erosion control during and after construction at the site should be to:

» Protect the land surface from erosion;
» Intercept and safely direct run-off water from undisturbed upslope areas through the site without allowing it to cause erosion within the site or become contaminated with sediment; and
» Progressively revegetate or stabilise disturbed areas.

These goals can be achieved by applying the management practices outlined in the following sections.

3.1. On-Site Erosion Management

General factors to consider regarding erosion risk at the site includes the following:

» Soil loss will be greater during wet periods than dry periods. Intense rainfall events outside of the wet season, such as occasional summer thunder storms can also cause significant soil loss. Therefore precautions to prevent erosion should be present throughout the year.
» Soils loss will be greater along the access road that traverses land type Db6. Therefore precautions to prevent erosion should be present throughout the construction phase.
- Soils loss will be greater on steeper slopes. Ensure that steep slopes are not de-vegetated unnecessarily and subsequently become hydrophobic (i.e. have increased runoff and a decreased infiltration rate) increasing the erosion potential.
» Soil loss is related to the length of time that soils are exposed prior to rehabilitation or stabilisation. Therefore the gap between construction activities and rehabilitation should be minimised. Phased construction and progressive rehabilitation, where practically possible, are therefore important elements of the erosion control strategy.
» The extent of disturbance will influence the risk and consequences of erosion. Therefore site clearing should be restricted to areas required for construction purposes only. As far as possible, large areas should not be cleared all at once, especially in areas where the risk of erosion is higher.
» Roads should be planned and constructed in a manner which minimises their erosion potential. Roads should therefore follow the natural contour as far as possible. Roads parallel to the slope direction should be avoided as far as possible.

» Where necessary, new roads constructed should include water diversion structures present with energy dissipation features present to slow and disperse the water into the receiving area.
» Roads and other disturbed areas should be regularly monitored for erosion. Any erosion problems recorded should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» Compacted areas should have adequate drainage systems to avoid pooling and surface flow. Heavy machinery should not compact those areas which are not intended to be compacted as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area. Where compaction does occur, the areas should be ripped.
» All bare areas should be revegetated with appropriate locally occurring species, to bind the soil and limit erosion potential.
» Silt fences should be used where there is a danger of topsoil or material stockpiles eroding and entering streams and other sensitive areas.
» Gabions and other stabilisation features should be used on steep slopes and other areas vulnerable to erosion to minimise erosion risk as far as possible.
» Activity at the site after large rainfall events when the soils are wet and erosion risk is increased should be reduced.
» Topsoil should be removed and stored separately during construction activities (as per the recommendations in the EMPr), and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
» Regular monitoring of the site for erosion problems during construction (on-going) and operation (at least twice annually) is recommended, particularly after large summer thunderstorms have been experienced. The ECO will determine the frequency of monitoring based on the severity of the impacts in the erosion prone areas.

3.1.1. Erosion control mechanisms

The contractor may use the following mechanisms (whichever proves more appropriate/ effective) to combat erosion when necessary:

» Reno mattresses;
» Slope attenuation;
» Hessian material;
» Shade catch nets;
» Gabion baskets;
» Silt fences;
» Storm water channels and catch pits;
» Soil bindings;
» Geofabrics;
» Hydro-seeding and/or re-vegetating;

» Mulching over cleared areas;
» Boulders and size varied rocks; and
» Tilling.

3.2. Engineering Specifications

A detailed engineering Storm-water Management Plan describing and illustrating the proposed stormwater control measures must be prepared by the Civil Engineers during the detailed design phase and should be based on the underlying principles of the Stormwater Management Plan (Appendix H of the EMPr) and this should include erosion control measures. Requirements for project design include:

» Erosion control measures to be implemented before and during the construction period, including the final stormwater control measures (post construction).
» All temporary and permanent water management structures or stabilisation methods must be indicated within the Stormwater Management Plan.
» An onsite Engineer or Environmental Officer (EO) to be responsible for ensuring implementation of the erosion control measures on site during the construction period. The ECO to monitor the effectiveness of these measures on the interval agreed upon with the Site Manager and EO.
» The Contractor holds ultimate responsibility for remedial action in the event that the approved Storm-Water Plan is not correctly or appropriately implemented and damage to the environment is caused.

3.3. Monitoring

The site must be monitored continuously during construction and operation in order to determine any indications of erosion. If any erosion features are recorded as a result of the activities on site the Environmental Officer (during construction) or Environmental Manager (during operation) must:

» Assess the significance of the situation.
» Take photographs of the soil degradation.
» Determine the cause of the soil erosion.
» Inform the contractor/operator that rehabilitation must take place and that the contractor/operator is to implement a rehabilitation method statement and management plan to be approved by the Site/Environmental Manager in conjunction with the ECO.
» Monitor that the contractor/operator is taking action to stop the erosion and assist them where needed.
» Report and monitor the progress of the rehabilitation weekly and record all the findings in a site register (during construction).

» All actions with regards to the incidents must be reported on a monthly compliance report which should be kept on file for if/when the Competent Authority requests to see it (during construction) and kept on file for consideration during the annual audits (during construction and operation).

The Contractor (in consultation with an appropriate specialist, e.g. an engineer) must:

» Select a system/mechanism to treat the erosion.
» Design and implement the appropriate system/mechanism
» Monitor the area to ensure that the system functions like it should. If the system fails, the method must be adapted or adjusted to ensure the accelerated erosion is controlled.
» Continue monitoring until the area has been stabilised.

4. CONCLUSION

The Erosion Management Plan is a document to assist the Proponent/ Contractor with guidelines on how to manage erosion during all phases of the project. The implementation of management measures is not only good practice to ensure minimisation of degradation, but also necessary to ensure compliance with legislative requirements. This document forms part of the EMPr, and is required to be considered and adhered to during the design, construction, operation and decommissioning phases of the project (if and where applicable).

5. REFERENCES

Department of Environmental Affairs. (1983). *Conservation of Agricultural Resources Act 43 of 1983.* Pretoria: Department of Environmental Affairs.

Coetzee, K. (2005). *Caring for Natural Rangelands.* Scottsville: University of KwaZulu-Natal Press.

Commission, F. R. (2009, March 10). *Forestry Commission*. Retrieved August Tuesday, 2012, from Forestry Commission: Forest Research : www.forestry.gov.uk

Tongway, D. J., & Ludwig, J. A. (2004). *Heterogeneity in arid and semi arid lands.* Queensland: Sustainable Ecosystems.

van der Linde, M., & Feris, L. (2010). *Compendium of South African Legislation.* Pretoria: Pretoria University Press.

Appendix K:

Environmental Team CV's

CURRICULUM VITAE

KAREN JODAS

SAVANNAH ENVIRONMENTAL (PTY) LTD

Profession	:	Environmental Consultant
Specialisation	:	Strategic environmental assessment and advice; project management and co-ordination of environmental projects; environmental compliance advise and monitoring; Environmental Impact Assessment; environmental management; peer review; policy, strategy and guideline formulation; renewable energy projects; water management
Work experience	:	Seventeen (17) years in the environmental assessment and management field

VOCATIONAL EXPERIENCE

Provide technical input for projects in the environmental management field, specialising in environmental auditing and compliance, strategic evaluation, Environmental Impact Assessment studies, Environmental Management Plans, integrated environmental management, environmental compliance monitoring (ECO role); peer review of EIA reports and processes, strategy and guideline development, and public participation. Key focus on overall Project Management, integration of environmental studies and environmental processes into larger engineering-based projects, strategic assessment, and the identification of environmental management solutions and mitigation/risk minimising measures.

Undertaking studies requiring all environmental-related disciplines has allowed for considerable experience to be gained in the environmental assessment and management fields. A specialist area of focus is on management and assessment of multi-faceted projects, mostly greenfields projects, including electricity generation and transmission projects (with a strong focus on the renewable energy sector), linear developments (roads and power lines), bulk infrastructure and supply (e.g. WTWs, pipelines, landfills), the mining industry, urban, rural and township developments, environmental aspects of IDPs, EMFs, SoERs, as well as environmental planning, development and management.

Working knowledge of environmental legislation, strategies, guidelines and policies. Compilation of the reports for environmental studies are in accordance with the all relevant environmental legislation, including the National Environmental Management Act, EIA Regulations and the Minerals and Petroleum Resources Development Act. Due consideration of Equator Principles and compliance with IFC performance standards is now a part of all projects.

SKILLS BASE AND CORE COMPETENCIES

- Seventeen years of experience in the environmental management and impact assessment field
- Fifteen years of experience in Project Management - Project management of large environmental assessment and management projects
- Strategic and compliance advise for all aspects of environmental assessment and management
- Compliance and auditing
- External and peer review of EIA reporting and EIA process
- Working knowledge of environmental planning policies, regulatory frameworks and legislation
- Identification and assessment of potential environmental impacts and benefits
- Development of practical and achievable mitigation measures and management plans and evaluation of risk to project execution

- Experienced in environmental compliance advise, monitoring and reporting for construction projects
- Compilation and review of the reports in accordance with all relevant environmental legislation
- Public participation/involvement and stakeholder consultation
- Environmental strategy, policy and guidelines development
- Experienced in assessments for both linear developments and nodal developments
- Key experience in the assessment of impacts associated with renewable energy projects
- Wide range of experience for public and private sector projects
- Completed projects in all nine Provinces of South Africa, as well as Zambia and Lesotho

EDUCATION AND PROFESSIONAL STATUS

Degrees:

- B.Sc Earth Sciences, majoring in Geography and Zoology, *Rhodes University, Grahamstown,* 1993
- B.Sc Honours in Geography (in Environmental Water Management), *Rhodes University, Grahamstown,* 1994. Major subjects included Water Resources Management, Streams Ecology, Fluvial Geomorphology and Geographic Information Systems.
- M.Sc in Geography (Geomorphology), *Rhodes University, Grahamstown,* 1996

Short Courses:
Water Quality Management, *Potchefstroom University,* 1998
Environmental Law Course, *Aldo Leopold Institute*, 2002
WindFarmer Wind Farm Design course, *Garrad Hassan*, 2009

Professional Society Affiliations:
Registered with the South African Council for Natural Scientific Professions as a Professional Natural Scientist: *Environmental Scientist (400106/99)*

Other Relevant Skills:
Xtrack Extreme – Advanced Off-Road Driving Course (2003)

EMPLOYMENT

2006 - Current: Director of *Savannah Environmental (Pty) Ltd.* Independent specialist environmental consultant, Environmental Assessment Practitioner (EAP) and advisor

Jan 1997 – September 2005: Associate of *Bohlweki Environmental (Pty) Ltd*. Environmental Management Unit: Manager; Principle Environmental Scientist focussing on Environmental Management and Project Management.

SELECTED RELEVANT PROJECT EXPERIENCE

Environmental and Social Governance Due Diligence for the Khobab and Loeriesfontein 140MW Wind Energy Facilities, South Africa	ACTIS	Report of status of compliance of projects against all legislated and other stipulated requirements, Equator Principles and IFC PSs to assess the potential for risk for the lender. To report on identified gaps, mitigation needed, and positive effects of the projects.
Environmental and Social Governance Due Diligence for the Noupoort 140MW Wind Energy Facilities, South Africa	ACTIS	Report of status of compliance of projects against all legislated and other stipulated requirements, Equator Principles and IFC PSs to assess the potential for risk for the lender. To report on identified gaps, mitigation needed, and positive effects of the projects.
EIA, EMPR review, Revision of the Environmental Management Plan (EMP), and Equator Principle review and Action Plan for the Mkuze Biomass facility, KwaZulu Natal, South Africa	Navosync / Building Energy	Review the EIA and EA and revise the EMP to ensure compliance and fill any gaps in mitigation. Report of status of compliance of projects against all legislated and other stipulated requirements, Equator Principles and IFC PSs. Develop an EP Action Plan. All work required to reach financial close.

Environmental and Social Governance Review of the proposed Hilton Garden Court Inn, Namibia	Vantage Capital	Report of status of compliance of projects against all legislated and other stipulated requirements, Equator Principles and IFC PSs to assess the potential for risk for the lender. To report on identified gaps, mitigation needed, and positive effects of the projects.
Environmental Management Plan for the Kuvaninga Gas Fired Power Station, Mozambique	Investec	Draft and compile Environmental Management Plan (EMP) for the project to meet all IFC performance standards. For construction and operation phases.
EIA, EMPR review, Revision of the Environmental Management Plan (EMP), and Equator Principle review and Action Plan for the Kathu CSP facility, Northern Cape, South Africa	GDF Suez	Review the EIA, EA and EMP to ensure compliance and fill any gaps in mitigation. Report of status of compliance of projects against all legislated and other stipulated requirements, Equator Principles and IFC PSs. Develop an EP Action Plan. All work required to reach financial close.
EIA, EMPR review, Revision of the Environmental Management Plan (EMP), and Equator Principle review and Action Plan for the Cookhouse Wind Energy facility, Eastern Cape, South Africa	ACED	Review the EIA, the EA and EMP to ensure compliance and fill any gaps in mitigation. Report of status of compliance of projects against all legislated and other stipulated requirements, Equator Principles and IFC PSs. All work required to reach financial close.

CURRICULUM VITAE
TEBOGO MAPINGA

Profession	:	Senior Environmental Consultant for Savannah Environmental Consultants
Specialisation	:	Environmental Management
Years of experience	:	8 years

KEY RESPONSIBILITIES

- Project Management and client liaison;
- Report writing and review;
- Compliance monitoring and audit reporting;
- Development of Proposals; and
- Staff monitoring.

SKILLS BASE AND CORE COMPETENCIES

- Report Writing, drafting proposals and tenders;
- Negotiating skill;
- Problem solving;
- Financial management and marketing;
- Understanding of all Environmental Legislation (NEMA, NEM:BA, NEM:WA, NEM:AQA, NEM:PAA, etc) and all other relevant legislation;
- Ability to work independently and in a team;
- Verbal, written and good presentation skills;
- Time management and workload management;
- Facilitation skills; and
- Organizational, planning and analytic skills.

EDUCATION AND PROFESSIONAL STATUS

Degrees:

- *Bsc Degree: The University of Limpopo, 2006; and*
- *Honours in Environmental Management: University of South Africa (in progress).*

Courses:

- Computer Literacy Course: University of Limpopo, 2005; and
- Environmental Impact Assessment Training: University of Pretoria, 2012.

Professional Society Affiliations:

- ***N/A***

EMPLOYMENT HISTORY

Environmental Practitioner/ Project Manager: Phaki Phakanani Environmental Consultants (January 2007 - March 2008) Tasks include:

- Training of junior staff;
- Client Liaison;

- Project co-ordination and facilitation;
- Managing specialists;
- Report writing and presentations;
- Compiling Environmental Impact Assessment Reports (Basic and Scoping/EIA Report); and
- Facilitating the Public Participation Process.

Environmental Manager: SEF (1 April 2008 – 30 February 2009) Tasks include:

- Compilation of Environmental Scoping Reports, Plan of Study, Environmental Impact Assessments, Basic Assessments and Environmental management plans;
- Co-ordination of the public participation process;
- Project management, including specialists and other team members;
- Development of terms of reference, project proposals and tenders; and
- Client liaison.

Environmental Project Manager: SEF (1 March 2009 until 31 April 2010) Tasks include:

- Compilation of Environmental Scoping Reports, Plan of Study, Environmental Impact Assessments, Basic Assessments and Environmental management plans;
- Co-ordination of the public participation process;
- Project management, including specialists and other team members;
- Development of terms of reference, project proposals and tenders;
- Client liaison;
- Marketing; and
- Financial Management of projects.

Environmental Officer Specialist production: Department of Environmental Affairs (1 April 2010 until 1 June 2013) Tasks include:

- Process EIA applications submitted to DEA within the stipulated legislated time frames;
- Implement the SID and ERP EIA guideline;
- Provide technical input into Appeal Response Report's (ARR's);
- Support Regulatory Services with compliance monitoring and enforcement;
- Implement DEA and Public Entity EIA forums; and
- Provide technical input into CD: IEA correspondence.

Environmental Scientist: GIBB Engineering and Science (Mega Projects) (1June 2013- 31 March 2014) Tasks include:

- Re-writing the Revised Draft EIR Version 2 Eskom Nuclear-1 EIA; and
- Liaison with the client and specialists.

PROJECT EXPERIENCE

ENVIRONMENTAL IMPACT ASSESSMENTS AND PUBLIC PARTICIPATION

- Wesley Peddie Power Line Basic Assessment (2015)
- Pofadder Wind and Solar Energy Facilities (2014-2015);
- Pofadder Power Line Basic Assessment Application (2014-2015)
- Castle Wind Energy Facility (2014-2015)
- Spitskop Wind Energy Facility (2014-2015);
- Bobididi Solar Facility-Environmental Screening (2014);
- Son Sitrus Solar Energy Facility (2014);
- Nuclear- 1 EIA (2013);
- Langkuil Industrial Development, 2008 (Environmental Manager and Project Manager);
- Township Development in Reitfontein, 2008/2009;
- Upgrading of the BP Golf Course, 2008;
- Construction of the BP Soshanguve VV Filling Station, 2008;
- Construction of the BP Soshanguve ZZ Filling Station, 2008;
- Shell Filling Stations(Project Manager and Client Liaison), 2008/ 2009:
- Watloo Filling Station
- Chantelle Filling Station
- M2 East Filling Station
- Orlando Filling Station
- Equestria Willowglen Filling Station
- President Park Filling Station
- Capital Park;
- Eskom- Komati Water Augmentation, 2008;
- Rainbow Junction Residential Development, 2008/ 2009;
- Township Development in Delmore Park Extension 7, 2008/ 2009;
- West Rand District Municipality- Bulk Water Supply 2009;
- West Rand District Municipality Air Quality Assessment;
- Lonmin K4 Shaft Mine Upgrading;
- Westlake Residential Development;
- Air Quality Management Plan;
- Montana Spruit Upgrading;
- Palm Ridge Township Development;
- HM Pitjie Roads;
- Vlaakplat S24G Application (Mokgale City Local Municipality);
- Rangeview Ext 2 S24G Application (Mogale City Local Municipality);
- Construction of Khetho Bridge, Greater Giyani Local Municipality, 2007;
- Demolition and Relocation of Malamulele High School, 2007;
- Construction of Malamulele Shopping Complex, 2007;
- The Subdivision of land in Ellisrus, 2007;
- Construction of the Senwabarwane Filling Station, 2007;

- Residential Development in Tlapeng Village, 2007;
- Township Development in Maphosa Village, 2007;
- Establishment of a Piggery in Mogalakwena Local Municipality, 2007;
- Establishment of two Piggeries in Elias Motsoaledi Local Municipality, 2007;
- Establishment of a Piggery in Modimolle Local Municipality, 2007;
- Township Development in Rietfontein, 2007;
- Public Participation and Section 24G Application for the National Taxi Scrapping Project, 2007;
- Construction of a Shopping Complex in Zebediela, 2007;
- Establishment of a Guest House (ECA application), 2008;
- Establishment of a Waste Management Depot in Rustenburg, 2008; and
- Establishment of a Waste Management Depot in Tzaneen and Nkowa-Nkowa, 2008.

CURRICULUM VITAE
GABRIELE WOOD

Profession	:	Public Participation and Social Consultant
Specialisation	:	Public Participation Process Implementation
Years experience	:	8 years

KEY RESPONSIBILITIES

Specific responsibilities as a Public Participation and Social Consultant include professional execution of public participation consulting for a variety of projects. This includes managing and coordinating public participation processes for Environmental Impact Assessments (EIA).

SKILLS BASE AND CORE COMPETENCIES

- Qualitative and Quantitative Social Research
- Social Assessment (Stakeholder and Social Analysis)
- Public participation process implementation, monitoring and evaluation
- Facilitation (Focus Groups, Community Meetings, Interest Group Meetings, Public Meetings, Public Open Days, Workshops, Forums, Committees, etc.)
- Stakeholder Management
- Community Needs Assessment
- Relocation Facilitation
- Project Administration
- Minute Taking
- Report Writing

EDUCATION AND PROFESSIONAL STATUS

Degrees:

- B. Hons. Anthropology (Cum Laude): University of Johannesburg (2004 – 2005)
- B.A. Psychology: University of Johannesburg (2002 – 2004)

Courses:

- South African Advertising Research Foundation (SAARF) living Standards Measure (LSM) Training (2010).
- Certificate in Focus Group Moderation Skills, Market Research for Africa (2007)
- Prestige Diploma in Public Relations: Allenby Campus Boksburg now Damlin College (2001

EMPLOYMENT

May 2012 – Current: Savannah Environmental (Pty) Ltd: Public Participation and Social Consultant

March 2007 – April 2012: NMA Effective Social Strategists (Pty) Ltd: Assistant Project Manager : Public Participation and Social Research

January 2005 – March 2007 (Part-time): University of Johannesburg: Department of Anthropology and Development Studies: Student Tutor and Research Assistant

PROJECT EXPERIENCE

Current projects include:

- Blackwood Solar Energy Facility - EIA (for VentuSA Energy)
- Amakhala Kopleegte Substation and Kopleegte – Poseidon Power Line – BA (for Cennergi)
- Garob – Kronos Power Line – BA (for juwi Renewable Energies)
- Nojoli Power Line and Substation – BA (for ACED)
- Umbani Coal-fired Power Station – EIA (for ISS Global Mining)
- Thabametsi Coal-fired Power Station – EIA (for GDF SUEZ Energy Southern Africa)
- Abengoa Upington CSP Phase 2 and 3 – EIA (for Abengoa Solar)
- Pofadder Renewable Energy Facilities – EIA (for Mainstream Renewable Power South Africa)
- Cuprum-Burchell and Burchell to Mooidraai – BA (for Eskom)
- Wolmaransstad Municipality Solar Energy Facility – EIA (for Bluewave)
- Blackwood Power Line and Substation – BA (for VentuSA Energy)
- Kotulo Tsatsi CSP and PV Solar Park – EIA (for Exheredo)
- Expansion of the Sekoko Colliery – EIA (for Sekoko Resources)
- Transalloys Coal Fired Power Station – EIA (for Transalloys)
- Castle Wind Energy Facility – EIA (for juwi Renewable Energies)
- Karreebosch Wind Energy Facility – EIA (for G7 Renewable Energies)
- Tatuka PV Solar Energy Facility – EIA (for Eskom)
- Majuba PV Solar Energy Facility – EIA (for Eskom)
- Lethabo PV Solar Energy Facility – EIA (for Eskom)
- Iziduli Power Line and Substation – BA (for Windlab)
- Kathu CSP Watercourse Crossings and Power Line – BA (for GDF Suez)
- Karreebosch Wind Energy Facility – EIA (for G7 Energies)
- SolarReserve Kotulo Tsatsi Energy CSP Facilities – EIA (for SolarReserve & Kotulo Tsatsi Energy)
  Grootdrink Solar PV Energy Facility – EIA (for Africoast Engineering
- Byromate Biomass Power Generation Facility – EIA (for Energuys)

WASTE MANAGEMENT LICENSES

- Integrated NEMA and Waste Management License application for the Thabametsi Coal Fired Power Station, Limpopo
- Integrated NEMA and Waste Management License application for the Umbani Coal Fired Power Station, Mpumalanga
- Integrated NEMA and Waste Management License application for the Transalloys Coal Fired Power Station, Mpumalanga
- Waste Management License application for South Deep for Goldfields, Gauteng
- Waste Management License application for Medupi PS pollution control dams, Limpopo
- Waste Management License application for REDISA Visserhok Tyre Depot, Western Cape
- Waste Management License application for REDISA Witbank Tyre Depot, Mpumalanga

CURRICULUM VITAE: D G Paterson

SURNAME: PATERSON
FIRST NAME(S): David Garry
KNOWN AS: Garry
DATE OF BIRTH: 25-08-1959 in Bellshill, Scotland
NATIONALITY: South African
I.D. No.: 5908255258088
LANGUAGE PROFICIENCY: English, Afrikaans (both fluent), French (poor)
MARITAL STATUS: Married, one son

ADDRESS: Institute for Soil, Climate and Water
Private Bag X79
Pretoria 0001
Republic of South Africa

TEL.: (012) 310 2601
083 556 2458

FAX: (012) 323 1157

E-MAIL ADDRESS: garry@arc.agric.za

ACADEMIC QUALIFICATIONS:

- Matriculated: 1976, Dalziel High School, Motherwell, Scotland
- BSc (Hons) Geography, 1980, University of Strathclyde, Glasgow, Scotland
- MSc (Soil Science) *cum laude*, 1998, University of Pretoria
- PhD (Soil Science), 2014, University of Pretoria

PROFESSIONAL CAREER:

- 1981-1987: Soil Scientist: Soil and Irrigation Research Institute, Pretoria
- 1987-1992: Senior Soil Scientist: Soil and Irrigation Research Institute, Pretoria
- 1992-present: Senior Soil Scientist: ARC-Institute for Soil, Climate & Water

FIELDS OF SPECIALITY AND COMPETENCE:

- Soil classification and mapping
- Soil interpretations
- Soil survey project management
- Environmental assessment
- Soil survey and land capability course presentation
- Ground penetrating radar

PUBLICATIONS (see attached list):

- Three refereed articles (S.A. Journal of Plant and Soil)
- Nine Congress papers/posters
- S.A. Soil Classification (1991) (Member of working group)
- Seven 1:250 000 Land Type Maps
- Three Land Type Memoirs
- More than 200 soil survey reports and/or maps

COURSES COMPLETED:

- Course in Project Management (University of Stellenbosch)
- Course in Junior Personnel Management (Dept of Agriculture)
- Course in Handling of Grievances and Complaints (Dept of Agriculture)
- Course in Marketing (ARC-ISCW)
- Course in National Qualifications Framework Assessment, ARC-CO
- Training Course in Ground Penetrating Radar (GSSI, USA)
- Introduction to ArcGIS 8, GIMS, 2004

PROFESSIONAL STATUS:

- Registered Natural Scientist: Soil Science (SA National Council for Natural Scientific Professions) – registration number 400463/04
- Member of South African Soil Classification Working Group, 1990-present
- Convenor of South African Soil Classification Working Group, 2013-
- Member of Soil Science Society of South Africa (1982-present)
- President of Soil Science Society of South Africa (2005-2007)
- Member of South African Soil Survey Organisation (2000-present)
- Council Member of South African Soil Survey Organisation (2002-2003)
- Member of International Erosion Control Association
- Scientific Referee, S.A. Journal for Plant and Soil
- External Examiner, University of Pretoria, University of Witwatersrand, University of Venda

AWARDS:

Best article on Soil Science, South African Journal for Plant and Soil, 2011

MISCELLANEOUS:

- Editor, Soil Science Society newsletter, 1993-present
- Member, Clapham High School (Pretoria) Governing Body 1998-2002
- Member, Northern Gauteng Football Referee's Association
- Committee Member, Rosslyn Golf Club (Club Champion 2002 and 2007)

INTERESTS:

Sport, especially golf and soccer; wildlife; reading; music

REFEREES:

Mr T.E. Dohse, ARC-Institute for Soil, Climate and Water.
Tel: 082 324 5389

Prof Robin Barnard, ARC-Institute for Soil, Climate and Water
Tel: 012 310 2549

Prof M.C. Laker (retired), (012) 361-2900; 082 785 5295

PUBLICATIONS LIST:

Refereed Articles:

BüHMANN, C., KIRSTEN, W.F.A., PATERSON, D.G. & SOBCZYK, M.E., 1993. Pedogenic differences between two adjacent basalt-derived profiles. 1. Textural and chemical characteristics. *S. Afr. J. Plant & Soil*, 10: 155-161

BüHMANN, C., KIRSTEN, W.F.A., PATERSON, D.G. & SOBCZYK, M.E., 1994. Pedogenic differences between two adjacent basalt-derived profiles. 2. Mineralogical characteristics.*S. Afr. J. Plant & Soil*, 11: 5-11

PATERSON, D.G. & LAKER, M.C., 1999. Using ground penetrating radar to investigate spoil layers in rehabilitated mine soils*. S. Afr. J. Plant & Soil*, 16:131-134.

PATERSON, D.G., BüHMANN, C., PIENAAR, G.M.E. & BARNARD, R.O., 2011. Beneficial effects of palm geotextiles on inter-rill erosion in South African soils and mine dam tailings: a rainfall simulator study. *S. Afr. J. Plant & Soil*, 28: 181-189.

PATERSON, D.G. & BARNARD, R.O., 2011. Beneficial effect of palm geotextiles on inter-rill erosion in South African soils . *S. Afr. J. Plant & Soil*, 28: 190-197.

BHATTACHARRYA, R., FULLEN, M.A., BOOTH, C.A., KERTESZ, A., TOTH, A., SZALAI, Z., JAKAB, G., KOZMA, K., JANKAUSKAS, B., JANKAUSKIENE, G., BÜHMANN, C., PATERSON, D.G., MULIBANA, N.E., NELL, J.P., VAN DER MERWE, G.M.E., GUERRA, A.J.T., MENDONCA, J.K.S., GUERRA, T.T., SATHLER, R., BEZERRA, J.F.R., PERES, S.M., ZHENG YI, LI YONGMEI, TANG LI, PANOMTARANICHAGUL, M., PEUKRAI, S., THU, D.C., CUONG, T.H., TOAN, T.T., 2011. Effectiveness of biological geotextiles for soil and water conservation in different agro-environments. *Land Degradation and Development*, 22: 495-504.

FULLEN, M.A., SUBEDI, M., BOOTH, C.A., SARSBY, R.W., DAVIES, K., BHATTACHARRYA, R., KUGAN, R., LUCKHURST, D.A., CHAN, K., BLACK, A.W., TOWNROW, D., JAMES, T., POESEN, J., SMETS, T., KERTESZ, A., TOTH, A., SZALAI, Z., JAKAB, G., JANKAUSKAS, B., JANKAUSKIENE, G., BÜHMANN, C., PATERSON, D.G., MULIBANA, N.E., NELL, J.P., VAN DER MERWE, G.M.E., GUERRA, A.J.T., MENDONCA, J.K.S., GUERRA, T.T., SATHLER, R., BEZERRA, J.F.R., PERES, S.M., ZHENG YI, LI YONGMEI, TANG LI, PANOMTARANICHAGUL, M., PEUKRAI, S., THU, D.C., CUONG, T.H., TOAN, T.T., JONSYN-ELLIS, F., SYLVA, J.T., COLE, A., MULHOLLAND, B., DERALOVE, M., CORKILL, C. & TOMLINSON, P., 2011. Utilising biological geotextiles: introduction to the Borassus Project and global perspectives. *Land Degradation and Development*, 22: 453-462.

SMETS, T., POESEN, J., BHATTACHARRYA, R., FULLEN, M.A., SUBEDI, M., BOOTH, C.A., KERTESZ, A., SZALAI, Z., TOTH, A., JANKAUSKAS, B., JANKAUSKIENE, G., GUERRA, A.J.T., BEZERRA, J.F.R., ZHENG YI, PANOMTARANICHAGUL, M., BÜHMANN, C. & PATERSON, D.G., 2011. Evaluation of biological geotextiles for reducing runoff and soil loss under various environmental conditions using laboratory and field data. *Land Degradation and Development*, 22: 480-494.

NETHONONDA. L.O., ODHIAMBO, J.J.O. & PATERSON, D.G., 2012. Indigenous knowledge of climatic conditions for sustainable crop production under resource-poor farming conditions using participatory techniques. *Sustainable Agriculture Research,* 2 (1), 26-31.

NETHONONDA, L.O., ODHIAMBO, J.J.O. & PATERSON, D.G., 2012. Assessment of spatial variability of selected soil chemical properties in a communal irrigation scheme under resource-poor farming conditions in Vhembe District of Limpopo Province, South Africa. *African J. Agric. Res.* 7 (39), 5445-5492.

PATERSON, D.G., SMITH. H.J. & VAN GREUNEN, A., 2013. Evaluation of soil conservation measures on a highly erodible soil in the Free State province, South Africa. *S. Afr. J. Plant & Soil*, 30: 213-217.

PATERSON, D.G., TURNER, D.P., WIESE, L.D., VAN ZIJL, G.M., CLARKE, C.E. & VAN TOL, J., 2015. Spatial soil information in South Africa – situational analysis, limitations and challenges. *S. Afr. J. Science* 111 (5/6). Art. #2014-0178, 7 pages. http://dx.doi.org/10.17159/sajs.2015/20140178

Books:

PATERSON, D.G. & MUSHIA, N.M., 2012. Chapter 32. Soil databases in Africa. *In: Handbook of Soil Science: Resource Management and Environmental Impacts (2nd Edn). Eds. P.M. Huang, Y Li & M.E. Sumner.* CRC Press, Boca Raton FL.

SOIL CLASSIFICATION WORKING GROUP*, 1991. Soil classification. A taxonomic system for South Africa. Institute for Soil, Climate & Water, Pretoria.

* Co-author as member of Working Group

Theses:

PATERSON, D.G., 1998. The use of ground penetrating radar to investigate subsurface features in selected South African soils. Unpublished MSc Thesis, University of Pretoria.

PATERSON, D.G., 2014. The use of palm leaf mats in soil erosion control. Unpublished PhD Thesis, University of Pretoria.

Congress Papers:

PATERSON, D.G., 1987. The relationship between geology and soil type in the northern Kruger National Park. 14th Congress of the Soil Science Society of S.A. Nelspruit, 14-17 July 1987.

PATERSON, D.G., 1990. A study of black and red clay soils on basalt in the northern Kruger National Park. 16th Congress of the Soil Science Society of S.A. Pretoria, 9-12 July 1990.

PATERSON, D.G., 1992. The potential of ground penetrating radar as an aid to soil investigation. 17th Congress of the Soil Science Society of S.A. Stellenbosch, 28-30 Jan.1992.

PATERSON, D.G., 1995. The complex soil mantle of South Africa. ARC Wise Land Use Symposium, Pretoria, 26-27 Oct. 1995

PATERSON, D.G. & LAKER, M.C., 1998. Locating subsoil features with ground penetrating radar. 21st Congress of the Soil Science Society of S.A. Alpine Heath, 20-22 Jan. 1998.

PATERSON, D.G., 2000. Mapping rehabilitated coal mine soils in South Africa using ground penetrating radar. Eighth International Conference on Ground Penetrating Radar, Gold Coast, Australia, 23-26 May 2000.

PATERSON, D.G. & VAN DER WALT, M., 2003. The soils of South Africa from the Land Type Survey. 24th Congress of the Soil Science Society of S.A., Stellenbosch, 20-24 Jan. 2003.

Land Type Maps:

PATERSON, D.G., 1990. 1:250 000 scale land type map 2230 Messina. Dept. Agriculture, Pretoria.

PATERSON, D.G. & HAARHOFF, D., 1989. 1:250 000 scale land type map 2326 Ellisras. Dept. Agriculture, Pretoria.

PATERSON, D.G., PLATH, B.L. & SMITH, H.W., 1987. 1:250 000 scale land type map 2428 Nylstroom. Dept. Agriculture, Pretoria.

PATERSON, D.G. & ROSS, P.G., 1989. 1:250 000 scale land type map 2330 Tzaneen. Dept. Agriculture, Pretoria.

PLATH, B.L. & PATERSON, D.G., 1987. 1:250 000 scale land type map 2426 Thabazimbi. Dept. Agriculture, Pretoria.

Land Type Memoirs:

PATERSON, D.G., PLATH, B.L. & SMITH, H.W., 1988. Field Investigation. In: *Land types of the maps 2426 Thabazimbi & 2428 Nylstroom. Mem. Agric. Nat. Res. S. Afr.* No. 10. Dept. Agriculture, Pretoria.

PATERSON, D.G., SCHOEMAN, J.L., TURNER, D.P., GEERS, B.C. & ROSS, P.G., 1989. Field Investigation. In: *Land types of the maps 2330 Tzaneen & 2430 Pilgrim's Rest. Mem. Agric. Nat. Res. S. Afr.* No. 12. Dept. Agriculture, Pretoria.

PATERSON, D.G., 1999. 1:250 000 land type survey of the former Ciskei (Unpublished). ISCW Report GW/A/99/24.

Also:

PATERSON, D.G., 1992. Ground penetrating radar applications in USA and South Africa. Report on an official study tour to USA, 13-29 July, 1991. ISCW Report GW/A/92/8.

PATERSON, D.G., 2000. Report on official overseas visit to GPR2000 Conference, Broadbeach, Australia, 23-26 May, 2000. ISCW Report GW/A/2000/40.

Plus ARC-ISCW Reports on:

- Ground penetrating radar investigations in: Kruger National Park; Enseleni, Natal; Weatherly, Maclear; Kleinkopje Mine

- Soil survey investigations at: Roodeplaat, Kathu, Steelpoort River, Palala River, Zeekoegat (Roodeplaat), Limpopo River, Lydenburg, Kendal, Clewer Sand (Witbank), Botha Sand (Witbank), Balmoral Colliery, Bafokeng (Rustenburg), Towoomba (Warmbaths), Hoeveld Stene (Middelburg), Quality Bricks (Witbank), Visagie Sand (Middelburg), Rosslyn, Coalbrook (Sasolburg), Stewart Coal (Delmas), Forzando Coal

(Hendrina), Vaalgro (Vereeniging), Ratanda (Heidelberg), Elspark (Boksburg), Thorncliffe Mine (Steelpoort), Jan Smuts Quarry (Boksburg), Ennerdale (Phase I & II), Thokoza, North Riding, Natalspruit (Alberton), Arnot, Kroondal (Phase I & II), Ga-Rankuwa, Hartebeespoort Dam, Kosmos, Assen, Grasmere, Magalies Moot (Pretoria), Valpre (Paulpietersburg), Cargo Carriers (Sasolburg), Waterval (Rustenburg), Rayton, Bronkhorstspruit, Zwavelpoort (Pretoria), Pietersburg, Trojan Mine (Steelpoort), Platinum Highway (Rustenburg), Moutse, Centurion, Salique (Klaserie), Northam, Greenside Colliery (Witbank), South Deep Mine (Westonaria), Bank Colliery, Steelpoort Platinum, Gautrain Route (Pta/Jbg), Rietspruit Mine (Ogies), Potgietersrus Platinum, Atok Mine (Lebowa), Blue Ridge Mine (Groblersdal), Ngodwana, Estancia (Breyton), Twickenham Mine (Steelpoort), Marikana.

CV Jaco van der Walt

PERSONAL PARTICULARS:

NAME:	Jaco van der Walt
MARITAL STATUS:	Married with two dependants
DATE OF BIRTH :	1977-11-04
Work Address	37 Olienhout Street, Modimolle, 0510
E-MAIL:	jaco.heritage@gmail.com
MOBILE:	+27 82 373 8491
FAX:	+27 86 691 6461

SYNOPSIS

Jaco has been actively involved as a professional archaeologist within the heritage management field in southern Africa for the past 15 years. Jaco acted as council member for the Association of Southern African Professional Archaeologist (ASAPA Member #159) in the Cultural Resource Management (CRM) portfolio for two years (2011 – 2012). Jaco was also a Research Associate with the University of Johannesburg from 2011 – 2013. He is well respected in his field and published in peer reviewed journals and presented his findings on various national and international conferences.

ACADEMIC QUALIFICATIONS:

Date of matriculation:		1995
Particulars of degrees/diplomas and/or other qualifications:		
Name of University or Institution:		University of Pretoria
Degree obtained	**:**	BA
Major subjects	**:**	Archaeology Cultural Heritage Tourism
Year of graduation	**:**	2001
Name of University or Institution:		University of the Witwatersrand
Degree obtained	**:**	BA [Honours]
Major subjects	**:**	Archaeology
Year of graduation	**:**	2002
Name of University or Institution	**:**	University of the Witwatersrand
Degree Obtained		**:**BA [Masters]
Major subject		**:**Archaeology
Year of Graduation		:2012

EMPLOYMENT HISTORY:

2011 – Present: **Owner - Heritage Contracts and Archaeological Consulting CC**.
2007 – 2010 : **CRM Archaeologist,** Managed the Heritage Contracts Unit at the University of the Witwatersrand.
2005 - 2007: **CRM Archaeologist**, Director of Matakoma Heritage Consultants
2004: **Technical Assistant**, Department of Anatomy University of Pretoria
2003: **Archaeologist**, Mapungubwe World Heritage Site
2001 - 2002: **CRM Archaeologists,** For R & R Cultural Resource Consultants, Polokwane
2000: **Museum Assistant**, Fort Klapperkop.

Countries of work experience include:
Republic of South Africa, Botswana, Zimbabwe, Mozambique, Tanzania, The Democratic Republic of the Congo, Lesotho and Zambia.

MEMBERSHIP OF PROFESSIONAL ASSOCIATIONS:

- Association of Southern African Association Professional Archaeologists. Member number 159
- Association of Southern African Association Professional Archaeologists Cultural Resource Management Section
  Accreditation: Field Director Iron Age Archaeology
  Field Supervisor – Colonial Period Archaeology, Stone Age Archaeology and Grave Relocation
- Accredited CRM Archaeologist with SAHRA
- Accredited CRM Archaeologist with AMAFA
- Co-opted council member for the CRM Section of the Association of Southern African Association Professional Archaeologists (2011 – 2012)

REFERENCES:

1. Prof Marlize Lombard — Senior Lecturer, University of Johannesburg, South Africa
   E-mail: mlombard@uj.ac.za
2. Prof TN Huffman
   Department of Archaeology Tel: (011) 717 6040
   University of the Witwatersrand

Alex Schoeman — University of the Witwatersrand E-mail: Alex.Schoeman@wits.ac.za

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C: 082 3326 502

SUMMARY OF EXPERTISE:
SIMON TODD

- Profession: Ecological Consultant
- Specialisation: Plant & Animal Ecology
- Years of Experience: 15 Years

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Fynbos, Succulent Karoo, Nama Karoo, Thicket, Arid Grassland and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

- 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute
- 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute
- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.

Experience Specific to the Current Proposal

- Conducted a large number of specialist assessments of wind energy facilities, distributed widely across South Africa and including sites in similar environments to the current study including several sites along the Mossel Bay – Gouritz coastline.
- Provided more than 10 full EIA assessments of wind energy facilities ranging from small developments of less than 20 turbines to very large projects in excess of 500 turbines and 50 000 ha.
- Worked on several wind energy facilities in areas with highly endangered species such as Riverine Rabbits and van Zyl's Golden Mole, which have required specific and specialized attention.
- Extensive experience in renosterveld vegetation types, as occur at the site. Currently supervising a UCT PhD student working on Renosterveld management in the Overberg region.

General Experience & Expertise

- Conducted a large number of fauna and flora specialist assessments distributed widely across South Africa.
- Extensive experience in the field and exceptional level of technical expertise, particularly with regards to GIS capabilities which is essential with regards to producing high-quality sensitivity maps for use in the design of final project layouts.
- Strong research background which has proved invaluable when working on several ecologically sensitive and potentially controversial sites containing some of the most threatened fauna in South Africa.
- Published numerous research reports as well as two book chapters and a large number of papers in leading scientific journals dealing primarily with human impacts on the vegetation and ecology of South Africa.
- Maintain several long-term vegetation monitoring projects distributed across Namaqualand and the karoo.
- Guest lecturer at two universities and have also served as an external examiner.
- Reviewed papers for more than 10 international ecological journals.
- Past chairman and current committee member of the Arid Zone Ecological Forum.
- SACNASP registered as a Professional Natural Scientist, (Ecology) No. 400425/11.

A selection of recent work is as follows:

Specialist Assessments:

Bitterfontein Solar Plant - Fauna & Flora Specialist Assessment. Specialist Report for Cape EAPrac. 2012.

Beaufort West Solar Facility, Erf 7388 - Fauna & Flora Specialist Assessment. Specialist Report for Cape EAPrac. 2012.

Plant Sweeps on Portion 2 of the Farm Demaneng 546, Kuruman District, Northern Cape Province for SA Manganese. 2011.

Proposed Olyven Kolk Solar Power Plant, Northern Cape: Botanical and Faunal Specialist Assessment. Specialist Report for Environmental Resources Management (ERM). 2011.

Klawer Wind Farm: Ecological and Biodiversity Assessment: Terrestrial Vertebrate Fauna & Botanical Specialist Study. Specialist Report for Environmental Resources Management. 2011.

Witberg Wind Farm: Ecological and Biodiversity Assessment: Terrestrial Vertebrate Fauna & Botanical Specialist Study. Specialist Report for Environmental Resources Management. 2011.

Lambert's Bay Wind Farm: Ecological and Biodiversity Assessment: Terrestrial Vertebrate Fauna & Botanical Specialist Study. Specialist Report for Environmental Resources Management. 2011.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility near Sutherland, Western and Northern Cape Provinces. Specialist Report for Environmental Resources Management. 2011.

Ecological Scoping & Baseline Study. Vleesbaai Wind Park Development. Vleesbaai Independent Power Producers, ERM 2011.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility near Beaufort West, Western Cape Province. Specialist Report for Environmental Resources Management. 2010.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy at Konstabel, Western Cape Province. Specialist Report for Environmental Resources Management. 2010.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility at Perdekraal, Western Cape Province. Specialist Report for Environmental Resources Management. 2010.

Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility near Victoria West, Western and Northern Cape Provinces. Specialist Report for Environmental Resources Management. 2010.

Research Reports & Peer Reviewed Publications:

Todd, S.W. 2010. Vegetation and Plant Communities Associated with the Tillite and Dolerite Renosterveld Types of the Avontuur Conservation Area, Nieuwoudtville, South Africa. DRYNET.

Todd, S.W., Milton, S.J., Dean, W.R.J. Carrick, P.J. & Meyer, A. 2009. Ecological best Practice Guidelines for the Namakwa District. The Botanical Society of South Africa.

Todd, S.W. 2009. Field-Based Assessment of Degradation in the Namakwa District. Final Report. Mapping Degradation in the Arid Subregions of the BIOTA South Transect. SANBI.

Todd, S.W. 2009. A fence-line in time demonstrates grazing-induced vegetation shifts and dynamics in the semi-arid Succulent Karoo. *Ecological Applications*, 19: 1897–1908.

Todd, S.W. 2007. Characterisation of Riparian Ecosystems. D14 of The WADE Project. Floodwater Recharge of Alluvial Aquifers in Dryland Environments. *GOCE-CT-2003-506680- WADE.* Sixth Framework Programme Priority 1.1.6.3 Global Change and Ecosystems.

Todd, S.W. 2006. Gradients in vegetation cover, structure and species richness of Nama-Karoo shrublands in relation to distance from livestock watering points. *Journal of Applied Ecology* 43: 293-304.

Benito, G., Rohde, R., Seely, M., Külls, C., Dahan, O., Enzel, Y., **Todd, S**. Botero, B., Morin, E., Grodek, T., Roberts, C. 2010. Management of Alluvial Aquifers in Two Southern African Ephemeral Rivers: Implications for IWRM. *Water Resources Management*, 24:641–667.

Hahn, B.D., Richardson, F.D., Hoffman, M.T., Roberts, R., **Todd, S.W.** and Carrick, P.J. 2005. A simulation model of long-term climate, livestock and vegetation interactions on communal rangelands in the semi-arid Succulent Karoo, Namaqualand, South Africa*. Ecological Modelling* 183, 211–230.

Malgas, R.R., Potts, A.J., Oettlé, N.M., Koelle, B., **Todd, S.W.**, Verboom G.A. & Hoffman M.T.. 2010. Distribution, quantitative morphological variation and preliminary molecular analysis of different growth forms of wild rooibos (*Aspalathus linearis*) in the northern Cederberg and on the Bokkeveld Plateau. *South African Journal of Botany*, 76, 72-81.

Mills, A., Fey, M., Donaldson, J.D., **Todd, S.W**. & Theron, L.J. 2009. Soil infiltrability as a driver of plant cover and species richness in the semi-arid Karoo, South Africa. *Plant and Soil* 320: 321–332.

Rahlao, J.S., Hoffman M.T., **Todd, S.W**. & McGrath, K. 2008. Long-term vegetation change in the Succulent Karoo, South Africa following 67 years of rest from grazing. *Journal of Arid Environments*, 72, 808-819.

Hoffman, M.T. & **Todd, S.W.** 2010. Using Fixed-Point Photography, Field Surveys, And Gis To Monitor Environmental Change: An Example From Riemvasmaak, South Africa. Chapter In *Repeat Photography: Methods And Applications In The Natural Sciences.* R.H. Webb, Editor. Island Press. In Press.

Curriculum Vitae

Tony Barbour

ENVIRONMENTAL CONSULTING AND RESEARCH

10 Firs Avenue, Claremont, 7708, South Africa
(Tel) 27-21-797 1361, (Fax) 27-21-7971361, (Cell) +27-82 600 8266
(E-Mail) tbarbour@telkomsa.net

Tony Barbour has 23 years' experience in the environmental sector. His experience includes ten years as an environmental consultant in the private sector in South Africa followed by four and a half years at the University of Cape Town's Environmental Evaluation Unit. In 2004 he established his own environmental consulting company, Tony Barbour Environmental Consulting and Research, with a focus on Social Impact Assessment (SIA), Strategic Environmental Assessment (SEA), Independent Review Work, Training and Capacity Building and Environmental Project Management.

PERSONAL DETAILS

Tony Barbour, born on 8 June 1961
Nationality: South African and Irish
Marital Status: Married

EDUCATION

- BSc (Geology and Economics) Rhodes, 1984;
- BEcon (Honours) Rhodes, 1985;
- MSc (Environmental Science) University of Cape Town, 1992

ADDITIONAL QUALIFICATIONS

- Advanced and basic mediation/facilitation skills training course, Centre for Conflict Resolution, University of Cape Town (1999);
- Multi-party negotiation and facilitation skills for natural resource management, MEPC/CIDA (1999).

ACADEMIC AWARDS

- Schwartz Award, Top Student, Geology III, Rhodes University;
- Shell Medal of Excellence, Top student, Masters Course Work, MSc Environmental Science, UCT.

AREAS OF EXPERIENCE AND EXPERTISE

Project management, proposal writing, preparation, review and editing of reports and documents, environmental planning and management, Social Impact Assessment (SIA); Environmental Impact Assessment (EIA); Strategic Environmental Assessment (SEA); waste management, environmental economics, facilitation, public participation, training and teaching. Countries with work experience include South Africa, Namibia, Botswana, Zambia, Lesotho, Swaziland, Ghana, Mozambique, Mauritius, Kenya, Ethiopia, Oman, South Sudan and Sudan.

EMPLOYMENT RECORD

- **Private Consultant:** November 2004-current.
- **University of Cape Town:** August 2000-October 2004, Environmental Evaluation Unit (EEU), University of Cape Town. Senior Environmental Consultant and Researcher;
- **Private sector:** 1991-August 2000
  1991-1996: Ninham Shand Consulting (Cape Town). Senior Environmental Scientist;
  1996-August 2000: Steffen, Robertson and Kirsten (SRK Consulting) – Associate Director, Manager Environmental Section, SRK Consulting, Cape Town.

RELEVANT AREAS OF EXPERIENCE AND EXPERTISE

SOCIAL IMPACT ASSESSMENT

Infrastructure and development projects

- SIA for small scale hydropower project on Orange River, South Africa (2015);
- SIA for 150 MW coal power station, Mpumalanga, South Africa (2014);
- SIA for waste to energy plant, Pretoria, South Africa (2014);
- SIA for mixed use development in Khayelitsha, Western Cape (2014);
- SIA for small scale hydro scheme on the Orange River, South Africa (2014);
- SIA for Eskom sub-station and power lines, George, South Africa (2014);
- SIA for Trawal Dam, Clanwilliam, Western Cape Province (2013);
- SIA for Eskom transmission lines from proposed Bantamsklip Nuclear Power Station, Western Cape (2010). Project put on hold after initial scoping phase;
- SIA for Eskom transmission lines from proposed Koeberg Nuclear Power Station, Western Cape (2010);
- SIA Bloubos Road, Somerset West, Western Cape (2010);
- SIA for Boschendal Farm Mixed Use Development, Stellenbosch, Western Cape (2008-current);
- SIA Driftsands Nature Reserve, Cape Town, Western Cape (2009);
- SIA Kidds Beach Golf Estate, East London (2009);
- SIA Swartland Regional Mall, Malmesbury, Western Cape (2009);
- SIA Klipfontein Mixed Use Residential Development, Malmesbury, Western Cape (2009);
- SIA Struisbaai Harbour Development, Struisbaai, Western Cape (2009);
- SIA De Plaat Mixed Use Residential Development, Velddrift, Western Cape (2009);
- SIA Woodlands Golf Estate, East London, Eastern Cape (2009);
- SIA Duttons Cove Residential Development, Herolds Bay, Western Cape (2008);
- SIA Ashton Mixed Use Development, Ashton, Western Cape (2009);
- SIA for Mandela Bay Mixed Development Precinct, Mandela Bay, Eastern Cape (2008);
- SIA for Annandale Mixed Development Precinct, Cape Town, Western Cape (2008);
- SIA for Garden Route Dam development, George, Western Cape (2008);
- SIA for Moropule Coal Power Station, Botswana (2007);
- SIA for proposed residential development near Stillbaai, Western Cape (2007);
- SIA for proposed residential development near Gansbaai, Western Cape (2007);
- SIA Bulk Water Scheme, City of Cape Town, Western Cape (2007);
- SIA Montague Golf Estate, Western Cape (2006);
- SIA for Schalkenbosch Golf Estate, Tulbagh, Western Cape (2006);
- SIA for 2010 World Cup Stadium on Green Point Common, Cape Town (2006);
- SIA for raising of the Clanwilliam Dam, Western Cape (2005-06);
- SIA Kransvlei Golf Estate, Clanwilliam, Western Cape (2005);
- SIA for road up-grade between Gansbaai and Bredadorp, Southern Cape (2005);
- SIA Zeekoevlei Golf Estate, Somerset West, Western Cape (2005)
- SIA Silwersand Golf and Resort Estate, Robertson, Western Cape (2003)
- SIA Assessment for Valkenberg East Site, Cape Town (2003).
- N2 – Outeniqua Pass by-pass, George, SA. Socio-economic assessment for proposed by-pass options between the N2 and the Outeniqua Pass (1997).
- Social Assessment for Sparrebosch Golf Course, Knysna, SA (1996).

- Social Assessment for Riversonderend Road By-pass (1991).

Mining and Industrial projects
- SIA for Lucunga Mine, Angola (current);
- Social Labour Plan for Granite Quarry, North West Province, South Africa (2015);
- Social Labour Plan for coal mine in Mpumalanga, South Africa (2014);
- SIA for heavy mineral separation plant, Vredendal, Western Cape Province (2012);
- SIA Otjizondo Manganese Mine, Namibia (2011);
- SIA for upgrade of PPC Riebeeck cement plant, Western Cape, South Africa (2009);
- SIA for Elitheni Coal Mine, Eastern Cape (2008);
- SIA and Resettlement Action Plan (RAP) for Southern Ashanti Gold Mining Project, Ghana (2007);
- SIA for Valencia Uranium Mine, Swakopmund, Namibia (2007);
- SIA for expansion of PPC cement factory, Riebeck West, Western Cape (2007);
- SIA and Social Labour Plan for Xolobeni Heavy Mineral Sands Project, Eastern Cape, South Africa (2007);
- SIA and Social Labour Plan for Tormin Heavy Mineral Sands Project, Western Cape, South Africa (2007);

Renewable energy projects
- SIAs for wind energy facilities: SIAs for over 50 wind energy projects in Western Cape, Eastern Cape and Northern Cape Province of South Africa (2008-current);
- SIAs for solar energy facilities: SIAs for over 60 solar energy projects in Western Cape, Northern Cape, Free State, North West, Mpumulanga and Limpopo Provinces of South Africa (2009-current).

Strategic social input into projects
- Social Specialist for funder review based on IFC standards for hydropower power project in Zambia (2014-2015);
- Social Specialist for identification of multi-sector investment opportunities in the Eastern Nile Basin, World Bank and Eastern Nile Technical Office (2015);
- SIA as part of SEA undertaken for industrial area located near Wellington, Western Cape Province (2014);
- Social specialist for assessment of large dam developments on the Eastern Nile Basin, specifically the Blue Nile (Abbay River) in Ethiopia and the consequences for the downstream countries of Sudan and Egypt, World Bank and Eastern Nile Technical Office (2012-2013);
- Social specialist for development and design of Decision Support System for the Nile Basin. Input included development of social indicators used to assess water related projects and development scenarios (dams and irrigation schemes) in the Nile Basin (2012);
- Social specialist for the water resource classification of the Olifants/Doorn Catchment Area (Western and Northern Cape Province) (2011-2012).

Social Impact Assessment and Resettlement Guidelines
- Development of Guidelines for Social Impact Assessment for Department of Environmental Affairs and Development Planning, Western Cape, (2007);
- Development of a Social Assessment and Development Framework for Department of Water Affairs and Forestry, South Africa, including development of guidelines for Social Impact Assessment, Conflict Management, Relocation and Resettlement and Monitoring and Evaluation (2005). The aim of these guidelines was to assist DWAF to identify, assess and manage social impacts (positive and negative) during the design, development, operation and closure of projects.

Resettlement Action Plans (RAPs)
- RAP for farming community located near Paarl in the Western Cape (current);
- SIA and RAP for Southern Ashanti Gold Mining Project, Ghana (2007);
- RAP for Mare Chicose Landfill Site, Mauritius (2005);
- Maguga Dam, Swaziland. Development of socio-economic monitoring and evaluation programme, including indicators, for the resettlement programme, Swaziland (2001).

Waste management projects

- SIA for Integrated Waste Management Facility, City of Cape Town (2015);
- SIA for Waste to Energy Facility, Wellington, Western Cape (current);
- SIA for Vissershok landfill expansion, Cape Town (2014);
- SIA for Stellenbosch Landfill Site (2011);
- SIA for Barka Landfill Site, Barka, Oman (2011);
- SIA Helderberg Waste Transfer Station, Western Cape, (2009);
- SIA for Mare Chicose Landfill Site, Mauritius (2005);
- SIA for Coastal Park Landfill Site (1998).

STRATEGIC ENVIRONMENTAL ASSESSMENT

- Project Manager SEA for assessment of option to develop biofuels in Northern Namibia (2010-2011);
- Project Manager SEA City of Windhoek, Namibia (2010-2011);
- Project manager for SEA for Phase 2 of the National Roads Strategy for Mozambique (2007).
- Joint project manager for SEA of Cape Town 2004 Olympic Bid, Cape Town, SA (1999).
- Baralink SEA, Johannesburg, SA. Specialist input on socio-economic aspects for Baralink SEA (1998).
- Series of 4 Strategic Environmental Assessment training courses for officials of the Government of Botswana, 2000 & 2001.
- Guest lecturer in SEA for MPhil course in Environmental Management at University of Cape Town, 2000-2004.
- Paper presented at IAIA 98, Christchurch, New Zealand (1998). Strategic Environmental Assessment of the Cape Town 2004 Olympic Bid,

ENVIRONMENTAL IMPACT ASSESSMENT

Experience includes developing proposals (technical and financial), liaising with clients, authorities and the public, developing terms of reference for specialist sub-consultants, project management and reviewing reports. Projects include:

- Barka Landfill Site, Barka, Oman (2011);
- Darling Wind Farm, Western Cape, South Africa. Environmental assessment of proposed Wind Farm near the town of Darling (2002).
- Walvis Bay Naval Facility, Walvis Bay, Namibia. Environmental assessment of the proposed naval facilities in Walvis Bay (2001).
- Portnet Saldanha, Western Cape, SA. EIA for the expansion of a bulk iron ore export facility at the Port of Saldanha (2000).
- Coastal Park Waste General Waste Site, Cape Town, SA. EIA, including public participation for a large, general waste site (1998).
- Sanderlings Development Plettenberg Bay, SA. EA, including public participation, for proposed residential development adjacent to the coast (1999).
- Stellenbosch Mountain Golf Course Development, Stellenbosch, SA. EIA, including public participation, for golf course, hotel and residential development (1998).
- Sparrebosch EIA, Knysna, South Africa (SA). EIA, including public participation, for golf course, hotel and residential development (1996).
- Stones Hill by-pass, Grahamstown, SA. EIA, including public participation, of a proposed by- pass near Stones-Hill, Grahamstown (1992).
- Riversonderend N2 by-pass, Riversonderend, SA.EIA, including public participation, of a proposed by pass of the N2 around the town of Riversonderend (1991).

REVIEW

- Review of SIA for N3 by-pass around Harrismith, Free State Province, (current)
- Review of social implications associated with proposed SANRAL N1-N2 Winelands Toll Road

Project as part of the City of Cape Town's legal challenge of SANRALs proposal to develop toll roads (2015);
- Internal Review of Gamsberg Zinc Mine SIA for ERM (Northern Cape Province, South Africa), March, 2013;
- Internal Review of Waterval Tailings Dam SIA for WSP (North West Province, South Africa), March, 2013,
- Review of SIA for the proposed N1-N2 Winelands Toll Road Project as part of the City of Cape Town's legal challenge to the proposed project (2011-2012);
- Review of SIA for Nuclear 1 for Arcus Gibb (3 conventional nuclear power plants) located along the western and south eastern coasts of South Africa (2009);
- Review of SIA for proposed PMBR Plant at Koeberg, Western Cape (2008);
- Review of specialist reports for the Groot Letaba Dam EIA, Mpumulanga, South Africa (2008).
- External Review Consultant for SIA component of N2 Wild Coast Toll Road EIA (2008).
- Internal Review Consultant for Golder Associates on Namakwa Sands Heavy Mineral Mining EIA, Western Cape (2006);
- Review of EIA for Palm Valley Golf Course Estate, Durbanville, Western Cape (2005);
- Review of EIA for Zeekoevlei Golf Course Estate, Somerset West, Western Cape (2005);
- Review of EIA for Oostenberg Waste Transfer Station, Brackenfell, Western Cape (2004);
- Review of Socio-Economic Study undertaken for the R300 Toll Road EIA, Cape Town, Western Cape (2004);
- Review of EIA for proposed establishment of Toll booths on Chapman's Peak Drive, Cape Town, Western Cape (2003);
- Review of EIA for Cell Phone Mast, Cedeberg, Western Cape (2003);
- Review of EIA for Hotel and Conference Center, Durbanville, Western Cape (2003);
- Review of EIA for N7 Road Up-grade, Clanwilliam, Western Cape (2002);
- Review of EIA for Up-grade of Sewage Works, Western Cape (2002).

ENVIRONMENTAL RESEARCH

Experience and projects include:
- Environmental and social specialist for the development of Mozambique Biofuels Strategy (2007).
- Development of strategy for the development of the Environmental Goods and Service Industry in the Western Cape for the Department of Environmental Affairs and Development Planning in the Western Cape (2006).
- Review of the Environmental Goods and Service Industry in South African and development of a strategy for the Department of Trade and Industry, South Africa (2006).
- Chapter on the South African Environmental Goods and Services Industry for study commissioned by the Department of Environmental Affairs and Tourism (2006).
- Integrating Sustainable Development into the Integrated Development Planning Process in South Africa. Review of 4 case studies in SA for the World Summit on Sustainable Development, Johannesburg (2002).
- Development of Integrated Sustainable Transportation Assessment Framework for Transportation Planning in South Africa. Project Manager for joint project between EEU and Urban Transportation Research Group at UCT (2003).
- Project Manager for South African Cleaner Development Mechanism (CDM) initiative being undertaken by South South North Trust. Project involves the recovery of methane gas from the Bellville South Landfill Site in Cape Town (2004)
- Development of Toolkit for incorporating Sustainable Development in to the Integrated Development Planning Process in South Africa (2004).
- Integrating Sustainable Development into the Eastern Cape Province Provincial Growth and Development Plan, 2004-2020 (2003-2004).
- Department of Housing, South Africa. Assessment of options for the development of energy and water efficient low cost housing in South Africa and an assessment of potential financing mechanisms, South Africa (2000).

ENVIRONMENTAL PLANNING

- Development of a Rehabilitation and Land Use Plan for the Alexkor Mining Area in the Richtersveld in the Northern Cape Province (2003-2007). This formed part of a land claim for the Richtersveld Community and included acting as the lead expert witness for the community in the associated court case.
- Southern Cape Spatial Development Framework (SCSDF), Southern Cape Region, SA. Environmental opportunities and constraints assessment for SCSDF study (2000).
- Stellenbosch Rivers Management Plan, Stellenbosch, SA. Integrated management plan for the urban river systems in Stellenbosch (1998).
- Wetton-Lansdowne corridor project, Cape Town, SA. Habitat conservation and biodiversity study to inform planning proposals for the Wetton-Lansdowne corridor (1998).
- Tygerberg Spatial Development Framework, City of Tygerberg, Cape Town, SA. Environmental baseline study for the spatial development framework study for the City of Tygerberg (1999).
- Protea Valley development options, City of Tygerberg, Cape Town, SA. Assessment and identification of suitable land use development options for Protea Valley (2000).

WASTE MANAGEMENT

- Project Manager, Al Wusta Regional Waste Site Investigation, Oman (2011).
- Project Manager, Al Batinah Regional Waste Site Investigation, Oman (2011);
- Project Manager, Barka Landfill Site EIA, Muscat, Oman (2010);
- Mare Chicose Landfill, Mauritius. SIA and Compensation and Relocation Plan for proposed expansion of the current landfill site (2005).
- Robertson Waste Site, Robertson, SA. EA, including public participation, for the identification of a new waste site (2000).
- Project Manager, Coastal Park General Waste Site, Cape Town, SA. EIA for proposed expansion of a large, general waste site (1998).
- Project Manager, Windhoek general and hazardous waste site, Windhoek, Namibia. Investigation to identify new general and hazardous waste disposal site for Windhoek (1997).
- Project Manager, Walvis Bay general and hazardous waste site, Walvis Bay, Namibia. Investigation to identify new general and hazardous waste disposal site for Walvis Bay (1998).
- Project Manager, Port Elizabeth Waste Site, Port Elizabeth, SA. Environmental Assessment for permit application (1998).
- Project Manager, Brackenfell general waste site, Cape Town, SA. Permit application report ad environmental assessment for Brackenfell waste site (1995).
- Project Manager, Ceres general waste site, Ceres, SA. Permit application report ad environmental assessment for Ceres waste site (1995)
- Project Manager, Caledon general waste site, Caledon, SA. Permit application report ad environmental assessment for Caledon waste site (1996).
- Project Manager, Wellington general waste site, Wellington, SA. Permit application report ad environmental assessment for Wellington waste site (1996).
- Project Manager, Greyton general waste site, Greyton, SA. Permit application report ad environmental assessment for Greyton waste site (1999);

ENVIRONMENTAL TRAINING AND CAPACITY BUILDING

Experience includes design of training courses, development of training manuals and running courses for both the private and public sector. Courses include:

- 2 X 5 day course on Resource Economics for Coastal Managers and Government Officials, Namibian Government (2009).
- 5 day course on EIA and Environmental Management course for Swaziland Local Authorities, 2004.
- Integrated Coastal Management course for Department of Marine and Coastal Management, 2004.
- 5 regional Social Assessment Training Workshops for officials from the South African Department of Water Affairs and Forestry, 2004.
- EIA training course for officials of the South African National Parks, Kruger National Park, 2003.

- Environmental Management course for Shell South Africa, 2003.
- 10 Local Agenda (LA) 21 training courses for provincial and local government departments in South Africa during period 2000-2002.
- Resource Economics Workshop for South African Department of Water Affairs and Forestry, 2002.
- Conflict Resolution Workshop for subsistence fishermen, Kwa-Zulzu Natal, 2002.
- Integrating the principles of LA 21 into Integrated Development Planning. Course presented at World Summit on Sustainable Development, Johannesburg, 2002.
- Environmental facilitation, mediation and conflict management. Training course for Independent Mediation Services in South Africa (IMSSA) facilitators, 1998, 1999 and 2000.
- Series of 4 Strategic Environmental Assessment training courses for officials of the Government of Botswana, 2000 & 2001.
- EIA training course for officials of the Government of Lesotho, 2000 and 2001.
- EIA training courses for local government officials in Cape Town, 2000.

LECTURING AND TEACHING

Experience includes lecturing and teaching at an under and post-graduate level since 1990. The areas of interest include Environmental Economics, EIA, SEA, SIA and Waste Management.

- Guest Lecturer in SIA, Department of Environmental and Geographical Science and Department of Planning, University of Cape Town (current);
- Lecturer in Environmental Economics for the MPhil course in Environmental Management at University of Cape Town from 1990 –2006.
- Guest lecturer in SIA, EIA and SEA for MPhil course in Environmental Management at UCT, 2000-2004.
- Coordinator and lecturer in Environmental Economics at Cape Technikon, 1999.
- Coordinator and lecturer of waste management course, Peninsula Technikon in 1998.
- Guest lecturer at Peninsula Technikon for waste management, 1994 – 1998.
- Moderator for Peninsula Tecknikon waste management course, 1994-2002.
- Environmental Management for senior managers, module on a business management course for AngloVaal Management run by Prof John Simpson of UCT, 2000 and 2001.
- Guest lecturer on SIA and EIA for Geography and Environmental Science Honours, UCT. 2000-2004.
- Presenter and coordinator on annual Integrated Environmental Management Short Course run by the Environmental Evaluation Unit at UCT (2000-2006).
- Presenter on Integrated Coastal Management course run by Environmental Evaluation Unit at UCT 2005-2006.

PUBLIC PARTICIPATION

Experience includes designing public participation processes and facilitating public meetings and workshops. Projects include:

- SEA for Wellington Industrial Area, managed and facilitated public meetings and workshops (2014).
- Green Point Common, Cape Town. Public participation and facilitation processes for development of new market area for informal traders (2005);
- Chapman's Peak Drive. Managed and facilitated the public participation processes for looking at the technical and funding options for re-opening Chapman's Peak Drive on the Cape Peninsula as a toll road (2001).
- Visserhok Hazardous waste disposal sites, Cape Town City Council and Wastetech, Cape Town, SA. Managed and facilitated the public participation processes for the permit application for two hazardous waste sites located at Visserhok (1994).
- Grand West Casino, Cape Town. Public participation processes for proposed establishment of the Grand West Casino at the Cape Show Grounds, Cape Town (1997).
- Coastal Park waste site, Cape Town, SA. Managed and facilitated public participation processes for the permit application for the Coastal Park general waste site (1998).
- Managed and facilitated public participation processes associated with EIA's listed above.

ENVIRONMENTAL MANAGEMENT PLANS AND REHABILITATION REPORTS

- Development of rehabilitation programme and cost estimate for damage caused by 80 years of alluvial diamond mining between Alexander Bay and Port Nolloth, West Coast, South Africa (current). This project is linked to the Richtersveld Land Claim and involved acting as an expert witness in the associated court case.
- Corridor Sands Heavy Mineral Project, Mozambique. Development of an Environmental Management Plan (EMP) for the construction phase of the project (2001).
- Walvis Bay Naval facilities, Walvis Bay, Namibia. EMP for the construction phase of the project (2001).
- APC cement factory, Otjiwarongo, Namibia. Operational management plan for up-grade to meet the legislative requirements (2000).
- Sparrebosch golf course, hotel and residential development, Knysna, SA. Environmental Management Plan (EMP) for the construction phase (1997).
- M3 highway up-grade, Johannesburg, SA. EMP for the design and construction phase of the M3 (1995).
- Trunk Road 46, Grahamstown-Port Alfred, Eastern Cape, SA. EMP for the construction phase (1994).
- Trunk Road 46, Grahamstown to Port Alfred, Eastern Cape, SA. Rehabilitation proposals for borrow pits, quarries, cuts, fills and road surfaces (1993).
- Trunk Road 19, Maclear to Halcyon Drift, Eastern Cape, SA. Rehabilitation proposals for borrow pits and quarries (1992).
- Namakwa Sands, Heavy Mineral Mining Operation, West Coast SA. Conceptual Rehabilitation Plan (1991).

ENVIRONMENTAL MANAGEMENT SYSTEMS AND AUDITS

- APC Cement Factory, Otjiwarongo, Namibia. Operational audit of APC cement factory to assess compliance with Namibian legislation (2000).
- Vodacom, SA. Conceptual Development of an Environmental Policy and outline for an Environmental Management System for Vodacom, SA (1998).
- Marine Oil, SA, initial site audit (1999).
- Rose Foundation, SA. Audit of 15 waste oil-recycling facilities in SA (1997).
- Zambian Copper Belt, Zambia. Pre-acquisition audit of 20 electrical transformer stations (1997).

SUPERVISION OF STUDENTS

- 1994-2006: Supervision of the thesis component of MPhil in Environmental Management for a number of students. Usually requested to act as supervisor for at least one or two students per year.
- Internal and external examiner for a number of theses submitted in fulfillment of the MPhil Environmental Management at UCT.

PUBLICATIONS AND PAPERS

Environmental publications and guidelines

- Principal Author of Health, Safety and Environmental Guidelines for Bitumen and Coal Tar Products, prepared for the SA Bitumen Association (Sabita), in 1994 and revised in 1998.
- Co-author of document outlining an integrated Waste Management Strategy for the Western Cape, SA, produced in 1995;
- Principal Author of Guidelines for Waste Management in South Africa, a handbook for local

authorities, produced by Ninham Shand in 1993.

Papers and articles

The majority of the articles aimed at the layperson as opposed to journal articles.

1. SOWMAN, M R, GLAZEWSKI, J I, FUGGLE, R F, BARBOUR, A (1990) " Planning and legal responses to sea-level rise in South Africa", South African Journal of Science, v 86, 1990.
2. BARBOUR, T (1992) 'Addressing the social impacts of waste disposal by incorporating permit applications into the latest Integrated Environmental Management (IEM) procedures", Paper presented at Wastecon '92, 3 – 5 November 1992.
3. BARBOUR, T (1992) "Internalising externalities: An attempt to address social costs", paper presented at a workshop on the Economy and Environment, 25 November 1992.
4. BARBOUR, T (1993) "The importance of taking waste disposal seriously", IMIESA, v 18 no 7 July 1993.
5. BARBOUR, T (1993) "Community based waste collection", Earthyear 5th edition, winter 1993.
6. BARBOUR, T (1993) "Guidelines for waste management in South Africa", Ninham Shand, 1993.
7. BARBOUR, T (1994) "Quarry Rehabilitation Reports: Are they effective working documents or merely legal requirements?", EPM, v 5, no 2, February 1994.
8. BARBOUR, T (1994) "Environmental factors relating to site selection for dams", Paper presented at SAICE one-day seminar on earth dam design, 3 June 1994.
9. BARBOUR, T (1994) "Environmental Economics", Earthyear 7th edition, Summer 1994.
10. BARBOUR, T (1996) "Lessons learnt from Vissershok for public participation and landuse planning", Paper presented at Wastecon 96, Durban, South Africa.
11. BARBOUR, T and COLEMAN, A (1996) "Towards an integrated waste management strategy for the Western Cape", Paper presented at Wastecon 96, Durban, South Africa.
12. BARBOUR, T (1998) Strategic Environmental Assessment of the Cape Town 2004 Olympic Bid", paper presented at IAIA 98, Christchurch, New Zealand.
13. BARBOUR, T (2000) Robertson Waste Site: A Case Study, paper presented at Wastecon 2000, Somerset West, SA.
14. BARBOUR, T (2000) National Environmental Management Act: Implications for Waste Management and the Minimum Requirements, paper presented at Wastecon 2000, Somerset West, SA.
15. BARBOUR, T (2001). The role of economic incentives in promoting and/or improving environmental rights. Paper presented a Conference on Environmental Rights, Cape Town, 30 July 2001.
16. BARBOUR, T (2002). The role of environmental assessments in land-use planning. Paper presented at Southern African Town Planning Conference, Somerset West, 18-19 March 2002.
17. BARBOUR, T (2002). Incorporating principles of environmental sustainability into policy making. Conference on Environmental Practices for the 21st Century, Somerset West, 24-25 May, 2002.
18. BARBOUR, T and Brownlie, S (2002). Have mandatory environmental impact assessments improved decision-making in South Africa, and are they making a significant contribution to sustainable development? International Association for Impact Assessment (SA), National Conference, 7-9 October 2002.
19. Barbour, T (2003). Developing and evaluating effective strategies for managing hazardous materials and wastes. Paper prepared for Chemical and Toxic Waste Management Conference Park Hyatt, Rosebank, Johannesburg, February 2003.
20. Barbour T (2004). Incorporating Sustainable Development considerations in to the IDP process. Paper prepared for conference on Environmental Management for Local Government, Johannesburg, June 2004.
21. THESIS TOPIC "Quarry Rehabilitation: The need to adopt a pre-planning approach towards rehabilitation (MSc Environmental Science)." An important component of the study was the development of a Rehabilitation Programme and Rehabilitation checklist to assist those involved in carrying out rehabilitation work.