WIND GARDEN WIND FARM, EASTERN CAPE PROVINCE

ENVIRONMENTAL MANAGEMENT PROGRAMME

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EMPR DETAILS

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

Assessment: The process or 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.

Commence: The start of any physical activity, including site preparation and any other activity on site 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.

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 as per the EIA Regulations. Construction begins with any activity which requires Environmental Authorisation.

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

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

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

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

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/occur 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 (EAP): 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, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing and reporting environmental impacts associated with an activity.

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

Environmental management programme: 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.

Incident: Section 30 of NEMA defines an 'incident' as "an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed."[1]

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

Indirect impacts: Indirect or induced changes that may occur because 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 because 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 public.

Mitigation hierarchy: The mitigation hierarchy is a framework for managing risks and potential impacts related to biodiversity and ecosystem services. The mitigation hierarchy is used when planning and implementing development projects, to provide a logical and effective approach to protecting and conserving biodiversity and maintaining important ecosystem services. It is a tool to aid in the sustainable management of living, natural resources, which provides a mechanism for making explicit decisions that balance conservation needs with development priorities

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

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 which do not require Environmental Authorisation (e.g. geotechnical surveys).

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."

[1]http://ipwis.pgwc.gov.za/ipwisdoc/Public/Publications/ChemicalsMgt/A%20Procedure%20for%20Section%2030%20of%20NEMA.pdf

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

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of 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 nacelle to which the rotor is attached, is constructed from tubular steel or concrete. It is approximately 130m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. The tower must be strong enough to support the nacelle and blades, and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Waste: Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to the Waste Amendment Act (as amended on June 2014); or any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister.

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.

ABBREVIATIONS AND ACRONYMS

DEFF	National Department of Environment, Forestry and Fisheries
DHSWS	Department of Human Settlements, Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EPC	Engineering Procurement Contractor
ECO	Environmental Control Officer
EO	Environmental Officer
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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CHAPTER 1: INTRODUCTION

This Environmental Management Programme has been compiled for the Wind Garden Wind Farm. The project site is located approximately 17km north-west of Makhanda (previously known as Grahamstown) (measured from the centre of the site) within the Makana Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province. The Wind Garden Wind Farm will include a maximum of 47 wind turbines with a contracted capacity of up to 264MW and associated infrastructure to be constructed over an area of approximately 4336ha in extent, known as the project site.

This EMPr has been developed on the basis of the findings of the Basic Assessment (BA), and must be implemented to protect sensitive on-site and off-site features through controlling construction, operation and decommissioning activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts. This EMPr is applicable to all Wind Garden (Pty) Ltd employees and contractors working on the pre-construction, construction, and operation and maintenance phases of the Wind Garden Wind Farm. The document must be adhered to and updated as relevant throughout the project life cycle. This document fulfils the requirement of the EIA Regulations, 2014 (as amended) and forms part of the BA report of the project.

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

CHAPTER 2: PROJECT DETAILS

The wind farm is proposed in response to identified objectives of the national and provincial government, and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to supply the electricity generated from the facilities to private off-takers nationally, with key customer focus areas primarily being within the industrial, mining, and commercial sectors where there is a need to shift towards cleaner and more sustainable sources of energy. The expected load requirements of potential customers are in excess of 1 000 GWh. The generated electricity will be evacuated through use of the national electricity grid and through a wheeling agreement with Eskom for the use of the existing grid connection infrastructure in the area.

A preferred project site with an extent of ~4336ha has been identified by Wind Garden (Pty) Ltd as a technically suitable area for the development of the Wind Garden Wind Farm. The project site consists of five affected properties which make up the project site (**Figure 2.1** and **Table 2.1**). The affected properties include:

- Remaining Extent of Farm Brackkloof No 183
- Portion 5 of Farm Hilton No 182
- Portion 8 of Farm Hilton No 182
- Portion 4 of Farm Vandermerweskraal No 132
- Portion 1 of Farm Thursford No183

A development envelope for the placement of the wind farm infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~3400ha in extent and the much smaller development footprint of ~66.6ha will be placed and sited within the development envelope. The development footprint will contain the following infrastructure to enable the wind farm to generate up to 264MW:

- Up to 47 wind turbines with a maximum hub height of up to 120m. The tip height of the turbines will be up to 200m.
- A 132kV switching station and a 132/33kV on-site collector substation to be connected via a 132kV overhead power line (twin turn dual circuit). The wind farm will be connected to the national grid through a connection from the 132/33kV collector substation via the 132kV power line which will connect to the 132kV switching station that will loop in and loop out of the existing Poseidon – Albany 132kV power line which will be located inside of the project site.
- Concrete turbine foundations and turbine hardstands.
- Temporary laydown areas which will accommodate the boom erection, storage and assembly area.
- Cabling between the turbines, to be laid underground where practical.
- Access roads to the site and between project components with a width of approximately 4,5m. The main access points will be 8m wide.
- A temporary concrete batching plant.
- Staff accommodation (temporary).
- Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitor's centre

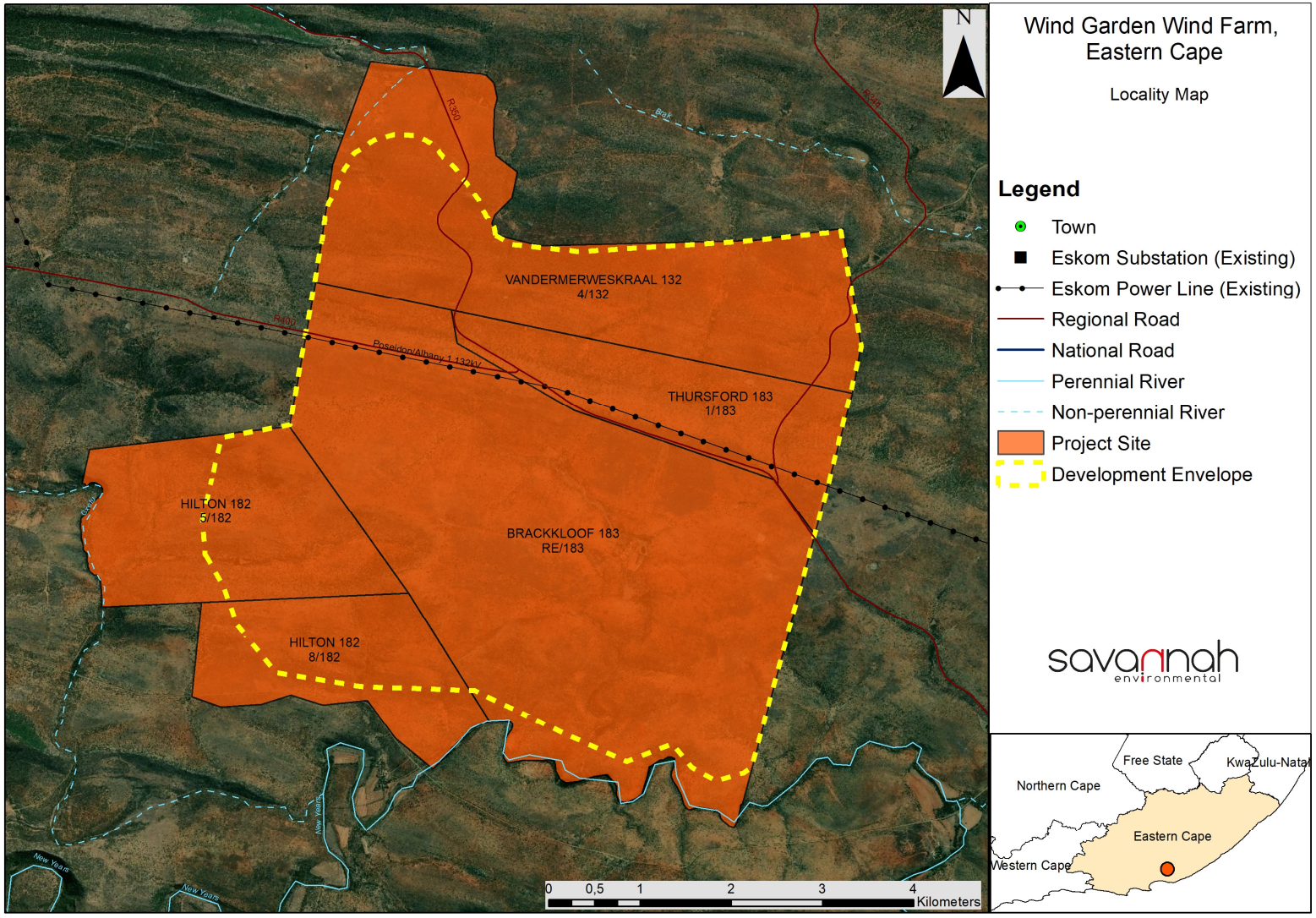


Figure 2.1: Locality map showing the location of the project site and development envelope proposed for the Wind Garden Wind Farm

Table 2.1: Detailed description of the Wind Garden Wind Farm project site

Province	Eastern Cape Province
District Municipality	Sarah Baartman District Municipality
Local Municipality	Makana Local Municipality
Ward number(s)	1
Nearest town(s) (measured from the centre of the project site)	Makhanda (~17km south-east); Riebeek East (~20km west) and Alicedale (~29km south-west)
Affected Properties: Farm name(s), number(s) and portion numbers	» Remaining Extent of Farm Brackkloof No 183 » Portion 5 of Farm Hilton No 182 » Portion 8 of Farm Hilton No 182 » Portion 4 of Farm Vandermerweskraal No 132 » Portion 1 of Farm Thursford No183
SG 21 Digit Code (s)	» Remaining Extent of Farm Brackkloof No 183 - C00200000000018300000 » Portion 5 of Farm Hilton No 182 - C00200000000018200005 » Portion 8 of Farm Hilton No 182 - C00200000000018200008 » Portion 4 of Farm Vandermerweskraal No 132 – C00200000000013200004 » Portion 1 of Farm Thursford No183 - C00200000000018300001
Current zoning and Land Use	Zoning: Agricultural Land Use: Grazing
Site co-ordinates (centre of project site)	33°13'20.26"S ; 26°22'9.38"E

2.1. Findings of the Environmental Impact Assessment

The BA report together with the specialist studies contained within **Appendices D-M** provide a detailed assessment of the potential impacts that may result from the development of the Wind Garden Wind Farm.

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

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

» Impacts on ecology, flora and fauna.
» Impacts on aquatic ecology.
» Impacts on avifauna.
» Impacts on bats.
» Impacts on land use, soils and agricultural potential.
» Impacts on heritage resources, including archaeology, palaeontology and the cultural landscape.
» Noise impacts due to the construction and operation of the wind farm.
» Visual impacts on the area imposed by the components of the facility.
» Positive and negative socio- economic impacts.
» Traffic impacts, including increased pressure on the existing road network.

The development footprint, as assessed, has been overlain with the relevant environmental sensitivities in **Figure 2.2**.

2.1.1 Impacts on Ecology

Based on the nature and significance of the post-mitigation ecological impacts, the Wind Garden Wind Farm development envelope and the development footprint is considered as a broadly suitable environment and placement of infrastructure for wind farm development from an ecological perspective.

Overall, there are no specific long-term impacts likely to be associated with the development of the Wind Garden Wind Farm that cannot be reduced to a low significance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

The ecological features of the area include Least Concern vegetation types on a broad-scale, with some areas of high sensitivity in terms of the fine-scale vegetation confirmed. Listed plant species are present within the development envelop. In terms of CBAs, there is a single turbine within a CBA 1 and seven turbines within CBA 2 areas, with the majority of the remainder of the site being an ESA. The CBAs within the site are based largely on broad-scale ecological patterns and processes such as transitions between vegetation types. The development of the wind farm would add to transformation in the area and increase fragmentation of the landscape to some degree. However, the total footprint is however low and very unlikely to compromise the overall ecological functioning of the affected CBAs and the receiving landscape in general. Since, the CBAs are not based on the known presence of specific biodiversity features of high value, the wind farm is considered largely compatible with biodiversity maintenance in the area and as such, the potential impact on the affected CBAs and ESAs is considered acceptable.

The Ecological Impact Assessment identified impacts within the construction, operation and decommissioning phases of the project.

The Ecological Impact Assessment has identified impacts of medium significance to be associated with the development of the Wind Garden Wind Farm prior to the implementation of appropriate recommendation and mitigation measures. With the implementation of the mitigation measures majority of impacts would be reduced to a low significance, with only one impact of a medium significance. All impacts are considered to be acceptable. No impacts of a high significance or fatal flaws are expected to occur after implementation of the recommended mitigation measures.

There are no impacts associated with the Wind Garden Wind Farm that cannot be mitigated to an acceptable level and as such, the assessed layout is considered acceptable. With the application of relatively simple mitigation and avoidance measures, the impact of the Wind Garden Wind Farm on the local environment can be reduced to an acceptable level.

2.1.2. Impacts on Aquatic Ecology

From the results of the aquatic assessment it is confirmed that the Wind Garden Wind Farm will not have direct impact on any very high sensitivity areas, mainstem riparian systems (outside of the development footprint) and pans that contain functioning aquatic environmental of a high sensitivity with the implementation of the limited adjustments of the development footprint recommended by the specialist.

The impacts from an aquatic ecological perspective will be of a low significance following mitigation. The impacts have been identified and assessed for the life-cycle of the facility, with all impacts being of a low significance following the implementation of mitigation. Potential impacts identified include disturbance and the loss of pans, impact on watercourses through physical disturbance, increase in surface water runoff that could lead to hydrological changes, an increase in sedimentation and erosion and impact on localised surface water quality.

From the results of the aquatic assessment, it is confirmed that the Wind Garden Wind Farm will not have direct impact on any very high sensitivity areas, mainstem riparian systems (outside of the development footprint) or pans that contain functioning aquatic environmental features of a high sensitivity with the implementation of the limited adjustments of the development footprint recommended by the specialist. The specialist indicates that the project can be authorised, subject to the implementation of the recommended mitigation measures.

Furthermore, a Water Use License (or General Authorisation) for water uses identified in Section 21 c and 21 i of the National Water Act (Act 36 of 1998) would be required where activities are undertaken within 500m of watercourses and pans.

2.1.3. Impacts on Avifauna

The avifauna described to be associated with Wind Garden Wind Farm project site and the impacts identified and assessed are based on the results of the four seasons of pre-construction monitoring which was conducted from June 2019 to August 2020 in accordance with the best practice guidelines.

The Avifauna Impact Assessment identified that all impacts associated with the development of the Wind Garden Wind Farm development footprint will be of a medium significance before mitigation and can be mitigated to an acceptable level of impact (i.e. medium or low significance, depending on the impact being considered). No impacts of a high significance or fatal flaws are expected to occur with the implementation of the recommended mitigation measures.

Considering the avifauna features identified within the project site and surrounding areas, specific buffers have been recommended by the specialist for the placement of infrastructure, as well as buffers where turbine placement must be avoided and mitigation increased. The implementation of buffers from known eagle nest sites were put in place primarily to reduce collision risk, but also removes the possibility of disturbance to these eagle nest sites. As these buffers have been considered in the layout, the main residual disturbance issue would therefore be the loss of foraging habitat around the wind farm as a result of displacement. From experience at existing wind farms by the specialist, birds are likely to avoid the close proximity of the wind turbines.

Considering the placement of turbines within the development area, there are thirteen (13) turbines located within cautionary buffers which require the minimisation of turbine placement within these areas. The specialist has indicated that the development as proposed would be acceptable for authorisation, subject to the implementation of the recommended appropriate mitigation measures. Considering this, the specialist is not requiring further minimisation of turbines within the cautionary buffers of 3km and 5km, respectively. However, the specialist does recommend that all turbines located within the cautionary buffers have a single blade painted black during construction. Given this is a novel mitigation, which has been

proven to be effective internationally, a post-construction monitoring scheme should be implemented to determine its effectiveness.

2.1.4. Impacts on Bats

Pre-construction bat monitoring was undertaken within the Wind Garden Wind Farm project site in accordance with the best practice guidelines. The monitoring was designed to monitor bat activity across the area for the Wind Garden Wind Farm. The baseline environment was investigated by using acoustic monitoring to document bat activity between 13 March 2019 and 16 June 2020 (459 sample nights).

Key habitat features have been identified for bats within the development envelope. These habitat features present specific uses and opportunities for bats including roosts, foraging resources and commuting resources. All features, except for drainage lines and some specific roosts, were buffered by 260m to turbine base (i.e. 200m to blade tip based on turbines with a hub height of 120m (the lowest being considered)) and blade lengths of 80m (the longest being considered). Drainage lines were buffered by 100m to blade tip. A tunnel roost entrance was buffered by 2.5km, even though only 100 least concern, low risk bats are currently present in the roost (which would require a 1km buffer), the roost has been used in the past by Natal long-fingered bats and it is a regionally important roost, and is an active site for bat research for a number of local and international universities. No turbines are allowed to be placed within these buffers (i.e. no-go areas), including the blades. Construction of associated infrastructure is permitted in the no-go areas (except roost buffers, where no construction can take place), but should be avoided as much as possible. Adherence to these buffers is the primary mitigation measure to avoid impacts.

Based on the bat activity recorded at the Wind Garden Wind Farm, the significance ratings for the majority of the impacts to bats posed by the development are predicted to be medium or high before mitigation. After mitigation, all impacts are predicted to be low. Based on the opportunity for reduction of the impacts through appropriate mitigation measures from a high or medium significance to a low acceptable significance no fatal flaws are expected to occur.

The development footprint proposed and assessed adheres to the no-go areas (buffers) and is in accordance with current knowledge on how to promote bat conservation with respect to wind energy by minimizing risk. All buffers are to blade tip.

Provided recommended mitigation measures are met, the development of the Wind Garden WEF will not result in unacceptable impacts to bats and can be authorised.

2.1.5. Impacts on Land Use, Soil and Agricultural Potential

The development envelope is considered to be mainly of a low and very low agricultural sensitivity, with some medium sensitivity patches and high sensitivity patches present within the central section of the development envelope.

No areas of high sensitivity were identified within proximity to any of the proposed activities associated with the Wind Garden Wind Farm. Considering the lack of sensitivity and the measures put in place in regard to stormwater management and erosion control, it is the specialist's opinion that all activities will have an acceptable impact on agricultural productivity. Also, no adjustment of infrastructure placement is required.

All aspects considered during the impact assessment has been determined to have low or moderate post-mitigation significance. The worst-case impact scenario includes Moderate final significance ratings associated with Moderate sensitivity resources. It is considered that erosion from increased overland flows following the development of various components is of most concern, given the fact that erosion could result in a direct loss of soil resources. Various mitigation measures and monitoring activities have been prescribed, which will remedy the potential effects that erosion might have on land capability. All impacts identified to be associated with the development of the Wind Garden Wind Farm are considered to be acceptable with the implementation of the recommendations and mitigation measures as provided by the specialist. No fatal flaws have been identified.

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

During the site survey 12 heritage sites were identified within the project site. Three (3) labourer houses (EWF1-01, EWF1-05, EWF1-06), two (2) sheds (EWF1-02 and EWF1-09), one (1) farmhouse (EWF1-03) and one (1) reservoir (EWF1-08) were identified and were rated as not conservation worthy and of no heritage significance. The ruins of one (1) house (EWF1-07) was also identified and has a low heritage significance and heritage rating of IIIC. A farmstead (EWF1-04) was also identified. This site has a heritage rating of IIIB and is of a medium heritage significance. Further to the above, a total of three (3) burial grounds (EWF1-10 – EWF1-12) were identified. Graves have heritage rating of IIIA and is of a high heritage significance.

The Wind Garden Wind Farm is underlain by the Dwyka Group, the Witpoort Formation, the Weltevrede Formation, which are part of the Witteberg Group of the Cape Supergroup. As such, there is a moderate to high chance of finding fossils in this area. No visible evidence of fossiliferous outcrops was found during the site survey.

There are many visual receptors in the area as it is located close to the main urban node of the region, Makhanda, and eco-tourism facilities are common in the area, with three regional roads passing through or past the proposed site. Historic farmsteads and their associated stock farms are permanently occupied and offer accommodation to visitors to the area. Conservation and protected biodiversity areas dominate the landscape outside the proposed WEF site. Situated on a plateau the site is theoretically visible from distances of up to 50km. The negative impact of the development on the cultural landscape with the recommended mitigation will be moderate.

Specific buffers for the avoidance of impacts on the heritage resources were identified. These are listed below:

- Historical Structures (EWF1-04) that were rated as high heritage significance must include a no-go-buffer-zone of at least 500m from the outer perimeter of the farmstead (which is currently occupied) from the closest infrastructure (including substation, turbines, facilities and roads). No infrastructure proposed as part of the development footprint is located within this buffer area.
- Graves and Burial grounds (EWF1-10 to EWF1-12) must be demarcated with a 30-meter no-go-buffer-zone and the graves should be avoided and left *in situ*. No infrastructure proposed as part of the development footprint is located within the buffer areas.

Majority of impacts identified on the heritage resources were either of a medium or low significance prior to the implementation of mitigation measures (except for the impact on historical structures of a high significance and graves and burial grounds). With the implementation of the mitigation measures the

impact significance will be reduced to a low acceptable impact. No impacts of a high significance are expected to occur with mitigation.

The CLA indicated that the project will have a significant Moderate to High impact on the CL. The project developer has indicated that the reduction of turbines as recommended by the CLA will not be economically feasible and cannot consider such turbine reductions. It must be further noted that the aspects considered in the CLA (ecological, aesthetic and heritage) have been considered in other specialist investigations undertaken as part of this BA process, and that all feasible buffers recommended in this regard have been adhered to. The remaining CL recommendations will still result in a marginal reduction of impact. However, the size and bulk of the turbines in the landscape will unlikely be totally mitigatable.

It must further be considered that the addition of the infrastructure of the WEF will constitute an additional layer to the cultural landscape and must be considered as such within a gazetted REDZ area. Through the implementation of the economically feasible recommendations as set out in the CLA and contained in this report it will be possible to preserve older layers of the cultural landscape and in some cases even enhance them through consideration such as the use of older name places in the naming of infrastructure and enhancing local heritage through the incorporation of such structures in project conservation initiatives to name a few.

Analysis of the findings of the SEIA for this project further reveals that the economic benefit for the region and the overall energy needs such project address outweighs the need for conservation of cultural resources at all costs.

The overall impact of the Wind Garden Wind Farm, on the heritage resources identified during this report, is considered as acceptable after the recommendations have been implemented and therefore, impacts can be mitigated to acceptable levels allowing for the development to be authorised.

2.1.7. Noise Impacts

Considering the ambient sound levels and character of the area, ambient sound levels are generally low and typical of a rural noise district during low wind conditions. Ambient sound levels will likely increase as wind speeds increase. Potential Noise Sensitive Developments (NSDs) were identified within the projects site and ambient noise levels were measured in specific locations.

Based on the results of the Noise Impact Assessment no adjustments in terms of the proposed development footprint are required.

Noise impacts will be of low significance for daytime construction activities, of medium significance for night-time construction activities (with mitigation proposed to reduce the significance to low) and of low significance for both day- and night-time operation activities. No impacts of a high significance or fatal flaws were identified.

The specialist has indicated that a noise monitoring programme must be undertaken before the development of the wind farm as well as noise monitoring after the first year of operation of the wind farm. The acoustic consultant will need to recommend whether future noise monitoring is required following this initial monitoring.

2.1.8. Visual Impacts

A visibility analysis was undertaken for the project. The result of the viewshed analysis displays the potential areas of visual exposure, as well as the potential frequency of exposure, and potential visual sensitive receptors. Negative impacts on visual receptors will occur during the undertaking of construction activities and the operation of the Wind Garden Wind Farm.

During the construction phase of the Wind Garden Wind Farm a noticeable increase in heavy vehicles utilising the roads will occur. This will result in a visual nuisance to other road users and landowners within the surrounding area.

The operation of the Wind Garden Wind Farm will have a high visual impact on observers/visitors residing at homesteads within a 5km radius of the proposed wind turbine structures, on observers travelling along the roads within a 5km radius of the wind turbines, on residents of (or visitors to) homesteads within a 5 - 10km radius of the wind turbine structures, on objecting landowners and residents of (or visitors to) homesteads and tourist facilities within a 10 - 20km radius of the wind turbine structures. No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice.

The Wind Garden Wind Farm could have a moderate visual impact on residents of (or visitors to) homesteads within a 10 - 20km radius of the wind turbine structures.

Shadow flicker is an impact relevant to the operation of the turbines. Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). Most shadow impact is associated with 3-4 times the height of the object. Based on this, an 800m buffer along the edge of the outer most turbines is identified as the zone within which there is a risk of shadow flicker occurring. There are no places of residence within the 800m buffer. The significance of shadow flicker is therefore anticipated to be low to negligible.

In terms of lighting impacts, the area immediately surrounding the proposed facility has a relatively low incidence of receptors and light sources, and therefore light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity. Further lighting impacts include the potential for sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. This anticipated lighting impact during operation is likely to be of high significance, and may be mitigated to moderate, especially within a 5 to 10km radius of the wind turbine structures.

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. This is especially true due to the strobing effect of the lights, a function specifically designed to attract the observer's attention. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts have traditionally been very low other than to restrict the number of lights to turbines that delineate the outer perimeter of the facility. It is the intention of the developer to make use of ground-breaking new technology in the development of strobing lights that only activate when an aircraft is detected nearby. This may aid in restricting light pollution

at night. This will be investigated and implemented by the project proponent, if available and permissible by the CAA.

In terms of ancillary infrastructure, the range of visual exposure will fall within that of the turbines. The anticipated visual impact resulting from this infrastructure is likely to be of low significance both before and after mitigation.

The greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality. The significance of the visual impacts on the sense of place within the region (i.e. beyond a 20km radius of the development and within the greater region) is expected to be of low significance. No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice.

It is likely that the Wind Garden Wind Farm will be met with concern and potential opposition from affected landowners and tour operators within the region from a visual perspective. The fact that the visual impact is expected to be of high significance is undisputed, however this is not considered to be a fatal flaw.

2.1.9. Socio-economic Impacts

Impacts are expected to occur with the development of the Wind Garden Wind Farm during the construction, operation and decommissioning phases. Both positive and negative impacts are identified and assessed.

Positive impacts during construction includes:
- Temporary stimulation of the national and local economy
- Temporary increase employment in the national and local economies
- Contribution to skills development in the country and local economy
- Temporary increase in household earnings
- Temporary increase in government revenue

Negative impacts during construction includes:
- Negative changes to the sense of place
- Negative impact on the local tourism, game industry and associated industries during construction
- Temporary increase in social conflicts associated with the influx of people
- Impact on economic and social infrastructure
- Impact on property and land value in the immediately affected area during construction

Positive impacts during operation includes:
- Sustainable increase in production and GDP nationally and locally
- Creation of sustainable employment positions nationally and locally
- Skills development of permanently employed workers
- Improved standards of living for benefiting households
- Sustainable increase in national and local government revenue
- Local economic and social development benefits derived from the project's operations
- Sustainable rental revenue for farms where the wind farm is located
- Sustainable increase in electricity available for the local region and South Africa

Negative impacts during operation includes:

» Negative changes to the sense of place
» Negative impact on local tourism, game farming and associated industries

i. Impacts during construction

During the construction phase, the proposed Wind Garden Wind Farm will have both positive and negative effects on the socio-economic environment.

The project is anticipated to make a prominent contribution towards the national and local economy. It is estimated that a total of R 14,6 billion of new business sales, R 2,8 billion of GDP and 1 691 FTE employment positions will be generated by the project in the national economy through multiplier effects. Aside from the above positive effects, the project will contribute to skills development in the country, specifically as far as construction of the wind facility is concerned as well as increasing household earnings. The increase in household earnings is also likely to improve the standards of living of the affected households albeit temporarily.

Aside from the positive impacts though, the project will be creating negative direct, secondary and cumulative impacts on the local communities, specifically areas surrounding the site where the proposed facility is to be built. The main factors that will cause this negative impact are (1) the influx of workers and job seekers from outside of the local community and (2) visual and noise disturbances that would be created by the construction activities as the footprint of the facility grows.

Potential negative impacts can be mitigated, although some more successfully than others. Visual impacts though cannot be eliminated although it is possible to reduce their significance.

ii. Impacts during operations

During the operation of the wind energy facility the socio-economic impacts are likely to last longer when compared to those observed during the construction phase. This is the case for both positive and negative effects.

The operation of the proposed wind energy facility will generate R 78 million of new business sales, contribute R 28 million to GDP and create 27 sustainable FTE employment positions. The developer's intended SED spend will also notably contribute towards local employment, skills development and various conservation enterprises within the immediate area.

Negative impacts include the potential loss of sense of place and potential loss of income from tourist-based businesses. These potential losses may, however, be isolated to specific businesses. Primary research undertaken in this SEIA and corroborated with internationally published literature on the impact of wind farms on the tourism industry cannot conclusively suggest that negative impacts on the local tourism industry and local property values will be detrimentally negative.

As in the case with the impacts observed during construction, negative effects can be mitigated, and positive impacts enhanced. Mitigation of the negative impacts though will not result in their complete

elimination as visual disturbance of the nature inherent to the project are difficult to eradicate entirely. Nevertheless, the significance ratings of the negative impacts are expected to be somewhat reduced.

iii. Impacts during decommissioning

Socio-economic impacts stimulated during the decommission phase are expected to be similar to those that take place during the construction phase. The impacts though are expected to be of low significance due to the very short duration therefore and lower magnitude. Enhancement and mitigation measures proposed for the construction phase impacts would also apply to the decommissioning phase.

iv. Net effect and trade off analysis

The assessment of the proposed facility, and its net effective impact from a socio-economic perspective, indicates that the project would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of its establishment. Stimulation of production, employment, government revenue, skills development and household income as a result of the investment in the project and its subsequent operations will outweigh possible production, employment and household income losses that could be experienced by local businesses affected by changes in the areas aesthetic and visual resources. It should be noted though that the positive and negative impacts will be distributed mostly amongst different receptors but will not result in inequality. Adherence to the proposed mitigation measures, however, would ensure that the offset of impacts is more balanced and that it also takes into account communities and businesses that will be negatively affected.

The positive effects generated by the project will not directly offset many of the negative impacts. These include impacts on the sense of place and property and business values that could occur during both construction and operation, the effect on social and economic infrastructure, and crime and social conflicts in the area that could be created during only the construction phase. These impacts though will only affect local communities either temporarily or over the long term. These impacts are not highly significant and can be traded off for the net positive impact created by the project in terms of production, employment, government revenue, community benefits and households' earnings. This means that when compared with the no-go option, the proposed project is associated with greater socio-economic benefits.

v. Recommendations

The net positive impacts associated with the development and operation of the Wind Garden Wind Farm are expected to outweigh the net negative effects. The project is also envisaged to have a positive stimulus on the local economy and employment creation, leading to the economy's diversification and a small reduction in the unemployment rate. The project should therefore be considered for development. It should, however, be acknowledged that the negative impacts would be largely borne by the nearby farms and households residing on them, whilst the positive impacts will be largely concentrated in the local and national economies. Due to this imbalance, it is recommended that the mitigation measures suggested be strictly adhered to. Application of these mitigation measures will ensure that the negative impacts on the nearby farms and businesses are minimised and that the distribution of the potential benefits of the project are more balanced.

2.1.10. Impacts on Traffic

Traffic impacts have been identified for the construction, operation and decommissioning phases, with the most significant impact expected to occur during the construction phase.

The traffic generated during the construction phase, although significant, will be temporary and impacts are considered to be negative and of medium significance before and of low significance after mitigation. During the operation phase impact would be minimal. The traffic generated during the decommissioning phase will be similar but less than the construction phase traffic and the impact on the surrounding road network will also be considered negative and of medium significance before and of low significance after mitigation.

No impacts of high significance were identified and no fatal flaws are associated with the Wind Garden Wind Farm from a traffic perspective.

2.1.11. Assessment of Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Wind Garden Wind Farm falls within the Cookhouse REDZ which has been identified by the DFFE as an area highly suitable for wind farms given a range of factors considered. Therefore, DFFE envisages dealing with multiple applications and cumulative issues within a REDZ area. The REDZs are of strategic importance for large scale wind and solar photovoltaic development, in terms of Strategic Integrated Project (SIP) 8. These zones are considered to be areas where significant negative impacts on the environment are limited and socio-economic benefits to the country can be enhanced. Multiple projects within the area have been successfully bid under the DMRE's REIPPP programme and are currently operational. The Wind Garden Wind Farm will contribute to the cumulative impact experienced within the area. The cumulative impacts associated with the Wind Garden Wind Farm have been assessed to be acceptable, with no unacceptable loss or risk expected.

Based on the specialist cumulative assessment and findings, the development of the Wind Garden Wind Farm and its contribution to the overall impact of all wind energy facilities to be developed within a 30km radius, it can be concluded that the Wind Garden Wind Farm cumulative impacts will be of a medium to low significance, with impacts of a high significance mainly relating to positive socio-economic impacts and negative visual impacts on the landscape. It was concluded that the development of the Wind Garden Wind Farm will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment.

2.1.12. Sensitivity Mapping

Figure 2.2 below illustrates the identified sensitive environmental features and areas present within the Wind Garden Wind Farm development envelope, overlain with the preferred development footprint.

Figure 2.3 below illustrates the preferred development footprint of the Wind Garden Wind Farm which avoids all sensitive environmental features present within the development envelope.

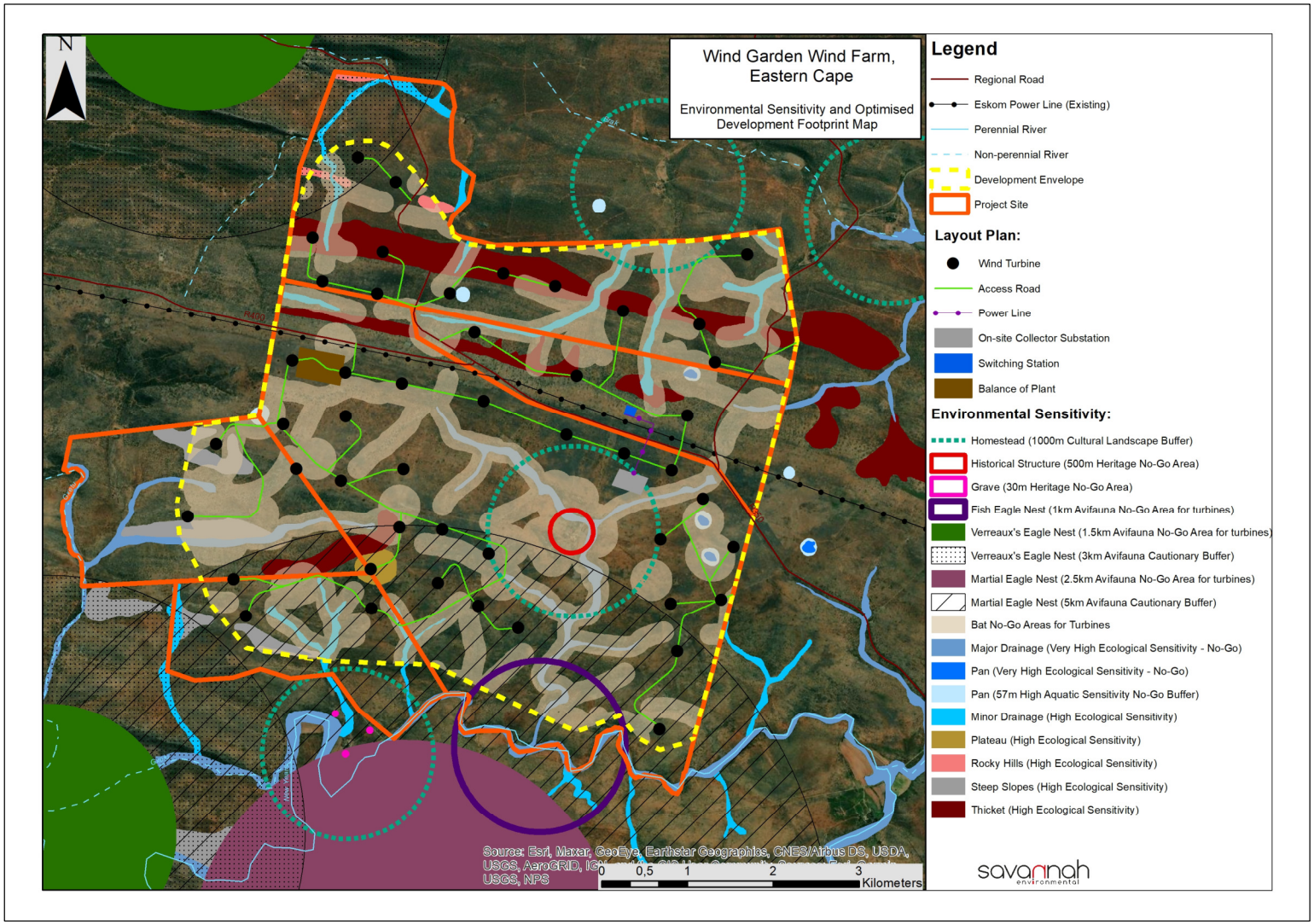


Figure 2.2: Final preferred (optimised) development footprint (~66.6ha) for the Wind Garden Wind Farm, overlain with the identified environmental sensitivities (refer to **Appendix A** for A3 maps).

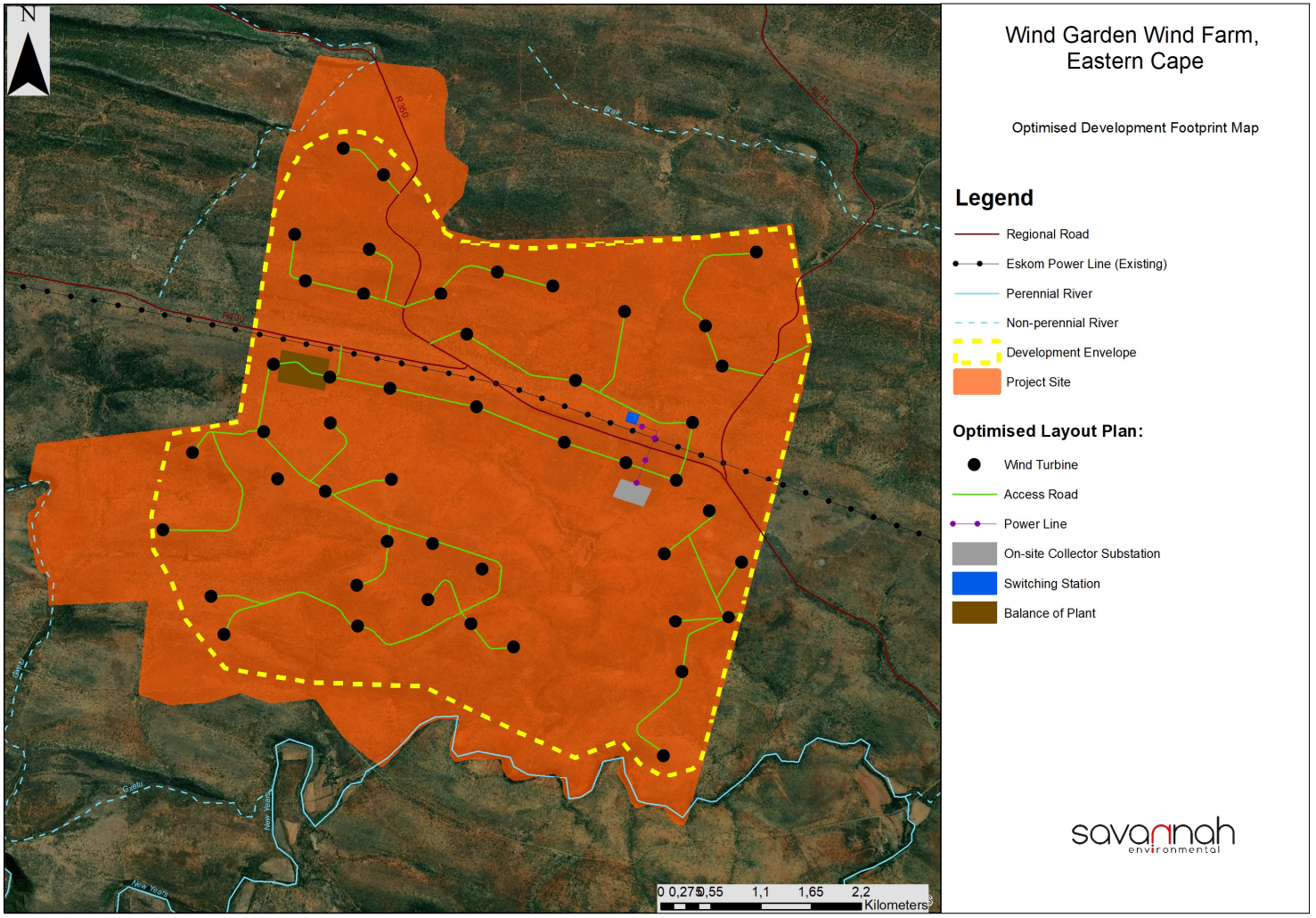


Figure 2.3: Final preferred (optimised) development footprint for the Wind Garden Wind Farm considered to be acceptable for development (refer to **Appendix A** for A3 maps).

2.3. Activities and Components associated with the Wind Garden Wind Farm

The main activities/components associated with the Wind Garden Wind Farm are detailed in **Table 2.2**.

Table 2.2: Activities associated with Planning, Construction, Operation and Decommissioning of the Wind Garden Wind Farm

Construction Phase	
Requirements	» Project requires Environmental Authorisation from DEFF, a generation license issued by NERSA, and a wheeling agreement secured with Eskom. » Duration dependent on the number of turbines; expected to be up to 30 months for the Wind Garden Wind Farm. » Create direct construction employment opportunities: Up to 620 jobs created and maintained for approximately two and a half years. » Staff accommodation will be provided on site during the construction phase which will house approximately 479 employees over the 30 months of construction. It is anticipated that the highest number of staff living on site throughout construction will be 211 employees at the peak of the construction phase. » Security staff will also be present during the night-time of the construction phase. » Waste removal and sanitation will be undertaken by a sub-contractor or the municipality, where possible. Waste containers, including containers for hazardous waste, will be located at easily accessible locations /turbine positions on site as well as within the BoP area when construction activities are undertaken. » Electricity required for construction activities will be generated by a generator or will be sourced from available 11kV or 22kV Eskom distribution networks in the area. » Water will be required for the construction phase, which will be approximately 19014.12kl in total for the construction activities and 12686.98kl for human consumption. Water will be sourced from existing boreholes in the area.
Activities to be undertaken	
Conduct surveys prior to construction	» Including, but not limited to: a geotechnical survey, site survey and confirmation of the turbine micro-siting footprint, survey of the on-site substation sites (i.e. switching station and collector substation to determine and confirm the locations of all associated infrastructure).
Establishment of access roads to the Site	» Access/haul roads and internal access roads within the site will be established at the commencement of construction. » Existing access roads will be utilised where possible to minimise impact and upgraded where required. » Access roads to the site will have a width of up to 8m. » Access roads to be established between the turbines for construction and/or maintenance activities within the development footprint. » Internal service road alignment will be approximately 4,5m wide, and will have a servitude of 13,5m.
Undertake site preparation	» Including the clearance of vegetation at the footprint of each turbine, establishment of the laydown areas, the establishment of internal access roads and excavations for foundations. » Stripping of topsoil to be stockpiled, backfilled, removed from site and/or spread on site. » To be undertaken in a systematic manner to reduce the risk of exposed ground being subjected to erosion.

	» Include search and rescue of floral species of concern (where required) and the identification and excavation of any sites of cultural/heritage value (where required).
Establishment of laydown areas and batching plant on site	» A laydown area for the storage of wind turbine components, including the cranes required for tower/turbine assembly and civil engineering construction equipment. » The laydown area will also accommodate building materials and equipment associated with the construction of buildings. » A crane hardstand at each turbine position where the main lifting crane will be erected and/or disassembled. » Infilling or depositing materials will be sourced from licenced borrow pits within the surrounding areas. The identification and permitting process of required borrow pits has been commenced as part of a separate EIA process and the Application for Environmental Authorisation is independent of the Wind Garden Wind Farm EIA application. » A temporary concrete batching plant of 50m x 50m in extent to facilitate the concrete requirements for turbine foundations. This will be located within the Balance of Plant area.
Construct foundation	» Concrete foundations of approximately 600m^3 in extent to be constructed at each turbine location. » Excavations to be undertaken mechanically. » Concrete foundation will be constructed to support a mounting ring. » Depending on geological conditions, the use of alternative foundations may be considered (e.g. reinforced piles).
Transport of components and equipment to and within the site	» Turbine units to be transported includes the tower segments, hub, nacelle, and three rotor blades. » Components to be transported to the site in sections on flatbed trucks by the turbine supplier. Imported components to be transported from the Port of Ngqura to the project site via the N2 past Colchester and Nanaga towards Makhanda. » Transportation will take place via appropriate National and Provincial roads, and the dedicated access/haul road to the site. » Components considered as abnormal loads in terms of Road Traffic Act (Act No 29 of 1989) due to dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle) will require a permit for the transportation of the abnormal loads on public roads. » Specialised construction and lifting equipment to be transported to site to erect the wind turbines. » Civil engineering construction equipment to be brought to the site for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement trucks, site offices etc.). » Components for the establishment of the switching station and collector substation (including transformers) and associated infrastructure to be transported to site.
Construction of the turbine	» A lifting crane will be utilised to lift the tower sections, nacelle and rotor into place. » Approximately 1 week is required to erect a single turbine depending on climatic conditions. » Lifting cranes are required to move between the turbine sites.
Construction of the substation	» One switching station and one on-site collector substation to be constructed within the development footprint. » Substations will be constructed with a high-voltage yard footprint.

Connection of wind turbines to the collector substation	» Each wind turbine is to be connected to the on-site collector substation via underground electrical cables. » Excavation of trenches are required for the installation of the cables. Trenches will be approximately 1.2m deep. » Underground cables are planned to follow the internal access roads, as far as possible.
Establishment of ancillary infrastructure	» Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre. » Temporary staff accommodation is required for the duration of construction. » Establishment will require the clearing of vegetation, levelling and the excavation of foundations prior to construction.
Connect substation to the power grid	» A 132kV switching station and a 132/33kV on-site collector substation is proposed to be developed which will be connected via a 132kV overhead power line (twin turn dual circuit). The wind farm will be connected to the national grid through a connection from the 132/33kV collector substation via the 132kV power line which will connect to the 132kV switching station that will loop in and loop out of the existing Poseidon – Albany 132kV line located within the project site.
Undertake site rehabilitation	» Commence with rehabilitation efforts once construction is completed in an area, and all construction equipment is removed. » On commissioning, access points to the site that will not be required for the operation phase will be closed and prepared for rehabilitation.
Operation Phase	
Requirements	» Duration will be 20-25 years. » Requirements for security and maintenance of the facility. » Employment opportunities relating mainly to operation activities and maintenance. Up to 15 full-time employment opportunities will be available. » Current land-use activities, i.e. farming activities, being undertaken within the project site can continue during the operation of the wind farm.
Activities to be undertaken	
Operation and Maintenance	» Full time security, maintenance and control room staff. » All turbines will be operational except under circumstances of mechanical breakdown, inclement weather conditions, or maintenance activities. » Wind turbines to be subject to periodic maintenance and inspection. » Disposal of waste products (e.g. oil) in accordance with relevant waste management legislation. » Areas which were disturbed during the construction phase to be utilised should a laydown area be required during operation.
Decommissioning Phase	
Requirements	» Decommissioning of the Wind Garden Wind Farm infrastructure at the end of its economic life. » Potential for repowering of the facility, depending on the condition of the facility at the time. » Expected lifespan of approximately 20 - 25 years (with maintenance) before decommissioning is required. » Decommissioning activities to comply with the legislation relevant at the time.
Activities to be undertaken	
Site preparation	» Confirming the integrity of site access to accommodate the required equipment and lifting cranes. » Preparation of the site (e.g. laydown areas and construction platform).

	» Mobilisation of construction equipment.
Disassemble and remove turbines	» Large crane required for the disassembling of the turbine and tower sections. » Components to be reused, recycled, or disposed of in accordance with regulatory requirements. » All parts of the turbine would be considered reusable or recyclable except for the blades. » Concrete will be removed to a depth as defined by an agricultural specialist and the area rehabilitated. » Cables will be excavated and removed, as may be required.
Components to be disposed of or recycled.	» Foundation » Tower » Electrical facilities in tower base » Rotor » Generator » Machine house » Regarding the foundation body and sub-base of the tower, the concrete will undergo crushing and be used as combined base/wearing course » Reinforcing steel will go through cleansing and milling to re-melt the components

CHAPTER 3: PURPOSE AND OBJECTIVES OF THE EMPR

An Environmental Management Programme (EMPr) is defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced". The objective of this EMPr is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMPr is to help ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMPr is concerned with both the immediate outcome as well as the long-term impacts of the project.

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

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

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

The EMPr has the following objectives:

- Outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation and operation phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the Wind Garden Wind Farm.
- Ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- Identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- Propose mechanisms and frequency for monitoring compliance, and prevent long-term or permanent environmental degradation.

» Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that were not considered in the BA process.

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

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

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

CHAPTER 4: STRUCTURE OF THIS EMPR

The first three chapters provide background to the EMPr and the Wind Garden Wind Farm, while the chapters which follow consider the following:

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

These chapters set out the procedures necessary for Wind Garden (Pty) Ltd as the project owner, to minimise environmental impacts and achieve environmental compliance. For each of the phases of implementation, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The EMPr 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 EMPr 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 to meet the overall goals; which take into account the findings of the EIA specialist studies

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

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

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

The objectives and EMPr tables are required to be reviewed and possibly modified throughout the life of the wind farm whenever changes, such as the following, occur:

» Planned activities change (i.e. in terms of the components of the wind farm).

» 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 in achieving an objective or target such that it should be re-examined to determine if it is still relevant or should be modified, etc.

4.1. Project Team

This EMP was compiled by:

EMP Compilers	
Lisa Opperman	Savannah Environmental
Jo-Anne Thomas	Savannah Environmental
Input from Specialist Consultants	
Terrestrial Ecology (including fauna and flora)	Simon Todd of 3foxes Biodiversity Solutions
Avifauna (including monitoring)	Adri Barkhuysen of East Cape Diverse Consultants and Dr Steve Percival of Ecology Consulting and Peer Review by Owen Davies of Arcus Consultancy Services South Africa
Bats (including monitoring)	Michael Brits and Mark Hodgson of Arcus Consultancy Services South Africa
Aquatic	Dr Brian Colloty of EnviroSci
Soil, Land Use, Land Capability and Agricultural Potential	Andrew Husted of The Biodiversity Company
Heritage (including archaeology, palaeontology and cultural landscape)	Cherene de Bruyn and Wouter Fourie of PGS Heritage and Elize Butler of Banzai Environmental
Noise	Morné de Jager of Enviro Acoustic Research (EAR)
Visual	Lourens du Plessis of LOGIS
Socio-economic	Conrad Swart and Matthew Keeley of Urban-Econ
Traffic	Iris Wink and Adrian Johnson of JG Africa

The Savannah Environmental team have extensive knowledge and experience in environmental impact assessment and environmental management, having been involved in EIA processes for more than fifteen (15) years. They have managed and drafted Environmental Management Programmes for other power generation projects throughout South Africa, including numerous wind and solar energy facilities.

CHAPTER 5: ROLES AND RESPONSIBILITIES

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

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

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

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

i) The Developer

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

ii) Project Manager/Site Manager

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

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

iii) Environmental Control Officer

A suitably qualified Environmental Control Officer (ECO)[2] must be appointed by the project proponent prior to the commencement of any authorised activities and will be responsible for monitoring, reviewing and verifying compliance by the Contractor with the environmental specifications of the EMPr and the conditions of the Environmental Authorisation. Accordingly, the ECO will:

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

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

iv) Contractors

The Lead Contractor is responsible for the following:

- Ensure compliance with the EA, environmental permits and the EMPr at all times during construction.
- Have the overall responsibility of the EMPr and its implementation.

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

- Ensure that all appointed contractors and sub-contractors are aware of the EMPr and their respective responsibilities.
- Provide all necessary supervision during the execution of the project.
- Comply with any special conditions as stipulated by landowners.
- Inform and educate all employees about the environmental risks associated with the various activities to be undertaken, and highlight those activities which should be avoided during the construction process in order to minimise significant impacts to the environment.
- Maintain an environmental register which keeps a record of all incidents which occur on the site during construction. These incidents include:
  - Public involvement / complaints
  - Health and safety incidents
  - Hazardous materials stored on site
  - Non-compliance incidents
  - Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.
- Where construction activities are undertaken is close to any inhabited area, the necessary precautions shall be taken by the Contractor to safeguard the lives and property of the inhabitants.
- Conduct audits to ensure compliance to the EMPr.
- Ensure there is communication with the Project Manager, the ECO, and relevant discipline engineers on matters concerning the environment.
- Should the Contractor require clarity on any aspect of the EMPr the Contractor must contact the Environmental Consultant/Officer for advice.

Contractors and Service Providers must be aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The contractor's obligations in this regard include the following:

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

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

- Ensuring adherence to the environmental management specifications
- Ensuring that Method Statements are submitted to the Site Manager (and ECO) for approval before any work is undertaken
- Any lack of adherence to the above will be considered as non-compliance to the specifications of the EMPr
- Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to

- Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting
- Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO
- Ensuring that a register of all public complaints is maintained
- Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMPr (i.e. ensure their staff are appropriately trained as to the environmental obligations)

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

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

The Contractor's SHE/EO should:

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

OBJECTIVE 2: Establish clear reporting, communication, and responsibilities during operation in relation to overall implementation of the EMPr during operation

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

- Operations Manager; and
- Environmental Manager

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

i) Operations Manager

The Plant Manager will:

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

ii) Environmental Manager

The Environmental Manager will:

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

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

CHAPTER 6: MANAGEMENT PROGRAMME: PLANNING AND DESIGN

Overall Goal: undertake the pre-construction (planning and design) phase 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.
- Ensures that adequate regard has been taken of identified environmental sensitivities, as well as any landowner and community concerns and that these are appropriately addressed through design and planning (where applicable).
- Enables the construction activities to be undertaken without significant disruption to other land uses and activities in the area.
- Ensures that the best environmental options are selected for the wind farm.

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

6.1. Objectives

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 DEFF, the optimised development footprint detailed in **Figure 2.2** must be implemented. Cognisance of sensitive areas defined in **Figure 2.3** and within the BA Report should be considered when undertaking the final design of the facility.

Project component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Design fails to respond optimally to the identified environmental considerations. » Employment creation for the construction, operation and decommissioning activities. » 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 and power line. » Positioning of balance of plant. » Pre-construction activities, e.g. geotechnical investigations.
Mitigation: Target/Objective	» To ensure that the design of the wind farm responds to the identified environmental constraints and opportunities, including the constraints identified through the BA process.

	» To ensure that pre-construction activities are undertaken in an environmentally friendly manner by e.g. avoiding identified sensitive areas. » Optimal planning of visual infrastructure to minimise visual impact.

Mitigation: Action/control	Responsibility	Timeframe
Plan and conduct pre-construction activities in an environmentally responsible manner and in a manner that does not lead to unnecessary impacts and disturbance.	Developer EPC Contractor	Pre-construction
Consider design level mitigation measures recommended by the specialists, especially with respect to noise, flora, fauna, aquatic ecology, avifauna, bats, and heritage sites, as detailed within the BA report and relevant appendices.	Developer EPC Contractor	Design phase
The minimum number of turbines should be constructed to achieve the required MW output. It is preferable to have a reduced number of turbines with a larger rotor compared with more turbines with a smaller rotor.	Developer EPC Contractor	Design phase
No turbines should be planned in no-go areas, while associated infrastructure should be avoided where possible in these areas. The turbine blade should not protrude into these areas, and therefore the bases should be constructed with sufficient distance from these areas to prevent this.	Developer EPC Contractor	Design phase
The hierarchy of sensitivity zones identified should be considered where possible with preferential placement of turbines in areas with no sensitivity score, followed by low sensitivity, medium sensitivity and medium-high sensitivity.	Developer EPC Contractor	Design phase
Placement of electrical infrastructure should consider avifaunal sensitivity zones and avoid areas of higher sensitivities where possible.	Developer EPC Contractor	Design phase
All new internal power lines linking the wind turbine generators to each other on site must be planned to be underground where technically and environmentally feasible. Certain spans can only be above ground if it is impossible and completely unfeasible to bury them or if there is a reasonable other environmental aspect present which prevents them being buried (e.g. a sensitive wetland area).	Developer EPC Contractor	Design phase
Any new overhead power lines must be of a design that minimises electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components and possible bird perches (e.g. cross arms) of 1.8 m or greater.	Developer EPC Contractor	Design phase
Plan to install appropriate marking devices (BFDs – bird friendly devices) on all new overhead power lines to increase visibility. The advice of a specialist should be sought regarding the type, placement and spacing of the BFDs to be used and the type of pylon structure to be used.	Developer EPC Contractor	Design phase
The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths.	Developer EPC Contractor	Design phase
The wind farm must be designed in such a way as to avoid the destruction of potential and actual bat roosts, particularly large mature trees, buildings, rocky crevices (if blasting is required),	Developer EPC Contractor	Design phase

Mitigation: Action/control	Responsibility	Timeframe
woodland habitat, mountainous areas and the major roost found near Wind Garden.		
Potential bat roosts, specifically large mature trees, buildings and rocky crevices, are buffered by 200m, inside which no turbine infrastructure may be placed. These buffers have been mapped and are to blade tip. No turbines should be installed within 50m of large mature trees	Developer EPC Contractor	Design phase
Design the layout of the project to avoid areas that are more frequently used by bats will reduce the likelihood of mortality and should be the primary mitigation measure. These areas include key microhabitats such as water features, trees, buildings, and rocky crevices.	Developer EPC Contractor	Design phase
Adhere to the bat sensitivity and no-go zones by planning to avoid building the collector substation and switching station within these areas (especially in mountainous and woodland areas) and strictly avoiding roost buffered areas.	Developer EPC Contractor	Design phase
There should be no turbines within the Very High ecological Sensitivity areas	Developer EPC Contractor	Design phase
A no-go-buffer zone of at least 500m from the outer perimeter of the farmstead recorded as part of Historical Structures (EWF1-04) is kept to the closest wind farm infrastructure (including turbines, substation facilities and roads). If development is to occur within 500m of EWF1-04, the main homesteads need to be satisfactorily studied and recorded before impact occurs. » Recording of the buildings i.e. (a) map indicating the position and footprint of all the buildings and structures (b) photographic recording of all the buildings and structures (c) measured drawings of the floor plans of the principal buildings. » A mitigation report must be compiled for the site within which the recorded drawings from the previous item as well as all existing information on the farmstead can be included. » The completed mitigation report must be submitted to the relevant heritage authorities with a permit application to allow for the impact to occur.	Developer EPC Contractor	Design phase
The footprint within ephemeral drainage lines should be minimized as much as possible.		
Ensure that laydown and other temporary infrastructure is placed within low sensitivity areas, preferably previously transformed areas, if possible.		
Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) where possible.	Developer EPC Contractor	Design phase
High traffic areas and buildings such as offices, batching plants, storage areas etc. should, where possible, be situated in areas that are already disturbed.	Developer EPC Contractor	Design phase
Make use of existing roads where possible when planning the access road layout for the wind farm. Take cognisance of the topography and limit cut and fill requirements.	Developer EPC Contractor	Design phase

Mitigation: Action/control	Responsibility	Timeframe
the number of roads should be reduced to the minimum possible and routes should also be adjusted to avoid areas of high sensitivity as far as possible.	Developer EPC Contractor	Design phase
Select an appropriate turbine model to ensure that the height of the lower blade swept area is maximised, and is not lower than 36 m.	Developer EPC Contractor	Design phase
Plan as little lighting as possible, and only where essential for operation of the facility.	Developer EPC Contractor	Design phase
Where lights need to be used such as at the collector substation and switching station and elsewhere, these should be planned have low attractiveness for insects such as low pressure sodium and warm white LED lights. High pressure sodium and white mercury lighting is attractive to insects and should not be used as far as possible.	Developer EPC Contractor	Design phase
Plan lighting as follows: » Implement needs-based night lighting if considered acceptable by the CAA. » Limit aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact. » Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). » Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. » Make use of minimum lumen or wattage in fixtures. » Make use of down-lighters, or shielded fixtures. » Make use of Low Pressure Sodium lighting or other types of low impact lighting. » Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.	Developer EPC Contractor	Design phase
Undertake a noise monitoring programme before the development of the wind farm.	Developer EPC Contractor	Design phase
Design the facility such that no runoff is directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond.	Developer EPC Contractor	Design phase

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

OBJECTIVE 2: Ensure that relevant permits and site-specific plans are in place to manage impacts on the environment

Project Component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Impact on identified sensitive areas. » Design fails to respond optimally to the environmental considerations.
Activities/Risk Sources	» Positioning of all project components » Pre-construction activities, e.g. geotechnical investigations, site surveys of substation footprint, power line servitude and internal access roads and environmental walk-through surveys. » Positioning of temporary sites.
Mitigation: Target/Objective	» To ensure that the design of the power plant responds to the identified environmental constraints and opportunities. » To ensure that pre-construction activities are undertaken in an environmentally friendly manner. » To ensure that the design of the power plant responds to the identified constraints identified through pre-construction surveys.

Mitigation: Action/Control	Responsibility	Timeframe
Obtain any additional environmental permits required prior to the commencement of construction.	Developer	Pre-construction
Obtain abnormal load permits for transportation of project components to site (if required).	Contractor(s)	Prior to construction
A detailed "walk down" of the final approved turbine locations, access roads, powerlines and substations will be required before construction commences. Any heritage features of significance identified during this walk down will require formal mitigation (i.e. permitting where required) or where possible a slight change in design could accommodate such resources.	Developer Specialist	Pre-construction
A Heritage Management Plan (HMP) for the heritage resources needs to be compiled and approved for implementation during construction and operations where heritage features of significance are identified.	Developer Specialist	Pre-construction
The final layout including roads and underground cables should be subject to an ecological walk-through before construction commences to ensure that sensitive habitats and species are avoided where possible and to micro-site roads and turbines..	Developer Specialist	Pre-construction
The necessary biodiversity permits must be obtained prior to removal of any species of concern.	Project developer	Pre-construction
A detailed geotechnical investigation is required for the design phase for all infrastructure components.	Developer	Design phase

Mitigation: Action/Control	Responsibility	Timeframe
Obtain any additional environmental permits required (e.g. water use license, protected plant permits, faunal relocation permit, etc.). Copies of permits/licenses must be submitted to the Director: Environmental Impact Evaluation at the DEFF, and kept on site during the construction and operation phases of the project.	Developer	Design phase
Search and rescue of species of conservation concern should be conducted prior to clearing activities.	Developer Contractor	Pre-construction
A stormwater management plan must be developed in the pre-construction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks.	Contractor(s)	Design phase
Develop a detailed method statement for the implementation of the alien invasive management plan and open space management plan for the site (refer to **Appendix C**).	Developer	Pre-construction
Develop a detailed method statement for the implementation of the plant rescue and protection plan for the site (refer to **Appendix E**).	Developer	Pre-construction
Develop a detailed method statement for the implementation of the re-vegetation and habitat rehabilitation plan for the site (refer to **Appendix D**).	Developer	Pre-construction
Develop a detailed method statement for the implementation of the traffic and transportation management plan for the site (refer to **Appendix F**).	Developer	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.	Developer	Pre-construction
Prepare a detailed Fire Management Plan in collaboration with surrounding landowners.	Developer	Pre-construction
Develop and implement an alien, invasive and weeds eradication/control plan.	Developer Specialist	Pre-construction
A comprehensive rehabilitation / monitoring plan must be developed in consultation with a specialist, and must be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed.	Developer Contractor Specialist	Pre-construction

Performance Indicator	» Layout does not destroy/degrade no-go areas. » No disturbance of no-go areas. » Permits are obtained and relevant conditions complied with. » Relevant management plans and Method Statements prepared and implemented.

Monitoring	» Review of the design by the Project Manager and the ECO prior to the commencement of construction. » Monitor ongoing compliance with the EMPr.

OBJECTIVE 3: Ensure compliance of required mitigation measures and recommendations by contractors

Project Component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Impact on identified sensitive areas. » Planning fails to respond optimally to the environmental considerations.
Activities/Risk Sources	» Positioning of all project components » Pre-construction activities. » Positioning of temporary sites. » Employment and procurement procedures.
Mitigation: Target/Objective	» To ensure that appropriate planning is undertaken by the contractor to ensure compliance with the conditions of the EA and EMPr. » To ensure that pre-construction and construction activities are undertaken in an environmentally friendly manner.

Mitigation: Action/Control	Responsibility	Timeframe
The terms of this EMPr and the Environmental Authorisation must be included in all tender documentation and Contractors contracts.	Developer Contractor	Pre-construction
Create awareness of skills through posters and media announcements and set-up a skills desk at a central and accessible location. The skills desk should serve to record local job seeker skills.	Developer Contractor	Pre-construction
Develop a local community safety forum to establish monitoring methods for the surrounding community.	Developer Contractor	Pre-construction
The developer should encourage the EPC contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies.	Developer Contractor	Pre-construction
The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers were feasible.	Developer Contractor	Pre-construction
The contractor must be made aware of the Eskom requirements for works at or near Eskom infrastructure and compliance therewith ensured.	Developer Contractor	Pre-construction Construction

Performance Indicator	» Conditions of the EA and EMPr form part of all contracts. » Local employment and procurement is encouraged.
Monitoring	» Monitor ongoing compliance with the EMPr and method statements.

OBJECTIVE 4: To ensure effective communication mechanisms

It is important to maintain on-going communication with the public (including affected and surrounding landowners) during the construction and operation phases of the Wind Garden 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. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Impacts on affected and surrounding landowners and land uses.
Activity/risk source	» Activities associated with pre-construction phase. » Activities associated with construction of the wind farm. » Activities associated with operation.
Mitigation: Target/Objective	» Effective communication with affected and surrounding landowners. » Addressing 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 (including the affected and surrounding landowners) (using **Appendix B**) to be implemented during both the construction and operation phases of the wind farm and if applicable during decommissioning. This procedure should include the 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. The mechanism must also include procedures to lodge complaints in order for the local community to express any complaints or grievances with the construction process. A Public Complaints register must be maintained by the Contractor to record all complaints and queries relating to the project and the actions taken to resolve the issue. A Project Specific Grievance Mechanism will be developed and implemented prior to construction.	Developer Contractor O&M Operator	Pre-construction (construction procedure) Pre-operation (operation procedure)

Mitigation: Action/control	Responsibility	Timeframe
Develop and implement a grievance mechanism for the construction, operation and closure phases of the wind farm for all employees, contractors, subcontractors and site personnel. This procedure should be in line with the South African Labour Law.	Developer Contractor O&M Operator	Pre-construction (construction procedure) Pre-operation (operation procedure)
Develop a public relations (PR) campaign prior to commencement of construction to communicate to community members the construction programme, inclusive of regular updates to generate excitement in the community.	Developer	Pre-construction
Meet with the affected owners and discuss their concerns over property and land values, as well as educate and inform them on the potential environmental impacts that could ensue.	Developer	Pre-construction
Create partnerships with local tourism and game farm industry to promote the development of green energy in the community and for these establishments to communicate to their guests the benefits of green energy	Developer	Pre-construction
Develop an incident reporting system to record non-conformances to the EMPr.	Contractor	Pre-construction Duration of construction

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

CHAPTER 7: MANAGEMENT PROGRAMME: CONSTRUCTION

Overall Goal: Undertake the construction phase in a way that:

» Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
» Enables construction activities to be undertaken without significant disruption to other land uses and activities in the area, in particular concerning noise impacts, farming practices, traffic and road use, and effects on local residents.
» Minimises the impact on the indigenous natural vegetation, protected tree species, and habitats of ecological value.
» Minimises impacts on fauna using the site.
» Minimises the impact on heritage sites should they be uncovered.
» Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed.

An environmental baseline must be established during the undertaking of construction activities, where possible.

7.1. Objectives

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

OBJECTIVE 1: Securing the site and site establishment

Project component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Hazards to landowners and public. » Security of materials. » Substantially increased damage to natural vegetation. » Potential impact on fauna and avifauna habitat.
Activities/risk sources	» Open excavations (foundations and cable trenches). » Movement of construction employees, vehicles and plant equipment 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 the site, working areas and excavations in an appropriate manner. Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.	Contractor EO	During site establishment Maintenance: for duration of Contract
The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. Where the public could be exposed to danger by any of the works or site activities, the Contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English 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.	Contractor	During site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure the area and implement access control procedures.	Contractor	During site establishment Maintenance: for duration of Contract
Establish SABS 089: 1999 Part 1 approved bunded areas for the storage of hazardous materials and hazardous waste.	Contractor	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. These must be situated outside of any delineated watercourses and pans/depressions or the buffers shown.	Contractor	During site establishment and during construction
Water consumption requirements for the site for the construction if not obtained from an authorised water user within the area, must be authorised by the Department of Human Settlements, Water and Sanitation.	Developer	Prior to water use
Supply adequate weather and vermin proof waste collection bins and skips (covered at minimum with secured netting or shadecloth) at sites where construction is being undertaken. Separate bins should be provided for general and hazardous waste. As far as possible, provision should be made for separation of waste for recycling.	Contractor	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	» Regular visual inspection of the 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. » ECO/ EO to monitor all construction areas on a continuous basis until all construction is completed; immediate reporting back to the site manager. » ECO/ EO to address any infringements with responsible contractors as soon as these are recorded.

OBJECTIVE 2: Appropriate management of the construction site and construction workers

Project Component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Damage to indigenous natural vegetation and sensitive areas. » Damage to and/or loss of topsoil (i.e. pollution, compaction etc.). » Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities. » Pollution/contamination of the environment.
Activities/Risk Sources	» Vegetation clearing and levelling of equipment storage area/s. » Access to and from the equipment storage area/s. » Ablution facilities. » Contractors not aware of the requirements of the EMPr, leading to unnecessary impacts on the surrounding environment.
Mitigation: Target/Objective	» Limit equipment storage within demarcated designated areas. » Ensure adequate sanitation facilities and waste management practices. » Ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment.

Mitigation: Action/Control	Responsibility	Timeframe
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 BA Report, and this EMPr, as well as the requirements of all relevant environmental legislation.	Contractors	Construction
Contractors must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct.	Contractor and sub-contractor/s	Pre-construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Contractor	Construction
All construction vehicles must adhere to clearly defined and demarcated roads. No driving outside of the development boundary must be permitted.	Contractor	Construction
Ensure all construction equipment and vehicles are properly maintained at all times.	Contractor	Construction
Minimise the development footprint within high sensitivity areas	Contractor	Construction
Develop an integrated management plan for the development area, which is beneficial to fauna and flora.	Specialist	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
Ensure that construction workers are clearly identifiable. All workers must carry identification cards and wear identifiable clothing.	Contractor	Construction
All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and snakes which are often persecuted out of fear or superstition, waste management and the importance of not undertaking activities that could result in pollution of those watercourses.	Contractor	Construction
Regular toolbox talks should be undertaken to ensure appropriate levels of environmental awareness.	Contractor	Construction
Contact details of emergency services must be prominently displayed on site.	Contractor	Construction
Contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff.	Contractor	Construction
Personnel trained in first aid must be on site to deal with smaller incidents that require medical attention.	Contractor	Construction
Road borders must be regularly maintained to ensure that vegetation remains short to serve as an effective firebreak. An emergency fire plan must be developed with emergency procedures in the event of a fire.	Contractor	Duration of construction
Strict control of the behaviour of construction workers must be implemented in terms of works near watercourses.	Contractor	Construction
Ensure waste storage facilities are maintained and emptied on a regular basis.	Contractor	Duration of construction
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Contractor	Duration of Contract
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. Proof of disposal to be retained as proof of responsible disposal.	Contractor	Duration of construction
All contaminated water must be contained by means of careful run-off management on site.	Contractor	Construction
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.	Contractor	During construction.
Ensure ablution facilities are appropriately maintained. Ablutions must be cleaned regularly and associated waste disposed of at a registered/permitted waste disposal site. Ablutions must be removed from site when construction is completed.	Contractor and sub-contractor/s	Duration of contract
Cooking and eating of meals must take place in a designated area. No fires are allowed on site. No firewood or kindling may be gathered from the site or surrounds.	Contractor and sub-contractor/s	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area. Particular attention needs to be paid to food waste.	Contractor and sub-contractor/s	Duration of contract
Keep a record of all hazardous substances stored on site. Clearly label all the containers storing hazardous waste.	Contractor	Duration of contract
A Method Statement must be compiled for the management of pests and vermin within the site, specifically relating to the canteen area if applicable.	Contractor	Construction
Ensure proper health and safety plans in place during the construction period to ensure safety on and around site during construction, including fencing of the property and site access restriction.	Contractor and sub-contractor/s	Pre-construction
All disturbed areas that are not used such as excess road widths, should be rehabilitated with locally occurring shrubs and grasses after construction to reduce the overall footprint of the development.	Contractor and sub-contractor/s	Construction
On completion of the construction phase, all construction workers must leave the site within one week of their contract ending.	Contractor and sub-contractor/s	Construction

Performance Indicator	» Code of Conduct drafted before commencement of the construction phase.Appropriate training of all staff is undertaken prior to them commencing work on the construction site. » Ablution and waste removal facilities are in a good working order and do not pollute the environment due to mismanagement. » All areas are rehabilitated promptly after construction in an area is complete. » Excess vegetation clearing and levelling is not undertaken. » No complaints regarding contractor behaviour or habits.
Monitoring	» Regular audits of the construction camps and areas of construction on site by the EO. » Proof of disposal of sewage at an appropriate licensed wastewater treatment works. » Proof of disposal of waste at an appropriate licensed waste disposal facility. » An incident reporting system must be used to record non-conformances to the EMPr. » Observation and supervision of Contractor practices throughout the construction phase by the EO. » Complaints will be investigated and, if appropriate, acted upon.

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 wind farm, even if the opportunities are only temporary. The procurement of local goods could furthermore result in positive economic spin-offs.

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.
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 Developer, 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 Developer should also develop a database of local BBBEE service providers.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Recruit local labour as far as feasible to increase the benefits to the local households.	Contractor	Construction
Create a local skills database.	Contractor	Construction
Employ labour intensive methods in construction where feasible.	Contractor	Construction
Co-ordinate with the local municipality and relevant labour unions to inform the local labour force about the project that is planned to be established and the jobs that can potentially be applied for.	Contractor	Construction
Establish a local skills desk (in Makhanda) to determine the potential skills that could be sourced in the area.	Contractor	Construction
Set up a recruitment office in the nearby towns (i.e. Makhanda, Riebeek East, Somerset East) and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in the hope of finding temporary employment.	Contractor	Construction
Employ labour-intensive methods in construction where feasible.	Contractor	Construction
Sub-contract to local construction companies particularly SMMEs and BBBEE compliant enterprises where possible.	Contractor	Construction
Use local suppliers where feasible and arrange with the local SMMEs to provide transport, catering and other services to the construction crews.	Contractor	Construction
Facilitate knowledge and skills transfer between foreign technical experts and South African professionals during the pre-establishment and construction phases.	Contractor	Construction
Set up apprenticeship programmes to build onto existing skill levels or develop new skills amongst construction workers, especially those from local communities.	Contractor	Construction
Facilitate broader skills development programme as part of socio-economic development commitments.	Contractor	Construction
Sub-contract to local construction companies where possible.	Contractor	Construction
Use local suppliers where feasible and arrange with local SMMEs and BBBEE compliant enterprises to provide transport, catering, and other services to the construction crews.	Contractor	Construction

Performance Indicator	» Maximum amount of semi and unskilled labour locally sourced where possible. » Local suppliers and SMMEs contracted where possible.

	» Skills transfer facilitated where required. » Apprenticeship programmes established
Monitoring and Reporting	» Contractors and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE 4: Avoid the negative social impacts on family structures and social networks due to the presence of construction workers from outside the area

The migration of people to the area could result in social conflicts between the local population and the migrant work force as the local population could perceive these migrant workers as "stealing" their employment opportunities. Likewise, the influx of people into the area, could potentially lead to a temporary increase in the level of crime, illicit activity and possibly a deterioration of the health of the local community through the spread of infectious diseases. Without any form of income these individuals run the risk of exacerbating the level of poverty within Makana. Aside from the broader community issues the increase in the number of people in the area is likely to have an adverse effect on crime levels, incidents of trespassing, development of informal trading and littering. There is also potentially a likelihood of increased stock theft.

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. » Presence of construction workers on site may result in loss of livestock due to stock theft and damage to farm infrastructure, such as gates and fences. Poaching of wild animals may also occur. » Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities. » Impact on the safety of farmers and communities (increased crime etc.) by construction workers and also damage to farm infrastructure such as gates and fences. » Increase in production and GDP-R.
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 their livelihoods. » To minimise impacts on the social and biophysical environment. » Maximise the economic benefit to the local municipality. » Prohibit theft of stock and valuables on impacted and adjacent farm portions. » Procure goods and services, as far as practically possible, from the local municipality. » Initiate site access control and monitor movement to and from the site.

Mitigation: Action/control	Responsibility	Timeframe
Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of job seekers to the area	Contractor	Construction
Ensure that any damages or losses to nearby affected farms that can be linked to the conduct of construction workers are adequately reimbursed	Contractor	Construction
Assign a dedicated person to deal with complaints and concerns of affected parties	Contractor	Construction
The construction of on-site accommodation will likely mitigate some social conflicts from taking place. The developer should, however, organise appropriate transport for the workers from the site to the nearest towns in order to access services or to buy goods. This will reduce the amount of time the staff spend walking to or from the site.	Contractor	Construction
Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in migration of workers	Contractor	Construction
Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations	Contractor	Construction
Implement a policy that no employment will be available at the gate.	Contractor	Pre-construction/ construction

Performance Indicator	» No criminal activities attributable to the construction workers are reported. » No complaints received from landowners or the general public.
Monitoring and Reporting	» An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site.

OBJECTIVE 5: Control of noise pollution stemming from construction activities

Various construction activities would be taking place during the development of the facility and may pose a noise risk to the closest receptors. These activities could include temporary or short-term activities where small equipment is used (such as the digging of trenches to lay underground power lines). The impact of such activities is generally very low. Impacts may however occur where activities are undertaken at night.

Project component/s	» Construction of turbine. » Cabling between turbines. » Substations. » Access roads.
Potential Impact	» Increased noise levels at potentially sensitive receptors.
Activity/risk source	» Any construction activities taking place within 500m from potentially noise sensitive developments (NSD). » Site preparation and earthworks. » Construction-related transport.

	» Foundations or plant equipment installation. » Building activities.
Mitigation: Target/Objective	» Ensure that maximum noise levels at potentially sensitive receptors are less than 65dBA. » Prevent the generation of disturbing or nuisance noises. » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors. » Ensure compliance with the National Noise Control Regulations. » Ensure night-time noise levels less than 45 dBA.

Mitigation: Action/control	Responsibility	Timeframe
Establish a line of communication and notify all stakeholders and NSDs of the means of registering any issues, complaints or comments.	Developer	Construction
Night-time construction activities (closer than 800 m from Noise Sensitive Developments (NSDs)) are not recommended and must be minimised where possible, and only if these activities can be minimised to one location using minimum equipment.	Developer	Construction
Roads must not be constructed within 150m from occupied dwellings used for residential purposes (to reduce noise levels below 42 dBA if construction traffic may use the road at night).	Developer	Construction
Ensure that all equipment is maintained and fitted with the required noise abatement equipment.	EPC Contractor	Weekly inspection
The construction crew must abide by the local by-laws regarding noise.	EPC Contractor	Construction phase

Performance Indicator	» Construction activities do not change the existing ambient sound levels with more than 7dB. » Ensure that maximum noise levels at potentially sensitive receptors are less than 65 dBA. » No noise complaints are registered
Monitoring and Reporting	» Ambient sound measurements are recommended to take place prior to the construction of the wind farm.

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

During the construction phase, limited gaseous or particulate emissions (and dust) is 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 turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.

Potential Impact	» Dust impacts can occur from cleared areas and from vehicle movement along gravel roads. » 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 construction vehicles and their activities on the site. » Clearing of vegetation and topsoil. » Excavation, grading and scraping. » Transport of materials, equipment and components. » 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 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
Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Contractor	Construction phase
Vehicles and equipment must be maintained in a road-worthy condition at all times. Road worthy certificates must be in place for all heavy vehicles at the outset of the construction phase and updated on a monthly basis.	Contractor	Construction phase
Vehicles used to transport sand and building materials must be fitted with tarpaulins or covers when travelling on roads.	Contractor	Construction phase
Ensure vehicles adhere to speed limits on public roads and speed limits set within the site by the Site Manager.	Contractor Transportation contractor	Duration of contract
Ensure that damage to gravel public roads and access roads attributable to construction vehicles is repaired before completion of the construction phase.	EPC Contractor	Before completion of construction phase
Disturbed areas must be re-vegetated as soon as practicable after construction is complete in an area.	EPC Contractor	At completion of the construction phase

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 the outset of the construction phase and updated on a monthly basis.
Monitoring and Reporting	» The Developer and appointed EO 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 must be developed and maintained on site.

OBJECTIVE 7: Conservation of the existing soil resource within the site and in the adjacent areas

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. Uncontrolled run-off relating to construction activities (excessive wetting, etc.) will also lead to accelerated erosion. Degradation of the natural soil profile due to excavation, stockpiling, compaction, pollution and other construction activities will affect soil forming processes and associated ecosystems.

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

Project component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Erosion and soil loss. » Increased runoff. » Downstream sedimentation.
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. » Roadside drainage ditches. » Project related infrastructure, such as buildings, turbines and fences.
Mitigation: Target/Objective	» To minimise erosion of soil from site during construction. » To minimise damage to vegetation by erosion or deposition. » To retain all topsoil with a stable soil surface

Mitigation: Action/control	Responsibility	Timeframe
Only the proposed access roads as per the development footprint are to be used to reduce any unnecessary compaction.	Contractor	Construction
Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks.	Contractor	Construction
Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion.	Contractor	Construction
Salvaging topsoil: » Topsoil must always be salvaged and stored separately from subsoil and lower-lying parent rock or other spoil material. * Topsoil stripping removes up to 30 cm or less of the upper soils.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
∗ 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. o 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. o 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.		
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 amount of beneficial micro-organisms in the soil. » Stockpile location should ideally be in a disturbed but weed-free area. » Storage of all topsoil that is disturbed should be of a maximum height of 2m and the maximum length of time before re-use is 18 months. » 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. » Do not mix overburden with topsoil stockpiles, as this will dilute the proportion of fertile soil (with less fertile subsoil or rock material). » Employ wind nets made from Hessian or similarly fibrous and biodegradable material, where required, to stabilise newly placed topsoil stockpiles and to reduce wind erosion. » 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 ponding on or between heaps of topsoil ∗ Covering topsoil berms ∗ Preventing all forms of contamination or pollution ∗ Preventing any form of compaction ∗ Monitoring the 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	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
» Where topsoil needs to be stored in excess of one year, 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 considered.		
Identify and demarcate construction areas for general construction work and restrict construction activity to these areas.	Contractor	Construction
Spillages of cement to be cleaned up immediately and disposed or re-used in the construction process.	Contractor	Construction
Spill kits to be kept on active parts of the construction site and at site offices.	Contractor	Construction
Cement batching to take place in designated areas only, as approved on site layout (if applicable).	Contractor	Construction
When preparing the hard setting area, cuts should be used for fill with little or no wastages.	Contractor	Construction
Implement erosion control measures denuded areas as required and monitor erosion and manage all occurrences according to the erosion management plan (refer to **Appendix G**). Erosion control measures should be implemented in areas where slopes have been disturbed.	Contractor	Construction
Control depth of all excavations and stability of cut faces/sidewalls.	Contractor	Construction
Reapplying topsoil: » Spoil materials and subsoil must be back-filled first, then covered with topsoil. » Immediate replacement of topsoil after the undertaking of construction activities within an area. » Generally, topsoil should be re-applied to a depth slightly greater than the topsoil horizon of a pre-selected undisturbed reference site. » The minimum depth of topsoil needed for re-vegetation to be successful is approximately 20 cm. » If the amount of topsoil available is limited, a strategy must be devised to optimise re-vegetation 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 re-vegetation efforts. » To stabilise reapplied topsoil and minimise raindrop impact and erosion: ∗ Use organic material from cleared and shredded woody vegetation where possible ∗ Alternatively, suitable geotextiles or organic erosion mats can be used as necessary	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
» Continued monitoring will be necessary to detect any sign of erosion early enough to allow timeous mitigation.		
Re-applied topsoil needs to be re-vegetated as soon as possible.	Contractor	Construction
Implement general erosion control measures/practises: » Runoff control and attenuation can be achieved by using any or a combination of sand bags, logs, silt fences, storm water channels and catch-pits, shade nets, geofabrics, seeding or mulching as needed on and around cleared and disturbed areas. ∗ Ensure that all soil surfaces are protected by vegetation or a covering to avoid the surface being eroded by wind or water. » Ensure that heavy machinery does not compact areas that are not meant to be compacted as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area. » Prevent the concentration or flow of surface water or storm water down cut or fill slopes or along pipeline routes or roads and ensure measures to prevent erosion are in place prior to construction. » Minimise and restrict site clearing to areas required for construction purposes only and restrict disturbance to adjacent undisturbed natural vegetation. » Vegetation clearing should occur in parallel with the construction progress to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then result in sedimentation. » When implementing dust control measures, prevent over-wetting, saturation, and run-off that may cause erosion and sedimentation.	Contractor	Construction
Conservation measures should be applied to ensure that soil does not get unusable or unproductive and to ensue soil stabilisation.	Contractor	Construction

Performance Indicator	» Minimal level of soil erosion around site. » Minimal level of soil degradation. » No activity outside demarcated areas. » Acceptable state of excavations. » No activity in restricted areas. » Acceptable state of excavations, as determined by EO and ECO. » Progressive return of disturbed and rehabilitated areas to the desired end state (refer also to the Plant Rescue and Protection Plan in **Appendix E**). » No indications of visible topsoil loss.
Monitoring and Reporting	» Continual inspections of the site by the EO. » Reporting of ineffective sediment control systems and rectification as soon as possible. » If soil loss is suspected, acceleration of soil conservation and rehabilitation measures must be implemented.

OBJECTIVE 8: Minimise the impacts on and loss of indigenous vegetation and control of alien invasive plants

The majority of the Wind Garden Wind Farm project site is mapped as falling within the Albany Broken Veld and Bhisho Thornveld vegetation types, with a smaller proportion of Kowie Thicket in the north of the site. All three of these vegetation types are classified as Least Threatened and have not experienced a high degree of transformation.

- *Albany Broken Veld*
  Albany Broken Veld is part of the Nama Karoo Biome and occurs in the Eastern Cape Province from north of the Zuurberg Mountains and south of Middlewater. It is associated with low mountain ridges and hills with an open grassy karroid dwarf shrubland with scattered low trees (*Boscia oleoides*, *Euclea undulata*, *Pappea capensis*, *Schotia afra* var. *afra*) with a matrix of dwarf shrubs (*Becium burchellianum*, *Chrysocoma ciliata*) and grasses (*Eragrostis obtusa*). Albany Broken Veld is classified as Least Threatened as less than 5% has been lost to transformation.

- *Bisho Thornveld*
  Bhisho Thornveld occurs in the Eastern Cape from near Mthatha in a band parallel to but inland on the coast to north of East London, turning to run along the southern side of the Amathole Mountains as far as Fort Beaufort. It also occurs on the dissected hills and low mountains around Makhanda (Grahamstown), especially to the southwest, and in a few fragments in valleys north-east of the Amathole Mountains. It is associated with undulating to moderately steep slopes, sometimes in shallow, incised drainage valleys. It comprises an open savannah characterised by small trees of *Acacia natalitia* with a short to medium, dense, sour grassy understorey, usually dominated by *Themeda triandra* when in good condition. A diversity of other woody species also occur, often increasing under conditions of overgrazing.

- *Kowie Thicket*
  Kowie Thicket occurs in the Eastern Cape Province along the river valleys of the Bushmans, Kariega, Kowie, Kleinemonde and Kap Rivers from near the Great Fish River Mouth to Kenton-on-Sea, extending inland up these valleys past Makhanda (Grahamstown) to just past Riebeeck East and Alicedale to north of the Zuurberg. Kowie Thicket is usually associated with steep and north-facing (dry) slopes. It consists of thickets dominated by succulent euphorbias and aloes with a thick understorey composed of thorny shrubs, woody lianas (*Capparis*, *Secamone*, *Rhoicissus*, *Aloe*), and shrubby succulents (*Crassulaceae*, *Asphodelaceae*). Moister south-facing slopes support thorny thickets dominated by low evergreen trees (*Cussonia*, *Euclea*, *Hippobromus*, *Pappea*, *Ptaeroxylon*, *Schotia*) and shrubs (*Azima*, *Carissa*, *Gymnosporia*, *Putterlickia*) with fewer succulent shrubs and trees. The herbaceous layer is poorly developed.

The site survey undertaken by the specialist has revealed that the VegMap provides a relatively coarse reflection of the vegetation of the site, which is much more heterogenous than the VegMap suggests. The primary drivers of vegetation differentiation at the project site include elevation, substrate and aspect. In addition, the VegMap does not map fine-scale features such as drainage lines and pans which also have different vegetation communities from the surrounding habitats.

Project component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Loss of plant cover leading to loss of faunal habitat and loss of specimens of protected plants. » Soil erosion. » Increased fire hazards. » Increased water use.
Activity/risk source	» Site preparation and clearing. » Soil disturbance » Introduction of plant propagules with people and vehicles. » Activities outside of designated construction areas. » Driving off designated routes.
Mitigation: Target/Objective	» To limit construction activities to designated areas. » Implement invasive plant clearing prior to construction, but after site demarcation.

Mitigation: Action/control	Responsibility	Timeframe
Communicate clearly to all contractors that no disturbance outside the demarcated areas will be tolerated.	Contractor	Construction
Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However, caution should be exercised to avoid using material that might entangle fauna.	Contractor	Construction
No fires should be allowed within the site as there is a risk of runaway veld fires.	Contractor	Construction
No fuelwood collection should be allowed on-site.	Contractor	Construction
Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.	Contractor	Construction
Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem plant species are already present in the area and are likely to increase rapidly if not controlled.	Contractor	Construction
Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility must be undertaken as these are also likely to be prone to invasion problems.	Contractor	Construction
Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	Contractor	Construction
Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Unnecessary impacts on surrounding natural vegetation must be avoided, The construction impacts must be contained to the footprint of the wind farm.	Contractor	Construction
Avoid creating conditions in which alien plants may become established: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible once construction is complete in an area » Do not import soil from areas with alien plants.	Contractor	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 and Act 43 of 1983 and NEM: Biodiversity Act).	Contractor	Construction
Immediately control any alien plants that become established using registered control methods appropriate for the particular species in question. Where necessary, obtain an opinion from a registered Pest Control Officer.	Contractor	Construction
All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor.	Contractor	Construction
The use of herbicides and pesticides and other related horticultural chemicals should be carefully controlled and only applied by personnel adequately certified to apply pesticides and herbicides (a registered Pest Control Officer). It must be ensured that WHO Recommended Classification of Pesticides by Hazard Class 1a (extremely hazardous) or 1b (highly hazardous) are not purchased, stored or used on site along with any other nationally or internationally similarly restricted/banned products.	Contractor	Construction
A registered Pest Control Officer must be appointed to implement the invasive alien plants and weeds management plan. The Pest Control Officer must supervise the clearing team to ensure compliance with the invasive alien plants and weeds management plan.	Contractor	Construction
All cleared areas should be revegetated with indigenous perennial species from the local area.	Contractor	Construction

Performance Indicator	» No disturbance outside of designated work areas. » Limited alien infestation within project control area. » Construction activities restricted to the development footprint.
Monitoring and Reporting	» Observation of vegetation clearing activities by ,the EO throughout the construction phase. » Monitoring of alien plant establishment within the site on an on-going basis.

OBJECTIVE 9: Protection of terrestrial fauna

As many as 50 different naturally-occurring mammal species have been recorded from the vicinity of the Wind Garden Wind Farm project site. Common species observed include Steenbok, Common Duiker, Kudu, Cape Porcupine, South African Ground Squirrel, Springhare, Aardvark, Grey Mongoose, Yellow Mongoose, Cape Hare, Bat-eared Fox, Vervet Monkey, Chacma Baboon, Suricate, Caracal and Black-backed Jackal. There is also a lot of game farming in the area, with the result that there are also many introduced or farmed species present in the area, but as these populations are mostly maintained and managed by the landowners within game farms, they are not considered further. Apart from the above common species, there are also several red-listed mammals which are confirmed present in the area or which may be present. These include Brown Hyena, Serval, African Clawless Otter, African Striped Weasel, Blue Duiker, Black-footed Cat, Leopard and Mountain Reedbuck. The majority of these species occur in the wider area at a low density and do not have well-established populations outside of conservation areas and larger game farms. Of greatest potential concern is likely to be the Mountain Reedbuck and Black-footed Cat which are the only two listed species likely to maintain free-ranging populations within the affected area. However, both have large national and provincial distribution ranges. The other listed species may be present in the wider area are habitat specialists and are not likely to occur regularly.

Based on the ADU database, sixty reptile species have been recorded from the area around the Wind Garden Wind Farm project site. This is a relatively high total, indicating that reptile diversity in the area is quite high and can be ascribed to the high diversity of habitats in the area, but also suggests that the area has been relatively well sampled. Common species observed or on previous projects in the immediate area include Thin-tailed Legless Skink, Southern Rock Agama, Cape Girdled Lizard, Spotted Gecko, Leopard Tortoise, Rock Monitor and Puff Adder. The drainage lines with dense riparian vegetation and the rocky hills and especially those with large rocky outcrops are considered to represent the most important reptile habitat at the project site. Although no listed species are known from the area, the Albany Sandveld Lizard Nucras taeniolata is a narrow endemic that was previously listed as Near Threatened but as of 2017 has been assessed as being of Least Concern. This species has a distribution range of 15453 km^2 and occurs in the Eastern Cape Province in the Algoa Bay region. Distribution extends from the Double Drift Game Reserve in the north, southwards through the Albany district to just north of Port Elizabeth, and westwards through Addo Elephant National Park to Groendal Wilderness Area and the Gamtoos Valley near Thornhill. According to the SANBI species account for this species, Nucras taeniolata is well represented in several existing protected areas and a number of mega-conservancy networks and park expansions are earmarked for the region in which it occurs. The species is therefore likely to maintain a viable long-term presence.

Amphibian diversity within the project site is likely to be relatively low. A total of 15 species are known from the area according to the ADU database and includes no species of conservation concern. Within the area, the ephemeral pans, farm dams and larger drainage lines are the most important habitats for amphibians. Species observed in the area include Raucous Toad, Bubbling Kassinia, Common Platanna, Bronze Caco and Common River Frog. The amphibian community can be broadly divided into those species strongly associated with water bodies such as River Frogs and Platanna and those species which are able to range more freely such as toads and Caco's which may breed in streams and ponds, but are more terrestrial in nature.

Project component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Vegetation clearance and associated impacts on faunal habitats. » Traffic to and from site.
Activity/risk source	» Site preparation and earthworks. » Foundations or plant equipment installation. » Mobile construction equipment movement on site. » Access road construction activities. » Substation construction facilities.
Mitigation: Target/Objective	» To minimise footprints of habitat destruction. » To minimise disturbance to resident and visitor faunal species.

Mitigation: Action/control	Responsibility	Timeframe
The extent of clearing and disturbance to the vegetation must be kept to a minimum so that impact on fauna and their habitats is restricted.	Contractor	Construction
During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.	Contractor	Construction
The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off of the construction site.	Contractor	Construction
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.	Developer EPC Contractor	Duration of contract
If any parts of the site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which should be directed downwards.	Contractor	Construction
All construction vehicles should adhere to a low-speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares. Speed limits should apply within the facility as well as on the public gravel access roads to the site.	Contractor	Construction
If parts of the facility such as the substation are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside.	Contractor	Construction
If any parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks.		

Performance Indicator	» No disturbance outside of designated work areas. » Minimised clearing of existing/natural vegetation and habitats for fauna. » Limited impacts on faunal species (i.e. noted/recorded fatalities), especially those of conservation concern.
Monitoring and Reporting	» Observation of vegetation clearing activities by the EO throughout construction phase. » Supervision of all clearing and earthworks by the EO.

OBJECTIVE 10: Protection of avifauna

Key avifaunal sensitivities have been identified within and within the surrounding area of the project site. Furthermore, key species have been identified as those of higher conservation value that would be at risk from the proposed Wind Garden Wind Farm. Through the pre-construction monitoring undertaken (from June 2019 – August 2020) a range of sensitivities have been identified. These sensitivities include:

» One active Verreaux's Eagle nest was confirmed 3.4km from the nearest proposed turbine location. Another potential site was found 2.8km to the north of the nearest proposed turbine location. The vantage point (VP) surveys did not indicate any areas of notably higher flight activity.

» Two territories for Martial Eagle were found in proximity to the wind farm, and a third further to the west outside the surveyed area. A nest site on the eastern edge of the survey area (7.2km from the nearest Wind Garden Wind Farm turbine location) was recorded in May 2019 with prey delivery and the second at a new location, 4.0km from the nearest Wind Garden Wind Farm turbine location was recorded in June 2020. The VP surveys did not indicate any areas of notably higher flight activity.

» A pair of African Fish Eagle was found nesting 1.4km from the nearest Wind Garden Wind Farm turbine location, but very little flight activity was observed through the wind farm site. Though this species is of lower conservation importance (Least Concern at both international and South Africa level), as a larger raptor it is likely to be at higher risk of collision.

» A breeding location for Crowned Eagle was identified 4km from any Wind Garden Wind Farm turbine location; however this species was not observed flying through the wind farm site. This species is of lower conservation importance but as a larger raptor may be at increased risk of collision.

» Blue Crane, Denham's Bustard, Southern Black Bustard and Secretarybird were all recorded during the baseline surveys within/in proximity to the Wind Garden wind Farm site. All are species of higher conservation importance. No particular concentrations of flight activity of any of these species was noted in this area during the VP surveys, and all were widely scattered at low density across the survey area during the vehicle transect surveys with no particularly important areas identified.

» Two Lanner Falcon nests adjacent to the site were reported previously, though the 2019-20 surveys did not find either territory to be occupied. One is 4.3km from the nearest proposed wind turbine location

for the Wind Garden Wind Farm, the other 8.7km (both are historic records). This species was recorded on only three occasions during the VP surveys and three times during the road transect surveys, with no evidence found of nesting within the survey area.

» There was a very low level of use by the Black Harrier in the survey area and no evidence of breeding within the Wind Garden Wind Farm site was recorded. In 2019, a single harrier was regularly seen hunting on the road verges of the R335 located within the Wind Garden Wind Farm project site. The harrier however disappeared and returned a few months later and then left again. It was never recorded in 2020.

Considering the avifauna features identified within the project site and surrounding areas, specific buffers have been recommended by the specialist for the placement of infrastructure, as well as buffers where turbine placement must be avoided and mitigation increased
The implementation of buffers from known eagle nest sites were put in place primarily to reduce collision risk, but also removes the possibility of disturbance to these eagle nest sites. The main residual disturbance issue would therefore be the loss of foraging habitat around the wind farm as a result of displacement. From experience at existing wind farms, birds are likely to avoid the close proximity of the wind turbines.

For the Verreaux's Eagle nests a buffer of 1.5km has been recommended which is the area around the nest sites within which no turbines must be placed (i.e. no-go area for the placement of turbines). Furthermore, a 3km buffer has been identified within which the number of turbines must be minimised and caution must be taken. It must be noted that none of the nests are present within the development envelope and development footprint. A 3km caution buffer does however infringe into the north-western corner of the development envelope with one (1) turbine proposed to be placed here. This is considered acceptable with the implementation of the relevant mitigation measures as recommended by the specialist

For the Martial Eagle nests a buffer of 2.5km has been recommended which is the area around the nest sites within which no turbines must be placed (i.e. no-go area for the placement of turbines). Furthermore, a 5km buffer has been identified within which the number of turbines must be minimised and caution must be taken. It must be noted that none of the nests are present within the development envelope and development footprint. A 5km caution buffer does however infringe into the southern section of the development envelope with twelve (12) turbines proposed to be placed here. This is considered acceptable with the implementation of the relevant mitigation measures as recommended by the specialist

A 1km buffer has also been identified for other large eagle nests (Crowned Eagle and African Fish-Eagle) identified. The 1km buffers are considered to be no-go areas for the placement of turbines. It must be noted that the 1km buffer of a African Fish-Eagle nest site infringes into the southern boundary of the Wind Garden Wind Farm development envelope, the other nests are to the west and outside of the development envelope. No turbines are proposed within these buffer areas.

Considering the placement of turbines within the development area, there are thirteen (13) turbines located within cautionary buffers which require the minimisation of turbine placement within these areas. The specialist has indicated that the development as proposed would be acceptable for authorisation, subject to the implementation of the recommended appropriate mitigation measures. Considering this, the specialist is not requiring further minimisation of turbines within the cautionary buffers of 3km and 5km, respectively. However, the specialist does recommend that all turbines located within the cautionary buffers have a single blade painted black during construction. Given this is a novel mitigation, which has been

proven to be effective internationally, a post-construction monitoring scheme should be implemented to determine its effectiveness.

Project component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Disturbance of birds (e.g. destruction of habitat). » Displacement of birds. » Collision with project components. » Traffic to and from site.
Activity/risk source	» Site preparation and earthworks. » Foundations or plant equipment installation. » Mobile construction equipment movement on site. » Access road construction activities. » Substation construction facilities.
Mitigation: Target/Objective	» To minimise footprints of habitat destruction. » To minimise disturbance to resident and visitor avifaunal species.

Mitigation: Action/control	Responsibility	Timeframe
The extent of clearing and disturbance to the vegetation must be kept to a minimum so that impact on avifauna and their habitats is restricted.	Contractor	Construction
Any clearing of large trees (>5m in height) especially stands of large alien trees (e.g. Blue Gum or Pine) on site should be approved by an avifaunal specialist. Before, clearing, the location and description of the trees should be provided to the avifauna specialist, who may request the EO to inspect the trees for any nests prior to clearing	Contractor	Construction
The construction Phase EO, the onsite Environmental Manager, and the client's representative on site (e.g. the resident engineer) are to be trained to identify Red Data and priority bird species, as well as their nests. If any nests or breeding locations for this species are located, an avifaunal specialist is to be contacted for further instruction.	Contractor	Construction
The EO must, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.	Contractor	Construction
During the construction phase, an avifaunal specialist must conduct a nest survey/exploration of the wind farm site. This	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
should be done during and after, the breeding season (i.e. approximately in April and again in June) of large Eagles (e.g. Martial and Verreaux's Eagle). The aim will be to locate any nest sites not yet found, so that these may continue to be monitored during the construction and operation phases, along with the monitoring of already identified nest sites.		
Appoint a specialist to design and conduct monitoring of the breeding of raptors at the various nests identified to date as well as any additionally located nests. This monitoring can be combined with the exploration described above and should be conducted on two occasions (i.e. approximately in April and again in June) across each calendar year, during construction. The aim will be to monitor any disturbance to or displacement of the breeding birds during construction.	Contractor	Construction
Any pylon for new overhead power lines must be fitted with a safe bird perch.	Contractor	Construction
All turbines located within the cautionary buffers must have a single blade painted black. Given this is a novel mitigation, which has been proven to be effective internationally, a post-construction monitoring scheme should be implemented to determine its effectiveness.	Contractor	Construction

Performance Indicator	» No disturbance outside of designated work areas. » Minimised clearing of existing/natural vegetation and habitats for avifauna. » Limited impacts on avifaunal species (i.e. noted/recorded fatalities), especially those of conservation concern.
Monitoring and Reporting	» Observation of vegetation clearing activities by the EO throughout construction phase. » Supervision of all clearing and earthworks by the EO.

OBJECTIVE 11: Protection of bats

Pre-construction monitoring was undertaken within the Wind Garden Wind Farm project site. The monitoring was designed to monitor bat activity across the area for the Wind Garden Wind Farm. The baseline environment was investigated by using acoustic monitoring to document bat activity between 13 March 2019 and 16 June 2020 (459 sample nights).

The project site falls within the actual or predicted distribution range of approximately 21 species of bat. However, the distributions of some bat species in South Africa, particularly rarer species, are poorly known so it is possible that more (or fewer) species may be present. Several echolocation calls characteristic of species in the Plain-faced bat family were recorded during the pre-construction monitoring programme, but these calls were unable to be separated into distinct species. Since most of the species that these calls could belong to have a conservation status of Least Concern, these calls were grouped together and referred to as Unidentified plain-faced bat (Table 8.4). However, some calls could potentially be from *Myotis tricolor*, but its presence has not been confirmed.

Seven high risk and five medium-high risk species have been confirmed to occur in the broader area (including the project sites) and of these, fatalities at operational wind farms in South Africa are known for at least six, namely Cape serotine, Egyptian free-tailed bat, Natal long-fingered bat, Egyptian rousette, Egyptian slit-faced bat and Wahlberg's epauletted fruit bat.

Project component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Disturbance of bats (e.g. destruction of habitat). » Displacement of bats. » Traffic to and from site.
Activity/risk source	» Site preparation and earthworks. » Foundations or plant equipment installation. » Mobile construction equipment movement on site. » Access road construction activities. » Substation construction facilities.
Mitigation: Target/Objective	» To minimise footprints of habitat destruction. » To minimise disturbance to resident and visitor bat species.

Mitigation: Action/control	Responsibility	Timeframe
During construction laydown areas and temporary access roads should be kept to a minimum in order to limit direct vegetation loss and habitat fragmentation. Construction of the infrastructure should, where possible, be situated in areas that are already disturbed.	Contractor	Construction
In order to limit roost abandonment, avoid construction activities near roosts, specifically the major roost found near C10 (near Wind Garden) and large mature trees within 50m of the turbine positions should be inspected for roosting bats.	Contractor	Construction
The wind farm must be constructed in such a way as to avoid the destruction of potential and actual roosts, particularly large mature trees, buildings, rocky crevices (if blasting is required), woodland habitat, mountainous areas and the major roost found near Wind Garden.	Contractor	Construction
Impacts on bat habitats must be reduced by limiting the removal of vegetation, particularly large mature trees within 50m of turbine positions.	Contractor	Construction
Lights should have low attractiveness for insects such as low pressure sodium and warm white LED lights. High pressure sodium and white mercury lighting is attractive to insects and should not be used as far as possible.	Contractor	Construction
Lighting should be fitted with movement sensors to limit illumination and light spill, and the overall lit time. In addition, the upward spread of light near to and above the horizontal plane	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
should be restricted and directed to minimise light trespass and sky glow.		
Increasing the spacing between lights, and the height of light units can reduce the intensity and volume of the light to minimise the area illuminated and give bats an opportunity to fly in relatively dark areas between and over lights.	Contractor	Construction

Performance Indicator	» No disturbance outside of designated work areas. » Minimised clearing of existing/natural vegetation and habitats for bats. » Limited impacts on bat species, especially those of conservation concern.
Monitoring and Reporting	» Observation of vegetation clearing activities by the EO throughout construction phase. » Supervision of all clearing and earthworks by the EO.

OBJECTIVE 12: Minimise impacts on heritage sites during the construction of the wind farm.

Project component/s	» Excavations of turbine foundations. » Excavations of trenches for the installation of cabling and infrastructure.
Potential Impact	» Loss of archaeological artefacts. » Loss of fossil resources. » Impacts on heritage sites. » Impacts on graves or burial sites. » Loss of resources going unnoticed. » Destruction of resources
Activity/risk source	» All bulk earthworks.
Mitigation: Target/Objective	» To facilitate the likelihood of noticing heritage resources and ensure appropriate actions in terms of the relevant legislation

Mitigation: Action/control	Responsibility	Timeframe
Contractors must be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow if they find sites. All staff must also be familiarised with procedures for dealing with heritage objects/sites.	Contractor	Construction
Graves and Burial Grounds (EWF1-10, EWF1-11, and EWF1-12) should be demarcated with a 30-meter no-go-buffer zone, as per the SAHRA BGG policy for General developments, and the graves should be avoided and left in situ.	Contractor	Construction
If an impact occurs within the 30m no-go-buffer zone, the graves need to be removed. A grave relocation process for these sites is recommended as a mitigation and management measure. This will involve the necessary social consultation and public participation process before grave relocation permits can be applied for with the SAHRA under the NHRA and National Health Act regulations.	Contractor	Construction
Names of routes and watercourses that refer to traditional use	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
during the time of the hunter-gatherers and herders, as well as the colonial era in the Cape, should be celebrated. Public access to these sites should be encouraged, and care should be taken to protect these names.		
Identified medicinal plants used for healing or ritual purposes should be conserved if threatened for use.	Contractor	Construction
Traditional planting patterns should be protected by ensuring that existing trees are not needlessly destroyed, as these signify traces of cultural intervention in a harsh environment. These planting patterns include the trees planted around the werfs and along travel routes, such as the aloes along the historic route on Draai Farm as it crosses over Hounslow and the driveway to Thursford homestead. In some cases, remnant planting patterns (even single trees) uphold the historic character of an area. Interpretation of these landscape features as historic remnants should occur.	Contractor	Construction
Farms in the area followed a system of stone markers to demarcate the farm boundaries in the area. Where these structures are found on the site, care should be taken that they are not needlessly destroyed, as they add to the layering of the area.	Contractor	Construction
Roads running through the area have historic stone way markers, such as observed along the R350. Where these are found care should be taken that they are left intact and in place. Road upgrades must not move or threaten their position and they should be visible from the road they are related to by passing travellers.	Contractor	Construction
Where the historic function of a building/site is still intact, the function has heritage value and should be protected.	Contractor	Construction
Surviving examples (wagon routes, outspans, and commonage), where they are owned in some public or communal way (or by a body responsible for acting in the public interest) and where they are found to be actively operating in a communal way, will have cultural and heritage value and should be enhanced and retained. The historic route running over Table Hill, Draai and Hounslow Farms is on private land and as such not publicly accessible. Where it is visible from the R350 it should be conserved together with the associated stone walling. The historic route to Kranzdrift through Kwandwe should be maintained as publicly accessible.	Contractor	Construction
The new roads (especially those that align with historic wagon routes) should display minimum scale designs where possible.	Contractor	Construction
Chance Find Procedure: » If a chance find is made the person responsible for the find must immediately stop working and all work must cease in the immediate vicinity of the find. » The person who made the find must immediately report the find to his/her direct supervisor which in turn must report the find to his/her manager and the Environmental Officer (EO)	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
(if appointed) or site manager . The EO must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates. » A preliminary report must be submitted to the Heritage Agency within 24 hours of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates. » Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found. Upon receipt of the preliminary report, the Heritage Agency will inform the EO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary. » The site must be secured to protect it from any further damage. No attempt should be made to remove material from their environment. The exposed finds must be stabilised and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find. » In the event that the fossil cannot be stabilised the fossil may be collected with extreme care by the EO (or site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site. » Once Heritage Agency has issued the written authorisation, the developer may continue with the development.		

Performance Indicator	» Reporting of and liaison about possible finds of heritage resources. » Heritage resources noticed and rescued. » All heritage items located are dealt with as per the legislative guidelines.
Monitoring and Reporting	» Ensure staff are aware of heritage resources and the procedure to follow when found. » EO to conduct inspections of open excavations.

OBJECTIVE 13: 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.
Potential Impact	» Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and the resulting erosion. » Construction traffic.
Activity/risk source	» The viewing of visual scarring by observers in the vicinity of the wind farm or from the roads in the surrounding area.
Mitigation: Target/Objective	» Minimal disturbance to vegetation cover in close vicinity of the wind farm and its related infrastructure. » Minimised construction traffic, where possible. » Minimal visual intrusion by construction activities and intact vegetation cover outside of the immediate construction work areas.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Retain and maintain natural vegetation in all areas outside of the development footprint.	Contractor	Construction
Ensure that vegetation is not unnecessarily removed during the construction period.	Contractor	Construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Contractor	Construction
Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts.	Contractor	Construction
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Contractor	Construction
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works.	Contractor	Construction
Local rocks found on the site could be used to slow stormwater (instead of concrete, or standard edge treatments), and prevent erosion that would be an unfortunate consequence that would alter the character of the site. By using rocks from site it helps to sensitively keep to the character.	Contractor	Construction
Avoid visual clutter in the landscape by intrusive signage, and the intrusion of commercial, corporate development along roads	Contractor	Construction

Performance Indicator	» Construction site maintained in a neat and tidy condition. » Site appropriately rehabilitated after construction is complete.
Monitoring	» Monitoring of vegetation clearing during construction by EO. » Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).

OBJECTIVE 13: Appropriate handling and management of waste

The construction of the wind farm and associated infrastructure will involve the generation of various wastes. In order to manage the wastes effectively, guidelines for the assessment, classification, and management of wastes, along with industry principles for minimising construction wastes must be implemented. The main wastes expected to be generated by the construction activities include:

- general solid waste
- hazardous waste
- inert waste (rock and soil)
- liquid waste (including grey water and sewage)

Project Component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices.
Activity/Risk Source	» Packaging. » Other construction wastes. » Hydrocarbon use and storage. » Spoil material from excavation, earthworks and site preparation.
Mitigation: Target/Objective	» To comply with waste management legislation. » To minimise production of waste. » To ensure appropriate waste storage and disposal. » To avoid environmental harm from waste disposal.

Mitigation: Action/Control	Responsibility	Timeframe
Implement an integrated waste management approach that is based on waste minimisation and incorporates reduction, recycling, re-use and disposal where appropriate. Where solid waste is disposed of, such disposal shall only occur at an appropriately licensed landfill.	Contractor	Construction
Construction method and materials must be carefully considered in view of waste reduction, re-use, and recycling opportunities.	Contractor	Construction
Construction contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	Construction
Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises is placed, dumped or deposited on adjacent/surrounding properties.	Contractor	Construction
Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap), and contaminated	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
waste as required. 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.		
Where practically 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	Construction
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Construction
Uncontaminated waste must be removed at least weekly for disposal, if feasible; other wastes must be removed for recycling/ disposal at an appropriate frequency.	Contractor	Construction
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area and clearly labelled. This must be regularly removed and recycled (where possible) or disposed of at an appropriately licensed landfill site.	Contractor	Construction
Waste must be stored in accordance with the relevant legislative requirements.	Contractor	Construction
Waste must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Construction
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.	Contractor	Construction
All liquid wastes must be contained in appropriately sealed vessels/ponds within the footprint of the development, and be disposed of at a designated waste management facility.	Contractor	Construction
Wastewater and sludge shall be managed by local authorities and service providers in an environmentally acceptable manner by adhering to the Guidelines for the Utilisation and Disposal of Wastewater Sludge Volumes 1 to 6 (Herselmann & Snyman, 2006).	Contractor	Construction
Documentation (waste manifest) must be maintained detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor	Construction
Regularly serviced chemical toilet facilities and/or septic tank must be used to ensure appropriate control of sewage.	Contractor	Construction
Daily inspection of all chemical toilets and septic tanks must be performed by environmental representatives on site.	Contractor	Construction
In the event where sewage is discharged into the environment, all contaminated vegetation/ rock and soil must be removed immediately and treated as hazardous waste.	Contractor	Construction
Under no circumstances may waste be burnt or buried on site.	Contractor	Construction
Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly, or at an appropriate frequency, at registered waste disposal sites.	Contractor	Construction
Upon the completion of construction, the area must be cleared of potentially polluting materials (including chemical toilets). Spoil stockpiles must also be removed and appropriately disposed of or the materials re-used for an appropriate purpose.	Contractor	Construction

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping. » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests for all waste streams.
Monitoring	» Observation and supervision of waste management practices throughout construction phase. » Waste collection will be monitored on a regular basis. » Waste documentation completed. » Proof of disposal of sewage at an appropriate wastewater treatment works. » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE 14: Appropriate handling and storage of chemicals, hazardous substances

The construction phase may involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents.

Project Component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Release of contaminated water from contact with spilled chemicals. » Generation of contaminated wastes from used chemical containers. » Soil pollution.
Activity/Risk Source	» Vehicles associated with site preparation and earthworks. » Construction activities of area and linear infrastructure. » Hydrocarbon spills by vehicles and machinery during levelling, vegetation clearance and transport of workers, materials and equipment and fuel storage tanks. » Accidental spills of hazardous chemicals. » Polluted water from wash bays and workshops. » Pollution from concrete mixing.
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. » Prevent and contain hydrocarbon leaks. » Undertake proper waste management. » Store hazardous chemicals safely in a bunded area.

Mitigation: Action/Control	Responsibility	Timeframe
Implement an emergency preparedness plan during the construction phase.	Contractor	Construction
Any liquids stored on site, including fuels and lubricants, must be stored in accordance with applicable legislation.	Contractor	Construction
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants. These must be maintained regularly.	Contractor	Construction
Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment must be contained using a drip tray with plastic sheeting filled with absorbent material when not parked on hard standing.	Contractor	Construction
Establish an appropriate Hazardous Stores and fuel storage area which is in accordance with the Hazardous Substance Amendment Act, No. 53 of 1992. This must include but not be limited to: » Designated area; » All applicable safety signage; » Firefighting equipment; » Enclosed by an impermeable bund as per the requirements of the relevant standards and any relevant by-laws; » Protected from the elements, » Lockable; » Ventilated; and » Has adequate capacity to contain 110% of the largest container contents.	Contractor	Construction
The storage of flammable and combustible liquids such as oils must be stored in compliance with Material Safety Data Sheets (MSDS) files.	Contractor	Construction
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. Where required, a NEMA Section 30 report must be submitted to DEFF within 14 days of the incident.	Contractor	Construction
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.	Contractor	Construction
Spilled concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Construction
Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately in line with procedures by trained staff with the appropriate equipment.	Contractor	Construction
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Construction
All machinery and equipment must be inspected regularly for faults and possible leaks,	Contractor	Construction
Routine servicing and maintenance of vehicles must not to take place on-site (except for emergencies). If repairs of vehicles	Contractor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
must take place, an appropriate drip tray must be used to contain any fuel or oils.		
Construction machinery must be stored in an appropriately sealed area.	Contractor	Construction
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Construction
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	Contractor	Construction
The sediment control and water quality structures used on-site must be monitored and maintained in an operational state at all times.	Contractor	Construction
An effective monitoring system must be put in place to detect any leakage or spillage of all hazardous substances during their transportation, handling, installation and storage.	Contractor	Construction
Precautions must be in place to limit the possibility of oil and other toxic liquids from entering the soil or clean stormwater system.	Contractor	Construction
As much material must be pre-fabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site.	Contractor	Construction
Have appropriate action plans on site, and training for contactors and employees in the event of spills, leaks and other potential impacts to the aquatic systems. All waste generated on-site during construction must be adequately managed.	Contractor	Construction
Minimise fuels and chemicals stored on site.	Contractor	Construction
Implement a contingency plan to handle spills, so that environmental damage is avoided.	Contractor	Construction
Drip trays must be used during all fuel/chemical dispensing and beneath standing machinery/plant.	Contractor	Construction
In the case of petrochemical spillages, the spill must be collected immediately and stored in a designated area until it can be disposed of in accordance with the Hazardous Chemical Substances Regulations, 1995 (Regulation 15).	Contractor	Construction

Performance Indicator	» No chemical spills outside of designated storage areas. » No water or soil contamination by spills. » Safe storage of hazardous chemicals. » Proper waste management.
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase. » A complaints register must be maintained, in which any complaints from the community will be logged. » An incident reporting system must be used to record non-conformances to the EMPr. » On-going visual assessment to detect polluted areas and the application of clean-up and preventative procedures. » Monitor hydrocarbon spills from vehicles and machinery during construction continuously and record volume and nature of spill, location and clean-up actions.

	» Monitor maintenance of drains and intercept drains weekly. » Analyse soil samples for pollution in areas of known spills or where a breach of containment is evident when it occurs. » Records of accidental spills and clean-up procedures and the results thereof must be audited on an annual basis by the ECO. » Records of all incidents that caused chemical pollution must be kept and a summary of the results must be reported to management annually.

OBJECTIVE 15: Effective management of concrete batching plant

Concrete is required during the construction of the wind farm. In this regard there could be a need to establish a temporary 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.
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	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	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	Construction phase
The concrete batching plant site should demonstrate good maintenance practices, including regular sweeping to prevent dust build-up.	Contractor	Construction phase

Mitigation: Action/control	Responsibility	Timeframe
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	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	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 directs material to a collection point. Belt cleaning devices at the conveyor head may also assist to reduce spillage.	Contractor	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	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	Construction phase
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	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	Construction phase
Where possible, waste concrete should be used for construction purposes at the batching plant or project site.	Contractor	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 and Reporting	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout the 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. » The Developer or appointed ECO/EO must monitor indicators listed above to ensure that they have been met for the construction phase.

OBJECTIVE 16: Traffic management and transportation of equipment and materials to site

The construction and decommissioning phases of the project will be the most significant in terms of 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 farm and ancillary infrastructure) and the external road network. This section should be read in conjunction with the Traffic and Transportation Plan attached as **Appendix F**.

Project component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.
Potential Impact	» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted. » Risk of accidents. » Deterioration of road pavement conditions (i.e. both surfaced and gravel road) due to abnormal loads.
Activity/risk source	» Construction vehicle movement. » Speeding on local roads. » Degradation of local road conditions. » Site preparation and earthworks. » Foundations or plant equipment installation. » Mobile construction equipment movement on-site. » Substation construction activities.
Mitigation: Target/Objective	» Minimise impact of traffic associated with the construction of the wind farm on the local traffic volume, existing infrastructure, property owners, animals, and road users. » To minimise the potential for negative interaction between pedestrians or sensitive users and traffic associated with the wind farm construction. » To ensure all vehicles are roadworthy and all materials/equipment are transported appropriately and within any imposed permit/licence conditions.

Mitigation: Action/control	Responsibility	Timeframe
Develop and implement a detailed method statement for the implementation of the traffic and transportation management plan (refer to **Appendix F**).	Contractor(s), (Transportation sub-contractor)	Construction
Heavy vehicles travelling on secondary roads should adhere to low-speed limits to minimise noise and dust pollution.	Contractor(s), (Transportation sub-contractor)	Construction
If feasible, no construction activities should be carried out during weekends and outside day time working hours	Contractor	Construction
Provide adequate signage along the R350, R400 & R344 to warn motorists of the construction activities taking place on the site. Signage must be maintained on an on-going basis.	Contractor	Construction
Stagger component delivery to the site.	Contractor	Construction
Stagger the construction period.	Contractor	Construction
The use of mobile batching plants and quarries in close proximity to the project site would decrease the impact on the surrounding road network.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Staff and general trips should occur outside of peak traffic periods.	Contractor	Construction
Regular maintenance of gravel roads by the contractor during the construction phase.	Contractor	Construction
A designated access (or accesses) to the proposed site must be created to ensure safe entry and exit.	Contractor	Construction
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
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 (barring clearing machinery) 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
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. » No complaints resulting from traffic congestion, delays or driver negligence associated with construction of the wind farm.
Monitoring	» Visual monitoring of traffic control measures to ensure they are effective. » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE 17: Ensure appropriate rehabilitation of disturbed areas such that residual environmental impacts are remediated or curtailed

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

Project component/s	» Wind turbines. » Access roads and crane hardstand areas. » Cabling between turbines. » Substations. » Power line. » Balance of Plant area. » All other associated infrastructure.

Potential Impact	» Environmental integrity of the 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. » 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**
A site rehabilitation programme should be compiled and implemented (refer to **Appendix D**).	EPC Contractor in consultation with Specialist	Construction
Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken.	Contractor	Following execution of the works
All cleared areas must be revegetated with indigenous perennial shrubs and succulents from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	Contractor	Following execution of the works
Rehabilitation of the working areas must be concurrent with the construction of the project.	Contractor	Construction
All temporary facilities, equipment and waste materials must be removed from site and appropriately disposed of.	Contractor	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	Following execution of the works
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Contractor	Following execution of the works
On-going alien plant monitoring and removal should be undertaken on all areas of natural vegetation on an annual basis.	Contractor	Construction

Performance Indicator	» All portions of site, including construction camp and working areas, cleared of equipment and temporary facilities. » Topsoil replaced on all areas and stabilised. » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites. » Closed site free of erosion and alien invasive plants.
Monitoring and Reporting	» On-going inspection of rehabilitated areas in order to determine the effectiveness of the rehabilitation measures implemented during the operational lifespan of the wind farm. » 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.

7.2. 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 practically be mitigated and managed for the duration of the contract, 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 and ECO.

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

- 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
- Any other information deemed necessary by the Site Manager

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 include:

- Site establishment (which explains all activities from induction training to offloading, construction sequence for site establishment and the different amenities and 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.
- Stipulate norms and standards for water supply and usage (i.e. comply strictly to licence and legislation requirements and restrictions).
- Stipulate the stormwater management procedures recommended in the stormwater management method statement.
- 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 the waste process.
  - Recycle, re-use and removal process and procedure.
- Liquid waste management:
  - 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 existing facilities or sewerage systems where possible. Where no facilities are available, grey water runoff must be controlled to ensure there is no unacceptable seepage occurs.
- Dust and noise pollution:
  - Describe the 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, cement, 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 the 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, re-vegetation process and bush clearing.
- Incident and accident reporting protocol.
- General administration.
- Designate access road and the protocol for when roads are in use.
- Requirements on gate control protocols.

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

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 approved.

7.3. Awareness and Competence: Construction Phase of the Wind Garden Wind Farm

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

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 on-site, clearly describing their obligations towards environmental controls and methodologies in terms of this EMPr. This training and awareness will be achieved in the following ways:

7.3.1 Environmental Awareness Training

Environmental Awareness Training must be undertaken by the EPC Contractor and must take the form of an on-site talk and demonstration by the EO 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 SHE Officer on site.

7.3.2 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 site.

This induction training should be undertaken by the Contractor's EO and should include discussing the developer'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 the overall "do's" and "don'ts" on site and clarify the repercussions of not complying with these. 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 SHE Officer on site.

7.3.3 Toolbox Talks

Toolbox talks should be held on a scheduled and regular basis (at least once a week) 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 the reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

7.4. Monitoring Programme: Construction Phase of the Wind Garden Wind Farm

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

A monitoring programme must be in place not only to ensure conformance with the 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. Monitoring during construction must be on-going for the duration of this phase. The Project Manager must ensure that the monitoring is conducted and reported.

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

» Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications

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

All documentation e.g. audit/monitoring/compliance reports and notifications, required to be submitted to the DEFF in terms of the Environmental Authorisation, must be submitted to the Director: Compliance Monitoring of the Department.

Records relating to monitoring and auditing must be kept on site and made available for inspection to any relevant and competent authority in respect of this development.

7.4.1. Non-Conformance Reports

All supervisory staff including Foremen, Resident Engineers, and the ECO must be provided with 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 within 48 (forty eight) hours.

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.

7.4.2. Incident Reports

According to Section 30 of National Environmental Management Act (NEMA), an "Incident" is defined as an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed.

In terms of the requirements of NEMA, the responsible person must, within 14 days of the incident, report to the Director General, provincial head of department and municipality such information as is available to enable an initial evaluation of the incident, including:

(a) the nature of the incident;
(b) the substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects;
(c) initial measures taken to minimise impacts;
(d) causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and
(e) measures taken and to be taken to avoid a recurrence of such incident.

7.4.3. Monitoring Reports

A monitoring report will be compiled by the ECO on a monthly basis (or as dictated by the conditions of the EA) and must be submitted to the Director: Compliance Monitoring at DEA for their records. 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, or any other aspect as per the Appendix 7 of the EIA Regulations (2014, as amended 2017). The EPC contractor must ensure that all waste manifests are provided to the ECO on a monthly basis in order to inform and update the DEA regarding waste related activities.

7.4.4. Audit Report

The Developer must ensure that project compliance with the conditions of the Environmental Authorisation is audited by an independent auditor, and that the audit reports are submitted to the Director: Compliance Monitoring at the DEA at intervals as dictated by the conditions of the EA. Such audits must be undertaken during both the construction and operation phases of the wind farm. The effectiveness of the mitigation measures and recommendations for amongst others the following: grievance incidents; waste management, alien and open space management, re-vegetation and rehabilitation, plant rescue and protection and traffic and transportation should be audited. The results must form part of the project monitoring and audit reports.

7.4.5. Final Audit Report

A final environmental audit report must be compiled by an independent external auditor and be submitted to DEA upon completion of the construction and rehabilitation activities (within 30 days of completion of the construction phase. This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the environmental authorisation conditions and the requirements of the EMPr.

CHAPTER 8: MANAGEMENT PROGRAMME: OPERATION

Overall Goal: To ensure that the operation of the wind farm does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the Wind Garden Wind Farm in a way that:

- Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
- Enables the wind farm operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to farming practices, traffic and road use, and effects on local residents.
- Minimises impacts on fauna using the site.

An environmental manager must be appointed during operation whose duty will be to ensure the implementation of the operational EMPr.

8.1. 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 and general maintenance during operation

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

General maintenance at the Wind Garden Wind Farm will be required during the operation of wind farm. The maintenance required may also include the replacement of wind turbines, if required during the operation lifetime of the facility.

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

Mitigation: Action/control	Responsibility	Timeframe
General onsite maintenance of the wind turbines during the operation phase must in no way impact or negatively affect the environment, and contractors or other service providers	O&M Operator	Operation phase

Mitigation: Action/control	Responsibility	Timeframe
providing onsite maintenance must be made aware of this EMPr and the content thereof.		
Secure access to the site and entrances.	O&M Operator	Operation phase
Post information boards about public safety hazards and emergency contact information.	O&M Operator	Operation phase
A grievance and consultation plan must be developed and kept on the site at all times during operation of the wind farm. All grievances between landowners and Wind Garden (Pty) Ltd and between Wind Garden (Pty) Ltd or any service provider or other entity should be recorded and dealt with in the appropriate grievance channels are outlined in the grievance plan which must be established. Community consultation with surrounding landowners and community members must continue through the life cycle of the project, and must be reported on as such in the grievance and consultation plan. This will allow the receipt of - and facilitate resolution of concerns and grievances about the project's social and environmental issues raised by individuals or groups during the project operational period.	O&M Operator	Operation phase
Should wind turbines be required to be replaced, the following will apply: » Site access must be confirmed for the transportation of the required turbine components and equipment to the site and turbine location of the infrastructure to be replaced. » Materials and turbine structures are to be stored within the previously disturbed construction laydown area. No disturbance of areas outside of these areas should occur. » Full clean-up of all materials must be undertaken after the removal and replacement of the wind turbine and associated infrastructure is complete, and disturbed areas appropriately rehabilitated. » Most of the materials used for wind turbines can be recycled. The majority of the turbine (excluding the blades) can be recovered and re-used or recycled. Recyclable materials must be transported off-site by truck and managed at appropriate facilities in accordance with relevant waste management regulations. No waste materials may be left on-site following the replacement. » Waste material which cannot be recycled shall be disposed of at an appropriately licensed waste disposal site or as required by the relevant legislation.	O&M Operator	Operation phase

Performance Indicator	» Site is secure and there is no unauthorised entry. » No members of the public/ landowners injured. » 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. » A 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 the 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. » Wind farm including access roads and laydown areas. » Areas disturbed during the construction phase and subsequently rehabilitated at its completion.
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
Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.	O&M Operator	Operation phase
The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except landowners or other individuals with the appropriate permits and permissions where required.	O&M Operator	Operation phase
If any parts of the site need to be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs) as far as possible, which do not attract insects.	O&M Operator	Operation phase
All vehicles accessing the site should adhere to a low-speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.	O&M Operator	Operation phase
If parts of the facility such as the substation are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and	O&M Operator	Operation phase

Mitigation: Action/Control	Responsibility	Timeframe
are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside.		
All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.	O&M Operator	Operation phase
Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance must be undertaken, as per the Erosion Management and Rehabilitation Plans for the project.	O&M Operator	Operation phase
All erosion problems observed must be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.	O&M Operator	Operation phase
Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem plant species are already present in the area and are likely to increase rapidly if not controlled.	O&M Operator	Operation phase
Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility must be undertaken as these are also likely to be prone to invasion problems.	O&M Operator	Operation phase
Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	O&M Operator	Operation phase
Identified medicinal plants used for healing or ritual purposes should be conserved if threatened for use.	O&M Operator	Operation phase
Vehicle movements must be restricted to designated roadways.	O&M Operator	Operation phase
In order to increase general faunal protection, the use of any pesticide in the wind farms area should be prohibited.	O&M Operator	Operation phase
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	O&M Operator	Operation phase
Vegetation control within the wind farm should be by manual clearing and herbicides should not be used except to control alien plants in the prescribed manner if necessary.	O&M Operator Specialist	Operation phase
All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor.	O&M Operator	Operation phase
The use of herbicides and other related horticultural chemicals should be carefully controlled and only applied by personnel adequately certified to apply pesticides and herbicides. It must be ensured that WHO Recommended Classification of Pesticides by Hazard Class 1a (extremely hazardous) or 1b (highly hazardous) are not purchased, stored or used on site along with any other nationally or internationally similarly restricted/banned products.	O&M Operator	Operation phase

Mitigation: Action/Control	Responsibility	Timeframe
Implement an animal removal plan to ensure safety of workers and fauna.	O&M Operator	Operation phase
Fire breaks should be established, where appropriate and as discussed with the landowners. Access roads could also act as fire breaks.	O&M Operator Specialist	Duration of contract
There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous perennial shrubs and succulents from the local area.	O&M Operator	Operation phase
Annual site inspection for erosion with follow up remedial action where problems are identified.	Specialist	Annual monitoring until successful re-establishment of vegetation in an area
Noise and disturbance on the site should be kept to a minimum during operation and maintenance activities.	O&M Operator	Operation phase

Performance Indicator	» No further disturbance to vegetation or terrestrial faunal habitats. » No erosion problems resulting from operational activities within the wind farm. » Low abundance of alien plants within affected areas. » Maintenance of a ground cover that resist erosion. » Continued improvement of rehabilitation efforts.
Monitoring	» Observation of vegetation on-site by environmental manager. » 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.

OBJECTIVE 4: Protection of avifauna

It is estimated that a total of 9 priority bird species occur in the broader area and the project site. The avifauna described to be associated with Wind Garden Wind Farm project site is based on the results of the four seasons of pre-construction monitoring which was conducted from June 2019 to August 2020.

Key raptor breeding locations were identified within and near the project site. An eagle nest is a confirmed breeding site while a territory is a suspected nest site based on the fact that eagles were seen displaying, carry prey, etc. Two Martial Eagle nest sites are located in close proximity to the project site, however outside of the development envelope.

Two Verreaux's Eagle nest sites were identified with one located to the south-west and one to the north-west and outside of the Wind Garden Wind Farm project site. Three Crowned Eagle nests and territories were identified outside of the project site (~5km away), at Palmietfontein (active), Hellspoort (one historic site) and at Smoerfontein (a potential site). All are located relatively far away from the Wind Garden Wind Farm project site. One African Fish-eagle territories were located on the edge and south of the Wind Garden Wind Farm. Other breeding locations identified included two Secretarybird territories and three Jackal Buzzards nests.

Project component/s	» Wind turbines. » Substations. » Power line.
Potential Impact	» Disturbance to or loss of birds as a result of collision with the turbine blades and project components. » Destruction of habitat. » Displacement of birds. » Collision with project components. » Electrocution on power line. » Traffic to and from site.
Activity/risk source	» Spinning turbine blades. » Substation. » Power line.
Mitigation: Target/Objective	» More accurately determine the impact of the operating wind farm on collision-prone Red Data species. » Minimise impacts associated with the turbines and the substation.

Mitigation: Action/control	Responsibility	Timeframe
Develop and implement a carcass search programme for birds as a minimum during the first three years of operation followed by year 5, 10, 15, 20 and 25, in line with the applicable South African monitoring guidelines	Developer Specialist	Operation phase
Develop and implement a minimum 12-month post-construction bird activity monitoring program that mirrors the pre-construction monitoring surveys completed by Ecology Consulting/ECDC and is in line with the applicable South African post-construction monitoring guidelines. This program must include thorough and ongoing nest searches and nest monitoring. The results of this monitoring and the relevant specialist (including carcass searchers) should advise the need for any additional ongoing activity monitoring or nest surveys beyond the 12-month period.	Developer Specialist	Operation phase
Develop and implement a carcass search programme for birds during the first two years of operation, in line with the South African monitoring guidelines (Jenkins et al. 2015). This program must include monitoring of overhead power lines.	Developer Specialist	Operation phase
Conduct frequent and regular review of the operation phase monitoring data (activity and carcass) and results by an avifaunal specialist. This review should also establish the requirement for continued monitoring studies (activity and carcass) throughout the operational and decommissioning phases of the development	Developer Specialist	Operation phase
The above reviews should strive to identify sensitive locations at the development including turbines and areas of increased collisions with power lines that may require additional mitigation. If unacceptable impacts are observed (in the opinion of the bird specialist after consultation with BLSA, relevant stakeholders and an independent review), the specialist should conduct a literature review specific to the impact (e.g. collision and/or electrocution) and provide updated and relevant mitigation	Developer Specialist	Operation phase

Mitigation: Action/control	Responsibility	Timeframe
options to be implemented. Mitigations that may need to be implemented (and should be considered in the project's financial planning) include: a) Onsite and off-site habitat management. A habitat management plan which aims to prevent an influx/increase in preferred prey items in the turbine area due to the construction and operation activities, while improving raptor habitat and promoting prey availability away from the site. b) Implementing a carcass management plan on the wind farm site, to remove any dead livestock as soon as possible, to reduce the likelihood of attracting scavenging juvenile eagles to the wind farm site. c) Using deterrent devices (e.g. visual and noise deterrents) and/or shutdown systems e.g. automatic bird detectors (e.g. automated camera-based monitoring systems – McClure et. al. 2018) if commercially available; or Radar Assisted Shutdown on Demand (RASOD) to reduce collision risk. d) Identify options to modify turbine operation (e.g. temporary curtailment or shut-down on demand) to reduce collision risk if absolutely necessary and if other methods have not had the desired results. e) Possibly offset programmes if no suitable mitigation measures can be implemented to reduced impacts sufficiently.		

Performance Indicator	» Minimal additional disturbance to bird populations on the wind farm site. » Continued improvement of bird protection devices, as informed by the operational monitoring. » Regular provision of clearly worded, logical and objective information on the interface between the local avifauna and operating wind farm. » Clear and logical recommendations on why, how and when to institute mitigation measures to reduce avian impacts of the development, from the pre-construction to operation phase.
Monitoring and Reporting	» Observation of avifaunal populations and incidence of injuries/death from collisions from turbine blades. » Monitoring of facility and reporting where fatalities do occur. » Review of bird monitoring report on a full year of post-construction monitoring.

OBJECTIVE 5: Protection of bat species

Based on the bat activity recorded at the Wind Garden Wind Farm, the significance ratings for the majority of the impacts to bats posed by the development are predicted to be medium or high before mitigation. After mitigation, all impacts are predicted to be low. Based on the opportunity for reduction of the impacts through appropriate mitigation measures from a high or medium significance to a low acceptable significance no fatal flaws are expected to occur.

Project component/s	» Wind turbines. » Substations.
Potential Impact	» Disturbance to or loss of bats as a result of collision with turbines and/or barotrauma. » Bat mortality and destruction of habitat / roosts.
Activity/risk source	» Spinning turbine blades.
Mitigation: Target/Objective	» More accurately determine the impact of the operating wind farm on bat species. » Minimise impacts associated with the turbines and substation.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Operational acoustic monitoring and carcass searches for bats must be performed, based on best practice, to monitor mortality and bat activity levels. Acoustic monitoring should include monitoring at height (from more than one location i.e. such as on turbines) and at ground level.	Developer Specialist	Operation phase
Apply curtailment during spring, summer and autumn if mortality occurs beyond threshold levels as determined based on applicable guidance. The threshold calculations must be done at a minimum of once a quarter (i.e. not only after the first year of operational monitoring) so that mitigation can be applied as quickly as possible (according to the contracted appropriate bat specialist's timeframe) should thresholds be reached. This should be defined and monitored by an appropriate bat specialist.	Developer Specialist	Operation phase

Performance Indicator	» Minimal additional disturbance to bat populations on the wind farm site. » Continued improvement of bat protection devices, as informed by the operational monitoring. » Regular provision of clearly worded, logical and objective information on the interface between the local bats and the proposed/ operating wind farm. » Clear and logical recommendations on why, how and when to institute mitigation measures to reduce bat impacts of the development, from the pre-construction to operation phase.
Monitoring and Reporting	» Monitoring of facility and reporting where fatalities do occur. » Review of bat monitoring report on a full year of post-construction monitoring.

OBJECTIVE 6: Minimisation of 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 aircraft warning lights mounted on top of the hub of the wind turbines are prescribed by the Civil Aviation Authority (CAA), and the potential to mitigate their visual impacts is low. The regulations for the CAA's *Marking of Obstacles* should be strictly adhered to, as the failure of complying with these guidelines may result in the developer being required to fit additional light fixtures at closer intervals thereby aggravating the visual impact.

Project component/s	» Wind farm (including access roads). » Substations and power line. » Ancillary infrastructure.
Potential Impact	» Risk to aircraft in terms of the potential for collision. » Enhanced visual intrusion. » Visual impact of the wind farm degradation (including operational wind turbines) and vegetation rehabilitation failure.
Activity/risk source	» Size/scale of turbines. » Associated lighting. » Wind turbines and other infrastructure. » Access roads. » Other associated infrastructure. » Viewing of the degradation and vegetation rehabilitation failure by observers on or near the site.
Mitigation: Target/Objective	» To minimise the potential for visual impact. » To ensure that the wind farm complies with Civil Aviation Authority requirements for turbine visibility to aircraft. » Minimise the contrast with the surrounding environment and visibility of the turbines to humans. » The containment of light emitted from the substation in order to eliminate the risk of additional night-time visual impacts. » Well maintained and neat facility.

Mitigation: Action/control	Responsibility	Timeframe
Maintain the general appearance of the facility as a whole, including the turbines, servitudes and the ancillary buildings.	O&M Operator	Operation and maintenance
Lighting of the wind farm (for example security lights) should be kept to a minimum. Lights should be directed downwards.	O&M Operator	Operation phase
Aviation warning lights must be mounted on the turbine hub or such measures specified by the Civil Aviation Authority consent.	O&M Operator	Operation and maintenance
Minimise night lighting with motion sensors and make use of an infra-red security system. Maintain lighting focused on the development and angled low.	O&M Operator	Operation phase
If turbines are to be lit at night, lighting should be kept to a minimum and should preferably not be white light. Flashing strobe-like lights should be used where possible.	O&M Operator	Operation phase

Performance Indicator	» Appropriate visibility of infrastructure to aircraft. » Well maintained and neat facility with intact vegetation on and in the vicinity of the wind farm.
Monitoring and Reporting	» Ensure that aviation warning lights or other measures are installed before construction is completed and are fully functional at all times. » Monitoring of the entire site on an ongoing basis by the operator.

OBJECTIVE 7: Minimisation of noise impacts from turbines

From the noise impacts assessed it is stated that there will be a low significance for daytime construction activities, a medium significance for night-time construction activities (with mitigation proposed to reduce the significance to low) and a low significance for both night-time operation activities. No impacts of a high significance or fatal flaws were identified.

The specialist has indicated that a noise monitoring programme must be undertaken before the development of the wind farm as well as noise monitoring after the first year of operation of the wind farm. The acoustic consultant will need to recommend whether future noise monitoring is required.

Project component/s	» Wind farm (including access roads).
Potential Impact	» Increased noise levels at potentially sensitive receptors. » Changing ambient sound levels could change the acceptable land use capability. » Disturbing character of noise from the wind turbines..
Activity/risk source	» Simultaneous operation of a number of wind turbines.
Mitigation: Target/Objective	» Define ambient sound levels at NSD04 prior to the development of the wind farm. » Ensure that the change in ambient sound levels as experienced by potentially sensitive receptors is less than 7 dBA. » Prevent the generation of nuisance noises. » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors. » Ensure that noises from wind turbines do not exceed 45 dBA at all NSDs.

Mitigation: Action/control	Responsibility	Timeframe
Undertake noise monitoring after the first year of operation of the wind farm. The acoustic consultant must recommend whether future noise monitoring is required.	O&M Operator	Operation phase

Performance Indicator	» Ensure that the change in ambient sound levels as experienced by potentially sensitive receptors is less than 7 dBA
Monitoring and Reporting	» Noise monitoring after the first year of operation and any additional monitoring as recommended by the specialist thereafter

OBJECTIVE 8: Appropriate handling and management of hazardous substances and waste

The operation of the wind farm 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	» Wind turbines. » Substations. » Associated infrastructure.
Potential Impact	» Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices.
Activity/risk source	» Generators and gearbox – turbines. » Transformers and switchgear – substation.

	» Fuel and oil storage.
Mitigation: Target/Objective	» To comply with waste management legislation. » To minimise production of waste. » To ensure appropriate waste disposal. » To avoid environmental harm from waste disposal.

Mitigation: Action/control	Responsibility	Timeframe
Hazardous substances must be stored in sealed containers within a clearly demarcated designated area.	O&M Operator	Operation phase
Storage areas for hazardous substances must be conducted within a secured and clearly demarcated area.	O&M Operator	Operation phase
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.	O&M Operator	Operation phase
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.	O&M Operator / waste management contractor	Operation phase
Used oils and chemicals: » Where these cannot be recycled, appropriate disposal must be arranged with a licensed facility in consultation with the administering authority. » Waste must be stored and handled according to the relevant legislation and regulations.	O&M Operator	Operation phase
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	O&M Operator	Operation phase
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	O&M Operator	Operation and maintenance
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	O&M Operator	Operation phase
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	O&M Operator/ waste management contractor	Operation phase
No waste may be burned or buried on site.	O&M Operator	Operation phase
Wastewater and sludge shall be managed by local authorities and service providers in an environmentally acceptable manner by adhering to the Guidelines for the Utilisation and Disposal of Wastewater Sludge Volumes 1 to 6 (Herselmann & Snyman, 2006).	O&M Operator	Operation phase

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. » No contamination of soil.
Monitoring and Reporting	» Waste collection must be monitored internally on a regular basis. » Waste documentation must be completed and made available for inspection on request. » An incidents/complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon. » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the environmental manager. All appropriate waste disposal certificates must accompany the monthly reports.

OBJECTIVE 9: Maximise benefits and opportunities for local communities associated with local employment, skills opportunities, socio-economic development plans and a community trust

The wind farm will create an estimated 31 permanent employment positions across the operation phase of the development which, will be retained for approximately 20 years. Of these, an estimated 27 will be South African based positions. It is envisaged that 27% of the skilled and low skilled staff will be employed from within the local area with the remaining staff being sourced from other parts of the Eastern Cape and the country. This means that approximately 3 out of 10 positions are expected to be filled by local labour, which is a small but, positive contribution towards addressing the high unemployment rates observed in both the Makana Local Municipality and the Eastern Cape.

Project component/s	» Wind farm. » Day to day operational activities associated with the wind farm including maintenance.
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 operation phase of the wind farm will create permanent employment opportunities. » The establishment of a wind farm has the potential to create an 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 opportunities for locals.

Mitigation: Action/control	Responsibility	Timeframe
The operator of the wind farm should be encouraged to, as far as possible, procure materials, goods and products required for the operation and maintenance of the facility from local suppliers to increase the positive impact in the local economy.	O&M Operator	Operation phase
Where possible, local labour should be considered for employment so as to increase the positive impact on the local economy.	O&M Operator	Operation phase
As far as possible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the facility.	O&M Operator	Operation phase

Mitigation: Action/control	Responsibility	Timeframe
The developer should consider establishing vocational training programmes for the local labour force to promote the development of skills required by the wind energy facility and thus provide for the opportunities for these people to be employed in other similar facilities elsewhere in the future	O&M Operator	Operation phase
A social development and economic development programme should be devised by the developer and implemented throughout the project's lifespan. The plan should be developed in consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits. These plans should be reviewed on an annual basis and, where necessary, updated. When identifying enterprise development initiatives, the focus should be on creating sustainable and self-sufficient enterprises. In devising the programmes to be implemented, the developer should take into account the local Integrated Development Plans (Makana, 2019)	O&M Operator	Operation phase
Socio-economic development commitments to further eco-tourism and conservation in the region should be established.	O&M Operator	Operation phase

Performance Indicator	» Maximum amount of semi and unskilled labour locally sourced where possible. » Local suppliers and SMMEs contracted where possible. » Skills transfer facilitated where required. » A social development and economic development programme developed and implemented.
Monitoring and Reporting	» Indicators listed above must be met for the operation phase.

OBJECTIVE 10: Implement an appropriate fire management plan during the operation phase

The vegetation on the site may be at risk of fire, especially during drought conditions experienced in the area. 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 farm 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 risk to the wind farm 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 firefighting equipment on site. Apply for membership to the local Fire Protection Association, should there be one.	O&M Operator	Operation phase
Provide fire-fighting training to selected operation and maintenance staff.	O&M Operator	Operation phase
Ensure that appropriate communication channels are established to be implemented in the event of a fire.	O&M Operator	Operation phase
Fire breaks should be established where and when required. 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.	O&M Operator	Operation phase
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.	O&M Operator	Operation phase
Contact details of emergency services should be prominently displayed on site.	O&M Operator	Operation phase

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

8.2. Monitoring Programme: Operation Phase of the Wind Garden Wind Farm

OBJECTIVE 11: To monitor the performance of the control strategies employed against environmental objectives and standards

A monitoring programme must be in place not only to ensure conformance with the 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. An internal environmental audit must be conducted every 6 months and an external audit must be conducted once a year in order to confirm compliance with the requirements of all environmental permits (including the Environmental Authorisation, once issued) for the project, this EMPr, and all relevant legislation. The results of the audit reports must be made available to the DEFF and the relevant authorities on request, and must be part of monitoring and audit reports. An annual audit report must be compiled and submitted to DEFF. The aim of the auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

» Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications.
» Ensure adequate and appropriate interventions to address non-compliance.
» Ensure adequate and appropriate interventions to address environmental degradation.
» Provide a mechanism for the lodging and resolution of public complaints.
» Ensure appropriate and adequate record keeping related to environmental compliance.

- Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site.
- Aid in the communication and feedback to authorities and stakeholders.

CHAPTER 9: MANAGEMENT PROGRAMME: DECOMMISSIONING

The turbine infrastructure which will be utilised for the Wind Garden Wind Farm is expected to have a lifespan of 25 to 30 years (with maintenance). Equipment associated with this wind farm 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 wind farm would comprise the dismantling and replacement of the turbines with more appropriate technology/infrastructure available at that time. It must be noted that decommissioning activities will need to be undertaken in accordance with the legislation applicable at that time, which may require this section of the EMPr to be revisited and amended.

The relevant mitigation measures contained under the construction section should be applied during decommissioning and therefore are not repeated in this section.

» ***Site Preparation***
Site preparation activities will include confirming the integrity of the access to the site to accommodate the required equipment, preparation of the site (e.g. laydown areas, construction platform) and the mobilisation of construction equipment.

» ***Dismantle and Remove Infrastructure***
The wind infrastructure (turbine and tower sections) of the wind farm will be dismantled once it reaches the end of its economic lifespan. A large crane would be required for dismantling the turbine and tower sections. Once dismantled, 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.

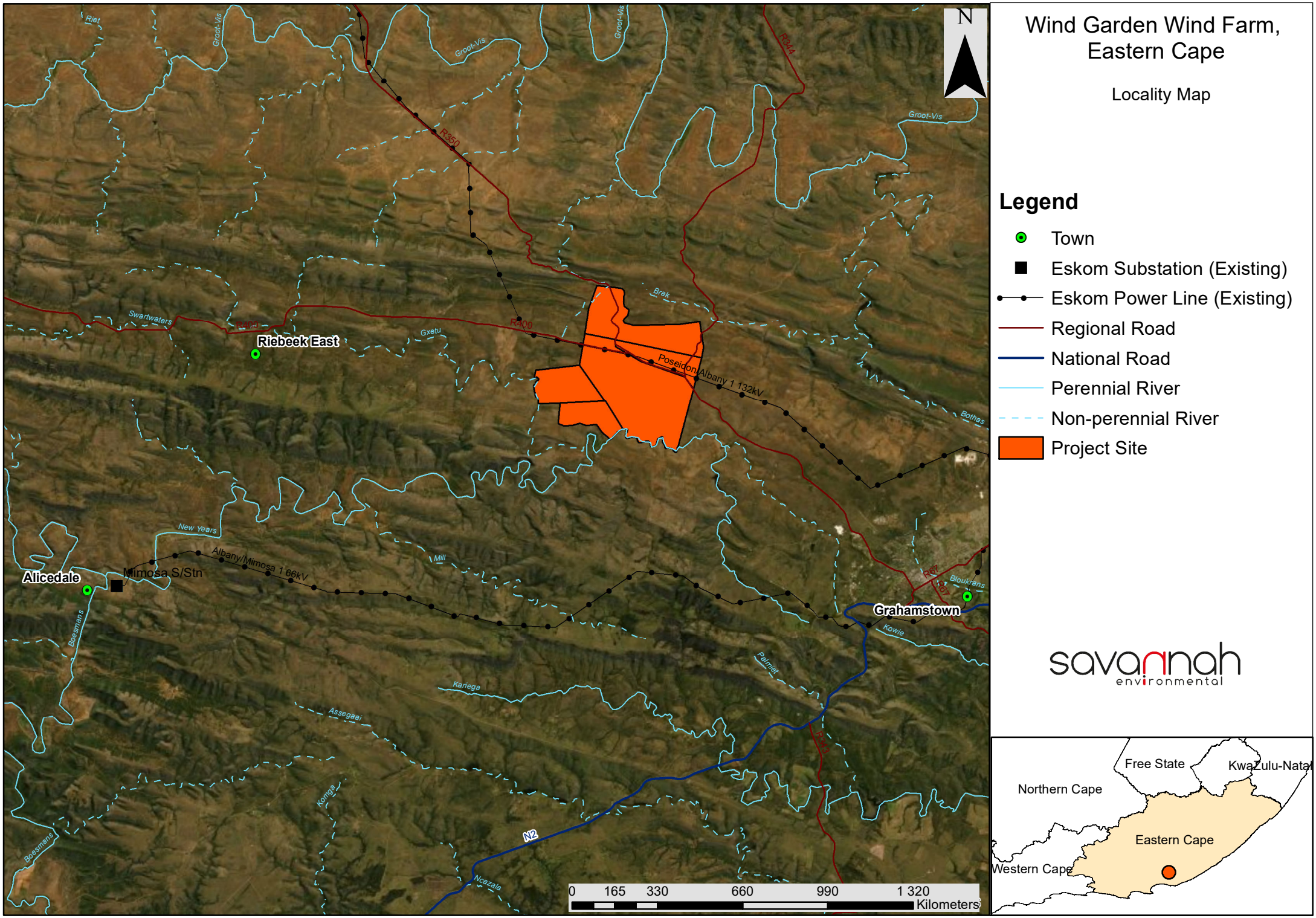
9.1. Objectives

In decommissioning the Wind Garden Wind Farm, Wind Garden (Pty) Ltd must ensure that:

» All structures not required for the post-decommissioning use of the site (may include the turbines, substation, ancillary buildings, monitoring masts) are dismantled and/or demolished, removed and waste material disposed of at an appropriately licensed waste disposal site or as required by the relevant legislation.
» Rehabilitate access/service roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.
» All disturbed areas are compacted, sloped and contoured to ensure drainage and runoff and to minimise the risk of erosion.
» Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.
» Any fauna encountered during decommissioning activities should be removed to safety by a suitably qualified person.
» All vehicles to adhere to low speed limits (i.e. 30km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust.
» Retrenchments should comply with South African Labour legislation of the day.

The general specifications of Chapter 6 (Construction) and Chapter 7 (Rehabilitation) are also relevant to the decommissioning of the Wind Garden Wind Farm and must be adhered to.

APPENDIX A:
FACILITY LAYOUT AND SENSITIVITY MAPS


Wind Garden Wind Farm, Eastern Cape
Locality Map
N
Legend
Town
Eskom Substation (Existing)
Eskom Power Line (Existing)
Regional Road
National Road
Perennial River
Non-perennial River
Project Site
Riebeek East
Alicedale
Mimosa S/Stn
Grahamstown
Albany/Mimosa 1 66kV
Poseidon/Albany 1 132kV
R350
R400
R344
R67
N2
Groot-Vis
Brak
Swartwaters
Gxetu
New Years
Mill
Bothas
Bloukrans
Kowie
Palmiet
Kariega
Assegaai
Komga
Boesmans
Ncaza la
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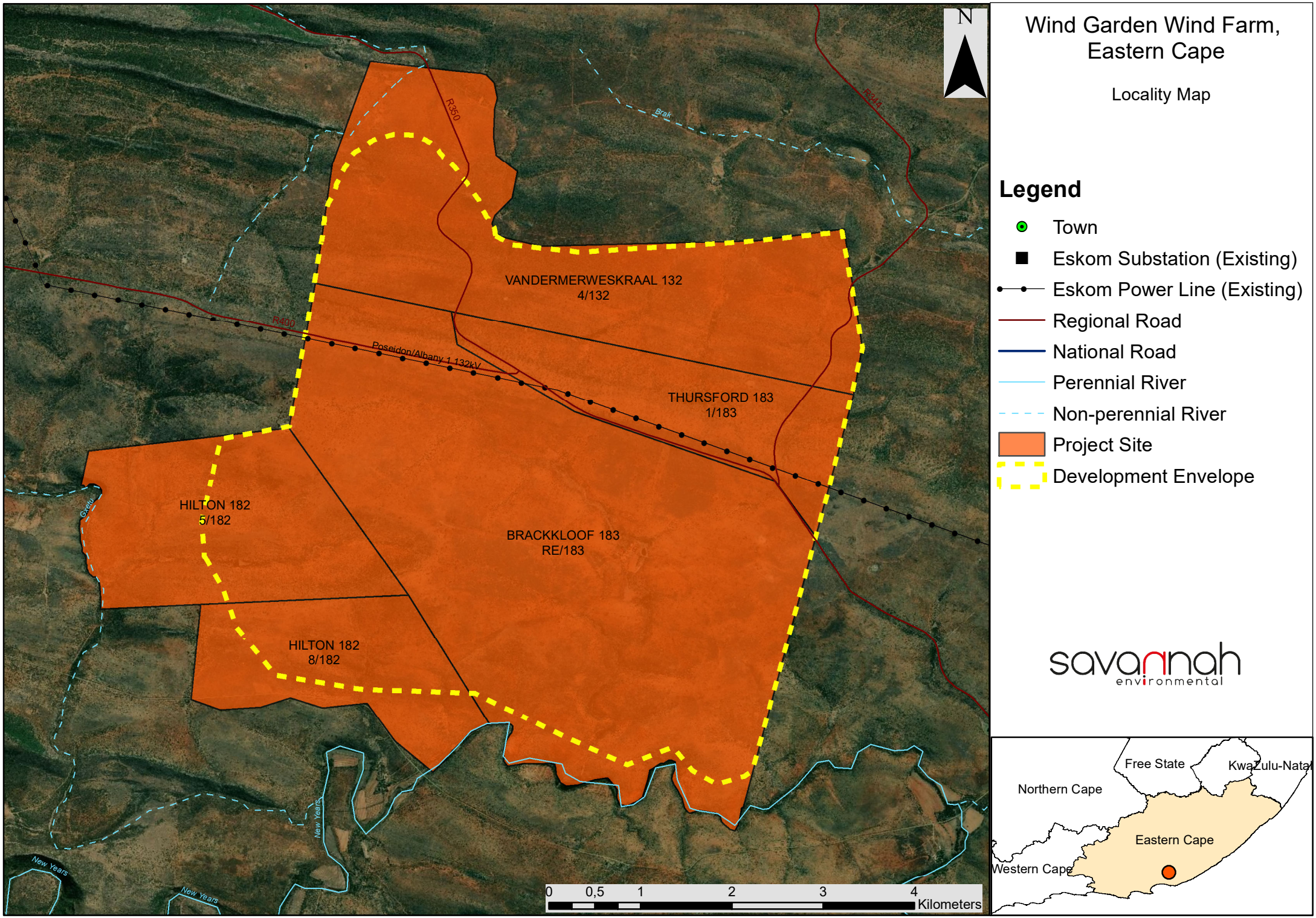

Wind Garden Wind Farm, Eastern Cape

Locality Map

Legend

- Town
- Eskom Substation (Existing)
- Eskom Power Line (Existing)
- Regional Road
- National Road
- Perennial River
- Non-perennial River
- Project Site
- Development Envelope

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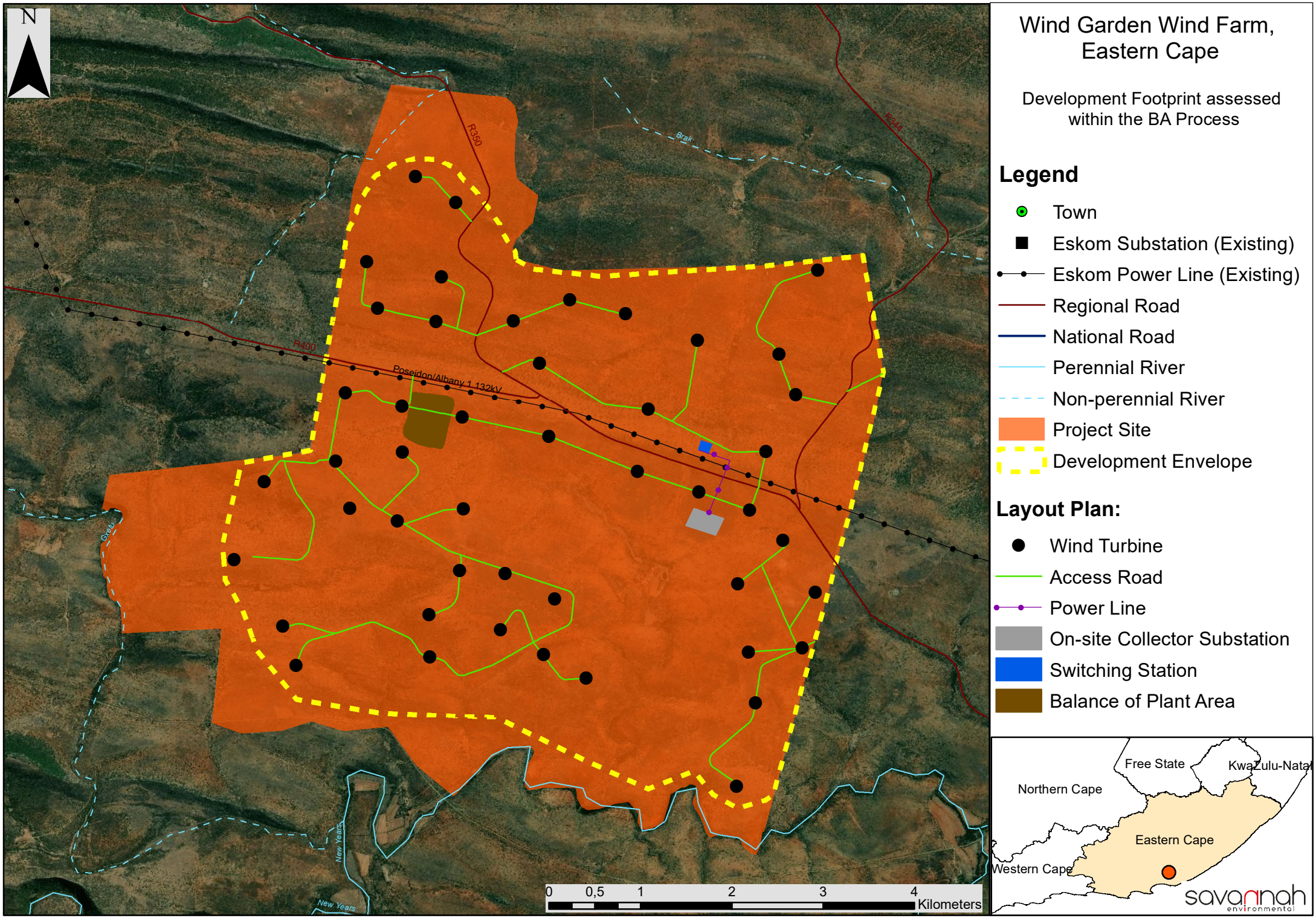


Wind Garden Wind Farm, Eastern Cape

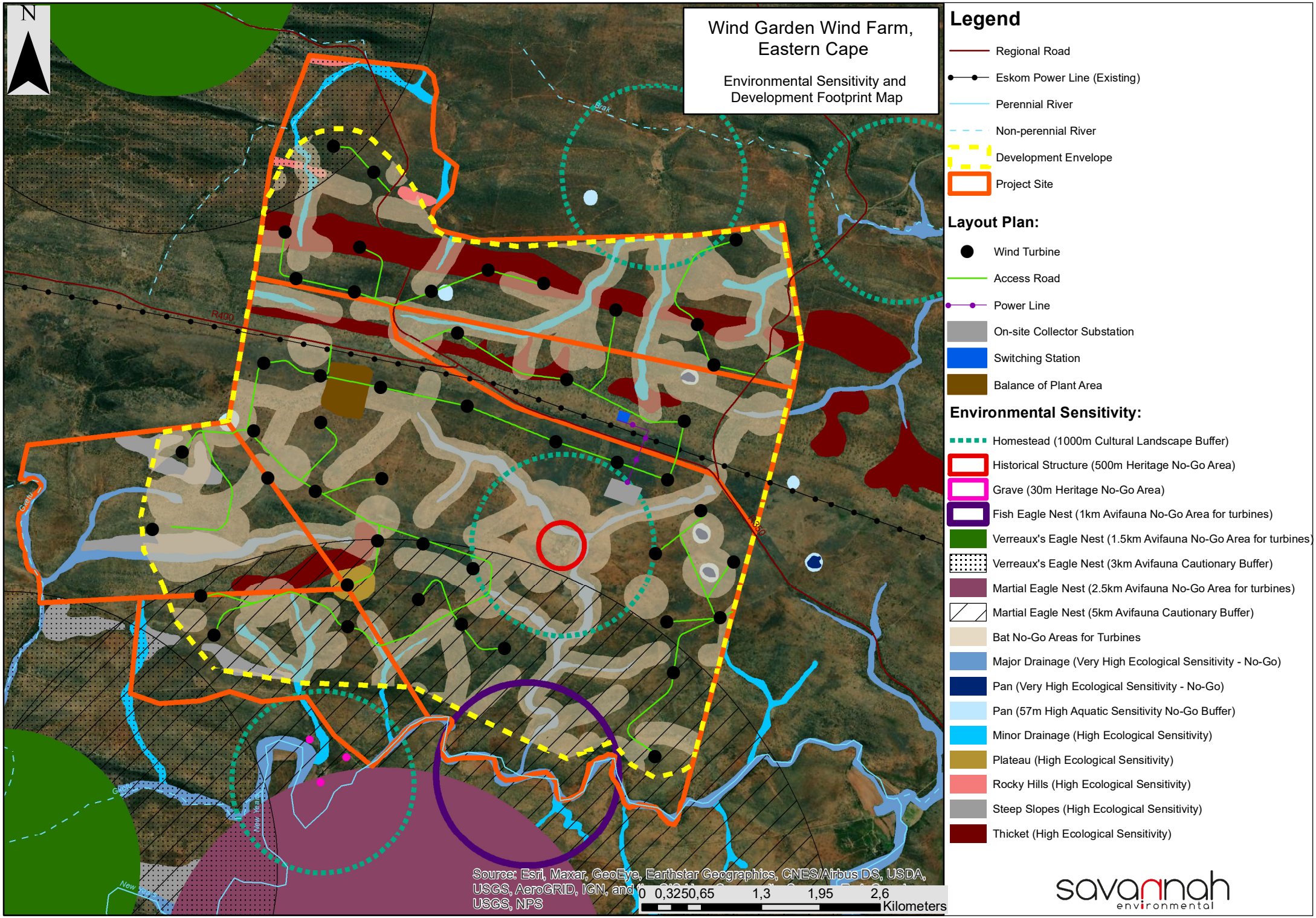
Development Footprint assessed within the BA Process

Legend

- Town
- Eskom Substation (Existing)
- Eskom Power Line (Existing)
- Regional Road
- National Road
- Perennial River
- Non-perennial River
- Project Site
- Development Envelope

Layout Plan:

- Wind Turbine
- Access Road
- Power Line
- On-site Collector Substation
- Switching Station
- Balance of Plant Area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Wind Garden Wind Farm,
Eastern Cape
Environmental Sensitivity and
Development Footprint Map
R400
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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and
USGS, NPS
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Kilometers
Legend
Regional Road
Eskom Power Line (Existing)
Perennial River
Non-perennial River
Development Envelope
Project Site
Layout Plan:
Wind Turbine
Access Road
Power Line
On-site Collector Substation
Switching Station
Balance of Plant Area
Environmental Sensitivity:
Homestead (1000m Cultural Landscape Buffer)
Historical Structure (500m Heritage No-Go Area)
Grave (30m Heritage No-Go Area)
Fish Eagle Nest (1km Avifauna No-Go Area for turbines)
Verreaux's Eagle Nest (1.5km Avifauna No-Go Area for turbines)
Verreaux's Eagle Nest (3km Avifauna Cautionary Buffer)
Martial Eagle Nest (2.5km Avifauna No-Go Area for turbines)
Martial Eagle Nest (5km Avifauna Cautionary Buffer)
Bat No-Go Areas for Turbines
Major Drainage (Very High Ecological Sensitivity - No-Go)
Pan (Very High Ecological Sensitivity - No-Go)
Pan (57m High Aquatic Sensitivity No-Go Buffer)
Minor Drainage (High Ecological Sensitivity)
Plateau (High Ecological Sensitivity)
Rocky Hills (High Ecological Sensitivity)
Steep Slopes (High Ecological Sensitivity)
Thicket (High Ecological Sensitivity)
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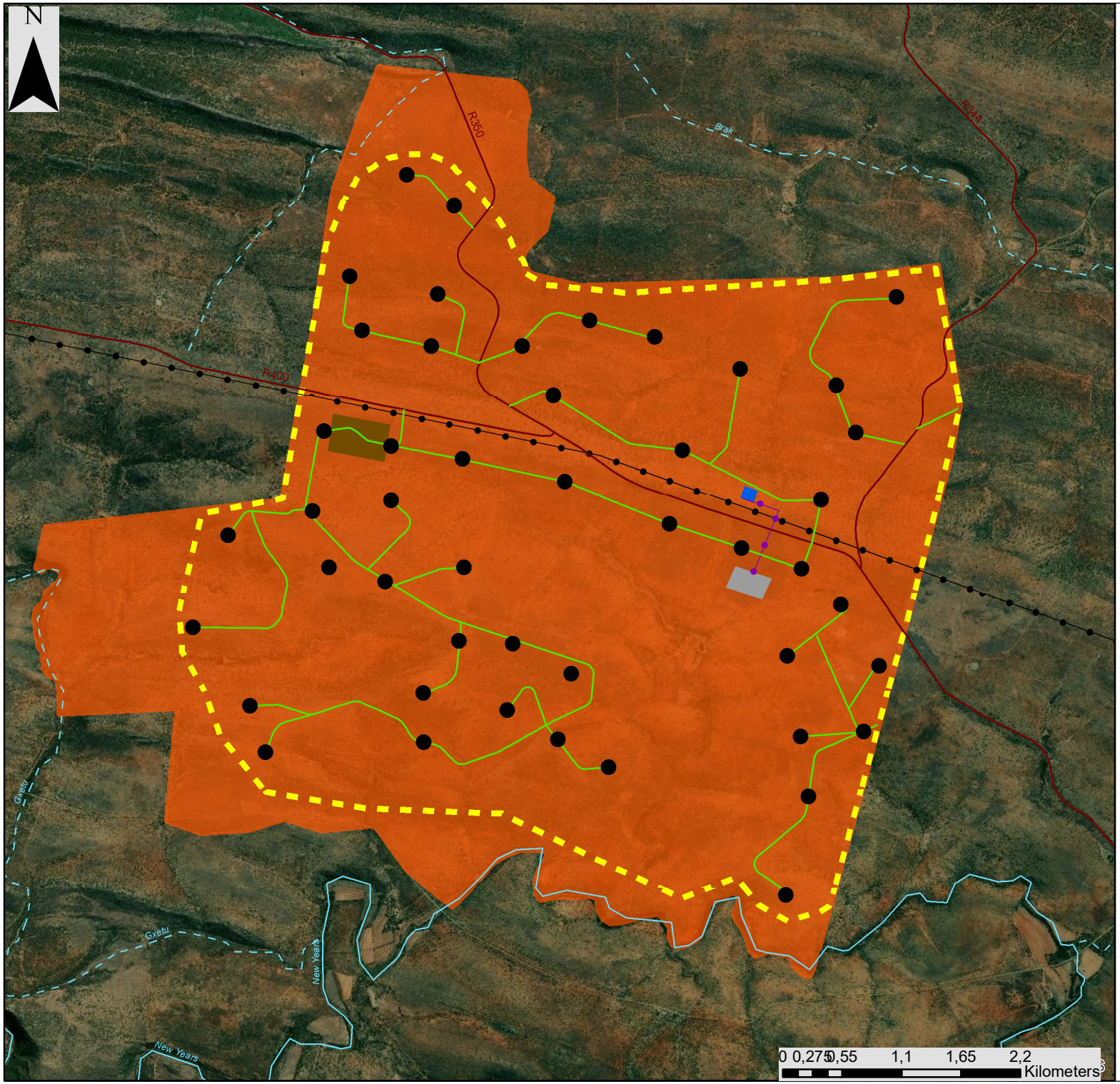
environmental



Wind Garden Wind Farm, Eastern Cape

Optimised Development Footprint Map

Legend

- Regional Road
- Eskom Power Line (Existing)
- Perennial River
- Non-perennial River
- Development Envelope
- Project Site

Optimised Layout Plan:

- Wind Turbine
- Access Road
- Power Line
- On-site Collector Substation
- Switching Station
- Balance of Plant

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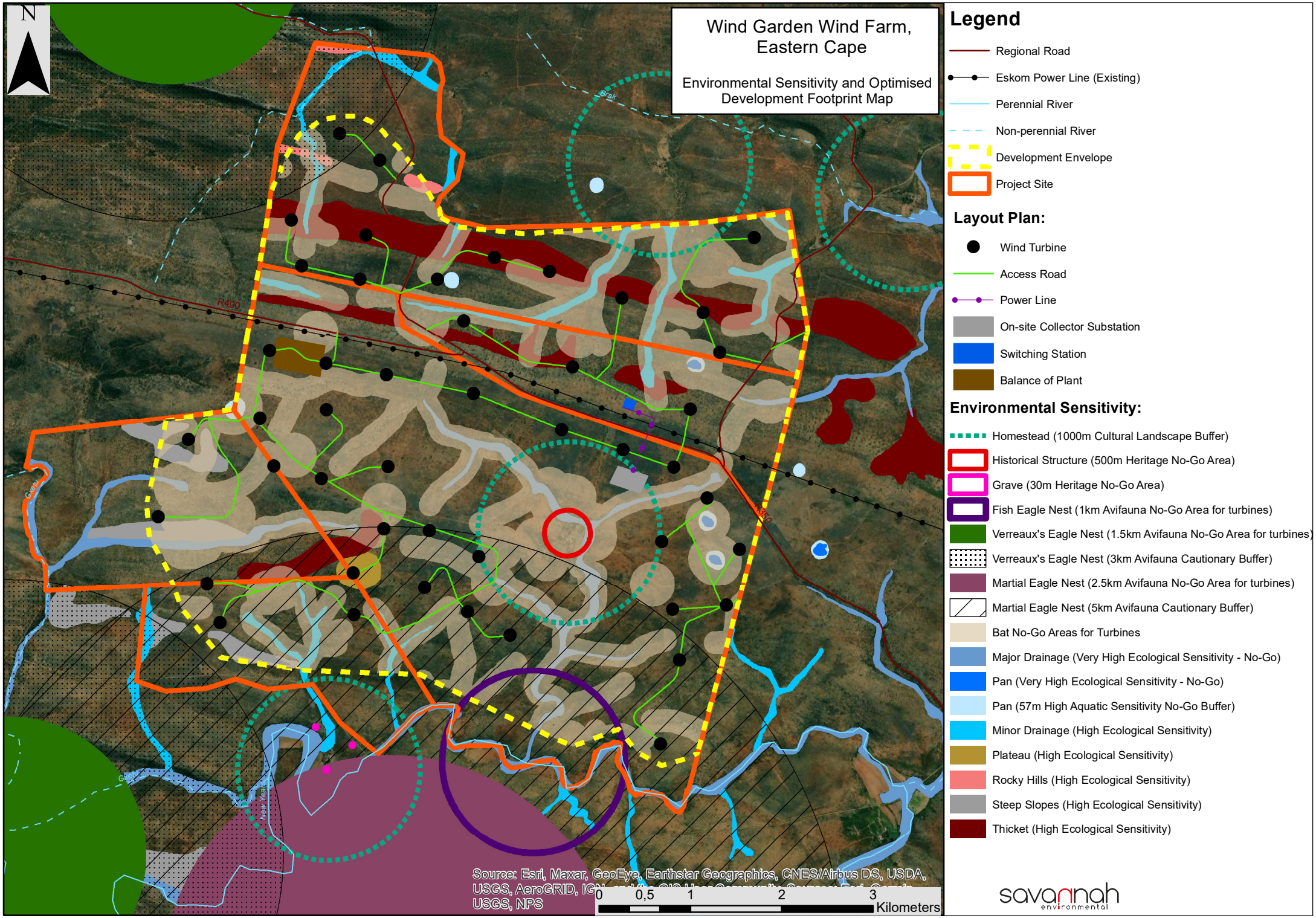
N
Wind Garden Wind Farm,
Eastern Cape
Environmental Sensitivity and Optimised
Development Footprint Map
R400
Brak
Legend
Regional Road
Eskom Power Line (Existing)
Perennial River
Non-perennial River
Development Envelope
Project Site
Layout Plan:
Wind Turbine
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Rocky Hills (High Ecological Sensitivity)
Steep Slopes (High Ecological Sensitivity)
Thicket (High Ecological Sensitivity)
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
USGS, NPS
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Kilometers
savannah environmental

APPENDIX B:
GRIEVANCE MECHANISM FOR COMPLAINTS AND ISSUES

GRIEVANCE MECHANISM / PROCESS

PURPOSE

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

- Provides a predictable, accessible, transparent, and credible process to all parties, resulting in outcomes that are fair and equitable, accountable and efficient.
- Promotes 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

The following proposed grievance procedures are to be complied with throughout the construction, operation and decommissioning phases of the project:

- Local landowners, communities and authorities must be informed in writing by the Developer of the grievance mechanism and the process by which grievances can be brought to the attention of the Developer through its designated representative. This must be undertaken with the commencement of the construction phase.
- A company representative must be appointed as the contact person in order for grievances to be addressed. The name and contact details of the contact person must be provided to local landowners, communities and authorities when requested.
- Project related grievances relating to the construction, operation and or decommissioning phases 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, by recording grievances and completing written grievance notices where applicable, translating requests or concerns or by facilitating contact with the nominated contact person. The following information should be obtained, as far as possible, regarding each written grievance, which may act as both acknowledgement of receipt as well as record of grievance received:
    a. The name and contact details of the complainant;
    b. The nature of the grievance;
    c. Date raised, received, and for which the meeting was arranged;
    d. Persons elected to attend the meeting (which will depend on the grievance); and
    e. A clear statement that the grievance procedure is, in itself, not a legal process. Should such avenues be desired, they must be conducted in a separate process and do not form part of this grievance mechanism.
- The grievance must be registered with the contact person who, within 2 working days of receipt of the grievance, must contact the Complainant to discuss the grievance and, if required, 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 2 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 and only if required).
- A grievance register must be kept on site (in electronic format, so as to facilitate editing and updating), and shall be made available to all parties wishing to gain access thereto.
- 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, as well as a suitable venue. The people who will be required to attend the meeting will depend on the nature of the grievance. While the Complainant and or Developer are entitled to invite their legal representatives to attend the meeting/s, it should be made clear to all the parties involved in the process that the grievance mechanism process is not a legal process, and that if the Complainant invites legal representatives, the cost will be their responsibility. It is therefore recommended that the involvement of legal representatives be limited as far as possible, as a matter of last resort, and that this process be primarily aimed at stakeholder relationship management as opposed to an arbitration or litigation mechanism
- The meeting should be chaired by the Developer's representative appointed to address grievances. The Developer must supply and nominate a representative to capture minutes and record the meeting/s.
- Draft copies of the minutes must be made available to the Complainant and the Developer within 5 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 5 working days of receipt of the draft minutes.
- The meeting agenda must be primarily the discussion of the grievance, avoidance and mitigation measures available and proposed by all parties, as well as a clear indication of the future actions and responsibilities, in order to put into effect the proposed measures and interventions to successfully resolve the grievance.
- In the event of the grievance being resolved to the satisfaction of all the parties concerned, the outcome must be 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 Developer 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 Developer will be required to identify three (3) mediators and forward the names and CVs to the Complainant within 2 weeks of the dispute being declared. The Complainant, in consultation with the Developer, must identify the preferred mediator and agree on a date for the next meeting. The cost of the mediator must be borne by the Developer. The Developer must supply and nominate a representative to capture minutes 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 Developer for comment before being finalised and signed by all parties, which signature may not be unreasonably withheld by either party. Unless otherwise agreed, comments on the draft report must be forwarded to the company representative appointed to manage the grievance mechanism within 5 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 is required, or indeed possible. Closure status must be classified and captured following mediation or successful resolution 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 despite mediation.
- 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 Developer, either party may be entitled to legal action if an appropriate option, however, this grievance mechanisms aims to avoid such interactions by addressing the grievances within a short timeframe, and to mutual satisfaction, where possible.

APPENDIX C:
OPEN SPACE MANAGEMENT PLAN

ALIEN PLANT AND OPEN SPACE MANAGEMENT PLAN

1. PURPOSE

Invasive alien plant species pose the second largest threat to biodiversity after direct habitat destruction. The purpose of this Alien Plant and Open Space Management Plan is to provide a framework for the management of alien and invasive plant species during the construction and operation of the Wind Garden Wind Farm and the associated infrastructure. The broad objectives of the plan include the following:

- Ensure alien plants do not become dominant in parts of the site, or the whole site, through the control and management of alien and invasive species presence, dispersal and encroachment.
- Develop and implement a monitoring and eradication programme for alien and invasive plant species.
- Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

This plan should be updated throughout the life-cycle of the wind farm, as required in order to ensure that appropriate measures are in place to manage and control the establishment of alien and invasive plant species and to ensure compliance with relevant legislation.

2. 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 alien plant species must be effectively controlled. Landowners are legally responsible for the control of invasive alien plants on their properties. In terms of this Act, alien invasive plant species are 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 NEM:BA. 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 Category 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 Category 3 plants to exist in riparian zones.

The following guide is a useful starting point for the identification of alien plant species: Bromilow, C. 2010. Problem Plants and Alien Weeds of South Africa. Briza, Pretoria.

It is important to note that alien plant 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.

3. ALIEN PLANT MANAGEMENT PRINCIPLES

3.1. Prevention and early eradication

A prevention strategy should be considered and established, including regular surveys and monitoring for 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 already on site, as well as those that are introduced to the site by the construction activities. 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 additional Invasive Alien Plant Species are recorded on site, an immediate response of locating the site for future monitoring and either hand-pulling the weeds or an application of a suitable herbicide (where permissible only) should be planned. It is, however, better to monitor regularly and act swiftly than to allow invasive alien plants to become established on site.

3.2. 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 of 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 use of chemicals are not recommended for any wetland areas. Herbicides should be applied directly to the plant and not to the soil. 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.

3.3. General Clearing and Guiding Principles

Alien species control programmes are long-term management projects and should consist of 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 won't 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 alien species 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 so that the clearing methods used do not encourage further invasion and that they are appropriate to the specific species of concern. As such, regardless of the methods used, disturbance to the soil should be kept to a minimum.

Fire should not be used for alien species control or vegetation management at the site. The best-practice clearing method for each species identified should be used.

» **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 a 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 plant 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.
- The use of chemicals is not recommended for wetland areas.

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 Environment, Forestry and Fisheries.

» **Biological control**

Biological weed control consists of 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 plant's 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 Environment, Forestry and Fisheries (DEFF) can be contacted.

3.4. General management practices

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

- Establish an on-going monitoring programme for the construction phase to detect and quantify any alien species that may become established.
- Alien vegetation regrowth on areas disturbed by construction must be immediately controlled.
- 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 herbicides break down on contact with the soil. Residual herbicides should not be used.
- 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 regrow, 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 plant 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. 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 plant 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 alien plants identified should be cleared using appropriate means.

3.5. Monitoring

In order to assess 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 plant invasion on site, as well as an assessment of the efficacy 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 should be implemented to ensure management of alien invasive plant species.

Construction Phase

Monitoring Action	Indicator	Timeframe
Document alien species present at the site	List of alien plant species	Preconstruction Monthly during Summer and Autumn 3 Monthly during Winter and Spring
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document and record alien plant control measures implemented	Record of clearing activities	3 Monthly

Operation Phase

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

APPENDIX D:
RE-VEGETATION AND HABITAT REHABILITATION PLAN

REVEGETATION AND REHABILITATION PLAN

1. PURPOSE

The purpose of the Revegetation and Rehabilitation Plan is to ensure that areas cleared or impacted during construction activities within the development footprint for the Wind Garden Wind Farm, and that are not required for operation, are rehabilitated to their original state before the operation phase commences, and that the risk of erosion from these areas is reduced. The purpose of the Rehabilitation Plan for the site can be summarised as follows:

- Achieve long-term stabilisation of all disturbed areas.
- Re-vegetate all disturbed areas with suitable local plant species.
- Minimise visual impact of disturbed areas.
- Ensure that disturbed areas are rehabilitated to a condition similar to that found prior to disturbance.

This Revegetation and Rehabilitation Plan must be read in conjunction with other relevant site-specific plans. Prior to the commencement of construction, a detailed Revegetation and Rehabilitation Plan and Method Statement for the site must be compiled with the aid of a suitably qualified and professionally registered specialist (with a botanical or equivalent qualification).

2. RELEVANT ASPECTS OF THE SITE

The majority of the Wind Garden Wind Farm project site is mapped as falling within the Albany Broken Veld and Bhisho Thornveld vegetation types, with a smaller proportion of Kowie Thicket in the north of the site. All three of these vegetation types are classified as Least Threatened and have not experienced a high degree of transformation.

Based on the SANBI POSA records for the site and surrounding area, 14 species of conservation concern are potentially present. While the majority of these species are associated with the wetter fynbos and high elevation grasslands that occur towards Makhanda, there are several that potentially occur within the project site and development envelope. Although none of these species were observed within the site, such species are by their nature rare and their presence within the site cannot be completely excluded. Species of concern that are potentially present include *Brachystelma luteum* (VU), *Eriospermum bracteatum* (VU), *Apodolirion macowanii* (VU), *Ornithogalum britteniae* (VU) and *Agathosma bicornuta* (EN). These listed species are all known from outside of the project site and there are currently no known populations from within the project site.

3. REHABILITATION METHODS AND PRACTISES

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

- Clearing of invaded areas must be conducted as per the Alien Management Plan, included in the EMPr.
- No harvesting of vegetation may be undertaken outside the area to be disturbed by construction activities.
- Indigenous plant material must be kept separate from alien material.

- Indigenous seeds may be harvested for purposes of revegetation in areas that are free of alien invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites.
- Topsoil must be reserved wherever possible on site, to be utilised during rehabilitation.
- Sods used for revegetation must be obtained directly from the site, but not from the sensitive areas. Sods must contain at least a 50mm topsoil layer and be minimally disturbed, in particular to existing root systems. Sods must ideally be obtained from areas as close as possible to the region that is to be rehabilitated.
- Water used for the irrigation of re-vegetated areas must be free of chlorine and other pollutants that might have a detrimental effect on the plants.
- All seeded, planted or sodded grass areas and all shrubs or trees planted are to be irrigated at regular intervals.
- 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 must be pegged down to ensure that it captures soil and organic matter flowing over the surface.
- The final rehabilitated area must resemble the current composition and structure of the soil as far as practicably possible.
- Progressive rehabilitation is an important element of the rehabilitation strategy and must be implemented where feasible.
- No construction equipment, vehicles or unauthorised personnel must be allowed onto areas that have been rehabilitated.
- Where rehabilitation sites are located within actively grazed areas, they must be fenced off, this must be undertaken in consultation with the landowner.
- Any runnels, erosion channels or wash-aways developing after revegetation must be backfilled and consolidated and the areas restored to a proper stable condition.
- Re-vegetated areas must be monitored frequently and prepared and revegetation from scratch should inadequate signs of surface coverage or grown be evident after two growth seasons. Adequate recovery must be assessed by a qualified botanist or rehabilitation specialist.
- The stockpiled vegetation from the clearing operations must be reduced to mulch where possible and retained along with topsoil to encourage seedbank regrowth and soil fertility.
- Mulches must be collected in such a manner as to restrict the loss of seed.
- Mulch must be stored for as short a period as possible.
- 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.
- Where herbicides are used to clear vegetation, species-specific chemicals must be applied to individual plants only. General spraying must be strictly prohibited, and only the correct herbicide type must be applied.
- Once rehabilitated, areas must be protected to prevent trampling and erosion.
- Fencing must be removed once a sound vegetative cover has been achieved.

4. MONITORING AND FOLLOW-UP ACTION

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of rehabilitated areas. During the construction phase, the Environmental Officer (EO) and EPC Contractor will be responsible for initiating and maintaining a suitable

monitoring system. Once the development is operational, the Developer will need to identify a suitable entity that will be able to take over and maintain the monitoring cycle and initiate adaptive management as soon as it is required. Monitoring personnel must be adequately trained.

The following are the minimum criteria that must be monitored:

» Associated nature and stability of surface soils.
» Re-emergence of alien and invasive plant species. If noted, remedial action must be taken immediately, as per the alien management plan and mitigation measures contained within the EMPr.

Rehabilitation success, monitoring and follow-up actions are important to achieve the desired cover and soil protection. The following monitoring protocol is recommended:

» Rehabilitation areas must be monitored every 4 months for the first 12 months following construction, or as per the recommendations of specialist.
» 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 timeframe between construction activities and rehabilitation must be minimised. Phased construction and progressive rehabilitation, where practically possible, are therefore important elements of the erosion control and rehabilitation strategy.
» Any areas showing erosion, must be adaptively managed with particular erosion control measures, depending on the situation.

If the current state of the environment prior to construction (which will be disturbed during the construction phase) is not achieved post impact, within the specified rehabilitation period, maintenance of these areas must continue until an acceptable state is achieved (excluding alien plant species or weeds). Additional rehabilitation methods may be necessary to achieve the current state before construction commences.

Monitoring of the rehabilitation success, as well as follow-up adaptive management, combined with the clearing of emerging alien plant species must all continue for as long as is considered necessary, depending on regrowth rates.

APPENDIX E:
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 mitigations included in the Environmental Management Programme (EMPr) to reduce the impact of the development of the wind farm and associated infrastructure on listed and protected plant species and their habitats during construction and operation. This subplan is required in order to ensure compliance with national and provincial legislation for vegetation clearing and any required destruction or translocation of provincially and nationally protected species within the footprint of the development.

The Plan first provides some legislative background on the regulations relevant to listed and protected species, under the Nature and Environmental Conservation Ordinance (Act 19 of 1974) and trees protected under the National List of Protected Tree Species. This is followed by an identification of protected species present within the development footprint and actions that should be implemented to minimise impact on these species and comply with legislative requirements.

2. IDENTIFICATION OF SPECIES OF CONSERVATION CONCERN

Plant species are protected at the national level as well as the provincial level and different permits may be required for different species depending on their protection level. At the national level, protected trees are listed by DEFF under the National List of Protected Trees, which is updated on a regular basis. Any clearing of nationally protected trees requires a permit from DAFF. At the provincial level, all species red-listed under the Red List of South African plants (http://redlist.sanbi.org/) as well as species listed under the Nature and Environmental Conservation Ordinance (Act 19 of 1974) are protected and require provincial permits. The Nature and Environmental Conservation Ordinance (Act 19 of 1974) lists a variety of species as protected.

3. IDENTIFICATION OF LISTED SPECIES

In this section, the listed species observed to occur within the broader area are identified and listed below.

Based on the SANBI POSA records for the site and surrounding area, 14 species of conservation concern are potentially present. These are listed below and while the majority of these species are associated with the wetter fynbos and high elevation grasslands that occur towards Makhanda, there are several that potentially occur within the project site and development envelope. Although none of these species were observed within the site, such species are by their nature rare and their presence within the site cannot be completely excluded. Species of concern that are potentially present include *Brachystelma luteum* (VU), *Eriospermum bracteatum* (VU), *Apodolirion macowanii* (VU), *Ornithogalum britteniae* (VU) and *Agathosma bicornuta* (EN). These listed species are all known from outside of the project site and there are currently no known populations from within the project site.

Table 1: List of plant species of conservation concern that are known to occur in the wider area around the site and their potential to be present within the site based on their recorded distribution and habitat requirements.

Family	Genus	Species		Subsp.	Status	Comment
Asphodelaceae	*Aloe*	*micracantha*			NT	Restricted to Fynbos. Not likely to occur within the project site.
Iridaceae	*Gladiolus*	*huttonii*			VU	Fynbos and sandy soils only. Not likely to occur within the project site as the required habitat is not present.
Apocynaceae	*Brachystelma*	*luteum*			VU	Occurs in Grahamstown Grassland Thicket, Albany Valley Thicket habitat types. It is associated with rocky grassland and may occur in the south of the project site.
Orchidaceae	*Disa*	*lugens*	var.	*lugens*	VU	Cape Peninsula to Somerset East and Cathcart. Not likely to occur within the project site. Existing observations are from the grasslands near Makhanda.
Ruscaceae	*Eriospermum*	*bracteatum*			VU	Occurs in the Makhanda district within the Grahamstown Grassland Thicket habitat type. Known from two locations and potentially threatened by harvesting for medicinal use, invasive alien plants and crop cultivation. The observation from near the site is along the R350 east of the project site. Potentially present on the site.
Amaryllidaceae	*Apodolirion*	*macowanii*			VU	There is a population on the farm Slaaikraal outside Makhanda. It is possibly more common than collections indicate, as the species is cryptic and easily overlooked. The known locations are east of the project site, but it is possible that it may occur in the south of the site.
Ericaceae	*Erica*	*glumiflora*			VU	Wilderness to East London and extending inland around Makhanda. Associated with Fynbos vegetation and would not occur within the site.
Hyacinthaceae	*Ornithogalum*	*britteniae*			VU	Known from one location on Table Farm near Makhanda. Potentially threatened by trampling by livestock. The known location is outside of the project site. Flat rocky areas in karroid scrub. Possibly present within the south of the site.
Aizoaceae	*Corpuscularia*	*lehmannii*			CR	Coega to Port Elizabeth. Not likely to occur within the project site.
Isoetaceae	*Isoetes*	*wormaldii*			CR	The only known population occurs in a small wetland on a privately owned farm near Makhanda. The observation is from Strowan Farm, well east of the site.
Rutaceae	*Agathosma*	*gonaquensis*			CR	Uitenhage to Port Elizabeth. Not likely to occur within the project site.
Hyacinthaceae	*Lachenalia*	*convallarioides*			CR	Suurberg Quartzite Fynbos. South-facing rocky quartzite outcrops, 17-1800 m. Not likely to occur within the project site.
Anacardiaceae	*Searsia*	*albomarginata*			CR	Known from fewer than 50 mature individuals from an EOO of 27 km². Albany, west of Makhanda. Grassy fynbos in rocky, red sandstone soils. Not likely to occur within the project site.

Family	Genus	Species		Subsp.	Status	Comment
Rutaceae	*Agathosma*	*bicornuta*			EN	Saltaire Karroid Thicket, Grahamstown Grassland Thicket, Albany Bontveld. Transition between grassy fynbos (on Ecca quartz) and Nama Karoo (on Dwyka formation) on south-facing ridges. Potentially occurs in the north of the project site within the areas of Kowie Thicket.

4. MITIGATION & AVOIDANCE OPTIONS

The primary mitigation and avoidance measure that must be implemented at the pre-construction phase is the Pre-construction Walk-Through of the development footprint. This defines which and how many individuals of listed and protected species are found within the development footprint. This information is required for the DEFF and Provincial Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) permits which must be obtained before construction can commence.

Where listed plant species fall within the development footprint and avoidance is not possible, then it may be possible to translocate the affected individuals outside of the development footprint. However, not all species are suitable for translocation. Recommendations in this regard would be made following the walk-through of the facility development footprint before construction, where all listed and protected species within the development footprint will be identified and located.

5. RESCUE AND PROTECTION PLAN

5.1. Pre-construction

» Identification of all listed species which may occur within the site, based on the SANBI POSA database as well as the specialist BA studies for the site and any other relevant literature.
» Before construction commences at the site, the following actions should be taken:
- A walk-through of the final development footprint by a suitably qualified botanist/ecologist to locate and identify all listed and protected species which fall within the development footprint. This should happen during the flowering season at the site.
- A walk-through report following the walk-through which identifies areas where minor deviations to roads and other infrastructure can be made to avoid sensitive areas and important populations of listed species. The report should also contain a full list of localities where listed species occur within the development footprint and the number of affected individuals in each instance, so that this information can be used to comply with the permit conditions required by the relevant legislation. Those species suitable for search as rescue should be identified in the walk-through report.
- A permit to clear the site and relocate species of concern is required from Provincial Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) before construction commences. A tree clearing permit is also required from DEFF to clear protected trees from the site.
- Once the permits have been issued, there should be a search and rescue operation of all listed species that cannot be avoided, which have been identified in the walk-through report as being suitable for search and rescue within the development footprint. Affected individuals should be translocated to a similar habitat outside of the development footprint and marked for monitoring purposes.

5.2. Construction

- Vegetation clearing should take place in a phased manner, so that large cleared areas are not left standing with no activity for long periods of time and pose a wind and water erosion risk. This will require coordination between the contractor and EO, to ensure that the EO is able to monitor activities appropriately.
- All cleared material must be handled according to the Revegetation and Rehabilitation Plan and used to encourage the recovery of disturbed areas.
- EO to monitor vegetation clearing at the site. Any deviations from the plans that may be required should first be checked for listed species by the EO and any listed species present which are able to survive translocation should be translocated to a safe site.
- All areas to be cleared should be demarcated with construction tape, survey markers or similar. All construction vehicles should work only within the designated area.
- Plants suitable for translocation or for use in rehabilitation of already cleared areas should be identified and relocated before general clearing takes place.
- Any listed species observed within the development footprint that were missed during the pre-construction plant sweeps must be translocated to a safe site before clearing commences.
- Many listed species are also sought after for traditional medicine or by collectors and so the EO and ECO must ensure that all staff attend environmental induction training in which the legal and conservation aspects of harvesting plants from the wild are discussed.
- The EO must monitor construction activities in sensitive habitats such as in dune areas carefully to ensure that impacts to these areas are minimised.

5.3. Operation

- Access to the site should be strictly controlled and all personnel entering or leaving the site must be required to sign in and out with the security officers.
- The collecting of plants of their parts must be strictly forbidden and signs stating so must be placed at the entrance gates to the site.

6. MONITORING AND REPORTING REQUIREMENTS

The following reporting and monitoring requirements are recommended as part of the plant rescue and protection plan:

- Pre-construction walk-through report detailing the location and distribution of all listed and protected species. This must include a walk-through of all infrastructure including all new access roads, cables, buildings and the substation. The report must include recommendations of route adjustments where necessary, as well as provide a full account of how many individuals of each listed species will be impacted by the development. Details of plants suitable for search and rescue must also be included.
- Permit applications to DEDEAT and DEFF. This requires the walk-through report as well as the identification and quantification of all listed and protected species within the development footprint. The permit is required before any search and rescue or vegetation clearance can take place. Where large numbers of listed species are affected, a site inspection and additional requirements may be imposed by Provincial Eastern Cape Department of Economic Development, Environmental Affairs and Tourism

(DEDEAT) and/or DEFF as part of the permit conditions. All documentation associated with this process needs to be retained and the final clearing permit must be kept at the site.

- Active daily monitoring of clearing during construction by the EO to ensure that listed species and sensitive habitats are avoided. All incidents must be recorded along with the remedial measures implemented.
- Post-construction monitoring of plants translocated during search and rescue to evaluate the success of the intervention. Monitoring for a year post-transplant should be sufficient to gauge success.

APPENDIX F:
TRAFFIC AND TRANSPORTATION 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 Wind Farm 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 project site is traversed by existing roads, namely the R350, R400 and R344 . In general, the traffic of the area is considered to be low.

3. TRAFFIC AND TRANSPORTATION MANAGEMENT PRINCIPLES

- Prior to the commencement of construction the contractor must develop their own detailed Transport Management Plan (TMP) based on traffic volumes and road carry capacity outlines.
- 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 project 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.
  - Traffic signs used must conform to the National Road Traffic Act and South African National Standards.
  - Appropriate signs must be installed at locations as deemed necessary.
  - Signage must be placed at intersections, speed limit alterations, severe changes in road grading, where road hazards are located and where usual traffic flow changes abruptly.
  - All traffic signs must be obeyed by all staff and visitors on site, without exception.
- The EPC Contractor must review the location of the designated access and will be responsible for ensuring construction travel is limited to designated routes. The entrance of 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 project site and must be maintained until construction is completed on the site.
- Speed limits must be established prior to commencement of construction and enforced for all construction traffic. The following limits are suggested for internal roads:
  - 60 km/hour where sign posted.
  - 40 km/hour where sign posted.
  - 20km/hour around workshop areas, in all car parks and yards.
  - A warning system, penalties or fines must be put in place where speed limits are not adhered to.
- 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.
- Inspect traffic/road signs regularly for cleanliness, condition and appropriateness. Take immediate action to rectify any problems with signage.
- Drivers must have an appropriate valid driver's license and other operation 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.
- A driver must not use the vehicle's horn except on the grounds of safety.
- Drivers of vehicles must always keep to the left and must be observant of other road users.
- Drivers must follow communication procedures and shall where applicable be trained in the correct use of two-way radios.
- Ensure all staff are trained upon entering the site regarding the meaning and correct response to each traffic sign utilised on site.
- All light vehicles must be fitted with a flashing amber strobe or revolving light.
- Persons authorized to operate on site must have a legal valid appropriate code provincial driver's license and competency certificate where applicable.
- No passengers allowed in any construction vehicles. If an assistant is required, they must obtain permission
- Vehicles must be maintained at approved intervals and must be inspected daily before use to ensure safe operation.
- All vehicles must only be used within the design specifications and limits set by the manufacturer.

- All construction vehicles will be used according to the Health & Safety Plan and related Method Statements and/or Risk Assessments.
- Weather and road conditions must be sufficient to allow safe operation to proceed. Head lights must be turned on at all times.
- No vehicle will be driven with any defect that may impact on the safe operation of that vehicle.
- Two-way radios shall only be used for official/work related matters.
- The use of mobile phones while driving a vehicle is prohibited.
- All vehicles shall carry a fire extinguisher (Dry Powder); 2.5kg for light vehicles, 4.5kg for haul trucks and 9kg for machinery.

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.

APPENDIX G:
STORMWATER AND EROSION MANAGEMENT PLAN

WIND GARDEN WIND FARM

Stormwater Management and Erosion Control Report

OCTOBER 2020

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Annexure B – Stormwater Crossing Summary Table

Annexure C – New Stormwater Crossing Detail Drawings

1 Introduction

1.1 Report Framework

Engineering Advice and Services Pty (Ltd) were appointed to provide professional engineering services related to the development of the **Wind Garden** wind farm. This Stormwater Management and Erosion Control Report, is one of such services and forms part of the supporting documentation required for the Environmental Impact Assessments (EIA) and application to DEDEAT, for the Wind Garden wind farm.

This report will highlight:

- stormwater management principles to be implemented, where possible and applicable, in the Project
- erosion control measures to be taken into account and implemented, where possible and applicable, in the project
- the location of stormwater crossings of rivers featuring on the 1:50 000 map within the Wind Garden wind farm
- a preliminary catchment and stormwater runoff analysis for the above
- preliminary stormwater infrastructure proposals to accommodate the stormwater runoff at the above crossings

Stormwater management and erosion control measures are by their nature *interrelated*, as the stormwater management, or lack thereof, has a **direct effect** on the erosion of soils and the natural landscape.

1.2 Initial Scope of Project

The **Wind Garden** wind farm project involves the construction of *up to* 47 wind turbines, dependent on the selected turbine model and size, in an area located north-west of Grahamstown, as depicted in Figure 1 below. The location of the wind turbines, stormwater crossing points along with the proposed spine and access roads may be found in Figure 2 overleaf, in the layout plan.

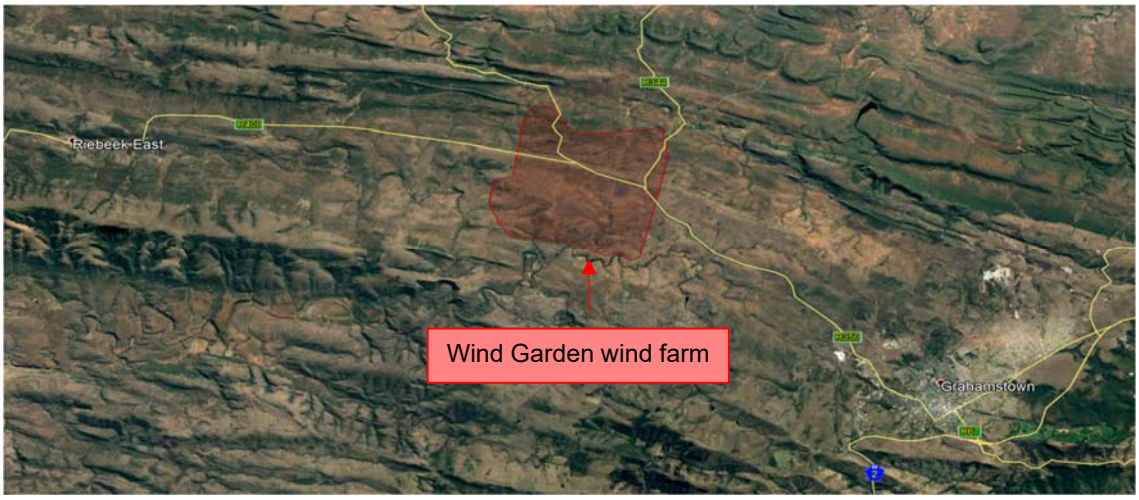


Figure 1 – Wind Garden Wind Farm Locality

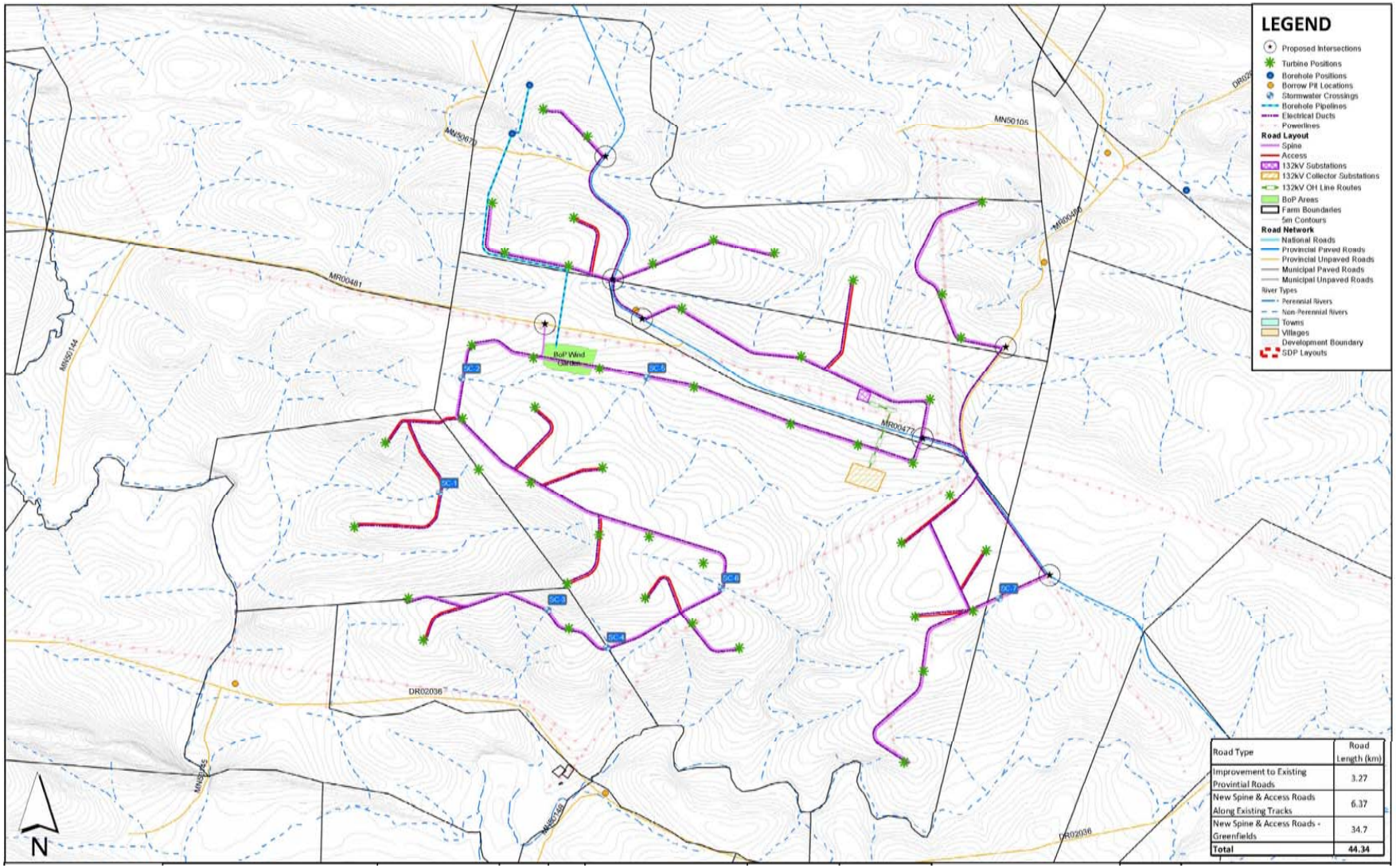


Figure 2 – Wind Garden Layout Plan

2 Stormwater Management

Stormwater planning and management play a vital role in the protection of the natural environment and the new infrastructure to be constructed for the project. Poor stormwater planning can lead to flooding and damage to the wind turbines and associated infrastructure, with significant financial implications.

The spine and access roads for the project will all be gravel roads, which are susceptible to erosion where poor or no stormwater management is implemented. The spine and access roads will play a key role in providing access to the remote turbine sites, and therefore disruptions due to sections of roads being inaccessible must be mitigated.

The Neighbourhood Planning and Design Guide recommends the following objectives should guide the planning and design of stormwater management systems:

a. Minimise the threat of flooding to the area
b. Protect the receiving water bodies in the area
c. Preserve biodiversity in the area
d. Promote the multi-functional use of stormwater management systems
e. Promote the use of the stormwater itself as a water resource
f. Develop sustainable stormwater systems

2.1 Measures to Mitigate Erosion and Flooding due to Stormwater

The following measures should be considered, and where possible and applicable be implemented to prevent stormwater flooding and erosion:

a. Minimise the clearing and grubbing of natural vegetation areas;
b. Minimise the removal of topsoil;
c. When site clearing for construction occurs, the clearing should be limited to the immediate construction operations. Large areas of bare soil can cause soil to be transported via wind and rapidly erode the bare area if left unprotected;
d. Avoid large impervious areas (hard stand areas), which could be left with undisturbed natural vegetation to reduce generated runoff;
e. Maintain natural vegetated buffers and vegetation strips;

f. Erosion and sedimentation into water courses must be minimised through stabilisation, such as gabion baskets and/or reno mattresses, and the re-vegetation of any disturbed riverbanks;
g. Make use of berms and / or contoured landscapes;
h. Make use cut-off drains or berms at the top of cut embankments above roads and platforms;
i. Discharge stormwater runoff as quickly as possible via mitre drains, or other stormwater structures;
j. Use vegetated open channels (grass lined) next to roads to convey stormwater runoff and as a result reduce the discharge velocity of the runoff;
k. Make use of stormwater runoff energy dissipaters in road side drains;
l. The washing and cleaning of plant and equipment should be done at dedicated demarcated areas at the balance of plant / site camp area. Berms or lined ponds should be constructed to prevent excessive soil erosion at the washing areas, and any cement, oils or fuel spillages must be contained and cleared appropriately;
m. In steep areas, such as fill embankments, suitable stormwater structures and restoration of disturbed vegetation must be implemented, to prevent soil erosion and prevent sediment from entering the downstream water courses;
n. Maintain stormwater structures, to ensure that there is no excessive sediment build up.

The Developer will be required to provide suitable stormwater management measures, such as those listed above, and will be required to maintain the stormwater structures for the duration of the operational lifetime of the wind farm.

3 Erosion Control

The control of erosion is inherently connected to the management of stormwater. Lack of, or poor stormwater management will lead to excessive and rapid erosion of soil. Erosion can lead to new unnatural channels being formed, which scar the surface of the natural environment.

The spine and access roads are to be gravel roads, which are not designed to carry runoff along the surface but to rather discharge water from the road surface, as rapidly as possible. If the gravel roads do not discharge the surface water efficiently, regular maintenance shall be required to rectify the issues.

3.1 Soil Erosion Prevention Principles

The following principles should be considered, and where possible and applicable be implemented:

a. Stabilisation of steep slopes;
b. Ensure vegetation is not stripped from areas, especially steep slopes, causing the area to dry out, decrease water infiltration and increase surface runoff;
c. Prevent water on site (rainfall or wastage from construction) from developing into surface flow;
d. Avoid pooling of water on site, particularly if the underlying soils are dispersive, as this can lead to increased infiltration in an area, which may cause the subsurface to erode;
e. Prevent unnecessary compaction by heavy machinery, in areas where compaction is not required. As this will result in less water infiltrating the area, and therefore increasing surface runoff;
f. Ensure compacted areas have adequate drainage systems in place to avoid pooling of water and surface runoff;
g. When dealing with cut and fill slopes, or along roads, prevent concentrated surface runoff;
h. High volume, high velocity runoff generated by hard surface areas should be discharged into appropriately protected areas, such as retention swales or gabion / reno mattress lined areas, to reduce the energy of the runoff;
i. Only clear areas required for construction and limit the clearing of areas adjacent to the construction areas;
j. Ensure vegetation clearing is performed in parallel to construction, in order to minimise surface runoff and the associated erosion;
k. Ensure no diversion of natural water flow paths occurs within the catchments;
l. Implement appropriate dust control measures;
m. Ensure that stormwater / stream crossings do not trap any runoff and therefore create ponding of water.

By implementing sound soil erosion prevention measures, such as those listed above, the Developer can maintain the *status quo* of the natural environment within the project development area, and ensure that the negative impacts associated with soil erosion are mitigated and the natural environment protected.

4 Visual Assessments

Visual assessments were performed on the existing stormwater infrastructure along the existing provincial and district roads, which fell within the study area. The size and type of stormwater structure was recorded, and georeferenced photographs taken.

Figure 3 alongside depicts the condition of the MR00481 Road, at the time of assessment.

Figure 3 – Condition of Road MR00481

Figure 4 alongside, depicts a typical stormwater crossing (pipe culvert), along the MR00481. Note the sediment build-up within the pipe and on the apron of the culvert.

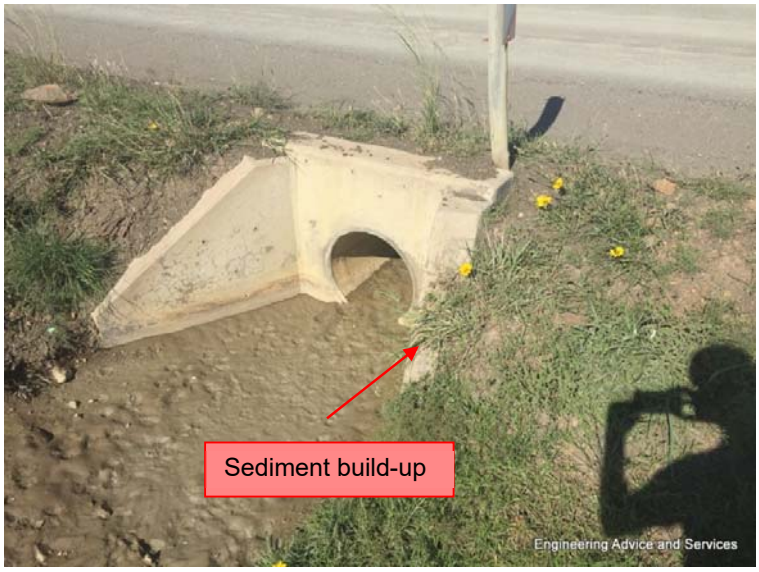


Figure 4 – Typical Stormwater crossing along MR00481

5 Stormwater Crossings

Road access to the proposed wind turbine positions will be via the existing roads, such as the MR00477 and MR00481, and a new internal network of spine and access gravel roads. The route of the internal roads for the project were selected based on the topographical limitations, to have the least negative impact on the natural environment, and to avoid crossing any rivers or streams. Where possible, **existing road tracks** were used for the spine and access roads, to minimise the impact on the natural environment.

Only seven (7) rivers or streams featuring on the 1:50 000 maps are crossed by the proposed roads for the Wind Garden development. The locations of the 7 stormwater crossings are shown in Figure 5 below, along with other information pertaining to the layout of the project. The stormwater crossings are labelled SC1 through to SC7 in Figure 5.

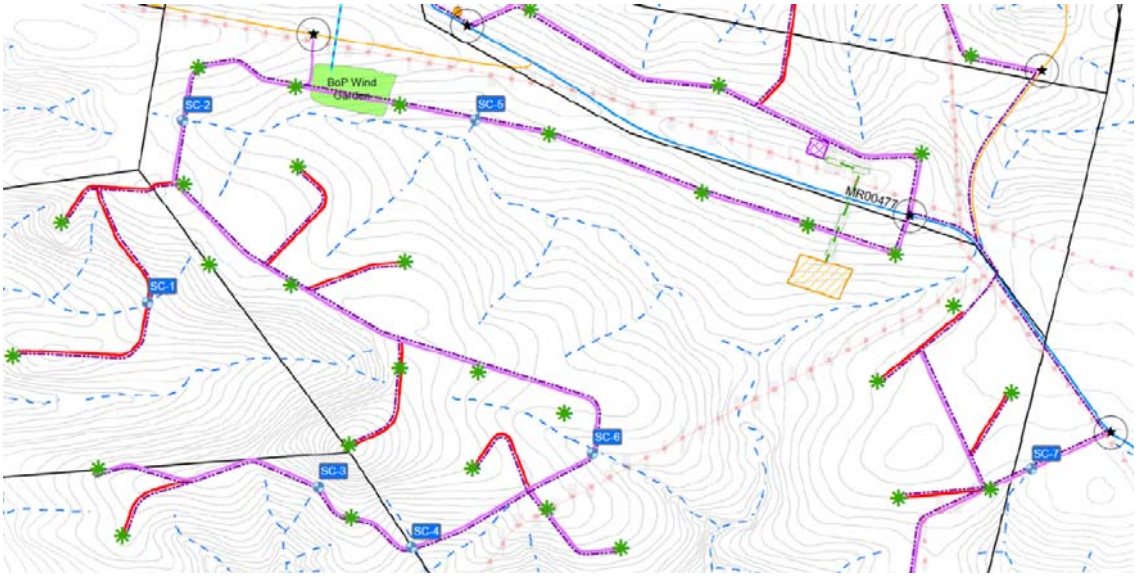
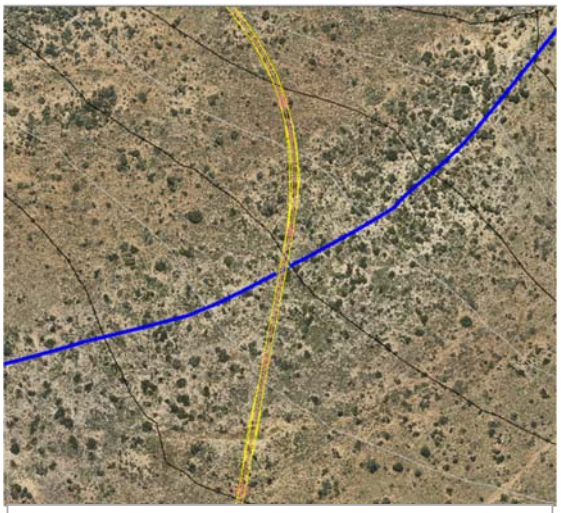


Figure 5 – Stormwater Crossing Locations

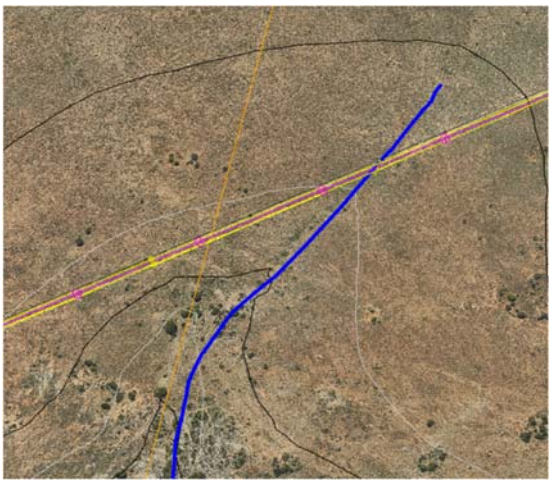
Any work done within the rivers or streams featuring on the 1:50 000 maps will require a Water Use License Application (WULA). All 7 of the identified stormwater crossings will require new infrastructure to be constructed and therefore will require a WULA. None of the existing structures assessed require any remedial work or upgrading and thus were not identified as potential WULA points.

The Figure alongside, and those to follow, are extracts from Civil Designer, of high-resolution satellite imagery, depicting the typical conditions of the 7 stormwater crossings. The blue line in each of the Figures represents the stream or river which the spine or access roads cross, the black and white lines represent 5-meter contours and the yellow lines the road edges.



SC1

In some instances, such as SC3, the road crosses the very edge of the river and the stormwater crossing could be removed if the road alignment is modified to avoid this point. However, at this stage the stormwater crossing has been included and allowed for in the catchment analysis to follow.

	
SC2	SC3
	
SC4	SC5
	
SC6	SC7

Upon inspection of the **7 stormwater crossings**, it can be seen that not all of the stormwater crossings are located within a defined water course, but rather in areas expected to experience sheet flow.

The contours are a good indication of the nature of the stormwater runoff one can expect at the crossing points. For instance, the contours of SC 6 indicate the beginning of a defined channel area, eventually feeding into a ravine area, as depicted below in Figure 6.

Figure 6 – Area downstream of SC 6

Based on the high-resolution satellite imagery of the stormwater crossings, it is anticipated that the stormwater crossings SC4 and SC6 may need special consideration, as the crossings have **sparser vegetation**, and more **distinct bare runoff paths** than the other crossings. This could lead to increased runoff velocities at these points, which could erode away at the natural environment and the proposed spine and access roads at each crossing. A more detailed inspection of the stormwater crossings would be necessary during the detailed design phase.

5.1 Catchment Analysis

Once the locations of the stormwater crossings were identified, the catchment draining to each stormwater crossing was analysed, as described below.

A catchment analysis was performed in Civil Designer for the identified stormwater crossings in the Wind Garden development area.

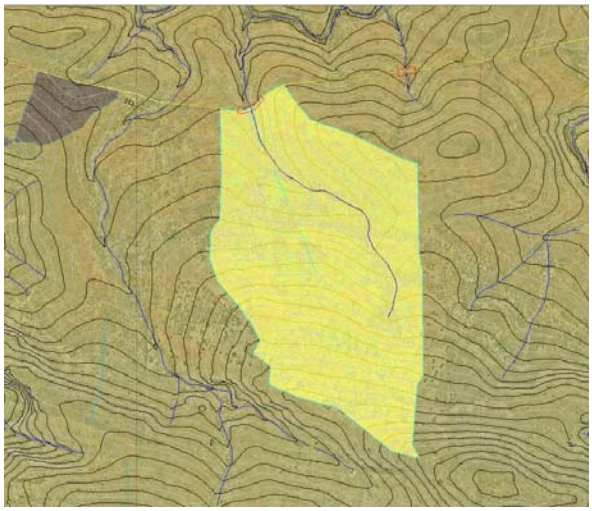


Figure 7 – Example of catchment area

The analysis involved determining the catchment area which drains into the stream or river under consideration, by following the contours of the area and determining the high points or watershed points. The area within these watershed points forms the catchment area, and all runoff within this area will drain into the stream or river under consideration. Figure 7 alongside depicts an example of a catchment area, highlighted in yellow, for one of the rivers featuring on the 1:50 000 map.

The theoretical volume of runoff was determined by means of the Rational Method and the Storm Water Management Model (SWMM) Method. The average theoretical volume of the two methods was used as the theoretical volume of runoff for each catchment area and hence the volume of water passing through each stormwater crossing structure. The Rational Method is the simplest and most commonly used method to determine the volume of stormwater runoff for a small catchment area (<15 km^2) and is well suited for the sizing of stormwater structures. The SWMM method was used to verify the results of the Rational Method, within Civil Designer, as the results from the alternative Rational Method (using Colebrook roughness coefficients) showed no distinct difference in values. Copies of the Rational Method calculations may be found in Annexure A, where the results are in line with those of Civil Designer. These results may not always be identical, due to computational factors within Civil Designer.

In order to determine the volume of runoff with the Rational Method, the Mean Annual Precipitation (MAP) for the area was required. With the town of Grahamstown being in such close proximity to the proposed wind farm, the **MAP value of 466mm** for Grahamstown was used. This are in line with the Mean Annual Precipitation map of South Africa, Figure 8 overleaf, obtained from HRU Report 2/28, A Depth- Duration-Frequency Diagram for Point Rainfall in Southern Africa (1978).

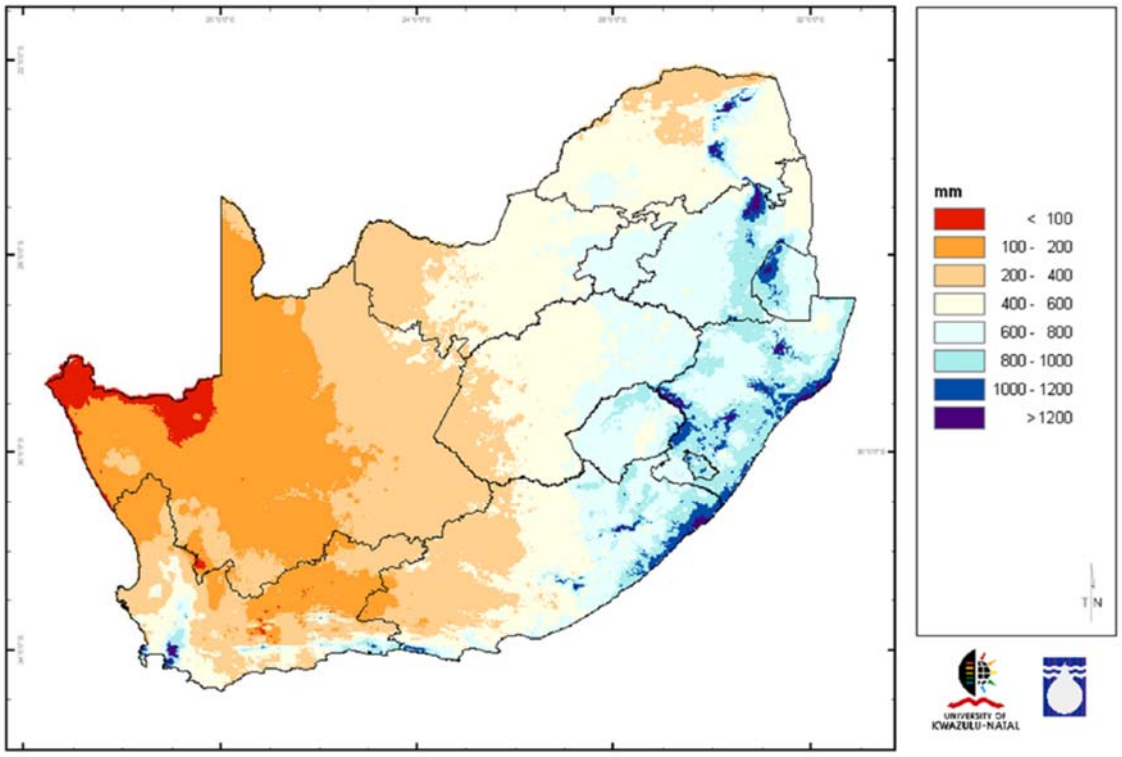


Figure 8 – Mean Annual Precipitation in South Africa (HRU Report 2/28)

Each stormwater crossing was analysed to determine the volume of stormwater runoff passing through the crossing. The stormwater analysis was performed for both a 1:5 and 1:10 year storm recurrence interval and the results of the 2 recurrence intervals compared.

In order to minimise the amount of disruption as a result of flooding and to be able to best control the volume of runoff produced, the preliminary design of the stormwater structures was based on the peak flows as a result of a storm with a 1:10 year recurrence interval.

Table 1 overleaf contains a summary of the catchment analysis results, with proposed stormwater infrastructure for each of the 7 stormwater crossings (WULA Points). A more detailed table may be found under Annexure B.

Table 1 – Catchment Analysis Results

Preliminary Stormwater Runoff Details for Water Use License Application Points								
Stream Crossing Name	**Catchment Area (km^2)**	**Rational Method (Manning) Peak Flows**		**Storm Water Management Model (SWMM) Method Peak Flows**		**Average of Rational and SWMM Methods Peak Flows**		**Preliminary Proposed Stormwater Infrastructure to Accommodate 1:10 year Flood**
		1:5 year flood (m^3/s)	**1:10 year flood (m^3/s)**	**1:5 year flood (m^3/s)**	**1:10 year flood (m^3/s)**	**1:5 year flood (m^3/s)**	**1:10 year flood (m^3/s)**	
SC-1	0.364	1.560	2.156	1.986	2.755	**1.773**	**2.456**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes
SC-2	0.395	1.642	2.236	2.049	2.790	**1.845**	**2.513**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes
SC-3	0.084	0.318	0.432	0.397	0.539	**0.357**	**0.486**	Concrete Lined Causeway
SC-4	0.229	1.176	1.641	1.411	1.970	**1.294**	**1.806**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes
SC-5	0.451	1.920	2.626	2.112	2.888	**2.016**	**2.757**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes
SC-6	0.745	2.901	3.949	3.095	6.311	**2.998**	**5.130**	Concrete Lined Causeway with 7 x 600mm Ø concrete pipes
SC-7	1.225	1.903	2.596	2.764	4.250	**2.334**	**3.423**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes

Figure 9 below, is an extract from the *SANRAL Drainage Manual*, and depicts the different factors which contribute to the overall C Factor in a Rural catchment.

Rural (C_1)					Urban (C_2)	
Component	Classification	Mean annual rainfall (mm)			Use	Factor
		< 600	600 - 900	> 900		
Surface slope (C_s)	Vleis and pans (<3%)	0,01	0,03	0,05	*Lawns*	
	Flat areas (3 to 10%)	0,06	0,08	0,11	- Sandy, flat (<2%)	0,05 – 0,10
	Hilly (10 to 30%)	0,12	0,16	0,20	- Sandy, steep (>7%)	0,15 – 0,20
	Steep areas (>30%)	0,22	0,26	0,30	- Heavy soil, flat (<2%)	0,13 – 0,17
					- Heavy soil, steep (>7%)	0,25 – 0,35
Permeability (C_p)	Very permeable	0,03	0,04	0,05	*Residential areas*	
	Permeable	0,06	0,08	0,10	- Houses	0,30 – 0,50
	Semi-permeable	0,12	0,16	0,20	- Flats	0,50 – 0,70
	Impermeable	0,21	0,26	0,30		
					Industry	
					- Light industry	0,50 – 0,80
Vegetation (C_v)	Thick bush and plantation	0,03	0,04	0,05	- Heavy industry	0,60 – 0,90
	Light bush and farm lands	0,07	0,11	0,15	*Business*	
					- City centre	0,70 – 0,95
	Grasslands	0,17	0,21	0,25	- Suburban	0,50 – 0,70
	No vegetation	0,26	0,28	0,30	- Streets	0,70 – 0,95
					- Maximum flood	1,00

Figure 9 – Runoff Coefficient Factors for the Rational Method

5.2 Stormwater Management Structures

Stormwater pipe diameters, or culvert sizes, are typically larger in the rural environment, when compared to the urban environment, due to high sediment loads. The larger size allows for easier maintenance, which is vital in maintaining the efficiency of a stormwater system, and acts as a safeguard for larger than expected storm events.

At preliminary design stage, there will be three different stormwater road crossing options for the new proposed stormwater crossings, based on the volume of water passing through each stormwater road crossing. These structures shall be:

- Concrete lined causeway
- Vented Concrete lined causeway with 3 x 600mm Ø pipes
- Vented Concrete lined causeway with 7 x 600mm Ø pipes

Each of the three structures will cater for a specific range of volume of water (e.g. 0.1 m^3/s – 1.0 m^3/s) and thus provide uniformity and simplified construction for the stormwater crossings, as opposed to having multiple different structures. Annexure C contains drawings of proposed new stormwater structure drawings. These structures are expected to provide the required capacity to handle the expected volumes of water, allow for overtopping and all the while being cost effective.

6 Spine and Access Roads Construction

The integration between the road and the stormwater drainage system is critical with unsurfaced roads. The drainage function of unsurfaced roads is dependent, and has a significant impact, on the planning of the road and access layout. If the roadway is to be used to channel and drain stormwater runoff, the velocity of this runoff should be such that minimal erosion occurs. Roads with steep gradients should, as far as possible, not be used as drainage ways, nor should any adjacent side drains be used without proper protection against erosion. This protection may include lined channels at critical sections, or regular drainage from the roadway into adjacent natural land, or drains.

Runoff from earth or gravel roads will contain grit and its conveyance in pipes can eventually block or damage the pipe network. Such blockages are difficult to clear, and if maintenance is not regularly performed, it will render the network ineffective. Therefore, larger pipe diameters should me made use of, to allow for ease of maintenance.

The longitudinal grade of the spine and access roads was limited to a maximum vertical grade equal of 8%. This is to ensure that the heavy vehicles are able to safely navigate the spine and access roads, while transporting turbine components to the turbine locations, as well as to minimise the amount of erosion occurring on the road surface.

The spine and access roads, within Wind Garden, are designed to **not carry stormwater runoff**, but to rather discharge runoff from the road surface as quickly as possible. This shall be achieved with a 3.5% camber, coupled with side drains, as depicted below in Figure 10.

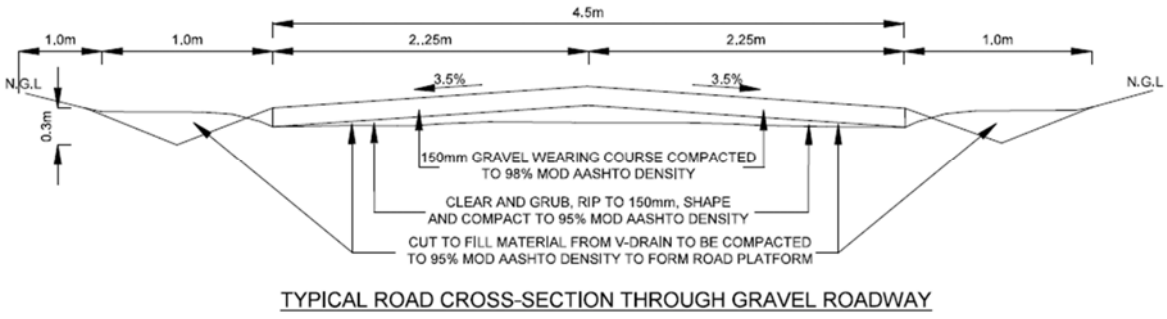


Figure 10 – Typical Gravel Road Cross Section

The side drains shall convey the runoff discharged from the road surface, and discharge the runoff at an appropriate velcoity into the adjacent environment, via mitre drains. If required, and as stated within the stormwater management principles, the side drains may be grass lined to prevent excessive erosion, and to decrease the runoff velocity. In extreme cases, where the runoff velocites are high, the drains should incorporate dissipators in the form of rip-rap or reno matresses.

7 Platform Construction

The crane platforms must have an appropriate load bearing capacity and fitness for use throughout the period of use considering the applicable loads. They must remain usable and their load-bearing capacity maintained even during heavy rainfall. Furthermore, the platforms must enable the safe assembly and erection of the turbine components.

For the platform area, a clear area of approximately 68.5m length x 35.5m width (excl. road area) was incorporated in the roadway design at each of the proposed platform positions. Over this length, a maximum longitudinal gradient of approximately 1% was maintained in the design. The platforms, where possible, were positioned parallel to the contours. By positioning the platforms in this manner, the amount of cut and fill material was kept to a minimum, and the grade over which the stormwater runoff will travel shall also be minimised, thus reducing the velocity of the runoff and reducing the amount or rate of erosion. Figure 11 below depicts a typical turbine platform layout.

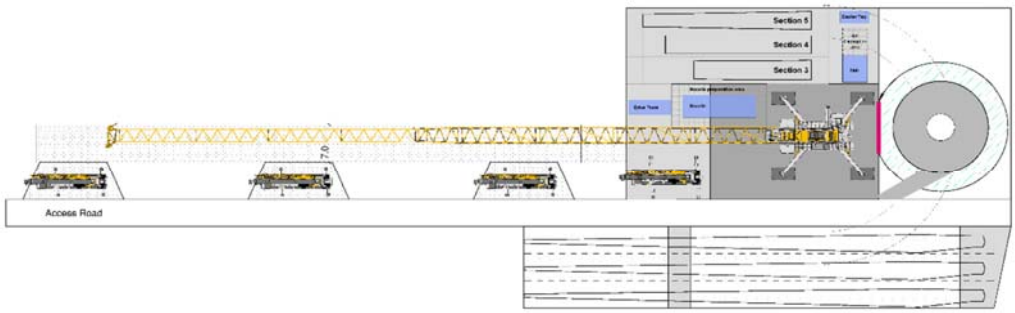


Figure 11 – Typical turbine platform layout

8 Conclusion and Recommendations

This Stormwater Management and Erosion Control Report forms an integral part of the supportive documentation required for the Environmental Impact Assessments (EIA) and application to DEDEAT.

The principles listed within Section 2.1 and Section 3.1, and those discussed elsewhere within this report, are recommended to be used during the detail design phase for Wind Garden, in order to mitigate the negative impacts of stormwater flooding and erosion as a result of stormwater.

Annexure A – Rational Method Calculation sheets

RATIONAL METHOD

Description of the catchment	Wind Garden							
River details	SC 1							
Calculated by	EAS				Date	15/10/2020		

Physical characteristics

Size of the catchment (A)	0.364	km^2		Rainfall region	Summer
Longest watercourse (L)	0.591	km		**Area distribution factors**	
Average slope (S_{av})	0.096	m/m		Rural (α)	1
Dolomite area ($D_{\%}$)	0	%		Urban (β)	0
Mean annual rainfall (MAP)	466	mm		Lakes (γ)	0

Rural				**Urban**			
Surface slope	%	Factor	C_s	**Description**	%	Factor	C_2
Vleis and pans (<3%)	10.00%	0.01	0.001	**Lawns**			
Flat areas (3% to 10%)	75.00%	0.06	0.045	Sandy, flat (<2%)	0.00%	0	0.000
Hilly (10% to 30%)	15.00%	0.12	0.018	Sandy, steep (>7%)	0.00%	0	0.000
Steep areas (>30%)	0.00%	0.22	0.000	Heavy soil, flat (<2%)	0.00%	0	0.000
Total	100.00%		**0.064**	Heavy soil,steep (>7%)	0.00%	0	0.000
Permeability	%	Factor	C_p	**Residential area**			
Very permeable	15.00%	0.03	0.005	Houses	0.00%	0	0.000
Permeable	50.00%	0.06	0.030	Flats	0.00%	0	0.000
Semi-permeable	30.00%	0.12	0.036	**Industry**			
Impermeable	5.00%	0.21	0.011	Light industry	0.00%	0	0.000
Total	100.00%		**0.081**	Heavy industry	0.00%	0	0.000
Vegetation	%	Factor	C_v	**Business**			
Thick bush & plantation	5.00%	0.03	0.002	City centre	0.00%	0	0.000
Light bush and farmlands	15.00%	0.07	0.011	Suburban	0.00%	0	0.000
Grasslands	70.00%	0.17	0.119	Streets	0.00%	0	0.000
No vegetation	10.00%	0.26	0.026	Maximum flood		0	
Total	100.00%		**0.157**	Total	0		**0.000**

Time of concentration (T_c)

Overland flow			**Defined watercourse**		
$Tc = 0.604 \left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$			$Tc = \left(\frac{0.87L^2}{1000S_{av}}\right)^{0.385}$		
Tc =	0.465	hours	Tc =	0.109	hours

Notes

Run-off coefficient

Return period (years), T	2	5	10	20	50	100	Max
Run-off coefficient C_1 ($C_1 = C_s + C_p + C_v$)		0.302	0.302				0.302
Adjusted for dolomitic areas, C_{1D} ($=C_1 (1 - D_{\%}) + C1\ D_{\%}(\sum(D_{factor} \times C_{S\%}))$)		0.302	0.302				0.302
Adjustment factor for initial saturation, F_t		0.55	0.6				0.600
Adjusted run-off coefficient, C_{1T} ($= C_{1D} \times F_t$)		0.166	0.181				0.181
Combined run-off coefficient C_t ($= \alpha C_{1T} + \beta_{C2} + \gamma_{C3}$)		0.166	0.181				0.181

Rainfall

Return period (years), T	2	5	10	20	50	100	Max
Point rainfall (mm), P_T		10.14	12.87				12.87
Point intensity (mm/hour), P_{IT} ($= P_T / T_C$)		93.00	118.00				118.00

Peak flow

Return period (years), T	2	5	10	20	50	100	Max
Peak flow (m3/s) $Q_T = \frac{C_T I_T A}{3.6}$		**1.561**	**2.160**				**2.160**

RATIONAL METHOD

Description of the catchment	Wind Garden				
River details	SC2				
Calculated by	EAS		Date	15/10/2020	

Physical characteristics

Size of the catchment (A)	0.395	km^2	Rainfall region	Summer
Longest watercourse (L)	0.975	km	**Area distribution factors**	
Average slope (S_{av})	0.033	m/m	Rural (α)	1
Dolomite area ($D_{\%}$)	0	%	Urban (β)	0
Mean annual rainfall (MAP)	466	mm	Lakes (γ)	0

Rural

Surface slope	%	Factor	C_s
Vleis and pans (<3%)	15.00%	0.01	0.002
Flat areas (3% to 10%)	70.00%	0.06	0.042
Hilly (10% to 30%)	15.00%	0.12	0.018
Steep areas (>30%)	0.00%	0.22	0.000
Total	100.00%		**0.062**

Permeability	%	Factor	C_p
Very permeable	20.00%	0.03	0.006
Permeable	50.00%	0.06	0.030
Semi-permeable	20.00%	0.12	0.024
Impermeable	10.00%	0.21	0.021
Total	100.00%		**0.081**

Vegetation	%	Factor	C_v
Thick bush & plantation	5.00%	0.03	0.002
Light bush and farmlands	20.00%	0.07	0.014
Grasslands	60.00%	0.17	0.102
No vegetation	15.00%	0.26	0.039
Total	100.00%		**0.157**

Urban

Description	%	Factor	C_2
Lawns			
Sandy, flat (<2%)	0.00%	0	0.000
Sandy, steep (>7%)	0.00%	0	0.000
Heavy soil, flat (<2%)	0.00%	0	0.000
Heavy soil,steep (>7%)	0.00%	0	0.000
Residential area			
Houses	0.00%	0	0.000
Flats	0.00%	0	0.000
Industry			
Light industry	0.00%	0	0.000
Heavy industry	0.00%	0	0.000
Business			
City centre	0.00%	0	0.000
Suburban	0.00%	0	0.000
Streets	0.00%	0	0.000
Maximum flood		0	
Total	0		**0.000**

Time of concentration (T_c)

Overland flow

$$Tc = 0.604 \left(\frac{rL}{\sqrt{S_{av}}} \right)^{0.467}$$

Tc = 0.755 hours

Defined watercourse

$$Tc = \left(\frac{0.87 L^2}{1000 S_{av}} \right)^{0.385}$$

Tc = 0.242 hours

Notes

Run-off coefficient

Return period (years), T	2	5	10	20	50	100	Max
Run-off coefficient C_1 ($C_1 = C_s + C_p + C_v$)		0.299	0.299				0.299
Adjusted for dolomitic areas, C_{1D} ($=C_1 (1 - D_{\%}) + C1\ D_{\%}(\sum(D_{factor} \times C_{S\%}))$)		0.299	0.299				0.299
Adjustment factor for initial saturation, F_t		0.55	0.6				0.600
Adjusted run-off coefficient, C_{1T} ($= C_{1D} \times F_t$)		0.164	0.179				0.179
Combined run-off coefficient C_t ($= \alpha C_{1T} + \beta_{C2} + \gamma_{C3}$)		0.164	0.179				0.179

Rainfall

Return period (years), T	2	5	10	20	50	100	Max
Point rainfall (mm), P_T		22.50	28.55				28.55
Point intensity (mm/hour), P_{IT} ($= P_T / T_C$)		93.00	118.00				118.00

Peak flow

Return period (years), T	2	5	10	20	50	100	Max
Peak flow (m3/s) $Q_T = \frac{C_T I_T A}{3.6}$		**1.680**	**2.325**				**2.325**

RATIONAL METHOD

Description of the catchment	Wind Garden							
River details	SC 3							
Calculated by	EAS					Date	15/10/2020	

Physical characteristics

Size of the catchment (A)	0.084	km^2		Rainfall region	Summer
Longest watercourse (L)	0.280	km		**Area distribution factors**	
Average slope (S_{av})	0.242	m/m		Rural (α)	1
Dolomite area ($D_{\%}$)	0	%		Urban (β)	0
Mean annual rainfall (MAP)	466	mm		Lakes (γ)	0

Rural				**Urban**			
Surface slope	%	Factor	C_s	**Description**	%	Factor	C_2
Vleis and pans (<3%)	0.00%	0.01	0.000	**Lawns**			
Flat areas (3% to 10%)	60.00%	0.06	0.036	Sandy, flat (<2%)	0.00%	0	0.000
Hilly (10% to 30%)	40.00%	0.12	0.048	Sandy, steep (>7%)	0.00%	0	0.000
Steep areas (>30%)	0.00%	0.22	0.000	Heavy soil, flat (<2%)	0.00%	0	0.000
Total	100.00%		**0.084**	Heavy soil,steep (>7%)	0.00%	0	0.000
Permeability	%	Factor	C_p	**Residential area**			
Very permeable	15.00%	0.03	0.005	Houses	0.00%	0	0.000
Permeable	60.00%	0.06	0.036	Flats	0.00%	0	0.000
Semi-permeable	25.00%	0.12	0.030	**Industry**			
Impermeable	0.00%	0.21	0.000	Light industry	0.00%	0	0.000
Total	100.00%		**0.071**	Heavy industry	0.00%	0	0.000
Vegetation	%	Factor	C_v	**Business**			
Thick bush & plantation	5.00%	0.03	0.002	City centre	0.00%	0	0.000
Light bush and farmlands	20.00%	0.07	0.014	Suburban	0.00%	0	0.000
Grasslands	60.00%	0.17	0.102	Streets	0.00%	0	0.000
No vegetation	15.00%	0.26	0.039	Maximum flood		0	
Total	100.00%		**0.157**	Total	0		**0.000**

Time of concentration (T_c)

Overland flow			**Defined watercourse**		
$Tc = 0.604 \left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$			$Tc = \left(\frac{0.87L^2}{1000S_{av}}\right)^{0.385}$		
Tc =	0.265	hours	Tc =	0.043	hours

Notes

Run-off coefficient

Return period (years), T	2	5	10	20	50	100	Max
Run-off coefficient C_1 ($C_1 = C_s + C_p + C_v$)		0.311	0.311				0.311
Adjusted for dolomitic areas, C_{1D} ($=C_1 (1 - D_{\%}) + C1\ D_{\%}(\sum(D_{factor} \times C_{S\%}))$)		0.311	0.311				0.311
Adjustment factor for initial saturation, F_t		0.55	0.6				0.600
Adjusted run-off coefficient, C_{1T} ($= C_{1D} \times F_t$)		0.171	0.187				0.187
Combined run-off coefficient C_t ($= \alpha C_{1T} + \beta_{C2} + \gamma_{C3}$)		0.171	0.187				0.187

Rainfall

Return period (years), T	2	5	10	20	50	100	Max
Point rainfall (mm), P_T		4.00	5.07				5.07
Point intensity (mm/hour), P_{IT} ($= P_T / T_C$)		93.00	118.00				118.00

Peak flow

Return period (years), T	2	5	10	20	50	100	Max
Peak flow (m3/s) $Q_T = \frac{C_T I_T A}{3.6}$		**0.369**	**0.511**				**0.511**

RATIONAL METHOD

Description of the catchment	Wind Garden				
River details	SC 4				
Calculated by	EAS		Date	15/10/2020	

Physical characteristics

Size of the catchment (A)	0.229	km^2	Rainfall region	Summer
Longest watercourse (L)	0.657	km	**Area distribution factors**	
Average slope (S_{av})	0.152	m/m	Rural (α)	1
Dolomite area ($D_{\%}$)	0	%	Urban (β)	0
Mean annual rainfall (MAP)	466	mm	Lakes (γ)	0

Rural				**Urban**			
Surface slope	%	Factor	C_s	**Description**	%	Factor	C_2
Vleis and pans (<3%)	5.00%	0.01	0.001	**Lawns**			
Flat areas (3% to 10%)	60.00%	0.06	0.036	Sandy, flat (<2%)	0.00%	0	0.000
Hilly (10% to 30%)	30.00%	0.12	0.036	Sandy, steep (>7%)	0.00%	0	0.000
Steep areas (>30%)	5.00%	0.22	0.011	Heavy soil, flat (<2%)	0.00%	0	0.000
Total	100.00%		**0.084**	Heavy soil,steep (>7%)	0.00%	0	0.000
Permeability	%	Factor	C_p	**Residential area**			
Very permeable	10.00%	0.03	0.003	Houses	0.00%	0	0.000
Permeable	50.00%	0.06	0.030	Flats	0.00%	0	0.000
Semi-permeable	30.00%	0.12	0.036	**Industry**			
Impermeable	10.00%	0.21	0.021	Light industry	0.00%	0	0.000
Total	100.00%		**0.090**	Heavy industry	0.00%	0	0.000
Vegetation	%	Factor	C_v	**Business**			
Thick bush & plantation	10.00%	0.03	0.003	City centre	0.00%	0	0.000
Light bush and farmlands	20.00%	0.07	0.014	Suburban	0.00%	0	0.000
Grasslands	60.00%	0.17	0.102	Streets	0.00%	0	0.000
No vegetation	10.00%	0.26	0.026	Maximum flood		0	
Total	100.00%		**0.145**	Total	0		**0.000**

Time of concentration (T_c)

Overland flow			**Defined watercourse**		
$Tc = 0.604 \left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$			$Tc = \left(\frac{0.87L^2}{1000S_{av}}\right)^{0.385}$		
Tc =	0.440	hours	Tc =	0.099	hours

Notes

Run-off coefficient

Return period (years), T	2	5	10	20	50	100	Max
Run-off coefficient C_1 ($C_1 = C_s + C_p + C_v$)		0.319	0.319				0.319
Adjusted for dolomitic areas, C_{1D} ($=C_1 (1 - D_{\%}) + C1\ D_{\%}(\sum(D_{factor} \times C_{S\%}))$)		0.319	0.319				0.319
Adjustment factor for initial saturation, F_t		0.55	0.6				0.600
Adjusted run-off coefficient, C_{1T} ($= C_{1D} \times F_t$)		0.175	0.191				0.191
Combined run-off coefficient C_t ($= \alpha C_{1T} + \beta_{C2} + \gamma_{C3}$)		0.175	0.191				0.191

Rainfall

Return period (years), T	2	5	10	20	50	100	Max
Point rainfall (mm), P_T		9.23	11.71				11.71
Point intensity (mm/hour), P_{IT} ($= P_T / T_C$)		93.00	118.00				118.00

Peak flow

Return period (years), T	2	5	10	20	50	100	Max
Peak flow (m3/s) $Q_T = \frac{C_T I_T A}{3.6}$		**1.036**	**1.434**				**1.434**

RATIONAL METHOD

Description of the catchment	Wind Garden						
River details	SC 5						
Calculated by	EAS				Date	15/10/2020	

Physical characteristics

Size of the catchment (A)	0.451	km^2		Rainfall region	Summer
Longest watercourse (L)	0.754	km		**Area distribution factors**	
Average slope (S_{av})	0.036	m/m		Rural (α)	1
Dolomite area ($D_{\%}$)	0	%		Urban (β)	0
Mean annual rainfall (MAP)	466	mm		Lakes (γ)	0

Rural				**Urban**			
Surface slope	%	Factor	C_s	**Description**	%	Factor	C_2
Vleis and pans (<3%)	10.00%	0.01	0.001	**Lawns**			
Flat areas (3% to 10%)	75.00%	0.06	0.045	Sandy, flat (<2%)	0.00%	0	0.000
Hilly (10% to 30%)	15.00%	0.12	0.018	Sandy, steep (>7%)	0.00%	0	0.000
Steep areas (>30%)	0.00%	0.22	0.000	Heavy soil, flat (<2%)	0.00%	0	0.000
Total	100.00%		**0.064**	Heavy soil,steep (>7%)	0.00%	0	0.000
Permeability	%	Factor	C_p	**Residential area**			
Very permeable	15.00%	0.03	0.005	Houses	0.00%	0	0.000
Permeable	50.00%	0.06	0.030	Flats	0.00%	0	0.000
Semi-permeable	30.00%	0.12	0.036	**Industry**			
Impermeable	5.00%	0.21	0.011	Light industry	0.00%	0	0.000
Total	100.00%		**0.081**	Heavy industry	0.00%	0	0.000
Vegetation	%	Factor	C_v	**Business**			
Thick bush & plantation	5.00%	0.03	0.002	City centre	0.00%	0	0.000
Light bush and farmlands	20.00%	0.07	0.014	Suburban	0.00%	0	0.000
Grasslands	65.00%	0.17	0.111	Streets	0.00%	0	0.000
No vegetation	10.00%	0.26	0.026	Maximum flood		0	
Total	100.00%		**0.152**	Total	0		**0.000**

Time of concentration (T_c)

Overland flow			**Defined watercourse**		
$Tc = 0.604 \left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$			$Tc = \left(\frac{0.87L^2}{1000S_{av}}\right)^{0.385}$		
Tc =	0.654	hours	Tc =	0.191	hours

Notes

Run-off coefficient

Return period (years), T	2	5	10	20	50	100	Max
Run-off coefficient C_1 ($C_1 = C_s + C_p + C_v$)		0.297	0.297				0.297
Adjusted for dolomitic areas, C_{1D} ($=C_1 (1 - D_{\%}) + C1\ D_{\%}(\sum(D_{factor} \times C_{S\%}))$)		0.297	0.297				0.297
Adjustment factor for initial saturation, F_t		0.55	0.6				0.600
Adjusted run-off coefficient, C_{1T} ($= C_{1D} \times F_t$)		0.163	0.178				0.178
Combined run-off coefficient C_t ($= \alpha C_{1T} + \beta_{C2} + \gamma_{C3}$)		0.163	0.178				0.178

Rainfall

Return period (years), T	2	5	10	20	50	100	Max
Point rainfall (mm), P_T		17.78	22.56				22.56
Point intensity (mm/hour), P_{IT} ($= P_T / T_C$)		93.00	118.00				118.00

Peak flow

Return period (years), T	2	5	10	20	50	100	Max
Peak flow (m3/s) $Q_T = \frac{C_T I_T A}{3.6}$		**1.903**	**2.634**				**2.634**

RATIONAL METHOD

Description of the catchment	Wind Garden						
River details	SC 6						
Calculated by	EAS				Date	15/10/2020	

Physical characteristics

Size of the catchment (A)	0.745	km^2		Rainfall region	Summer
Longest watercourse (L)	1.255	km		**Area distribution factors**	
Average slope (S_{av})	0.041	m/m		Rural (α)	1
Dolomite area ($D_{\%}$)	0	%		Urban (β)	0
Mean annual rainfall (MAP)	466	mm		Lakes (γ)	0

Rural				**Urban**			
Surface slope	%	Factor	C_s	**Description**	%	Factor	C_2
Vleis and pans (<3%)	5.00%	0.01	0.001	**Lawns**			
Flat areas (3% to 10%)	60.00%	0.06	0.036	Sandy, flat (<2%)	0.00%	0	0.000
Hilly (10% to 30%)	35.00%	0.12	0.042	Sandy, steep (>7%)	0.00%	0	0.000
Steep areas (>30%)	0.00%	0.22	0.000	Heavy soil, flat (<2%)	0.00%	0	0.000
Total	100.00%		**0.079**	Heavy soil,steep (>7%)	0.00%	0	0.000
Permeability	%	Factor	C_p	**Residential area**			
Very permeable	10.00%	0.03	0.003	Houses	0.00%	0	0.000
Permeable	50.00%	0.06	0.030	Flats	0.00%	0	0.000
Semi-permeable	30.00%	0.12	0.036	**Industry**			
Impermeable	10.00%	0.21	0.021	Light industry	0.00%	0	0.000
Total	100.00%		**0.090**	Heavy industry	0.00%	0	0.000
Vegetation	%	Factor	C_v	**Business**			
Thick bush & plantation	10.00%	0.03	0.003	City centre	0.00%	0	0.000
Light bush and farmlands	20.00%	0.07	0.014	Suburban	0.00%	0	0.000
Grasslands	60.00%	0.17	0.102	Streets	0.00%	0	0.000
No vegetation	10.00%	0.26	0.026	Maximum flood		0	
Total	100.00%		**0.145**	Total	0		**0.000**

Time of concentration (T_c)

Overland flow			**Defined watercourse**		
$Tc = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$			$Tc = \left(\frac{0.87L^2}{1000S_{av}}\right)^{0.385}$		
Tc =	0.807	hours	Tc =	0.270	hours

Notes

Run-off coefficient

Return period (years), T	2	5	10	20	50	100	Max
Run-off coefficient C_1 ($C_1 = C_s + C_p + C_v$)		0.314	0.314				0.314
Adjusted for dolomitic areas, C_{1D} ($=C_1 (1 - D_{\%}) + C1\ D_{\%}(\sum(D_{factor} \times C_{S\%}))$)		0.314	0.314				0.314
Adjustment factor for initial saturation, F_t		0.55	0.6				0.600
Adjusted run-off coefficient, C_{1T} ($= C_{1D} \times F_t$)		0.172	0.188				0.188
Combined run-off coefficient C_t ($= \alpha C_{1T} + \beta_{C2} + \gamma_{C3}$)		0.172	0.188				0.188

Rainfall

Return period (years), T	2	5	10	20	50	100	Max
Point rainfall (mm), P_T		25.15	31.92				31.92
Point intensity (mm/hour), P_{IT} ($= P_T / T_C$)		93.00	118.00				118.00

Peak flow

Return period (years), T	2	5	10	20	50	100	Max
Peak flow (m3/s) $Q_T = \frac{C_T I_T A}{3.6}$		**3.316**	**4.590**				**4.590**

RATIONAL METHOD

Description of the catchment	Wind Garden						
River details	SC 7						
Calculated by	EAS				Date	15/10/2020	

Physical characteristics

Size of the catchment (A)	0.516	km^2		Rainfall region	Summer
Longest watercourse (L)	0.647	km		**Area distribution factors**	
Average slope (S_{av})	0.025	m/m		Rural (α)	1
Dolomite area ($D_{\%}$)	0	%		Urban (β)	0
Mean annual rainfall (MAP)	466	mm		Lakes (γ)	0

Rural				**Urban**			
Surface slope	%	Factor	C_s	**Description**	%	Factor	C_2
Vleis and pans (<3%)	20.00%	0.01	0.002	**Lawns**			
Flat areas (3% to 10%)	60.00%	0.06	0.036	Sandy, flat (<2%)	0.00%	0	0.000
Hilly (10% to 30%)	20.00%	0.12	0.024	Sandy, steep (>7%)	0.00%	0	0.000
Steep areas (>30%)	0.00%	0.22	0.000	Heavy soil, flat (<2%)	0.00%	0	0.000
Total	100.00%		**0.062**	Heavy soil,steep (>7%)	0.00%	0	0.000
Permeability	%	Factor	C_p	**Residential area**			
Very permeable	15.00%	0.03	0.005	Houses	0.00%	0	0.000
Permeable	60.00%	0.06	0.036	Flats	0.00%	0	0.000
Semi-permeable	20.00%	0.12	0.024	**Industry**			
Impermeable	5.00%	0.21	0.011	Light industry	0.00%	0	0.000
Total	100.00%		**0.075**	Heavy industry	0.00%	0	0.000
Vegetation	%	Factor	C_v	**Business**			
Thick bush & plantation	10.00%	0.03	0.003	City centre	0.00%	0	0.000
Light bush and farmlands	20.00%	0.07	0.014	Suburban	0.00%	0	0.000
Grasslands	60.00%	0.17	0.102	Streets	0.00%	0	0.000
No vegetation	10.00%	0.26	0.026	Maximum flood		0	
Total	100.00%		**0.145**	Total	0		**0.000**

Time of concentration (T_c)

Overland flow			**Defined watercourse**		
$Tc = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$			$Tc = \left(\frac{0.87L^2}{1000S_{av}}\right)^{0.385}$		
Tc =	0.667	hours	Tc =	0.198	hours

Notes

Run-off coefficient

Return period (years), T	2	5	10	20	50	100	Max
Run-off coefficient C_1 ($C_1 = C_s + C_p + C_v$)		0.282	0.282				0.282
Adjusted for dolomitic areas, C_{1D} ($=C_1 (1 - D_{\%}) + C1\ D_{\%}(\sum(D_{factor} \times C_{S\%}))$)		0.282	0.282				0.282
Adjustment factor for initial saturation, F_t		0.55	0.6				0.600
Adjusted run-off coefficient, C_{1T} ($= C_{1D} \times F_t$)		0.155	0.169				0.169
Combined run-off coefficient C_t ($= \alpha C_{1T} + \beta_{C2} + \gamma_{C3}$)		0.155	0.169				0.169

Rainfall

Return period (years), T	2	5	10	20	50	100	Max
Point rainfall (mm), P_T		18.37	23.31				23.31
Point intensity (mm/hour), P_{IT} ($= P_T / T_C$)		93.00	118.00				118.00

Peak flow

Return period (years), T	2	5	10	20	50	100	Max
Peak flow (m3/s) $Q_T = \frac{C_T I_T A}{3.6}$		**2.066**	**2.860**				**2.860**

Annexure B – Stormwater Crossing Summary Table

Wind Garden

Preliminary Stormwater Runoff Details for Water Use License Application Points

Primary DWA Drainage Region	15: Fish to Tsitsikamma
MAP (mm)	466

Stream Crossing	Stream Crossing Name	Latitude	Longitude	Road Location	Catchment Area (km^2)	Longest Water Path (m)	Time of Concentration (hours)	Rational Method - Manning		Storm Water Management Model (SWMM) Method		Average of Rational and SWMM Methods		Proposed Stormwater Infrastructure to Accommodate 1:10 year Flood
								Peak Flow for 1:5 year Flood (m^3/s)	Peak Flow for 1:10 year Flood (m^3/s)	Peak Flow for 1:5 year Flood (m^3/s)	Peak Flow for 1:10 year Flood (m^3/s)	Peak Flow for 1:5 year Flood (m^3/s)	Peak Flow for 1:10 year Flood (m^3/s)	
1	SC-1	33° 13' 22.9659" S	26° 20' 30.0661" E	Access Road to GE120	0.364	591	0.109	1.560	2.156	1.986	2.755	**1.773**	**2.456**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes
2	SC-2	33° 12' 45.4375" S	26° 20' 38.9835" E	Spine Road to GE63 GE64 GE104	0.395	975	0.242	1.642	2.236	2.049	2.790	**1.845**	**2.513**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes
3	SC-3	33° 14' 01.4619" S	26° 21' 11.8555" E	Spine Road to GE105 GE71 GE94	0.084	280	0.303	0.318	0.432	0.397	0.539	**0.357**	**0.486**	Concrete Lined Causeway
4	SC-4	33° 14' 14.0356" S	26° 21' 34.6718" E	Spine Road to GE105 GE71 GE94	0.229	657	0.099	1.176	1.641	1.411	1.970	**1.294**	**1.806**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes
5	SC-5	33° 12' 45.6670" S	26° 21' 51.1504" E	Spine Road to GE88 GE51 GE48 GE17 GE38	0.451	754	0.191	1.920	2.626	2.112	2.888	**2.016**	**2.757**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes
6	SC-6	33° 13' 54.7272" S	26° 22' 19.3484" E	Spine Road to GE105 GE71 GE94	0.745	1255	0.270	2.901	3.949	3.095	6.311	**2.998**	**5.130**	Concrete Lined Causeway with 7 x 600mm Ø concrete pipes
7	SC-7	33° 13' 54.7272" S	26° 22' 19.3484" E	Spine Road to GE105 GE71 GE95	0.516	647	0.667	1.903	2.596	2.764	4.250	**2.334**	**3.423**	Concrete Lined Causeway with 3 x 600mm Ø concrete pipes

Annexure C – New Stormwater Crossing Detail Drawings

APPENDIX H:
WASTE MANAGEMENT PLAN

WASTE MANAGEMENT PLAN

1. PURPOSE

A Waste Management Plan (WMP) plays a key role in achieving sustainable waste management throughout all phases of the project. The plan prescribes measures for the collection, temporary storage and safe disposal of the various waste streams associated with the project and includes provisions for the recovery, re-use and recycling of waste. The purpose of this plan is therefore to ensure that effective procedures are implemented for the handling, storage, transportation and disposal of waste generated from the project activities on site.

This WMP has been compiled as part of the project EMPr and is based on waste stream information available at the time of compilation. Construction and operation activities must be assessed on an ongoing basis in order to determine the efficacy of the plan and whether further revision of the plan is required. This plan should be updated should further detail regarding waste quantities and categorisation become available, during the construction and/or operation stages.

2. RELEVANT ASPECTS OF THE SITE

It is expected that the development of the Wind Garden Wind Farm will generate construction solid waste, general waste and hazardous waste during the lifetime of the wind farm.

Waste generated on site, originates from various sources, including but not limited to:

- Concrete waste generated from spoil and excess concrete.
- Contaminated water, soil, rocks and vegetation due to hydrocarbon spills.
- Hazardous waste from vehicle, equipment and machinery parts and servicing, fluorescent tubes, used hydrocarbon containers, and waste ink cartridges.
- Recyclable waste in the form of paper, glass, steel, aluminium, wood/ wood pallets, plastic (PET bottles, PVC, LDPE) and cardboard.
- Organic waste from food waste as well as alien and endemic vegetation removal.
- Sewage from portable toilets and septic tanks.
- Inert waste from spoil material from site clearance and trenching works.

3. LEGISLATIVE REQUIREMENTS

Waste in South Africa is currently governed by several regulations, including:

- National Environmental Management: Waste Act (NEM:WA), 2008 (Act 59 of 2008);
- National Environmental Management: Waste Amendment Act, 2014 (Act 26 of 2014);
- The South African Constitution (Act 108 of 1996);
- Hazardous Substances Act (Act 5 of 1973);
- Health Act (Act 63 of 1977);
- Environment Conservation Act (Act 73 of 1989);
- Occupational Health and Safety Act (Act 85 of 1993);
- National Water Act (Act 36 of 1998);
- The National Environmental Management Act (Act 107 of 1998) (as amended);

- Municipal Structures Act (Act 117 of 1998);
- Municipal Systems Act (Act 32 of 2000);
- Mineral and Petroleum Resources Development Act (Act 28 of 2002); and
- Air Quality Act (Act 39 of 2004).

Storage of waste must be conducted in accordance with the National Norms and Standards for the Storage of Waste, published in GNR 926.

4. WASTE MANAGEMENT PRINCIPLES

An integrated approach to waste management is needed on site. Such an approach is illustrated in **Figure 1**.

It is important to ensure that waste is managed with the following objectives in mind during all phases of the project:

- Reducing volumes of waste is the greatest priority;
- If reduction is not feasible, the maximum amount of waste is to be recycled; and
- Waste that cannot be recycled is to be disposed of in the most environmentally responsible manner.

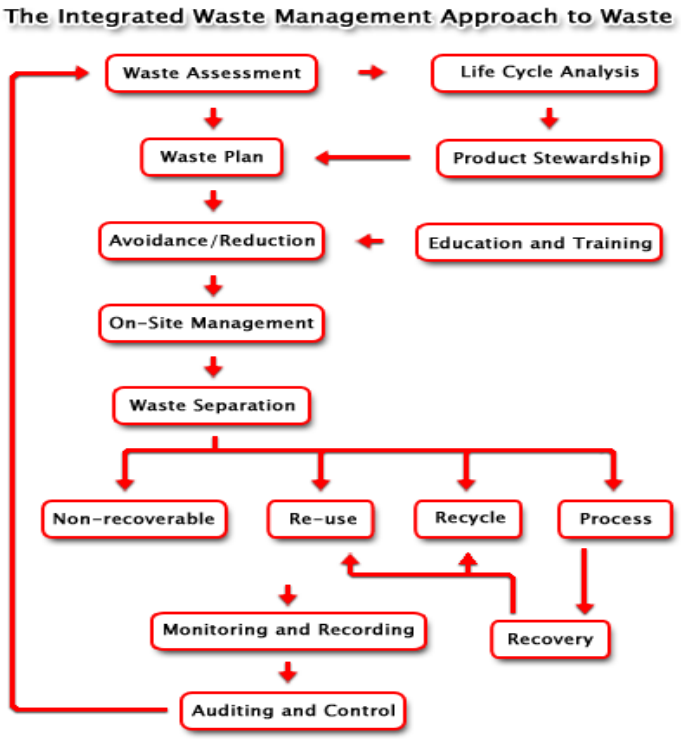


Figure 1: Integrated Waste Management Flow Diagram
(Source: http://www.enviroserv.co.za/pages/content.asp?SectionId=496)

4.1. Construction phase

A plan for the management of waste during the construction phase is detailed below. A Method Statement detailing specific waste management practices during construction should be prepared by the Contractor prior to the commencement of construction, for approval by the Resident Engineer and/or ECO.

4.1.1. Waste Assessment / Inventory

- The Environmental Officer (EO), or designated staff member, must develop, implement and maintain a waste inventory reflecting all waste generated during construction for both general and hazardous waste streams.
- Construction methods and materials should be carefully considered in view of waste reduction, re-use, and recycling opportunities, to be pro-actively implemented.
- Once a waste inventory has been established, targets for the recovery of waste (minimisation, re-use, recycling) should be set.
- The EO must conduct waste classification and rating in terms of SANS 10288 and Government Notice 634 published under the NEM: WA.

4.1.2. Waste collection, handling and storage

- It is the responsibility of the EO to ensure that each subcontractor implements their own waste recycling system, i.e. separate bins for food waste, plastics, paper, wood, glass cardboard, metals, etc. Such practises must be made contractually binding upon appointment of the subcontractors.
- Waste manifests and waste acceptance approvals (i.e. receipts) from designated waste facilities must be kept on file at the site office, in order to record and prove continual compliance for future auditing.
- Septic tanks and portable toilets must be monitored by the EO or responsible subcontractor and maintained regularly. Below ground storage of septic tanks must withstand the external forces of the surrounding environment. The area above the tank must be demarcated to prevent any vehicles or heavy machinery from moving around in the surrounding area.
- Waste collection bins and hazardous waste containers must be provided by the principal contractor and subcontractors and placed at strategic locations around the site for the storage of organic, recyclable and hazardous waste.
- A dedicated waste area must be established on site for the storage of all waste streams before removal from site. The storage period must not trigger listed waste activities as per the NEMWA, GN 921 of November 2013.
- Signage/ colour coding must be used to differentiate disposal areas for the various waste streams (i.e. paper, cardboard, metals, food waste, glass etc.).
- Hazardous waste must be stored within a bunded area constructed according to SABS requirements, and must ensure complete containment of the spilled material in the event of a breach. As such, appropriate bunding material, design, capacity and type must be utilised to ensure that no contamination of the surrounding environment will occur despite a containment breach. The net capacity of a bunded compound in a storage facility should be at least 120% of the net capacity of the largest tank.
- Take into consideration the capacity displaced by other tanks within the same bunded area and any foundations.

- Treat interconnected tanks as a single tank of equivalent total volume for the purposes of the bund design criteria
- The location of all temporary waste storage areas must aim to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control, while being reasonably placed in terms of centrality and accessibility on site. Where required, an additional temporary waste storage area may be designated, provided identical controls are exercised for these locations.
- Waste storage shall be in accordance with all Regulations and best-practice guidelines and under no circumstances may waste be burnt on site.
- A dedicated waste management team must be appointed by the principal contractors' SHE Officer, who will be responsible for ensuring the continuous sorting of waste and maintenance of the area. The waste management team must be trained in all areas of waste management and monitored by the SHE Officer.
- All waste removed from site must be done by a registered/ licensed subcontractor, who must supply information regarding how waste recycling/ disposal will be achieved. The registered subcontractor must provide waste manifests for all removals at least once a month or for every disposal made, records of which must be kept on file at the site camp for the duration of the construction period.

4.1.3. Management of waste storage areas

- The position of all waste storage areas must be located so as to ensure minimal degradation to the environment. The main waste storage area must have a suitable stormwater system separating clean and contaminated stormwater.
- Collection bins placed around the site and at subcontractors' camps (if at a different location than the main site camp) must be maintained and emptied on a regular basis by the principal contractor to avoid overflowing receptacles.
- Inspections and maintenance of the main waste storage area must be undertaken daily. Skips and storage containers must be clearly marked or colour coded and well-maintained. Monitor for rodents and take corrective action if they become a problem.
- Waste must be stored in designated containers and not on the ground.
- Inspections and maintenance of bunds must be undertaken regularly. Bunds must be inspected for leaks or cracks in the foundation and walls.
- It is assumed that any rainwater collected inside the bund is contaminated and must be treated by oil/water separation (or similar method) prior to dewatering, or removed and stored as hazardous waste, and not released into the environment.
- If any leaks occur in the bund, these must be removed immediately.
- Bund systems must be designed to avoid dewatering of contaminated water, but to rather separate oil and hydrocarbons from water prior to dewatering.
- Following rainfall event bunds must always be dewatered in order to maintain a sufficient storage capacity in the event of a breach.
- No mixing of hazardous and general waste is allowed.

4.1.4. Disposal

- Waste generated on site must be removed on a regular basis. This frequency may change during construction depending on waste volumes generated at different stages of the construction process,

however removal must occur prior to the storage capacity being reached to avoid overflow of containers and poor waste storage.
» Waste must be removed by a suitably qualified contractor and disposed of at an appropriately licensed landfill site. Proof of appropriate disposal must be provided by the contractor to the EO and ECO.

4.1.5. Record keeping

The success of the Waste Management Plan is determined by measuring criteria such as waste volumes, cost recovery from recycling and cost of disposal. Recorded data can indicate the effect of training and education, or the need for education. It will provide trends and benchmarks for setting goals and standards. It will provide clear evidence of the success or otherwise of the plan.

» Documentation (waste manifest, certificate of issue or safe disposal) must be kept detailing the quantity, nature, and fate of any regulated waste for audit purposes.
» Waste management must form part of the monthly reporting requirements in terms of volumes generated, types, storage and final disposal.

4.1.6. Training

Training and awareness regarding waste management shall be provided to all employees and contractors as part of the toolbox talks or on-site awareness sessions with the EO and at the frequency as set out by the ECO.

4.2. Operation phase

It is expected that the operation phase will result in the production of limited amounts of general waste consisting mostly of cardboard, paper, plastic, tins, metals and a variety of synthetic compounds. Hazardous wastes (including grease, oils) will also be generated. All waste generated will be required to be temporarily stored at the facility in appropriate sealed containers prior to disposal at a permitted landfill site or other facilities.

The following waste management principles apply during the operation phase:

» The SHE Manager must develop, implement and maintain a waste inventory reflecting all waste generated during operation for both general and hazardous waste streams.
» Adequate waste collection bins at site must be supplied. Separate bins should be provided for general and hazardous waste.
» Recyclable waste must be removed from the waste stream and stored separately.
» All waste must be stored in appropriate temporary storage containers (separated between different operation wastes, and contaminated or wet waste).
» Waste storage shall be in accordance with all best-practice guidelines and under no circumstances may waste be burnt on site.
» Waste generated on site must be removed on a regular basis throughout the operation phase.
» Waste must be removed by a suitably qualified contractor and disposed at an appropriately licensed landfill site. Proof of appropriate disposal must be provided by the contractor and kept on site.

5. Monitoring of Waste Management Activities

Records must be kept of the volumes/ mass of the different waste streams that are collected from the site throughout the life of the project. The appointed waste contractor is to provide monthly reports to the operator containing the following information:

- Monthly volumes/ mass of the different waste streams collected;
- Monthly volumes/ mass of the waste that is disposed of at a landfill site;
- Monthly volumes/ mass of the waste that is recycled;
- Data illustrating progress compared to previous months.

This report will aid in monitoring the progress and relevance of the waste management procedures that are in place. If it is found that the implemented procedures are not as effective as required, this WMP is to be reviewed and amended accordingly. This report must from part of the EO's reports to the ECO on a monthly basis.

APPENDIX I:
EMERGENCY PREPARDENESS, RESPONSE AND FIRE MANAGEMENT PLAN

EMERGENCY PREPAREDNESS, RESPONSE AND FIRE MANAGEMENT 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 responses 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 responses 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 Performance Standard 1 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 Wind Garden project site is located approximately 17km north-west of Makhanda (previously known as Grahamstown) (measured from the centre of the site) within the Makana Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province. The Wind Garden Wind Farm will include a maximum of 47 wind turbines with a contracted capacity of up to 264MW and associated infrastructure to be constructed over an area of approximately 4336ha in extent, known as the project site.

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;
» Flood events;
» 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 cooling the adjacent areas. Then confine and extinguish the fire (where appropriate) making sure that re-ignition cannot occur.

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/contained or bunded 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 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.

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 the spill to limit entering surrounding areas.
5. Identify the substance spilled.
6. Quantify the spill (under or over guideline/threshold levels).
7. Notify the Site Manager and emergency response crew and authorities (in the event of major spill).
8. Inform users (and downstream users) of the potential risk.
9. Clean up of the spill using spill kit or by HazMat team.
10. Record of the 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 the trench required. Spilled substances can then be recovered using a pump or sorbent materials.

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 the 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 of the potential risk of fire.
7. Record the incident on the company database or filing register.

ii. Procedures

Because large scale fires may spread very fast 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 at strategic locations throughout the site, in line with the Building Code of South Africa and the relevant provincial building code. All emergency equipment including

portable fire extinguisher, hose reels and 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 the 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

In terms of the requirements of NEMA, the responsible person must, within 14 days of the incident, report to the Director General, provincial head of department and municipality.

» 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

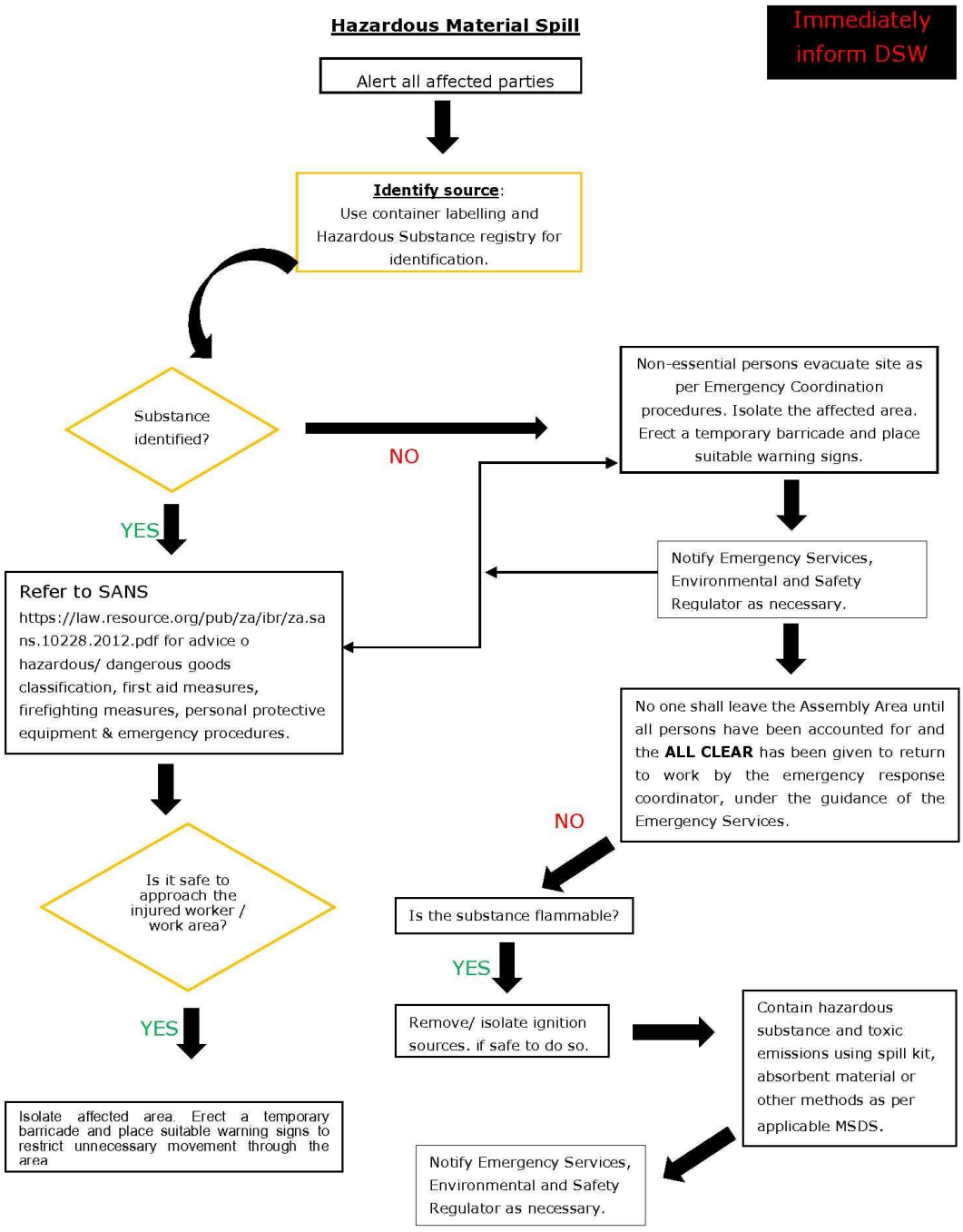


Figure 1: Hazardous Material Spill

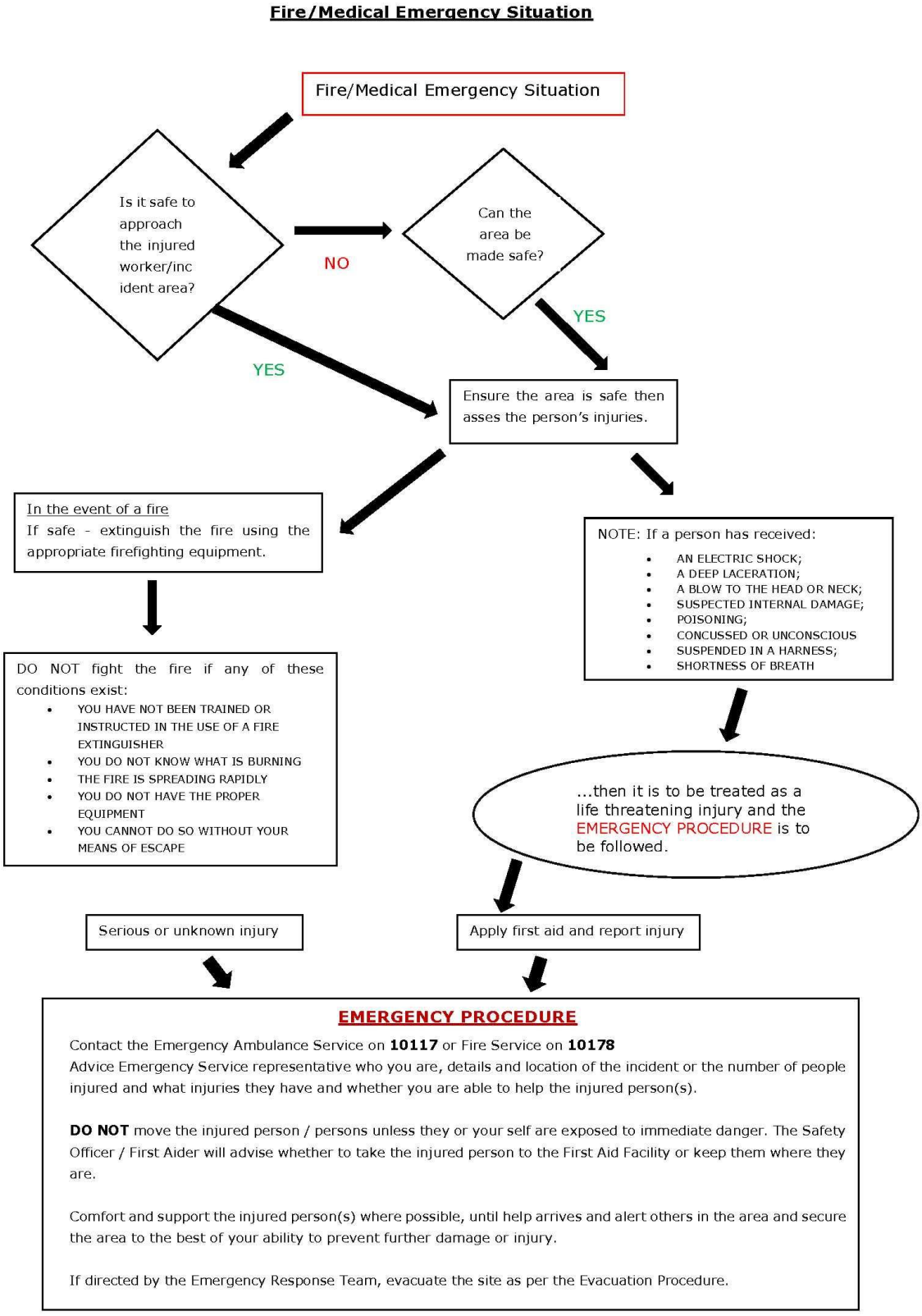


Figure 2: Emergency Fire/Medical

4. PROCEDURE RESPONSIBILITY

The Contractor's Safety, Health and Environment (SHE) Representative, employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the SHE must act as liaison and advisor on all environmental and related issues.

The local authorities will provide their assistance when deemed necessary, or when it has been requested and/or indicated in Section 30 (8) of NEMA. The provincial authority will provide assistance and guidance where required and conduct awareness programmes.

APPENDIX J:
CURRICULCUM VITAE OF THE PROJECT TEAM

savannah environmental

1st Floor, Block 2, 5 Woodlands Drive Office Park
Woodlands Drive, Woodmead
Johannesburg, South Africa

Email: joanne@savannahsa.com
Tel: +27 (11) 656 3237

CURRICULUM VITAE OF JO-ANNE THOMAS

Profession:	Environmental Management and Compliance Consultant; Environmental Assessment Practitioner
Specialisation:	Environmental Management; Strategic environmental advice; Environmental compliance advice & monitoring; Environmental Impact Assessments; Policy, strategy & guideline formulation; Project Management; General Ecology
Work experience:	Twenty one (21) years in the environmental field

VOCATIONAL EXPERIENCE

Provide technical input for projects in the environmental management field, specialising in Strategic Environmental Advice, Environmental Impact Assessment studies, environmental auditing and monitoring, environmental permitting, public participation, Environmental Management Plans and Programmes, environmental policy, strategy and guideline formulation, and integrated environmental management. Key focus on integration of the specialist environmental studies and findings into larger engineering-based projects, strategic assessment, and providing practical and achievable environmental management solutions and mitigation measures. Responsibilities for environmental studies include project management (including client and authority liaison and management of specialist teams); review and manipulation of data; identification and assessment of potential negative environmental impacts and benefits; review of specialist studies; and the identification of mitigation measures. Compilation of the reports for environmental studies is in accordance with all relevant environmental legislation.

Undertaking of numerous environmental management studies has resulted in a good working knowledge of environmental legislation and policy requirements. Recent projects have been undertaken for both the public- and private-sector, including compliance advice and monitoring, electricity generation and transmission projects, various types of linear developments (such as National Road, local roads and power lines), waste management projects (landfills), mining rights and permits, policy, strategy and guideline development, as well as general environmental planning, development and management.

SKILLS BASE AND CORE COMPETENCIES

- Project management for a range of projects
- Identification and assessment of potential negative environmental impacts and benefits through the review and manipulation of data and specialist studies
- Identification of practical and achievable mitigation and management measures and the development of appropriate management plans
- Compilation of environmental reports in accordance with relevant environmental legislative requirements
- External and peer review of environmental reports & compliance advice and monitoring
- Formulation of environmental policies, strategies and guidelines
- Strategic and regional assessments; pre-feasibility & site selection
- Public participation processes for a variety of projects
- Strategic environmental advice to a wide variety of clients both in the public and private sectors
- Working knowledge of environmental planning processes, policies, regulatory frameworks and legislation

EDUCATION AND PROFESSIONAL STATUS

Degrees:

- B.Sc Earth Sciences, University of the Witwatersrand, Johannesburg (1993)
- B.Sc Honours in Botany, University of the Witwatersrand, Johannesburg (1994)
- M.Sc in Botany, University of the Witwatersrand, Johannesburg (1996)

Short Courses:

- Environmental Impact Assessment, Potchefstroom University (1998)
- Environmental Law, Morgan University (2001)
- Environmental Legislation, IMBEWU (2017)
- Mining Legislation, Cameron Cross & Associates (2013)
- Environmental and Social Risk Management (ESRM), International Finance Corporation (2018)

Professional Society Affiliations:

- Registered with the South African Council for Natural Scientific Professions as a Professional Natural Scientist: Environmental Scientist (400024/00)
- Registered with the International Associated for Impact Assessment South Africa (IAIAsa): 5601
- Member of the South African Wind Energy Association (SAWEA)

EMPLOYMENT

Date	Company	Roles and Responsibilities
January 2006 - Current	Savannah Environmental (Pty) Ltd	Director Project manager Independent specialist environmental consultant, Environmental Assessment Practitioner (EAP) and advisor.
1997 – 2005	Bohlweki Environmental (Pty) Ltd	Senior Environmental Scientist at. Environmental Management and Project Management
January – July 1997	Sutherland High School, Pretoria	Junior Science Teacher

PROJECT EXPERIENCE

Project experience includes large infrastructure projects, including electricity generation and transmission, wastewater treatment facilities, mining and prospecting activities, property development, and national roads, as well as strategy and guidelines development.

RENEWABLE POWER GENERATION PROJECTS: PHOTOVOLTAIC SOLAR ENERGY FACILITIES

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
Christiana PV 2 SEF, North West	Solar Reserve South Africa	Project Manager & EAP
De Aar PV facility, Northern Cape	iNca Energy	Project Manager & EAP
Everest SEF near Hennenman, Free State	FRV Energy South Africa	Project Manager & EAP
Graafwater PV SEF, Western Cape	iNca Energy	Project Manager & EAP
Grootkop SEF near Allanridge, Free State	FRV Energy South Africa	Project Manager & EAP
Hertzogville PV 2 SEF with 2 phases, Free State	SunCorp / Solar Reserve	Project Manager & EAP
Karoshoek CPV facility on site 2 as part of the larger Karoshoek Solar Valley Development East of Upington, Northern Cape	FG Emvelo	Project Manager & EAP

Project Name & Location	Client Name	Role
Kgabalatsane SEF North-East for Brits, North West	Built Environment African Energy Services	Project Manager & EAP
Kleinbegin PV SEF West of Groblershoop, Northern Cape	MedEnergy Global	Project Manager & EAP
Lethabo Power Station PV Installation, Free State	Eskom Holdings SoC Limited	Project Manager & EAP
Majuba Power Station PV Installation, Mpumalanga	Eskom Holdings SoC Limited	Project Manager & EAP
Merapi PV SEF Phase 1 – 4 South-East of Excelsior, Free State	SolaireDirect Southern Africa	Project Manager & EAP
Sannaspos Solar Park, Free State	SolaireDirect Southern Africa	Project Manager & EAP
Ofir-Zx PV Plant near Keimoes, Northern Cape	S28 Degrees Energy	Project Manager & EAP
Oryx SEF near Virginia, Free State	FRV Energy South Africa	Project Manager & EAP
Project Blue SEF North of Kleinsee, Northern Cape	WWK Development	Project Manager & EAP
S-Kol PV Plant near Keimoes, Northern Cape	S28 Degrees Energy	Project Manager & EAP
Sonnenberg PV Plant near Keimoes, Northern Cape	S28 Degrees Energy	Project Manager & EAP
Tutuka Power Station PV Installation, Mpumalanga	Eskom Transmission	Project Manager & EAP
Two PV sites within the Northern Cape	MedEnergy Global	Project Manager & EAP
Two PV sites within the Western & Northern Cape	iNca Energy	Project Manager & EAP
Upington PV SEF, Northern Cape	MedEnergy Global	Project Manager & EAP
Vredendal PV facility, Western Cape	iNca Energy	Project Manager & EAP
Waterberg PV plant, Limpopo	Thupela Energy	Project Manager & EAP
Watershed Phase I & II SEF near Litchtenburg, North West	FRV Energy South Africa	Project Manager & EAP
Alldays PV & CPV SEF Phase 1, Limpopo	BioTherm Energy	Project Manager & EAP
Hyperion PV Solar Development 1, 2, 3, 4, 5 & 6	Building Energy	Project Manager & EAP

Basic Assessments

Project Name & Location	Client Name	Role
Aberdeen PV SEF, Eastern Cape	BioTherm Energy	Project Manager & EAP
Christiana PV 1 SEF on Hartebeestpan Farm, North-West	Solar Reserve South Africa	Project Manager & EAP
Heuningspruit PV1 & PV 2 facilities near Koppies, Free State	Sun Mechanics	Project Manager & EAP
Kakamas PV Facility, Northern Cape	iNca Energy	Project Manager & EAP
Kakamas II PV Facility, Northern Cape	iNca Energy	Project Manager & EAP
Machadodorp 1 PV SEF, Mpumalanga	Solar To Benefit Africa	Project Manager & EAP
PV site within the Northern Cape	iNca Energy	Project Manager & EAP
PV sites within 4 ACSA airports within South Africa, National	Airports Company South Africa (ACSA)	Project Manager & EAP
RustMo1 PV Plant near Buffelspoort, North West	Momentous Energy	Project Manager & EAP
RustMo2 PV Plant near Buffelspoort, North West	Momentous Energy	Project Manager & EAP
RustMo3 PV Plant near Buffelspoort, North West	Momentous Energy	Project Manager & EAP
RustMo4 PV Plant near Buffelspoort, North West	Momentous Energy	Project Manager & EAP
Sannaspos PV SEF Phase 2 near Bloemfontein, Free State	SolaireDirect Southern Africa	Project Manager & EAP
Solar Park Expansion within the Rooiwal Power Station, Gauteng	AFRKO Energy	Project Manager & EAP
Steynsrus SEF, Free State	SunCorp	Project Manager & EAP

Project Name & Location	Client Name	Role
Sirius Solar PV Project Three and Sirius Solar PV Project Four (BA in terms of REDZ regulations), Northern Cape	SOLA Future Energy	Project Manager & EAP

Screening Studies

Project Name & Location	Client Name	Role
Allemans Fontein SEF near Noupoort, Northern Cape	Fusion Energy	Project Manager & EAP
Amandel SEF near Thabazimbi, Limpopo	iNca Energy	Project Manager & EAP
Arola/Doornplaat SEF near Ventersdorp, North West	FRV & iNca Energy	Project Manager & EAP
Bloemfontein Airport PV Installation, Free State	The Power Company	Project Manager & EAP
Brakspruit SEF near Klerksorp, North West	FRV & iNca Energy	Project Manager & EAP
Carolus Poort SEF near Noupoort, Northern Cape	Fusion Energy	Project Manager & EAP
Damfontein SEF near Noupoort, Northern Cape	Fusion Energy	Project Manager & EAP
Everest SEF near Welkom, Free State	FRV & iNca Energy	Project Manager & EAP
Gillmer SEF near Noupoort, Northern Cape	Fusion Energy	Project Manager & EAP
Grootkop SEF near Allansridge, Free State	FRV & iNca Energy	Project Manager & EAP
Heuningspruit PV1 & PV 2 near Koppies, Free State	Cronimat	Project Manager & EAP
Kimberley Airport PV Installation, Northern Cape	The Power Company	Project Manager & EAP
Kolonnade Mall Rooftop PV Installation in Tshwane, Gauteng	Momentous Energy	Project Manager & EAP
Loskop SEF near Groblersdal, Limpopo	S&P Power Unit	Project Manager & EAP
Marble SEF near Marble Hall, Limpopo	S&P Power Unit	Project Manager & EAP
Morgenson PV1 SEF South-West of Windsorton, Northern Cape	Solar Reserve South Africa	Project Manager & EAP
OR Tambo Airport PV Installation, Gauteng	The Power Company	Project Manager & EAP
Oryx SEF near Virginia, Free State	FRV & iNca Energy	Project Manager & EAP
Rhino SEF near Vaalwater, Limpopo	S&P Power Unit	Project Manager & EAP
Rustmo2 PV Plant near Buffelspoort, North West	Momentous Energy	Project Manager & EAP
Spitskop SEF near Northam, Limpopo	FRV & iNca Energy	Project Manager & EAP
Steynsrus PV, Free State	Suncorp	Project Manager & EAP
Tabor SEF near Polokwane, Limpopo	FRV & iNca Energy	Project Manager & EAP
UpingtonAirport PV Installation, Northern Cape	The Power Company	Project Manager & EAP
Valeria SEF near Hartebeestpoort Dam, North West	Solar to Benefit Africa	Project Manager & EAP
Watershed SEF near Lichtenburg, North West	FRV & iNca Energy	Project Manager & EAP
Witkop SEF near Polokwane, Limpopo	FRV & iNca Energy	Project Manager & EAP
Woodmead Retail Park Rooftop PV Installation, Gauteng	Momentous Energy	Project Manager & EAP

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO and bi-monthly auditing for the construction of the Adams Solar PV Project Two South of Hotazel, Northern Cape	Enel Green Power	Project Manager
ECO for the construction of the Kathu PV Facility, Northern Cape	REISA	Project Manager
ECO and bi-monthly auditing for the construction of the Pulida PV Facility, Free State	Enel Green Power	Project Manager
ECO for the construction of the RustMo1 SEF, North West	Momentous Energy	Project Manager
ECO for the construction of the Sishen SEF, Northern	Windfall 59 Properties	Project Manager

Project Name & Location	Client Name	Role
Cape		
ECO for the construction of the Upington Airport PV Facility, Northern Cape	Sublanary Trading	Project Manager
Quarterly compliance monitoring of compliance with all environmental licenses for the operation activities at the Kathu PV facility, Northern Cape	REISA	Project Manager
ECO for the construction of the Konkoonsies II PV SEF and associated infrastructure, Northern Cape	BioTherm Energy	Project Manager
ECO for the construction of the Aggeneys PV SEF and associated infrastructure, Northern Cape	BioTherm Energy	Project Manager

Compliance Advice and ESAP Reporting

Project Name & Location	Client Name	Role
Aggeneys Solar Farm, Northern Cape	BioTherm Energy	Environmental Advisor
Airies II PV Facility SW of Kenhardt, Northern Cape	BioTherm Energy	Environmental Advisor
Kalahari SEF Phase II in Kathu, Northern Cape	Engie	Environmental Advisor
Kathu PV Facility, Northern Cape	Building Energy	Environmental Advisor
Kenhardt PV Facility, Northern Cape	BioTherm Energy	Environmental Advisor
Kleinbegin PV SEF West of Groblershoop, Northern Cape	MedEnergy	Environmental Advisor
Konkoonises II SEF near Pofadder, Northern Cape	BioTherm Energy	Environmental Advisor
Konkoonsies Solar Farm, Northern Cape	BioTherm Energy	Environmental Advisor
Lephalale SEF, Limpopo	Exxaro	Environmental Advisor
Pixley ka Seme PV Park, South-East of De Aar, Northern Cape	African Clean Energy Developments (ACED)	Environmental Advisor
RustMo1 PV Plant near Buffelspoort, North West	Momentous Energy	Environmental Advisor
Scuitdrift 1 SEF & Scuitdrift 2 SEF, Limpopo	Building Energy	Environmental Advisor
Sirius PV Plants, Northern Cape	Aurora Power Solutions	Environmental Advisor
Upington Airport PV Power Project, Northern Cape	Sublunary Trading	Environmental Advisor
Upington SEF, Northern Cape	Abengoa Solar	Environmental Advisor
Ofir-ZX PV SEF near Keimoes, Northern Cape	Networx S28 Energy	Environmental Advisor
Steynsrus PV1 & PV2 SEF's, Northern Cape	Cronimet Power Solutions	Environmental Advisor
Heuningspruit PV SEF, Northern Cape	Cronimet Power Solutions	Environmental Advisor

Due Diligence Reporting

Project Name & Location	Client Name	Role
5 PV SEF projects in Lephalale, Limpopo	iNca Energy	Environmental Advisor
Prieska PV Plant, Northern Cape	SunEdison Energy India	Environmental Advisor
Sirius Phase One PV Facility near Upington, Northern Cape	Aurora Power Solutions	Environmental Advisor

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
Biodiversity Permit & WULA for the Aggeneys SEF near Aggeneys, Northern Cape	BioTherm Energy	Project Manager & EAP
Biodiversity Permit for the Konkoonises II SEF near Pofadder, Northern Cape	BioTherm Energy	Project Manager & EAP
Biodiversity Permitting for the Lephalale SEF, Limpopo	Exxaro Resources	Project Manager & EAP

Project Name & Location	Client Name	Role
Environmental Permitting for the Kleinbegin PV SEF West of Groblershoop, Northern Cape	MedEnergy	Project Manager & EAP
Environmental Permitting for the Upington SEF, Northern Cape	Abengoa Solar	Project Manager & EAP
Environmental Permitting for the Kathu PV Facility, Northern Cape	Building Energy	Project Manager & EAP
Environmental Permitting for the Konkoonsies Solar Farm, Northern Cape	BioTherm Energy	Project Manager & EAP
Environmental Permitting for the Lephalale SEF, Limpopo	Exxaro Resources	Project Manager & EAP
Environmental Permitting for the Scuitdrift 1 SEF & Scuitdrift 2 SEF, Limpopo	Building Energy	Project Manager & EAP
Environmental Permitting for the Sirius PV Plant, Northern Cape	Aurora Power Solutions	Project Manager & EAP
Environmental Permitting for the Steynsrus PV1 & PV2 SEF's, Northern Cape	Cronimet Power Solutions	Project Manager & EAP
Environmental Permitting for the Heuningspruit PV SEF, Northern Cape	Cronimet Power Solutions	Project Manager & EAP
Permits for the Kleinbegin and UAP PV Plants, Northern Cape	MedEnergy Global	Project Manager & EAP
S53 Application for Arriesfontein Solar Park Phase 1 – 3 near Danielskuil, Northern Cape	Solar Reserve / SunCorp	Project Manager & EAP
S53 Application for Hertzogville PV1 & PV 2 SEFs, Free State	Solar Reserve / SunCorp	Project Manager & EAP
S53 Application for the Bloemfontein Airport PV Facility, Free State	Sublunary Trading	Project Manager & EAP
S53 Application for the Kimberley Airport PV Facility, Northern Cape	Sublunary Trading	Project Manager & EAP
S53 Application for the Project Blue SEF, Northern Cape	WWK Developments	Project Manager & EAP
S53 Application for the Upington Airport PV Facility, Free State	Sublunary Trading	Project Manager & EAP
WULA for the Kalahari SEF Phase II in Kathu, Northern Cape	Engie	Project Manager & EAP
Environmental Permitting for the Steynsrus PV1 & PV2 SEF's, Northern Cape	Cronimet Power Solutions	Project Manager & EAP
Environmental Permitting for the Heuningspruit PV SEF, Northern Cape	Cronimet Power Solutions	Project Manager & EAP

RENEWABLE POWER GENERATION PROJECTS: CONCENTRATED SOLAR FACILITIES (CSP)

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
Ilanga CSP 2, 3, 4, 5, 7 & 9 Facilities near Upington, Northern Cape	Emvelo Holdings	Project Manager & EAP
Ilanga CSP near Upington, Northern Cape	Ilangethu Energy	Project Manager & EAP
Ilanga Tower 1 Facility near Upington, Northern Cape	Emvelo Holdings	Project Manager & EAP

Project Name & Location	Client Name	Role
Karoshoek CPVPD 1-4 facilities on site 2 as part of the larger Karoshoek Solar Valley Development East of Upington, Northern Cape	FG Emvelo	Project Manager & EAP
Karoshoek CSP facilities on sites 1.4; 4 & 5 as part of the larger Karoshoek Solar Valley Development East of Upington, Northern Cape	FG Emvelo	Project Manager & EAP
Karoshoek Linear Fresnel 1 Facility on site 1.1 as part of the larger Karoshoek Solar Valley Development East of Upington, Northern Cape	FG Emvelo	Project Manager & EAP

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the construction of the !Khi CSP Facility, Northern Cape	Abengoa Solar	Project Manager
ECO for the construction of the Ilanga CSP 1 Facility near Upington, Northern Cape	Karoshoek Solar One	Project Manager
ECO for the construction of the folar Park, Northern Cape	Kathu Solar	Project Manager
ECO for the construction of the KaXu! CSP Facility, Northern Cape	Abengoa Solar	Project Manager
Internal audit of compliance with the conditions of the IWUL issued to the Karoshoek Solar One CSP Facility, Northern Cape	Karoshoek Solar One	Project Manager

Screening Studies

Project Name & Location	Client Name	Role
Upington CSP (Tower) Plant near Kanoneiland, Northern Cape	iNca Energy and FRV	Project Manager & EAP

Compliance Advice and ESAP reporting

Project Name & Location	Client Name	Role
Ilanga CSP Facility near Upington, Northern Cape	Ilangethu Energy	Environmental Advisor
Ilangalethu CSP 2, Northern Cape	FG Emvelo	Environmental Advisor
Kathu CSP Facility, Northern Cape	GDF Suez	Environmental Advisor
Lephalale SEF, Limpopo	Cennergi	Environmental Advisor
Solis I CSP Facility, Northern Cape	Brightsource	Environmental Advisor

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
Environmental Permitting for the Ilanga CSP Facility near Upington, Northern Cape	Ilangethu Energy	Project Manager & EAP
Environmental Permitting for the Kathu CSP, Northern Cape	GDF Suez	Project Manager & EAP
WULA for the Solis I CSP Facility, Northern Cape	Brightsource	Project Manager & EAP

RENEWABLE POWER GENERATION PROJECTS: WIND ENERGY FACILITIES

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
Sere WEF, Western Cape	Eskom Holdings SoC Limited	EAP

Project Name & Location	Client Name	Role
Aberdeen WEF, Eastern Cape	Eskom Holdings SoC Limited	Project Manager & EAP
Amakhala Emoyeni WEF, Eastern Cape	Windlab Developments	Project Manager & EAP
EXXARO West Coast WEF, Western Cape	EXXARO Resources	Project Manager & EAP
Goereesoe Wind Farm near Swellendam, Western Cape	iNca Energy	Project Manager & EAP
Hartneest WEF, Western Cape	Juwi Renewable Energies	Project Manager & EAP
Hopefield WEF, Western Cape	Umoya Energy	EAP
Kleinsee WEF, Northern Cape	Eskom Holdings SoC Limited	Project Manager & EAP
Klipheuwel/Dassiesfontein WEF within the Overberg area, Western Cape	BioTherm Energy	Project Manager & EAP
Moorreesburg WEF, Western Cape	iNca Energy	Project Manager & EAP
Oyster Bay WEF, Eastern Cape	Renewable Energy Resources Southern Africa	Project Manager & EAP
Project Blue WEF, Northern Cape	Windy World	Project Manager & EAP
Rheboksfontein WEF, Western Cape	Moyeng Energy	Project Manager & EAP
Spitskop East WEF near Riebeeck East, Eastern Cape	Renewable Energy Resources Southern Africa	Project Manager & EAP
Suurplaat WEF, Western Cape	Moyeng Energy	Project Manager & EAP
Swellendam WEF, Western Cape	IE Swellendam	Project Manager & EAP
Tsitsikamma WEF, Eastern Cape	Exxarro	Project Manager & EAP
West Coast One WEF, Western Cape	Moyeng Energy	Project Manager & EAP

Basic Assessments

Project Name & Location	Client Name	Role
Amakhala Emoyeni Wind Monitoring Masts, Eastern Cape	Windlab Developments	Project Manager & EAP
Beaufort West Wind Monitoring Masts, Western Cape	Umoya Energy	Project Manager & EAP
Hopefield Community Wind Farm near Hopefield, Western Cape	Umoya Energy	Project Manager & EAP
Koekenaap Wind Monitoring Masts, Western Cape	EXXARO Resources	Project Manager & EAP
Koingnaas WEF, Northern Cape	Just Palm Tree Power	Project Manager & EAP
Laingsburg Area Wind Monitoring Masts, Western Cape	Umoya Energy	Project Manager & EAP
Overberg Area Wind Monitoring Masts, Western Cape	BioTherm Energy	Project Manager & EAP
Oyster Bay Wind Monitoring Masts, Eastern Cape	Renewable Energy Systems Southern Africa (RES)	Project Manager & EAP

Screening Studies

Project Name & Location	Client Name	Role
Albertinia WEF, Western Cape	BioTherm Energy	Project Manager & EAP
Koingnaas WEF, Northern Cape	Just Pal Tree Power	Project Manager & EAP
Napier Region WEF Developments, Western Cape	BioTherm Energy	Project Manager & EAP
Tsitsikamma WEF, Eastern Cape	Exxarro Resources	Project Manager & EAP
Various WEFs within an identified area in the Overberg area, Western Cape	BioTherm Energy	Project Manager & EAP
Various WEFs within an identified area on the West Coast, Western Cape	Investec Bank Limited	Project Manager & EAP
Various WEFs within an identified area on the West Coast, Western Cape	Eskom Holdings Limited	Project Manager & EAP

Project Name & Location	Client Name	Role
Various WEFs within the Western Cape	Western Cape Department of Environmental Affairs and Development Planning	Project Manager & EAP
Velddrift WEF, Western Cape	VentuSA Energy	Project Manager & EAP
Wind 1000 Project	Thabo Consulting on behalf of Eskom Holdings	Project Manager & EAP
Wittekleibosch, Snylip & Doriskraal WEFs, Eastern Cape	Exxarro Resources	Project Manager & EAP

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the construction of the West Coast One WEF, Western Cape	Aurora Wind Power	Project Manager
ECO for the construction of the Gouda WEF, Western Cape	Blue Falcon	Project Manager
EO for the Dassiesklip Wind Energy Facility, Western Cape	Group 5	Project Manager
Quarterly compliance monitoring of compliance with all environmental licenses for the operation activities at the Gouda Wind Energy facility near Gouda, Western Cape	Blue Falcon	Project Manager
Annual auditing of compliance with all environmental licenses for the operation activities at the West Coast One Wind Energy facility near Vredenburg, Western Cape	Aurora Wind Power	Project Manager
External environmental and social audit for the Amakhala Wind Farm, Eastern Cape	Cennergi	Project Manager
External environmental and social audit for the Tsitsikamma Wind Farm, Eastern Cape	Cennergi	Project Manager
ECO for the construction of the Excelsior Wind Farm and associated infrastructure, Northern Cape	BioTherm Energy	Project Manager
External compliance audit of the Dassiesklip Wind Energy Facility, Western Cape	BioTherm Energy	Project Manager

Compliance Advice

Project Name & Location	Client Name	Role
Amakhala Phase 1 WEF, Eastern Cape	Cennergi	Environmental Advisor
Dassiesfontein WEF within the Overberg area, Western Cape	BioTherm Energy	Environmental Advisor
Excelsior Wind Farm, Western Cape	BioTherm Energy	Environmental Advisor
Great Karoo Wind Farm, Northern Cape	African Clean Energy Developments (ACED)	Environmental Advisor
Hopefield Community WEF, Western Cape	African Clean Energy Developments (ACED)	Environmental Advisor
Rheboksfontein WEF, Western Cape	Moyeng Energy	Environmental Advisor
Tiqua WEF, Western Cape	Cennergi	Environmental Advisor
Tsitsikamma WEF, Eastern Cape	Cennergi	Environmental Advisor
West Coast One WEF, Western Cape	Moyeng Energy	Environmental Advisor

Due Diligence Reporting

Project Name & Location	Client Name	Role
Witteberg WEF, Western Cape	EDPR Renewables	Environmental Advisor
IPD Vredenburg WEF within the Saldanha Bay area, Western Cape	IL&FS Energy Development Company	Environmental Advisor

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
Biodiversity Permitting for the Power Line between the Tsitikamma Community WEF & the Diep River Substation, Eastern Cape	Cennergi	Project Manager & EAP
Biodiversity Permitting for the West Coast One WEF, Western Cape	Aurora Wind Power	Project Manager & EAP
Environmental Permitting for the Excelsior WEF, Western Cape	BioTherm Energy	Project Manager & EAP
Plant Permits & WULA for the Tsitsikamma Community WEF, Eastern Cape	Cennergi	Project Manager & EAP
S24G and WULA for the Rectification for the commencement of unlawful activities on Ruimsig AH in Honeydew, Gauteng	Hossam Soror	Project Manager & EAP
S24G Application for the Rheboksfontein WEF, Western Cape	Ormonde - Theo Basson	Project Manager & EAP
S53 Application & WULA for Suurplaat and Gemini WEFs, Northern Cape	Engie	Project Manager & EAP
S53 Application for the Hopefield Community Wind Farm near Hopefield, Western Cape	Umoya Energy	Project Manager & EAP
S53 Application for the Project Blue WEF, Northern Cape	WWK Developments	Project Manager & EAP
S53 for the Oyster Bay WEF, Eastern Cape	RES	Project Manager & EAP
WULA for the Great Karoo Wind Farm, Northern Cape	African Clean Energy Developments (ACED)	Project Manager & EAP

CONVENTIONAL POWER GENERATION PROJECTS (COAL)

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
Mutsho Power Station near Makhado, Limpopo	Mutsho Consortium	Project Manager & EAP
Coal-fired Power Station near Ogies, Mpumalanga	Ruukki SA	Project Manager & EAP
Thabametsi IPP Coal-fired Power Station, near Lephalale, Limpopo	Axia	Project Manager & EAP
Transalloys Coal-fired Power Station, Mpumalanga	Transalloys	Project Manager & EAP
Tshivasho IPP Coal-fired Power Station (with WML), near Lephalale, Limpopo	Cennergi	Project Manager & EAP
Umbani Coal-fired Power Station, near Kriel, Mpumalanga	ISS Global Mining	Project Manager & EAP
Waterberg IPP Coal-Fired Power Station near Lephalale, Limpopo	Exxaro Resources	Project Manager & EAP

Basic Assessments

Project Name & Location	Client Name	Role
Coal Stockyard on Medupi Ash Dump Site, Limpopo	Eskom Holdings	Project Manager & EAP

Project Name & Location	Client Name	Role
Biomass Co-Firing Demonstration Facility at Arnot Power Station East of Middleburg, Mpumlanaga	Eskom Holdings	Project Manager & EAP

Screening Studies

Project Name & Location	Client Name	Role
Baseload Power Station near Lephalale, Limpopo	Cennergi	Project Manager & EAP
Coal-Fired Power Plant near Delmas, Mpumalanga	Exxaro Resources	Project Manager & EAP
Makhado Power Station, Limpopo	Mutsho Consortium, Limpopo	Project Manager & EAP

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the Camden Power Station, Mpumalanga	Eskom Holdings	Project Manager

Compliance Advice

Project Name & Location	Client Name	Role
Thabametsi IPP Coal-fired Power Station, near Lephalale, Limpopo	Axia	Environmental Advisor

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
Permit application for the Thabametsi Bulk Water Pipeline, near Lephalale, Limpopo	Axia	Project Manager & EAP
S53 & WULA for the Waterberg IPP Coal-Fired Power Station near Lephalale, Limpopo	Exxaro Resources	Project Manager & EAP
S53 Application for the Tshivasho Coal-fired Power Station near Lephalale, Limpopo	Cennergi	Project Manager & EAP

CONVENTIONAL POWER GENERATION PROJECTS (GAS)

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
Ankerlig OCGT to CCGT Conversion project &400 kV transmission power line between Ankerlig and the Omega Substation, Western Cape	Eskom Holdings SoC Limited	Project Manager & EAP
Gourikwa OCGT to CCGT Conversion project & 400 kV transmission power line between Gourikwa & Proteus Substation, Western Cape	Eskom Holdings SoC Limited	Project Manager & EAP
Richards Bay Gas to Power Combined Cycle Power Station, KwaZulu-Natal	Eskom Holdings SoC Limited	Project Manager & EAP
Richards Bay Gas to Power Plant, KwaZulu-Natal	Richards Bay Gas	Project Manager & EAP
Decommissioning & Recommissioning of 3 Gas Turbine Units at Acacia Power Station & 1 Gas Turbine Unit at Port Rex Power Station to the existing Ankerlig Power Station in Atlantis Industria, Western Cape	Eskom Holdings	Project Manager & EAP
Two 132kV Chickadee Lines to the new Zonnebloem Switching Station, Mpumalanga	Eskom Holdings	Project Manager & EAP

Screening Studies

Project Name & Location	Client Name	Role
Fatal Flaw Analysis for 3 area identified for the establishment of a 500MW CCGT Power Station	Globeleq Advisors Limited	Project Manager & EAP
Richards Bay Gas to Power Combined Cycle Power Station, KwaZulu-Natal	Eskom Holdings SoC Limited	Project Manager & EAP

GRID INFRASTRUCTURE PROJECTS

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
Aggeneis-Oranjemond Transmission Line & Substation Upgrade, Northern Cape	Eskom Transmission	Project Manager & EAP
Ankerlig-Omega Transmission Power Lines, Western Cape	Eskom Transmission	Project Manager & EAP
Karoshoek Grid Integration project as part of the Karoshoek Solar Valley Development East of Upington, Northern Cape	FG Emvelo	Project Manager & EAP
Koeberg-Omega Transmission Power Lines,, Western Cape	Eskom Transmission	Project Manager & EAP
Koeberg-Stikland Transmission Power Lines, Western Cape	Eskom Transmission	Project Manager & EAP
Kyalami Strengthening Project, Gauteng	Eskom Transmission	Project Manager & EAP
Mokopane Integration Project, Limpopo	Eskom Transmission	Project Manager & EAP
Saldanha Bay Strengthening Project, Western Cape	Eskom Transmission	Project Manager & EAP
Steelpoort Integration Project, Limpopo	Eskom Transmission	Project Manager & EAP
Transmission Lines from the Koeberg-2 Nuclear Power Station site, Western Cape	Eskom Transmission	Project Manager & EAP
Tshwane Strengthening Project, Phase 1, Gauteng	Eskom Transmission	Project Manager & EAP

Basic Assessments

Project Name & Location	Client Name	Role
Dassenberg-Koeberg Power Line Deviation from the Koeberg to the Ankerlig Power Station, Western Cape	Eskom Holdings	Project Manager & EAP
Golden Valley II WEF Power Line & Substation near Cookhouse, Eastern Cape	BioTherm Energy	Project Manager & EAP
Golden Valley WEF Power Line near Cookhouse, Eastern Cape	BioTherm Energy	Project Manager & EAP
Karoshoek Grid Integration project as part of the Karoshoek Solar Valley Development East of Upington, Northern Cape	FG Emvelo	Project Manager & EAP
Konkoonsies II PV SEF Power Line to the Paulputs Substation near Pofadder, Northern Cape	BioTherm Energy	Project Manager & EAP
Perdekraal West WEF Powerline to the Eskom Kappa Substation, Westnern Cape	BioTherm Energy	Project Manager & EAP
Rheboksfontein WEF Powerline to the Aurora Substation, Western Cape	Moyeng Energy	Project Manager & EAP
Soetwater Switching Station near Sutherland, Northern Cape	African Clean Energy Developments (ACED)	Project Manager & EAP

Solis Power I Power Line & Switchyard Station near Upington, Northern Cape	Brightsource	Project Manager & EAP
Stormwater Canal System for the Ilanga CSP near Upington, Northern Cape	Karoshoek Solar One	Project Manager & EAP
Tsitsikamma Community WEF Powerline to the Diep River Substation, Eastern Cape	Eskom Holdings	Project Manager & EAP

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the construction of the Ferrum-Mookodi Transmission Line, Northern Cape and North West	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Gamma-Kappa Section A Transmission Line, Western Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Gamma-Kappa Section B Transmission Line, Western Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Hydra IPP Integration project, Northern Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Kappa-Sterrekus Section C Transmission Line, Western Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
EO for the construction of the Namaqualand Strengthening project in Port Nolloth, Western Cape	Trans-Africa Projects on behalf of Eskom	Project Manager
ECO for the construction of the Neptune Substation Soil Erosion Mitigation Project, Eastern Cape	Eskom	Project Manager
ECO for the construction of the Ilanga-Gordonia 132kV power line, Northern Cape	Karoshoek Solar One	Project Manager

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
Environmental Permitting and WULA for the Rockdale B Substation & Loop in Power Lines,	Eskom Holdings	Project Manager & EAP
Environmental Permitting and WULA for the Steelpoort Integration project, Limpopo	Eskom Holdings	Project Manager & EAP
Environmental Permitting for Solis CSP near Upington, Northern Cape	Brightsource	Project Manager & EAP

MINING SECTOR PROJECTS

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
Elitheni Coal Mine near Indwe, Eastern Cape	Elitheni Coal	Project Manager & EAP
Groot Letaba River Development Project Borrow Pits	liso	Project Manager & EAP
Grootegeluk Coal Mine for coal transportation infrastructure between the mine and Medupi Power Station (EMPr amendment) , Limpopo	Eskom Holdings	Project Manager & EAP
Waterberg Coal Mine (EMPr amendment), Limpopo	Seskoko Resources	Project Manager & EAP
Aluminium Plant WML & AEL, Gauteng	GfE-MIR Alloys & Minerals	Project Manager & EAP

Basic Assessments

Project Name & Location	Client Name	Role
Rare Earth Separation Plant in Vredendal, Western Cape	Rareco	Project Manager & EAP

Decommissioning and Demolition of Kilns 5 & 6 at the Slurry Plant, Kwa-Zulu Natal	PPC	Project Manager & EAP

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO for the construction of the Duhva Mine Water Recovery Project, Mpumalanga	Eskom Holdings SoC Limited	Project Manager
External compliance audit of Palesa Coal Mine's Integrated Water Use License (IWUL), near KwaMhlanga, Mpumalanga	HCI Coal	Project Manager
External compliance audit of Palesa Coal Mine's Waste Management License (WML) and EMP, near KwaMhlanga, Mpumalanga	HCI Coal	Project Manager
External compliance audit of Mbali Coal Mine's Integrated Water Use License (IWUL), near Ogies, Mpumalanga	HCI Coal	Project Manager
Independent External Compliance Audit of Water Use License (WUL) for the Tronox Namakwa Sands (TNS) Mining Operations (Brand se Baai), Western Cape	Tronox Namakwa Sands	Project Manager
Independent External Compliance Audit of Water Use License (WUL) for the Tronox Namakwa Sands (TNS) Mineral Separation Plant (MSP), Western Cape	Tronox Namakwa Sands	Project Manager
Independent External Compliance Audit of Water Use License (WUL) for the Tronox Namakwa Sands (TNS) Smelter Operations (Saldanha), Western Cape	Tronox Namakwa Sands	Project Manager
Compliance Auditing of the Waste Management Licence for the PetroSA Landfill Site at the GTL Refinery, Western Cape	PetroSA	Project Manager

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
Waste Licence Application for the Rare Earth Separation Plant in Vredendal, Western Cape	Rareco	Project Manager & EAP
WULA for the Expansion of the Landfill site at Exxaro's Namakwa Sands Mineral Separation Plant, Western Cape	Exxaro Resources	Project Manager & EAP
S24G & WML for an Aluminium Plant, Gauteng	GfE-MIR Alloys & Minerals	Project Manager & EAP

INFRASTRUCTURE DEVELOPMENT PROJECTS (BRIDGES, PIPELINES, ROADS, WATER RESOURCES, STORAGE, ETC)

Environmental Impact Assessments and Environmental Management Programmes

Project Name & Location	Client Name	Role
Bridge across the Ngotwane River, on the border of South Africa and Botswana	Eskom Holdings	Project Manager & EAP
Chemical Storage Tanks, Metallurgical Plant Upgrade & Backfill Plant upgrade at South Deep Gold Mine, near Westornaria, Gauteng	Goldfields	Project Manager & EAP
Expansion of the existing Welgedacht Water Care Works, Gauteng	ERWAT	Project Manager & EAP

Project Name & Location	Client Name	Role
Golden Valley WEF Access Road near Cookhouse, Eastern Cape	BioTherm Energy	Project Manager & EAP
Great Fish River Wind Farm Access Roads and Watercourse Crossings near Cookhouse, Eastern Cape	African Clean Energy Developments (ACED)	Project Manager & EAP
Ilanga CSP Facility Watercourse Crossings near Upington, Northern Cape	Karoshoek Solar one	Project Manager & EAP
Modification of the existing Hartebeestfontein Water Care Works, Gautng	ERWAT	Project Manager & EAP
N10 Road Realignment for the Ilanga CSP Facility, East of Upington, Northern Cape	SANRAL	Project Manager & EAP
Nxuba (Bedford) Wind Farm Watercourse Crossings near Cookhouse, Eastern Cape	African Clean Energy Developments (ACED)	Project Manager & EAP
Pollution Control Dams at the Medupi Power Station Ash Dump & Coal Stockyard, Limpopo	Eskom	Project Manager & EAP
Qoboshane borrow pits (EMPr only), Eastern Cape	Emalahleni Local Municipality	Project Manager & EAP
Tsitsikamma Community WEF Watercourse Crossings, Eastern Cape	Cennergi	Project Manager & EAP
Clayville Central Steam Plant, Gauteng	Bellmall Energy	Project Manager & EAP
Msenge Emoyeni Wind Farm Watercourse Crossings and Roads, Eastern Cape	Windlab	Project Manager & EAP

Basic Assessments

Project Name & Location	Client Name	Role
Harmony Gold WWTW at Doornkop Mine, Gauteng	Harmony Doornkop Plant	Project Manager & EAP
Ofir-ZX Watercourse Crossing for the Solar PV Facility, near Keimoes, Northern Cape	Networx S28 Energy	Project Manager & EAP
Qoboshane bridge & access roads, Eastern Cape	Emalahleni Local Municipality	Project Manager & EAP
Relocation of the Assay Laboratory near Carletonville, Gauteng	Sibanye Gold	Project Manager & EAP
Richards Bay Harbour Staging Area, KwaZulu-Natal	Eskom Holdings	Project Manager & EAP
S-Kol Watercourse Crossing for the Solar PV Facility, East of Keimoes, Northern Cape	Networx S28 Energy	Project Manager & EAP
Sonnenberg Watercourse Crossing for the Solar PV Facility, West Keimoes, Northern Cape	Networx S28 Energy	Project Manager & EAP
Kruisvallei Hydroelectric Power Generation Scheme, Free State	Building Energy	Project Manager & EAP
Masetjaba Water Reservoir, Pump Station and Bulk Supply Pipeline near Nigel, Gauteng	Naidu Consulting Engineers	Project Manager & EAP
Access Road for the Dwarsug Wind Farm, Northern Cape Province	South Africa Mainsteam Renewable Power	Project Manager & EAP
Upgrade of the Cooling Water Treatment Facility at the Kriel Power Station, Mpumalanga	Eskom	Project Manager & EAP

Screening Studies

Project Name & Location	Client Name	Role
Roodepoort Open Space Optimisation Programme (OSOP) Precinct, Gauteng	TIMAC Engineering Projects	Project Manager & EAP
Vegetable Oil Plant and Associated Pipeline, Kwa-Zulu Natal	Wilmar Oils and Fats Africa	Project Manager & EAP

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
ECO and bi-monthly auditing for the construction of the Olifants River Water Resources Development Project (ORWRDP) Phase 2A: De Hoop Dam, R555 realignment and housing infrastructure	Department of Water and Sanitation	Project Manager Auditor
ECO for the Rehabilitation of the Blaaupan & Storm Water Channel, Gauteng	Airports Company of South Africa (ACSA)	Project Manager
Due Diligence reporting for the Better Fuel Pyrolysis Facility, Gauteng	Better Fuels	Project Manager
ECO for the Construction of the Water Pipeline from Kendal Power Station to Kendal Pump Station, Mpumalanga	Transnet	Project Manager
ECO for the Replacement of Low-Level Bridge, Demolition and Removal of Artificial Pong, and Reinforcement the Banks of the Crocodile River at the Construction at Walter Sisulu National Botanical Gardens, Gauteng Province	South African National Biodiversity Institute (SANBI)	Project Manager
External Compliance Audit of the Air Emission Licence (AEL) for a depot in Bloemfontein, Free State Province and in Tzaneen, Mpumalanga Province	PetroSA	Project Manager

Environmental Permitting, S53, Water Use Licence (WUL), Waste Management Licence (WML) & Other Applications

Project Name & Location	Client Name	Role
WULA for the Izubulo Private Nature Reserve, Limpopo	Kjell Bismeyer, Jann Bader, Laurence Saad	Project Manager & EAP
WULA for the Masodini Private Game Lode, Limpopo	Masodini Private Game Lodge	Environmental Advisor
WULA for the Ezulwini Private Nature Reserve, Limpopo	Ezulwini Investments	Project Manager & EAP
WULA for the Masodini Private Game Lode, Limpopo	Masodini Private Game Lodge	Project Manager & EAP
WULA for the N10 Realignment at the Ilanga SEF, Northern Cape	Karoshoek Solar One	Project Manager & EAP
WULA for the Kruisvallei Hydroelectric Power Generation Scheme, Free State	Building Energy	Project Manager & EAP
S24G and WULA for the Ilegal construction of structures within a watercourse on EFF 24 Ruimsig Agricultural Holdings, Gauteng	Sorror Language Services	Project Manager & EAP

HOUSING AND URBAN PROJECTS

Basic Assessments

Project Name & Location	Client Name	Role
Postmasburg Housing Development, Northern Cape	Transnet	Project Manager & EAP

Compliance Advice and reporting

Project Name & Location	Client Name	Role
Kampi ya Thude at the Olifants West Game Reserve, Limpopo	Nick Elliot	Environmental Advisor

Project Name & Location	Client Name	Role
External Compliance Audit of WUL for the Johannesburg Country Club, Gauteng	Johannesburg Country Club	Project Manager

Environmental Compliance, Auditing and ECO

Project Name & Location	Client Name	Role
Due Diligence Audit for the Due Diligence Audit Report, Gauteng	Delta BEC (on behalf of Johannesburg Development Agency (JDA))	Project Manager

ENVIRONMENTAL MANAGEMENT TOOLS

Project Name & Location	Client Name	Role
Development of the 3rd Edition Environmental Implementation Plan (EIP)	Gauteng Department of Agriculture and Rural Development (GDARD)	Project Manager & EAP
Development of Provincial Guidelines on 4x4 routes, Western Cape	Western Cape Department of Environmental Affairs and Development Planning	EAP
Compilation of Construction and Operation EMP for the Braamhoek Transmission Integration Project, Kwazulu-Natal	Eskom Holdings	Project Manager & EAP
Compilation of EMP for the Wholesale Trade of Petroleum Products, Gauteng	Munaca Technologies	Project Manager & EAP
Operational Environmental Management Programme (OEMP) for Medupi Power Station, Limpopo	Eskom Holdings	Project Manager & EAP
Operational Environmental Management Programme (OEMP) for the Dube TradePort Site Wide Precinct	Dube TradePort Corporation	Project Manager & EAP
Operational Environmental Management Programme (OEMP) for the Kusile Power Station, Mpumalanga	Eskom Holdings	Project Manager & EAP
Review of Basic Assessment Process for the Wittekleibosch Wind Monitoring Mast, Eastern Cape	Exxaro Resources	Project Manager & EAP
Revision of the EMPr for the Sirius Solar PV	Aurora Power Solutions	Project Manager & EAP
State of the Environment (SoE) for Emalahleni Local Municipality, Mpumalanga	Simo Consulting on behalf of Emalahleni Local Municipality	Project Manager & EAP
Aspects and Impacts Register for Salberg Concrete Products operations	Salberg Concrete Products	EAP
First State of Waste Report for South Africa	Golder on behalf of the Department of Environmental Affairs	Project Manager & EAP
Responsibilities Matrix and Gap Analysis for the Kruisvallei Hydroelectric Power Generation Scheme, Free State Province	Building Energy	Project Manager
Responsibilities Matrix and Gap Analysis for the Roggeveld Wind Farm, Northern & Western Cape Provinces	Building Energy	Project Manager

PROJECTS OUTSIDE OF SOUTH AFRICA

Project Name & Location	Client Name	Role
Advisory Services for the Zizabona Transmission Project, Zambia, Zimbabwe, Botswana & Namibia	PHD Capital	Advisor
EIA for the Semonkong WEF, Lesotho	MOSCET	Project Manager & EAP
EMP for the Kuvaninga Energia Gas Fired Power Project, Mozambique	ADC (Pty) Ltd	Project Manager & EAP
Environmental Screening Report for the SEF near Thabana Morena, Lesotho	Building Energy	EAP
EPBs for the Kawambwa, Mansa, Mwense and Nchelenge SEFs in Luapula Province, Zambia	Building Energy	Project Manager & EAP
ESG Due Diligence for the Hilton Garden Inn Development in Windhoek, Namibia	Vatange Capital	Project Manager
Mandahill Mall Rooftop PV SEF EPB, Lusaka, Zambia	Building Energy	Project Manager & EAP
Monthly ECO for the PV Power Plant for the Mocuba Power Station	Scatec	Project Manager

APPENDIX K:
APPLICABLE LEGISLATION

APPLICABLE LEGISLATION

Table 1: Applicable Legislation, Policies and/or Guidelines associated with the development of the Wind Garden Wind Farm

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
Constitution of the Republic of South Africa (No. 108 of 1996)	In terms of Section 24, the State has an obligation to give effect to the environmental right. The environmental right states that: "*Everyone has the right –* » *To an environment that is not harmful to their health or well-being, and* » *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:* * *Prevent pollution and ecological degradation,* * *Promote conservation, and* * *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*."	Applicable to all authorities	There are no permitting requirements associated with this Act. The application of the Environmental Right however implies that environmental impacts associated with proposed developments are considered separately and cumulatively. It is also important to note that the "right to an environment clause" includes the notion that justifiable economic and social development should be promoted, through the use of natural resources and ecologically sustainable development.
National Environmental Management Act (No 107 of 1998) (NEMA)	The 2014 EIA Regulations have been promulgated in terms of Chapter 5 of NEMA. Listed activities which may not commence without EA are identified within the Listing Notices (GNR 327, GNR 325 and GNR 324) which form part of these Regulations (GNR 326). In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation.	DEFF – Competent Authority Eastern Cape DEDEAT – Commenting Authority	The listed activities triggered by the proposed project have been identified and are being assessed as part of the BA process currently underway for the project. The BA process will culminate in the submission of a final BA Report to the competent authority in support of the application for EA.

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	Considering the location of the project site within the Cookhouse Renewable Energy Development Zone and the requirements GNR114 of 16 February 2018, a Basic Assessment Process is required to be undertaken for the proposed project. All relevant listing notices for the project (GN R327, GN R325 and GN R324) will be applied for.		
National Environmental Management Act (No 107 of 1998) (NEMA)	In terms of the "Duty of Care and Remediation of Environmental Damage" provision in Section 28(1) of NEMA every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment. In terms of NEMA, it is the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	DEFF Eastern Cape DEDEAT	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section finds application through the consideration of potential cumulative, direct, and indirect impacts. It will continue to apply throughout the life cycle of the project.
Environment Conservation Act (No. 73 of 1989) (ECA)	The Noise Control Regulations in terms of Section 25 of the ECA contain regulations applicable for the control of noise in the Provinces of Limpopo, North West, Mpumalanga, Northern Cape, Eastern Cape, and KwaZulu-Natal Provinces. The Noise Control Regulations cover the powers of a local authority, general prohibitions, prohibitions of disturbing noise, prohibitions of noise nuisance, use of measuring instruments, exemptions, attachments, and penalties. In terms of the Noise Control Regulations, no person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device	DEFF Eastern Cape DEDEAT Makana Local Municipality	Noise impacts are expected to be associated with the construction and operation phases of the project. A Noise Impact Assessment (**Appendix J of the BA Report**) has been undertaken for the Wind Garden Wind Farm which indicates that the impact of the project will have a medium and low significance from a noise perspective.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	or apparatus or any combination thereof (Regulation 04).		
National Water Act (No. 36 of 1998) (NWA)	A water use listed under Section 21 of the NWA must be licensed with the Regional DWS, unless it is listed in Schedule 1 of the NWA (i.e. is an existing lawful use), is permissible under a GA, or if a responsible authority waives the need for a licence. Water use is defined broadly, and includes consumptive and non-consumptive water uses, taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. Consumptive water uses may include taking water from a water resource (Section 21(a)) and storing water (Section 21(b)). Non-consumptive water uses may include impeding or diverting of flow in a water course (Section 21(c)), and altering of bed, banks or characteristics of a watercourse (Section 21(i)).	Regional Department of Water and Sanitation	Watercourses and pans are present within the development footprint of the Wind Garden Wind Farm as identified in the Aquatic Impact Assessment (**Appendix G of the BA report**). Where the development activities impede or divert the flow of water in a watercourse, or alter the bed, banks, course or characteristics of a watercourse, Section 21(c) and 21(i) of the NWA (Act 36 of 1998) would be triggered and the project proponent would need to apply for a WUL or register a GA with the DWS.
Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA)	In accordance with the provisions of the MPRDA a mining permit is required in accordance with Section 27(6) of the Act where a mineral in question is to be mined, including the mining of materials from a borrow pit.	Department of Mineral Resources and Energy (DMRE)	Any person who wishes to apply for a mining permit in accordance with Section 27(6) must simultaneously apply for an Environmental Authorisation in terms of NEMA. No borrow pits are expected to be required for the construction of the project, and as a result a mining permit or EA in this regard is not required to be obtained.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Section 53 of the MPRDA states that any person who intends to use the surface of any land in any way which may be contrary to any object of the Act, or which is likely to impede any such object must apply to the Minister for approval in the prescribed manner.		In terms of Section 53 of the MPRDA approval is required from the Minister of Mineral Resources and Energy to ensure that the proposed development does not sterilise a mineral resource that might occur on site.
National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM:AQA)	The National Dust Control Regulations (GNR 827) published under Section 32 of NEM:AQA prescribe the general measures for the control of dust in all areas, and provide a standard for acceptable dustfall rates for residential and non-residential areas. In accordance with the Regulations (GNR 827) any person who conducts any activity in such a way as to give rise to dust in quantities and concentrations that may exceed the dustfall standard set out in Regulation 03 must, upon receipt of a notice from the air quality officer, implement a dustfall monitoring programme. Any person who has exceeded the dustfall standard set out in Regulation 03 must, within three months after submission of the dustfall monitoring report, develop and submit a dust management plan to the air quality officer for approval.	Eastern Cape DENC / Sarah Baartman District Municipality	In the event that the project results in the generation of excessive levels of dust the possibility could exist that a dustfall monitoring programme would be required for the project, in which case dustfall monitoring results from the dustfall monitoring programme would need to be included in a dust monitoring report, and a dust management plan would need to be developed. However, with mitigation measures implemented, the Wind Garden Wind Farm is not anticipated to result in significant dust generation.
National Heritage Resources Act (No. 25 of 1999) (NHRA)	Section 07 of the NHRA stipulates assessment criteria and categories of heritage resources according to their significance. Section 35 of the NHRA provides for the protection of all archaeological and palaeontological sites, and meteorites. Section 36 of the NHRA provides for the conservation and care of cemeteries and graves by SAHRA where this is not the	South African Heritage Resources Agency (SAHRA) Eastern Cape Provincial Heritage Resources Authority – provincial heritage authority	A full Heritage Impact Assessment (HIA) (with field work) has been undertaken as part of the BA process (refer to **Appendix I** of the BA Report). Sites of varying significance have been identified within the project site and specific mitigation measures have been recommended by the specialist with regards to each identified find.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	responsibility of any other authority. Section 38 of the NHRA lists activities which require developers or any person who intends to undertake a listed activity to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development. Section 44 of the NHRA requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction.		Should a heritage resource be impacted upon, a permit may be required from SAHRA or the Eastern Cape Provincial Heritage Resources Authority in accordance with of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668). This will be determined as part of the final walk through survey once the final location of the development footprint and its associated infrastructure has been determined.
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Section 53 of NEM:BA provides for the MEC / Minister to identify any process or activity in such a listed ecosystem as a threatening process. Three government notices have been published in terms of Section 56(1) of NEM:BA as follows: » Commencement of TOPS Regulations, 2007 (GNR 150). » Lists of critically endangered, vulnerable and protected species (GNR 151). » TOPS Regulations (GNR 152). It provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), and vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and	DEFF Eastern Cape DEDEAT	Under NEM:BA, a permit would be required for any activity that is of a nature that may negatively impact on the survival of a listed protected species. The Ecological Impact Assessment (**Appendix D of the BA Report**) identified listed species. Based on the SANBI POSA records for the site and surrounding area, 14 species of conservation concern are potentially present on the site. Species of concern that are potentially present include *Brachystelma luteum* (VU), *Eriospermum bracteatum* (VU), *Apodolirion macowanii* (VU), *Ornithogalum britteniae* (VU) and *Agathosma bicornuta* (EN).

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	national maps of listed ecosystems (NEM:BA: National list of ecosystems that are threatened and in need of protection, (Government Gazette 37596, GNR 324), 29 April 2014).		
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Chapter 5 of NEM:BA pertains to alien and invasive species, and states that a person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7 of NEM:BA, and that a permit may only be issued after a prescribed assessment of risks and potential impacts on biodiversity is carried out. Applicable, and exempted alien and invasive species are contained within the Alien and Invasive Species List (GNR 864).	DEFF Eastern Cape DEDEAT	The Ecological Impact Assessment (**Appendix D of the BA Report**) identified some woody aliens present in the area and additional alien plant invasion following construction is highly likely and regular alien plant clearing activities would be required.
Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA)	Section 05 of CARA provides for the prohibition of the spreading of weeds. Regulation 15 of GN R1048 published under CARA provides for the classification of categories of weeds and invader plants, and restrictions in terms of where these species may occur. Regulation 15E of GN R1048 published under CARA provides requirement and methods to implement control measures for different categories of alien and invasive plant species.	Department of Agriculture, Land Reform and Rural Development (DALRD)	CARA will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies need to be developed and implemented. In addition, a weed control and management plan must be implemented. In terms of Regulation 15E (GN R1048) where Category 1, 2 or 3 plants occur a land user is required to control such plants by means of one or more of the following methods: » Uprooting, felling, cutting or burning. » Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			killer. » Biological control carried out in accordance with the stipulations of the Agricultural Pests Act (No. 36 of 1983), the ECA and any other applicable legislation. » Any other method of treatment recognised by the executive officer that has as its object the control of plants concerned, subject to the provisions of sub-regulation 4. » A combination of one or more of the methods prescribed, save that biological control reserves and areas where biological control agents are effective shall not be disturbed by other control methods to the extent that the agents are destroyed or become ineffective.
National Forests Act (No. 84 of 1998) (NFA)	According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. Notice of the List of Protected Tree Species under the National Forests Act (No. 84 of 1998) was published in GNR 734. 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".	Department of Agriculture, Land Reform and Rural Development (DALRD)	A licence is required for the removal of protected trees. It is therefore necessary to conduct a survey that will determine the number and relevant details pertaining to protected tree species present in the development footprint for the submission of relevant permits to authorities prior to the disturbance of these individuals. The Ecological Impact Assessment (**Appendix D of the BA Report**) identified listed species. Based on the SANBI POSA records for the site and surrounding area,

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			14 species of conservation concern are potentially present on the site. Species of concern that are potentially present include *Brachystelma luteum* (VU), *Eriospermum bracteatum* (VU), *Apodolirion macowanii* (VU), *Ornithogalum britteniae* (VU) and *Agathosma bicornuta* (EN).
National Veld and Forest Fire Act (No. 101 of 1998) (NVFFA)	Chapter 4 of the NVFFA places a duty on owners to prepare and maintain firebreaks, the procedure in this regard, and the role of adjoining owners and the fire protection association. Provision is also made for the making of firebreaks on the international boundary of the Republic of South Africa. The applicant must ensure that firebreaks are wide and long enough to have a reasonable chance of preventing a veldfire from spreading to or from neighbouring land, it does not cause soil erosion, and it is reasonably free of inflammable material capable of carrying a veldfire across it. Chapter 5 of the Act places a duty on all owners to acquire equipment and have available personnel to fight fires. Every owner on whose land a veldfire may start or burn or from whose land it may spread must have such equipment, protective clothing and trained personnel for extinguishing fires, and ensure that in his or her absence responsible persons are present on or near his or her land who, in the event of fire, will extinguish the fire or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant fire protection association, if any.	DEFF	While no permitting or licensing requirements arise from this legislation, this Act will be applicable during the construction and operation of the Wind Garden Wind Farm, in terms of the preparation and maintenance of firebreaks, and the need to provide appropriate equipment and trained personnel for firefighting purposes.
Hazardous Substances Act (No. 15 of 1973) (HAS)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the	Department of Health (DoH)	It is necessary to identify and list all Group I, II, III, and IV hazardous substances that may be on site and in what operational

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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 or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance » Group IV: any electronic product, and » 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.		context they are used, stored or handled. If applicable, a license would be required to be obtained from the Department of Health (DoH).
National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA)	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 NEM:WA (GNR 912), a BA or EIA is required to be undertaken for identified listed activities.	DEFF – Hazardous Waste Eastern Cape DEDEAT – general waste	No waste listed activities are triggered by the Wind Garden Wind Farm, therefore, no Waste Management License is required to be obtained. General and hazardous waste handling, storage and disposal will be required during construction and operation. The National Norms and Standards for the Storage of Waste (GNR 926) published under Section 7(1)(c) of NEM:WA will need to be considered in this regard.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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. » 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.		
National Road Traffic Act (No. 93 of 1996) (NRTA)	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 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	South African National Roads Agency (SANRAL) – national roads Eastern Cape Department of Transport	An abnormal load/vehicle permit will 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 project components may not meet specified dimensional limitations (height and width).

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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 No. 21 of 2007)	The Astronomy Geographic Advantage (AGA) Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto. Chapter 2 of the Act allows for the declaration of astronomy advantage areas whilst Chapter 3 pertains to the management and control of astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following: * Restrictions on use of radio frequency spectrum in astronomy advantage areas * Declared activities in core or central astronomy advantage area * Identified activities in coordinated astronomy advantage area; and Authorisation to undertake identified activities.	Department of Science and Technology.	The site proposed for the development of the Wind Garden Wind Farm is located within the Eastern Cape Province and therefore falls outside of the areas considered to be uniquely suited in terms of nationally significant astronomy advantage areas.
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	Civil Aviation Authority (CAA)	This Act will find application during the operation phase of the Wind Garden Wind Farm. Appropriate marking on the project infrastructure is required to meet the specifications as detailed in the CAR Part 139.01.33. An obstacle approval for the Wind Garden Wind Farm is required to be

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	to aviation shall be 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.		obtained from the CAA.
	Provincial Policies / Legislation		
Nature and Environmental Conservation Ordinance (Act 19 of 1974)	This Act provides for the establishment of nature reserves, conservation measures, protection of wild animals, protection of Rhinoceroses, protection of fish in inland waters and protection of flora. The Act also provides schedules of endangered wild animals, protected wild animals, endangered flora and protected floral. Permits will be required for the disturbance and destruction of any of the species listed on the respective schedules.	Eastern Cape DEDEAT	A collection/destruction permit must be obtained from the Eastern Cape DEDEAT for the removal of any protected plant or animal species found on site. The Ecological Impact Assessment (**Appendix D of the BA Report**) identified listed species. Based on the SANBI POSA records for the site and surrounding area, 14 species of conservation concern are potentially present on the site. Species of concern that are potentially present include *Brachystelma luteum* (VU), *Eriospermum bracteatum* (VU), *Apodolirion macowanii* (VU), *Ornithogalum britteniae* (VU) and *Agathosma bicornuta* (EN).