PROPOSED POORTJIES WIND ENERGY FACILITY PROJECT, LOCATED NEAR POFADDER IN THE NORTHERN CAPE PROVINCE

DRAFT SPLIT ENVIRONMENTAL MANAGEMENT PROGRAMME

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PROJECT 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.

Department/ the competent authority: Refers to the Department of Environmental Affairs.

Development footprint: in respect of land, means any evidence of its physical transformation as a result of the undertaking of any activity.

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

Environment: the surroundings within which humans exist and that are made up of:
(i) The land, water and atmosphere of the earth.
(ii) Micro-organisms, plant and animal life;

(iii) Any part or combination of (i) and (ii) and the interrelationships among and between them; and
(iv) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

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

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

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

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

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

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

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

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

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

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.

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."

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 80 m to 140m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 80 to 140 m tall. 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: Is defined as follows:

a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or
b) 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 this Act; or
c) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste.

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

DEA	National Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and Environment
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EO	Environmental Office
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: PROJECT DETAILS

1.1. Overview of the Proposed Project

South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream) is currently authorised for the proposed establishment of a commercial wind energy facility and associated infrastructures on an identified site located near Pofadder. The project received Environmental Authorisation on 28 May 2015 (DFFE REF: 14/12/16/3/3/2/681) which would have lapsed on 28 May 2018, an extension of Environmental Authorisation validity was granted on 06 June 2018 (DFFE REF: 14/12/16/3/3/2/681/AM1) by an additional 3 years. The project received a further extension by an additional 4 years and a re-issue of the EA (DFFE REF: 14/12/16/3/3/2/681/1) following a split of the project into two portions namely Eskom portion and an Independent Power Producer (IPP) portion, such that each portions has its own separate EA and Environmental Management Programme (EMPr).

The proposed site is located within the Khai-Ma Local Municipality. Pofadder situated approximately ~21 km north-north-east of the study area while Aggeneys is ~38 km to the north-west. This proposed project is referred to as the **Poortjies Wind Energy Facility**.

The **Poortjies Wind Energy Facility** is currently authorised for the following infrastructures:

- Up to 50 wind turbines
- Foundations to support the turbine towers
- Cabling between the project components, to be lain underground where practical
- An on-site 132 kV IPP substation (12.5ha) to facilitate the grid connection (Alternative 1 position)
- Internal access roads (~33km)
- Workshop area for maintenance and storage
- Permanent wind monitoring masts
- Battery Energy Storage System (BESS) with a footprint of up to ~2.8ha, within the authorised footprint of the on-site substation.

1.2. Conclusions and Recommendations of the EIA

This EMPr has been developed based on the findings of the Environmental Impact Assessment (EIA) (Savannah Environmental, 2021), and must be implemented to protect sensitive on-site and off-site features through controlling construction and operation activities that could have a detrimental effect on the environment, and through avoiding or minimising potential impacts.

The construction of the Poortjies Wind Farm will lead to permanent disturbance of an area of approximately 46 km^2 in extent (i.e. 2.9% of the site). Permanently affected areas include the turbine footprints and associated infrastructure, as well as the internal underground internal connection cable routes and the internal access roads. From the specialist investigations undertaken for the proposed wind energy facility development site, it was concluded that the majority of impacts identified through the EIA are of moderate to low significance with the implementation of appropriate mitigation. Limited areas of potential high sensitivity were identified (refer to the sensitivity map - Figure 1.1). These potentially sensitive areas and general EIA findings include:

- **Ecology:** The major sensitive features of the site are the drainage lines. The principle mitigation should be avoidance of identified sensitive areas, i.e. seasonal drainage lines and any quartzite koppies. No protected trees were recorded in the study area. However, natural vegetation will be impacted, which would require a permit from Northern Cape Department of Environment and Nature Conservation (DENC).
- **Freshwater ecosystems:** The proposed layout of the project area will have a negligible impact on the aquatic environment. This is based on the assumption that no infrastructure will be placed directly within any active channels.
- **Bat sensitive areas:** Potential roosting sites are present along several drainage lines and rocky elevations found throughout the proposed study site. These areas often have favourable weather conditions which cause increases in insect abundance and thus possible increases in bat activity. Based on the final layout recommended within the EIA, two turbines are currently located within the bat high sensitivity areas and their respective buffers.
- **Bird Habitat and Sensitive Areas:** Due to the overall low flight activity recorded on site, the collision risk index that was developed for the site highlighted very limited spatial patterns in flight activity. No turbine re-positioning is recommended as a result of the collision risk index. The significance of impacts on avifauna as a result of habitat destruction, disturbance of birds, and displacement of birds is rated as medium significance. Collision of birds with turbines is rated as low significance. Site sensitivity mapping has identified buffers around water points. Based on the final layout recommended in the EIA, no turbines are currently located within these no-go areas.
- **Noise sensitive receptors (NSRs):** Noise sensitive receptors do occur in and around the site. The significance of the noise impact is considered to be of a low significance for all Noise Sensitive Developments.
- **Visual receptors:** The wind turbines would likely be exposed to a number of farm residences and sections of secondary roads traversing near or over the development site. It is envisaged that the structures (where visible from shorter distances) may constitute a high visual prominence, potentially resulting in a high visual impact.

No construction housing will be established on the site, and construction workers will be housed in the towns of Pofadder, or other available/existing accommodation. Construction activities on the site will be restricted to daylight hours. The construction phase is anticipated to extend over approximately 18 - 24 months. Negative impacts on the social environment during construction relate mainly to impacts due to presence of construction workers and visual impacts imposed by the facility on the local environment. With the implementation of the recommended mitigation measures, negative impacts will be reduced to be of medium to low significance, and are therefore considered acceptable.

There will be a positive impact due to employment creation, which is a much needed relief by the Khai-Ma Local Municipality (which has high unemployment levels). The positive impact due to employment creation will be lower during operation as there will be a limited number of staff required compared to the construction phase. The potential negative social impacts of the proposed development are offset by the potential positive impacts. With the implementation of the recommended enhancement measures, positive impacts will be of medium to high significance, and are therefore considered acceptable.

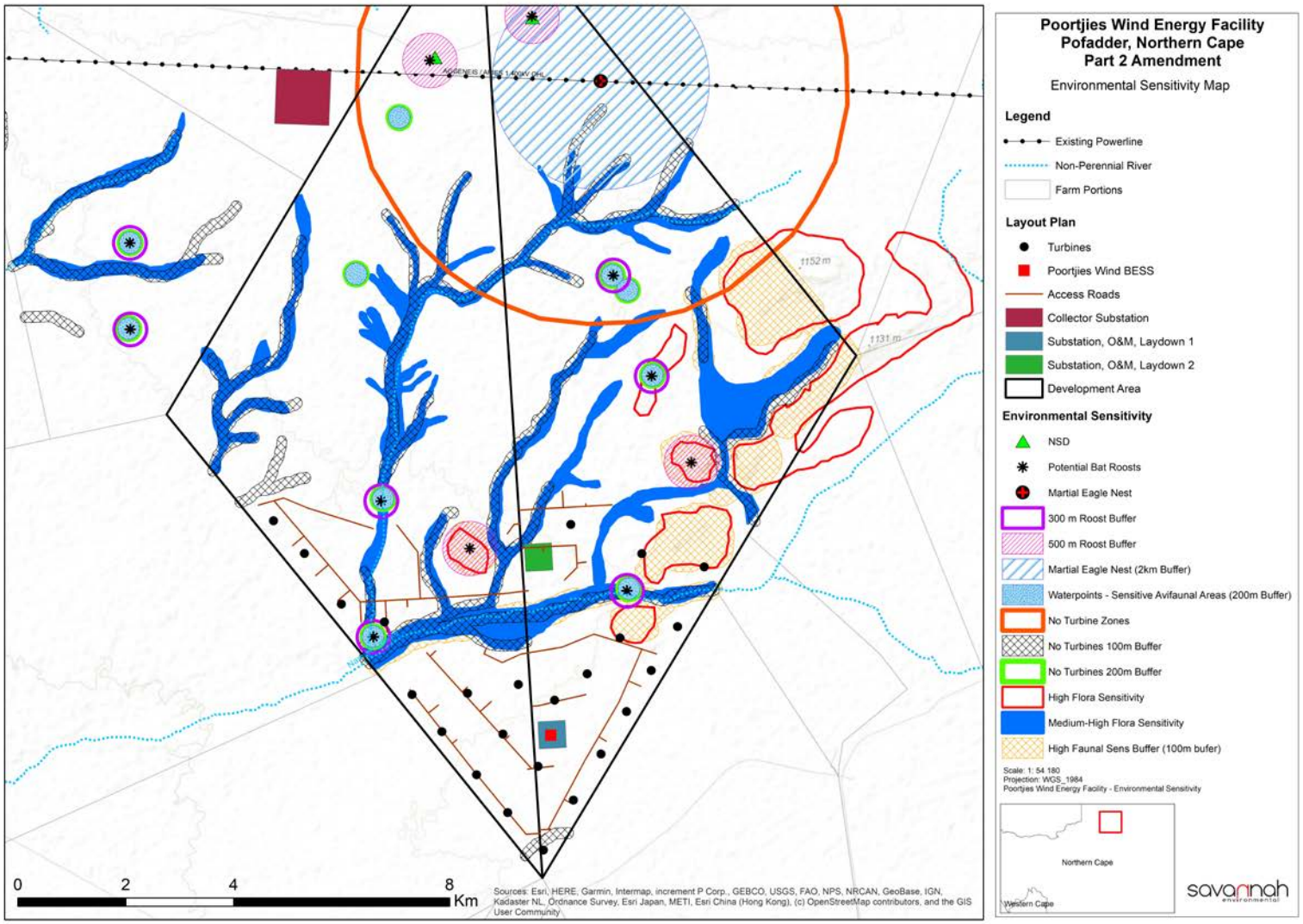

Figure 1.1: Sensitivity map for the Poortjies Wind Energy Facility site showing areas of high ecological, avifauna, fauna and bat sensitivity

1.3. Activities and Components associated with the Facility

The main activities/components associated with the Poortjies Wind Energy Facility are detailed in Table 1.1.

Table 1.1: Activities Associated with Planning, Construction, Operation and Decommissioning of the Facility

Main Activity / Project Component	Components of Activity	Details
	Planning	
Conduct technical surveys	» Geotechnical survey by geotechnical engineer; » Site survey and confirmation of the infrastructure micro-siting footprint; » Survey of internal access routes; and » Survey of on-site substation.	» All surveys are to be undertaken prior to initiating construction.
	Construction	
Establishment of access roads	» Upgrade access/haul roads to the site, as required (this only refers to the main access roads leading directly to site itself). Establish internal access roads: 8m wide permanent roadway within the site between the turbines for use during construction and operation phase. » Temporary track for use during construction phase only.	» Access roads will be constructed/upgraded in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary. » Existing access roads to the site will be utilised, and upgraded where required. Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. » The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines (as well as specialist surveys). To accommodate the large crawler crane required for turbine assembly, a temporary track of up to 12 m in width is required to be established on the site. Permanent roads are expected to be up to 7m in width.
Undertake site preparation	» Site establishment of offices / workshop with ablutions and stores, contractor's yards.	» These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site.

Main Activity / Project Component	Components of Activity	Details
	» Establishment of internal access roads (permanent and temporary roads). » Clearance of vegetation at the footprint of each turbine. » Excavations for foundations.	
Establishment of lay down and hardstand areas on site	» Lay down areas (temporary footprint) at each turbine position for the storage of wind turbine components » Hardstand areas for crane lifting equipment. » Temporary lay down area for crane assembly. » Construction site offices.	» Each turbine needs a flat lay down area during the construction process for the storage of wind turbine components. This area can be rehabilitated after construction unless required during operation. » The hardstand area will need to accommodate the cranes required in tower/turbine assembly. Hardstand and lay down areas will be required to be established for the normal civil engineering construction equipment which will be required on site. A large hardstand area will be required at each position where the main lifting crawler crane may be required to be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the crawler crane from all sides. » Such areas to make use of already compacted areas as far as possible, such as roadways or other laydown areas.
Construct wind turbine foundations	» Concrete foundations at each turbine location (final dimensions to be defined by geotechnical survey of the site).	» Foundation holes will be mechanically excavated (with blasting being utilised only where required). » Shoring and safety barriers will be erected around open excavation. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of a small concrete batching plant close to the activities.
Transport of components and equipment to site	» Flatbed trucks will be used to transport all components to site: » The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks,	» Turbine units consist of a tower comprised of typically 4 segments, a nacelle, rotor and three blades. » Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. mobile assembly crane and a main crane) to erect the wind turbines.

Main Activity / Project Component	Components of Activity	Details
	graders, compaction equipment, cement mixers, etc.). » The components required for the establishment of the on-site IPP substation(including transformers) * Components required for the establishment of the power line (including towers and cabling)	» Other components include components required for the establishment of the on-site IPP substation(including transformers) and those required for the establishment of the power line (including towers and cabling). » The wind turbine, including tower, will be brought to site by the supplier in sections. The individual components are defined as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.) and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc.) as a result of abnormal loading. The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself. It is estimated that 10 trucks will be used for the transport of each turbine.
Erect turbines	» Large lifting crane used for lifting of large, heavy components » A small crane for the assembly of the rotor	» The large lifting crane will lift the tower sections into place, assisted by the smaller crane. » The nacelle, which contains the gearbox, generator and yawing mechanism, will then be placed onto the top of the assembled tower. » The rotor (i.e. the blades of the turbine) will then be assembled or partially assembled on the ground by the smaller crane. It will then be lifted to the nacelle by the large crane, and bolted in place. Alternatively, the blades may be lifted into position on the nacelle individually by the main crane. » It will take approximately 2-4 days to erect each turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.

Main Activity / Project Component	Components of Activity	Details
Construct substations and associated ancillary infrastructure.	» A satellite 132 kV on-site IPP substation to facilitate grid connection. » On-site IPP substation components. » Security fencing around high-voltage (HV) Yard. » Operations and Maintenance buildings » Workshop.	» Will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. » A lay down area for building materials and equipment associated with these buildings will also be required. » The on-site substations will be constructed with a HV yard footprint of up to 100 m x 100 m. » The on-site IPP substation would be constructed as follows: * Step 1: Survey of the site * Step 2: Site clearing and levelling and construction of access road to on-site IPP substation site * Step 3: Construction of terrace and foundations * Step 4: Assembly, erection and installation of equipment (including transformers) * Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.
Connection of the wind turbines to the on-site substations	» Wind turbines » 33 kV underground (where practical) electrical cabling connecting each turbine to the substations.	» The installation of these cables will require the excavation of trenches, approximately 1 m in depth within which these cables can then be laid. The underground cables would follow the internal access roads as far as reasonably possible.
Connect substations to power grid[1]	» A new 132kV overhead power line feeding into the power grid	» The route for the power lines will be assessed, surveyed, and pegged prior to construction. » A servitude of approximately 32 m will be required for each of the power lines.
Commissioning of the facility	» Wind Energy Facility commissioning	» Prior to the start-up of a wind turbine, a series of checks and tests will be carried out, including both static and dynamic tests to make sure the turbine is working within appropriate limits.

[1] A separate basic assessment process for the power line is being undertaken.

Main Activity / Project Component	Components of Activity	Details
		» Grid interconnection and unit synchronisation will be undertaken to confirm the turbine performance. Physical adjustments may be needed such as changing the pitch of the blades of the turbines.
Undertake site rehabilitation	» Remove all construction equipment from the site. » Rehabilitation of temporarily disturbed areas where practical and reasonable.	» On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.
Operation		
Operation	» Operation of turbines within the wind energy facility	» Once operational, the Renewable Energy Facility will be monitored remotely. » No permanent staff will be required on site for any extended period. It is anticipated that there will be full time security, maintenance and control room staff required on site. » Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather conditions, or maintenance activities.
Maintenance	Maintenance activities include: » Oil and grease – turbines; » Transformer oil – substation; and » Waste product disposal	» The wind turbines will be subject to periodic maintenance and inspection. » Periodic oil changes will be required and any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation. » The turbine infrastructure is expected to have a lifespan of approximately 20 - 30 years, with maintenance.
Decommissioning		
Site preparation	» Confirming the integrity of the access to the site to accommodate required equipment and lifting cranes. » Preparation of the site (e.g. lay down areas, construction platform) » Mobilisation of construction equipment	» Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.

Main Activity / Project Component	Components of Activity	Details
Disassemble wind turbines	» A large crane will be used to disassemble the turbine and tower sections.	» Turbine components would be reused, recycled or disposed of in accordance with regulatory requirements. » The hours of operation for noisy construction activities are guided by the Environment Conservation Act (noise control regulations). If the project requires construction work outside of the designated hours, regulatory authorities and affected stakeholders will be consulted and subsequent negotiations will be made to ensure the suitability of the revised activities (if applicable).

CHAPTER 2: PURPOSE AND OBJECTIVES OF THE EMPR

Savannah Environmental (Pty) Ltd undertook an Environmental Impact Assessment (EIA)process on behalf of South Africa Mainstream Renewable Power Developments (Pty) Ltd for the construction of the proposed construction of a 100 MW Poortjies Wind Energy Facility on Portion 1 of the Farm Poortje 209 and the Remainder of the Farm Poortje near Pofadder located within the Khai-Ma Local Municipality, Northern Cape Province in terms of the EIA Regulations of 2010 (Government Notices R543, R544, R545 and R546) published under the National Environmental Management Act (No. 107 of 1998). The Final Environmental Impact Assessment Report was submitted to the National Department of Forestry, Fisheries and Environment (DFFE; previously known as the Department of Environmental Affairs (DEA)), as the competent authority, in February 2015. On the basis of the outcomes of the EIA process, South Africa Mainstream Renewable Power Developments (Pty) Ltd ('the proponent') received an Environmental Authorisation (EA) dated 28 May 2015 (DEFF Reference 14/12/16/3/3/2/681), The proponent decided to split the on-site substation into two portions as per the Eskom requirements (i.e. all grid connection infrastructure) will be transferred to Eskom's name following completion of construction) namely an Eskom portion and an Independent Power Producer (IPP) portion, such that each portion has its own separate EA and Environmental Management Programme (EMPr).The project then received a Split EA on 24 June 2021 (DFFE REF: 14/12/16/3/3/2/681/1).The purpose of the proposed wind energy facility is to sell the electricity generated to Eskom under the Renewable Energy Independent Power Producers (IPP) Procurement Programme. The IPP Procurement Programme has been introduced by the Department of Energy (DoE) to promote the development of renewable power generation facilities (derived from) by IPPs in South Africa.

Page 5 and 6 of the Split EA dated 24 June 2021 (DEA Reference: 14/12/16/3/3/2/681/1) details the main infrastructure associated with the Poortjies Wind Energy Facility, including the technical details.

The proponent is now applying for a substantive amendment (Part II) towards amending the Split EA as follows:

i. Amendment of the turbine specifications, to be as follows:
   - The increase of the hub height from 140m (authorised in 2015 and re-issued in 2021) to reflect as 'up to 200m'
   - The increase of the rotor diameter from 140m (authorised in 2015 and re-issued in 2021) to reflect as 'up to 200m'.
   - Inclusion of the Blade tip height of 'up to 300m.
   - A reduction in the authorised number of turbines from the currently authorised 50 turbines (authorised in 2015 and re-issued in 2021), to reflect as 'up to 24'.

Information in the report which has been updated has been underlined for ease of reference. Otherwise, the information presented here is identical to that presented in the original EIA report.

An Environmental Management Programme (EMPr) is defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced"[2]. The objective of this 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 those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site rehabilitation (soil stabilisation, re-vegetation) and operation. The EMPr also defines monitoring requirements in order to ensure that the specified objectives are met.

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

The EMPr has the following objectives:

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

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

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

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

Mainstream must ensure that the implementation of the project complies with the requirements of any and all environmental authorisations and permits (once issued), as well as with obligations emanating from all relevant environmental legislation. This obligation is partly met through the development of the EMPr, and the implementation of the EMPr through its integration into the contract documentation for activities associated with both construction and operation. Since this EMPr is part of the EIA process undertaken for the proposed Poortjies Energy Wind Facility, it is important that this document be read in conjunction with the Scoping Report and EIA Report (January 2015), as well as the Environmental Authorisation (once issued). This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. This EMPr for construction and operation activities has been compiled in accordance with Section 33 of the EIA Regulations and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project. This EMPr should be considered a dynamic document, requiring regular review and updating as new information becomes available in order for it to remain relevant to the requirements of the site and the environment.

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

» Ensuring that employees have a basic understanding of the key environmental features of the construction site and the surrounding environment.

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

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

CHAPTER 3: STRUCTURE OF THIS EMPR

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

- Planning and design activities
- Construction activities
- Operation activities
- Decommissioning activities

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

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

Project component/s	List of project components affecting the objective, i.e.: » Wind turbines » Access roads » Substations
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 facility whenever changes, such as the following, occur:

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

Any amendments must be approved by the Competent Authority (i.e. DEA) prior to implementation, unless these are required to address an emergency situation.

Relevant EMP sections according to approval of scoping report

Plan / Study	Inclusion in EMP / EIA
Plan Rescue & Protection Plan	Appendix A
Alien Invasive Management Plan	Appendix B
Re-vegetation plan	Chapter 6, Objective 1 of EMP
Transportation plan	Appendix F
Traffic Management Plan	Appendix F
Stormwater Management Plan	Appendix G
Services Report	Refer to EIA, Chapter 2, Table 2.1
Fire Management Plane	Chapter 7, Objective 8 in EMP report
Erosion Management Plan	Appendix C
Open Space Management Plan	Appendix J

3.1. Project Team

This EMP was compiled by:

EMP Compilers	
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John von Mayer	Savannah Environmental
Karen Jodas	Savannah Environmental
Input from Specialists	
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Avifauna	Chris van Rooyen of Chris van Rooyen Consulting
12- month Bat Monitoring	Jonathan Aronson and Jennifer Slack of Arcus Consultancy Services
Soils, erosion and agricultural potential	Johann Lanz
Visual	Mandy van der Westhuizen of NuLeafe Planning & Environment and Lourens du Plessis of MetroGIS
Heritage	Tim Hart of ACO Associates
Noise	Morné de Jager of Enviro Acoustic Research cc
Social Impact	Tony Barbour (Environmental Consultant and Researcher)
Aquatic Assessment	Brian Colloty of Scherman Colloty and Associates

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 ten (10) 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 4: MANAGEMENT PLAN FOR THE WIND ENERGY FACILITY: - PRE-CONSTRUCTION

4.1. Goal for Pre-Construction

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

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

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

4.2. Objectives

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

From the specialist investigations undertaken for the proposed Poortjies Wind Energy Facility development site, areas of high sensitivity were identified (refer to Figure 1.1). The principle mitigation should be avoidance of identified sensitive areas.

Project component/s	» Wind turbines » Access roads » Substations and buildings
Potential Impact	» Design fails to respond optimally to the identified environmental considerations
Activities/risk sources	» Positioning of turbines and access roads » Positioning of substations and buildings
Mitigation: Target/Objective	» To ensure that the design of the facility responds to the identified environmental constraints and opportunities

Mitigation: Action/control	Responsibility	Timeframe
Consider design level mitigation measures recommended by the specialists, especially with respect to visual aesthetics, noise, flora, ecology, avifauna and bat sites, as detailed within the EIA report and relevant appendices.	Engineering Design Consultant / turbine supplier Mainstream	Tender design, design review stage
As far as possible, access roads and cable trenches which could potentially impact on sensitive areas should be shifted in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not possible, alternative mitigation measures as detailed in this report must be implemented.	Engineering Design Consultant Mainstream	Tender design, design review stage
Align underground cables and internal access roads as far as possible along existing infrastructure and disturbances.	Mainstream	Design
A buffer of at least 50m (from centre of stream for drainage) should be maintained around drainage lines	Mainstream	Design
The locations of potential bat roosts are shown in the sensitivity map above and a buffer of 300 m and 500 m should be applied around these according to the kind of roost	Mainstream	Design
The quartzite koppies identified in the ecological report and mapped on Figure 1.1 should be avoided.	Mainstream	Design
A walk-though survey of final infrastructure positions for the wind energy facility and associated infrastructure should be undertaken by a specialist ecologist prior to the commencement of construction. The EMPr for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMPr must be submitted to DEA for approval prior to the commencement of construction.	Specialists	Final design phase
Should the layout (or type of wind turbines used) change significantly during the final design, the new layout must be submitted to the Department.	Mainstream	Design phase
A detailed geotechnical investigation is required for the design phase for all infrastructure components.	Mainstream	Design phase
Implement a stormwater management plan for hard/compacted surfaces (e.g. on-site IPP substation footprints) as part of the final design of the project (see Appendix J for generic plan)	Mainstream	Design phase

Mitigation: Action/control	Responsibility	Timeframe
Make use of existing roads where possible when planning the access road layout for the facility.	Relevant specialists Mainstream	Design phase
Obtain any additional environmental permits required (e.g. water use license, protected tree and protected plant permits, etc.). Copies of permits/licenses must be submitted to the Director: Environmental Impact Evaluation at the DEA.	Mainstream	Design phase
Mining permit/license to be obtained for any borrow pits to be established for the project (if applicable).	Mainstream	Design phase
Obtain required abnormal load permits for transportation of project components to site.	Mainstream /contractor	Design phase
The noise emission specifications of wind turbine generators should be considered when selecting the equipment in order to ensure that noise impacts are minimised as far as possible.	Mainstream	Design phase
Plan the placement of lay-down areas and temporary construction accommodation in order to minimise vegetation clearing.	Mainstream	Design phase
Ensure that proper planning is undertaken regarding the placement of lighting structures for the substation and that light fixtures only illuminate areas inside the on-site IPP substation site.	Mainstream	Design
A lighting engineer must be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass. In addition, the possibility of motion activated security lighting should be investigated. This will allow for a predominantly dark site to be lit only as required.	Mainstream	Design
Aviation warning lights must be planned on turbine hub or such measures required by the Civil Aviation Authority. Indications are that the facility may not be required to fit a light to each turbine, but rather place synchronous flashing lights on the turbines representing the outer perimeter of the facility.	Mainstream	Design
ECO to be appointed prior to the commencement of any authorised activities. Once appointed the name and contact details of the ECO must be submitted to the Director: Compliance Monitoring at the DEA.	Mainstream	Pre-construction

Mitigation: Action/control	Responsibility	Timeframe
Identify potential opportunities for local businesses.	Mainstream	Tender Design and Review stage
Develop a database of local BEE service providers and ensure that they are informed of relevant tenders and job opportunities.	Mainstream	Pre-construction
This EMP and the Environmental Authorisation must be included in all tender documentation and Contractors contracts.	Mainstream	Tender process

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

OBJECTIVE 2: To ensure effective communication mechanisms

On-going communication with affected and surrounding landowners is important to maintain during the construction and operational phases of the wind energy facility. 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 » Substations and buildings
Potential Impact	» Impacts on affected and surrounding landowners and land uses
Activity/risk source	» Activities associated with construction » Activities associated with operation
Mitigation: Target/Objective	» Effective communication with affected and surrounding landowners » Addressing of any issues and concerns raised as far as possible in as short a timeframe as possible

Mitigation: Action/control	Responsibility	Timeframe
Compile and implement a grievance mechanism procedure for the public (as outlined in Appendix E) to be implemented during both the construction and operational phases of the facility. This procedure should include details of the contact person who will be receiving issues	Mainstream	Pre-construction (construction procedure) Pre-operation (operation procedure)

Mitigation: Action/control	Responsibility	Timeframe
raised by interested and affected parties, and the process that will be followed to address issues.		
Develop and implement a grievance mechanism for the construction, operational and closure phases of the project for all employees, contractors, subcontractors and site personnel. This procedure should be in line with the South African Labour Law.	Mainstream	Pre-construction (construction procedure) Pre-operation (operation procedure)
Liaison with landowners is to be undertaken prior to the commencement of construction in order to agree on landowner-specific conditions during construction and maintenance.	Mainstream	Pre-construction

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

CHAPTER 5: MANAGEMENT PLAN FOR WIND ENERGY FACILITY - CONSTRUCTION

5.1. Overall Goal for Construction

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

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

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

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

The **Project Manager** / **Mainstreams' Overall Representative** will:

» Ensure of all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these.
» Ensure that Mainstream and its Contractor(s) are made aware of all stipulations within the EMPr.
» Ensure that the EMPr is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.

» Be fully conversant with the Environmental Impact Assessment for the project, the EMPr, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.

The **Site Manager** (Mainstream On-site Representative or Engineers Representative) will:

» Be fully knowledgeable with the contents of the Environmental Impact Assessment.
» Be fully knowledgeable with the contents and conditions of the Environmental Authorisation (once issued).
» Be fully knowledgeable with the contents of the Environmental Management Programme.
» Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these.
» Have overall responsibility of the EMPr and its implementation.
» Conduct audits to ensure compliance to the EMPr.
» Ensure there is communication with the Project Manager, the Environmental Control Officer and relevant discipline Engineers on matters concerning the environment.
» Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.

The **Safety, Health and Environmental Representatives (Mainstream and Main Contractor)** will:

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

Main Contractor: All contractors are ultimately responsible for:

» Ensuring adherence to all environmental management specifications contained within this EMPr (and the Environmental Authorisation, once issued), as well as any specific specifications detailed by Mainstream.
» Ensuring that Method Statements are submitted to the Site Manager (and ECO) for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the 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 EMP (i.e. ensure their staff are appropriately trained as to the environmental obligations).

An independent **Environmental Control Officer (ECO)** must be appointed by the project proponent prior to the commencement of any authorised activities and will be responsible for monitoring, reviewing and verifying compliance by the EPC Contractor with the environmental specifications of the EMP and the conditions of the Environmental Authorisation. Accordingly, the ECO will:

- » Be fully knowledgeable with the contents with the Environmental Impact Assessment.
- » Be fully knowledgeable with the contents with the conditions of the Environmental Authorisation (once issued).
- » Be fully knowledgeable with the contents with the Environmental Management Programme.
- » Be fully knowledgeable of all the licences and permits issued to the site.
- » Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
- » Ensure that the contents of this EMPr are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
- » Ensure that the compliance of the EMPr is monitored through regular and comprehensive inspection of the site and surrounding areas.
- » Ensure that if the EMPr conditions 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).
- » Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.
- » Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
- » Ensure that activities on site comply with all relevant environmental legislation.
- » Remedial action will be required by the responsible party in the event of contravention of the specifications of the EMPr.
- » Ensure that the compilation of progress reports for submission to the Project Manager, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.

» Ensure that there is communication with the Site Manager regarding the monitoring of the site.
» Ensure that any non-compliance or remedial measures that need to be applied are reported.
» Keep record of all activities on site, problems identified, transgressions noted and a schedule of tasks undertaken by the ECO in the form of a daily diary.
» Independently report to DEA in terms of compliance with the specifications of the EMP and conditions of the Environmental Authorisation (once issued).

As a general mitigation strategy, the Environmental Control Officer (ECO) should be present for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, 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 weekly site compliance inspections would probably be sufficient. However, in the absence of the ECO, there should be a designated environmental officer present to deal with any environmental issues that may arise such as fuel or oil spills. The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site handed over for operation.

Contractor's Safety, Health and Environment Representative: The Contractor's Safety, Health and Environment (SHE) Representative, employed by the Contractor, must be a suitably qualified individual appointed to be 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 and ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor.

The Contractor's Safety, Health and Environment Representative 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.

5.3. Objectives

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

OBJECTIVE 1: Securing the site and site establishment

The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. Where the public could be exposed to danger by any of the works or site activities, the Contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English and any other relevant indigenous languages, all to the approval of the Site Manager.

Project component/s	» Wind turbines » Access roads » Substations » Operation and maintenance buildings
Potential Impact	» Hazards to landowners/public » Security of materials » Substantially increased damage to natural vegetation
Activities/risk sources	» Open excavations (foundations and cable trenches) » Movement of construction vehicles in the area and on-site
Mitigation: Target/Objective	» To secure the site against unauthorised entry » To protect members of the public/landowners/residents

Mitigation: Action/control	Responsibility	Timeframe
Secure site, working areas and excavations in an appropriate manner, as agreed with the ECO.	Contractor	During site establishment Maintenance: for duration of Contract
Where necessary to control access, fence and secure area and implement access control procedures.	Contractor	During site establishment Maintenance: for duration of Contract
Fence and secure Contractor's equipment camp.	Contractor	During site establishment Maintenance: for duration of Contract
Location of concrete batching plant/s to be located in areas of low sensitivity within the approved development area.	Contractor	During site establishment
All unattended open excavations shall be adequately demarcated and/or fenced (fencing shall consist of a minimum of three strands of wire wrapped with danger tape).	Contractor	Erection: during site establishment Maintenance: for duration of Contract

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

OBJECTIVE 2: Maximise local employment and business opportunities associated with the construction phase

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

Project component/s	» Construction activities associated with the establishment of the wind energy facility, including associated infrastructure.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised. However, due to the relatively small size of the facility the number of employment and business opportunities for locals will be limited.
Activities/risk sources	» The employment of outside contractors to undertake the work and who make use of their own labour will reduce the employment and business opportunities for locals. Employment of local labour will maximise local employment opportunities.
Mitigation: Target/Objective	» The appointed contractor should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. » Mainstream should develop a database of local BEE service providers.

Mitigation: Action/control	Responsibility	Timeframe
Employ as many workers (skilled, semi-skilled / low-skilled) from the local area/ nearby towns as possible.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Where required, implement appropriate training and skills development programmes prior to the initiation of the construction phase to ensure that local employment target is met.	Contractor	Pre-construction

Performance Indicator	» Source as many local labourers as possible. » Database of potential local BEE services providers in place before construction phase commences.
Monitoring and Reporting	» Mainstream and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site.

OBJECTIVE 3: Avoid the negative social impacts on family structures and social networks due to the presence of construction workers

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

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

Project component/s	» Construction and establishment activities associated with the establishment of the wind energy facility, including associated infrastructure.
Potential Impact	» The presence of construction workers who live outside the area and who are housed in local towns can impact on family structures and social networks.

	» 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. » Due the relatively small number of workers associated with the construction of the proposed facility, the risk of impacts is likely to be low.
Activities / risk sources	» The presence of construction workers can impact negatively on family structures and social networks, especially in small, rural communities. » The presence of construction workers on the site can result in stock thefts and damage to farm infrastructure.
Mitigation: Target / Objective	» Avoid and or minimise the potential impact of construction workers on the local community and livelihoods.

Mitigation: Action / control	Responsibility	Timeframe
Employ as many workers (skilled, semi-skilled / low-skilled) from the local area as possible. This should be included in the tender documents. Construction workers should be recruited from the local area in and around the towns such as Sutherland.	Contractor	Identify suitable local contractors prior to the tender process for the construction phase.
Establish contact with the adjacent farmers and develop a Code of Conduct for construction workers. Ensure that construction workers attend a briefing session before they commence activities. The aim of the briefing session is to inform them of the rules and regulations governing activities on the site as set out in the Code of Conduct. Ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct.	Mainstream & Contractor	Briefing session for construction workers held before they commence work on site.
Ensure that construction workers who are found guilty of breaching the Code of Conduct are dealt with appropriately. Dismissals must be in accordance with South African labour legislation.	Mainstream and contractors	Construction
No housing of construction workers on the site to be permitted, apart from security personnel.	Contractors	Construction
Implement a policy that no employment will be available at the gate.	Contractors	Construction
Compensate farmers / community members for cost for any losses, such as livestock, damage to infrastructure etc. proven to be associated with the project.	Contractors	Construction

Performance Indicator	» Employment policy and tender documents that set out requirement for local employment and targets completed before construction phase commences. » Code of Conduct developed and approved prior to commencement of construction phase. » Labour locally sourced, where possible. » Tender documents for contractors include recommendations for construction camp. » All construction workers made aware of Code of Conduct within first week of being employed. » Briefing session with construction workers held at outset of construction phase.
Monitoring and Reporting	» Mainstream and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. » An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE 4: Noise control

Various construction activities would be taking place during the development of the facility and may pose a noise risk to sensitive receptors. While the study undertaken in the EIA investigated likely and significant noisy activities, it did not evaluate all potential activities that could result in a noise impact, as these were not defined at the time of the study. Other construction activities not evaluated could include temporary or short-term activities where small equipment is used (such as the digging of trenches to lay underground power-cables).

Project component/s	» Construction of turbine (foundation, tower, nacelle and rotor) » Substations and buildings » Access roads
Potential Impact	» Nuisance noise from construction activities affecting the surrounding community
Activity/risk source	» Any construction activities taking place within 500 m from potentially sensitive receptors (PSR)
Mitigation: Target/Objective	» Ensure equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors. » Ensure that maximum noise levels at potentially sensitive receptors be less than 65 dBA.

	» Prevent the generation of a disturbing or nuisance noises » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors. » Ensuring compliance with the Noise Control Regulations

Mitigation: Action / control	Responsibility	Timeframe
Where possible, construction work should be undertaken during normal working hours (06H00 – 18H00), from Monday to Friday. If work is required on the weekend / public holiday, agreements can be reached (in writing) with the landowners adjacent to the work, these working hours can be extended.	Contractor	Construction
The construction crew must abide by the national standards and local by-laws regarding noise.	Contractor	Construction
All construction equipment, including vehicles, must be properly and appropriately maintained in order to minimise noise generation.	Contractor	Construction
Establish a line of communication and notify all stakeholders and sensitive receptors of the means of registering any issues, complaints or comments.	Contractor	All phases of project
Notify potentially sensitive receptors about work to take place at least 2 days before the activity in the vicinity (within 500 m) of the PSR is to start. The following information to be presented in writing: » Description of activity to take place » Estimated duration of activity » Working hours » Contact details of responsible party	Contractor	At least 2 days, but not more than 5 days before activity is to commence

Performance Indicator	» No complaints received concerning noise. » Equivalent A-weighted noise levels below 45 dBA at potentially sensitive receptors. » Maximum noise levels at potentially sensitive receptors are less than 65 dBA.
Monitoring and Reporting	» Should a compliant about noise be reported, Mainstream to look into the matter and determine steps to deal with the complaint. An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE 5: Management of dust and emissions and damage to roads

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

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

Mitigation: Action/control	Responsibility	Timeframe
Implement appropriate dust suppression measures on site such as wetting roads on a regular basis.	Contractor	Construction
Haul vehicles moving outside the construction site carrying material that can be wind-blown should be covered with tarpaulins.	Contractor	Duration of contract
Ensure vehicles adhere to speed limits on public roads and speed limits set within the site by the Site Manager. Vehicles should be fitted with recorders to record when vehicles exceed the speed limit.	Contractor/ transportation contractor	Duration of contract
Disturbed areas must be re-vegetated as soon as practicable after construction is complete in an area.	Contractor	At completion of the construction phase
Vehicles and equipment must be maintained in a road-worthy condition at all times.	Contractor	Prior to construction phase
Ensure that damage to gravel public roads and access roads attributable to construction vehicles is repaired before completion of construction phase.	Contractor	Before completion of construction phase
Regular dust control of materials (sand, soil, cement) must be used at concrete batching plants on site	Contractor	Construction

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. » All heavy vehicles equipped with speed monitors before they are used in the construction phase. » Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.
Monitoring and Reporting	» Mainstream and appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase. » Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager. » An incident reporting system must be used to record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE 6: Soil and rock degradation and erosion control

The natural soil on the site needs to be preserved as far as possible to minimise impacts on the environment. Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern in areas underlain by fine grained soil which can be mobilised when disturbed, even on relatively low slope gradients (accelerated erosion). Uncontrolled run-off relating to construction activity (excessive wetting, etc.) 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. Steep slope are prone to soil erosion and good soil management must be undertaken during construction.

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

Project component/s	» wind turbines » access roads » substations » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas). » All other infrastructure
Potential Impact	» Erosion and soil loss » Negative impacts on wetlands

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

Mitigation: Action / control	Responsibility	Timeframe
Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 50 m away from drainage lines. Limit the height of stockpiles to 2m to reduce compaction.	Contractor	During site establishment and any activity related to earthworks as well as the duration of construction
New access roads to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement and compaction of soil.	Engineer / Contractor	Before and during construction

Mitigation: Action/control	Responsibility	Timeframe
Identify and demarcate construction areas for general construction work and restrict construction activity to these areas.	Contractor	Construction
Rehabilitate disturbance areas as soon as construction in an area is completed.	Contractor	During and after construction
Stockpiles not used in three (3) months after stripping must be seeded or appropriately covered to prevent dust and erosion - only if natural seeding does not occur.	Contractor	During and after construction
Erosion control measures: Implement run-off attenuation on slopes (sand bags, logs), silt fences, stormwater catch-pits, shade nets or temporary mulching over denuded areas.	Contractor	Erection: Before construction Maintenance: Duration of contract
Particular care should be taken in the design of road drainage line and wetland crossings in order to ensure there is no step in the channel bed, substrate continuity is maintained and no undue constriction of flow takes place.	Contractor	Erection: during site establishment Maintenance: for duration of contract
Where access roads cross natural drainage lines or wetlands, culverts (or other appropriate measures) must be designed to allow free flow. Regular maintenance of the culverts must be carried out.	Engineer / Contractor	Before and during construction
Control depth of all excavations and stability of cut faces/sidewalls.	Engineer / Contractor	Maintenance over duration of contract
Compile a comprehensive stormwater management plan as part of the final design of the project and implement during construction and operation.	Contractor	Compile during design; implement during construction & operation
Cement batching to take place in designated areas only, as approved on site layout (if applicable).	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 & at site offices.	Contractor	Construction
Soil erosion control measures (such as hessian mats and gabions) be used for in erosion prone areas such as steep slopes.	Contractor	Construction

Performance Indicator	» No activity outside of designated areas

	» Minimal level of soil erosion around site as a result of construction activities » Minimal level of increased siltation in drainage lines as a result of construction activities » Minimal level of soil degradation as a result of construction activities
Monitoring and Reporting	» Continual inspections of the site by ECO » Fortnightly inspections of sediment control devices by ECO » Reporting of ineffective sediment control systems and rectification as soon as possible. » An incident reporting system must record non-conformances to the EMP. » Public complaints register must be developed and maintained on site.

OBJECTIVE 7: Limit disturbance and avoid damage to drainage lines

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

Project component/s	» access roads » cabling
Potential Impact	» Damage to drainage line areas by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material within wetlands). The focus should be on the functioning of the drainage line as a natural system.
Activity/risk source	» Construction of access roads and cabling
Mitigation: Target/Objective	» No damage to drainage lines within project area

Mitigation: Action/control	Responsibility	Timeframe
Rehabilitate any disturbed areas as soon as possible once construction is completed in an area.	Contractor	Construction
Control stormwater and runoff water. Contaminated runoff from the construction site(s) should be prevented from entering the rivers/streams.	Contractor	Construction
For any new construction where direct impacts on drainage lines are unavoidable cross watercourses perpendicularly to minimise disturbance footprints.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Construction must not result in the width of the watercourse being narrowed.	Contractor	Construction
Utilise erosion control measures on access roads and drainage lines where required.	Contractor	Construction
Ablution facilities at the construction sites must be located at least 100m away from drainage lines and regularly serviced	Contractor	Construction
Concrete batching plants and stockpiles to be located more than 500m away from drainage lines.	Contractor	Construction

Performance Indicator	» No impacts on water quality, water quantity, wetland vegetation, natural status of wetland
Monitoring and Reporting	» Habitat loss in watercourses should be monitored before and after construction. » 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 8: Limit disturbance of vegetation and loss of protected flora during construction

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

Project component/s	All infrastructure and activities which result in vegetation loss or clearing including: » Clearing for roads and excavation for turbine foundations » Underground cabling » Access roads
Potential Impact	» Loss of plant cover leading to erosion as well as loss of faunal habitat and loss of specimens of protected plants
Activity/risk source	Vegetation clearing for the following: » Turbine construction and service areas » Access roads » Laydown areas » Construction Camps
Mitigation: Target/Objective	» To reduce the footprint and low impact on terrestrial environment » To reduce the impact on protected plant species

Mitigation: Action/control	Responsibility	Timeframe
Preconstruction walk-through of development footprint and use micro-siting to reduce local impact.	Specialists	Construction
Revegetation of cleared areas or monitoring should be implemented to ensure that recovery is taking place	Contractor	Construction
A site rehabilitation programme should be compiled and implemented.	Contractor in consultation with Specialist	Duration of contract
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, Act 43 of 1983 and NEM: Biodiversity Act)	Contractor	Construction
Immediately control any alien plants that become established using registered control methods.	Contractor	Construction

Performance Indicator	» Vegetation loss must be restricted to infrastructure footprint » Low impact on protected plant species » A permit must be obtained for the destruction or translocate affected individuals of protected species.
Monitoring and Reporting	ECO to monitor construction to ensure that: » Vegetation is cleared only within essential areas » Erosion risk is maintained at an acceptable level through flow regulation structures where appropriate and the maintenance of plant cover wherever possible

OBJECTIVE 9: Protection of fauna, avifauna and bats

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

No construction activities with the potential to affect any bat roosts will be permitted without the express permission of a suitably qualified bat specialist following appropriate investigation and construction mitigation.

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

Mitigation: Action/control	Responsibility	Timeframe
Clearly mark areas to be cleared in order to eliminate unnecessary clearing/disturbance.	Contractor in consultation with Specialist	Pre-construction
Potential bat roosts should be monitored at least once a month for the duration of the construction phase to search for evidence of roosting bats (i.e. guano, culled insects remains). If and construction roosting bats are located, a bat specialist should be consulted to determine future actions	Contractor in consultation with Specialist	Construction
The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on fauna and their habitats is restricted.	Contractor	Site establishment & duration of contract
A site rehabilitation programme should be compiled and implemented.	Contractor in consultation with Specialist	Duration of contract

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

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

OBJECTIVE 11: 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 » access roads » Wind turbines
Potential Impact	» The potential scarring of the landscape due to the creation of new access roads/tracks or the unnecessary removal of vegetation. » Construction traffic
Activity/risk source	» The viewing of visual scarring by observers in the vicinity of the facility or from the roads traversing the site
Mitigation: Target/Objective	» Minimal disturbance to vegetation cover in close vicinity to the proposed facility and its related infrastructure » Minimised construction traffic, where possible

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

Performance Indicator	» Construction site maintained in a neat and tidy condition. » Vegetation cover that remains intact with no erosion scarring in close proximity of the facility. » Site appropriately rehabilitated after construction is complete.
Monitoring	» Monitoring of vegetation clearing during the construction phase.

	» Monitoring of rehabilitation activities to ensure appropriate rehabilitation of the site. » An incident reporting system will be used to record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site.

OBJECTIVE 12: Appropriate handling and storage of chemicals, hazardous substances and waste

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

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

Mitigation: Action/control	Responsibility	Timeframe
The storage of flammable and combustible liquids such as oils must be in designated areas which are appropriately bunded, and stored in compliance with	Contractor	Duration of contract

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

Mitigation: Action/control	Responsibility	Timeframe
Documentation (waste manifest) must be maintained detailing the quantity, nature and fate of any hazardous waste.	Contractor	Duration of contract
An incident/complaints register must be established and maintained on-site.	Contractor	Duration of contract
Hazardous and non-hazardous waste must be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered.	Contractors	Erection: during site establishment Maintenance: for duration of Contract within a particular area
All solid waste collected must be disposed of at a registered waste disposal site. A certificate of disposal must be obtained and kept on file. The disposal of waste must be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site.	Contractors	Erection: during site establishment Maintenance: for duration of Contract within a particular area
Supply waste collection bins at construction equipment and construction crew camps.	Contractors	Erection: during site establishment Maintenance: for duration of Contract within a particular area
Construction equipment must be refuelled within designated refuelling locations, or where remote refuelling is required, appropriate drip trays must be utilised.	Contractor	Duration of contract
All stored fuels to be maintained within a bund and on a sealed surface.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function.	Contractor	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
Oily water from bunds at the on-site IPP substation must be removed from site by licensed contractors.	Contractor	Duration of contract
Spilled cement and concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures.		
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents. Spill kits to be kept on-site	Contractor	Duration of contract
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of contract
Upon the completion of construction, the area will be cleared of potentially polluting materials.	Contractor	Completion of construction

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

OBJECTIVE 13: Ensure disciplined conduct of on-site contractors and workers

In order to minimise impacts on the surrounding environment, Contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the Environmental Authorisation

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

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

Mitigation: Action/control	Responsibility	Timeframe
Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no abluting must be permitted outside the designated area. These facilities must be regularly serviced by appropriate contractors. Ablution facilities must not be placed within 100m from any river, wetland or drainage line.	Contractor (and sub-contractor/s)	Duration of contract
Cooking must take place in a designated area. No firewood or kindling may be gathered from the site or surrounds.	Contractor (and sub-contractor/s)	Duration of contract
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.	Contractor (and sub-contractor/s)	Duration of contract
No one other than the ECO or personnel authorised by the ECO, will disturb flora or fauna outside of the demarcated construction area/s.	Contractor (and sub-contractor/s)	Duration of contract

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

OBJECTIVE 14: To avoid and or minimise the potential risk of increased veld fires during the construction phase.

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

Mitigation: Action/control	Responsibility	Timeframe
Ensure that open fires on the site for cooking or heating are not allowed except in designated areas.	Contractor	Construction
Provide adequate firefighting equipment on-site.	Contractor	Construction
Provide fire-fighting training to selected construction staff.	Contractor	Construction
Compensate farmers / community members at full market related replacement cost for any losses due to the wind energy facility project, such as livestock, damage to infrastructure etc.	Contractor	Construction

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

5.4. Detailing Method Statements

OBJECTIVE 15: 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:

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

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

5.5. Awareness and Competence: Construction Phase of the Renewable Energy Facility

OBJECTIVE 16: 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:

- Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- Ensuring that a copy of the EMPr is readily available on-site, and that all site staff are aware of the location and have access to the document. Employees will be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the facility.
- Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- Basic training in the identification of archaeological sites/objects, paleontological sites, and protected flora and fauna that may be encountered on the site.
- Awareness of any other environmental matters, which are deemed necessary by the ECO.
- Ensuring that appropriate communication tools are used to outline the environmental “do’s” and “don’ts” (as per the environmental awareness training course) to employees.
- Records must be kept of those that have completed the relevant training.
- Refresher sessions must be held to ensure the contractor’s staff are aware of their environmental obligations.

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

OBJECTIVE 17: To monitor the performance of the control strategies employed against environmental objectives and standards

An environmental monitoring programme should be developed and implemented not only to ensure conformance with the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMP that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of environmental monitoring will most likely be stipulated by the Environmental Authorisation.

Where this is not clearly dictated, Mainstream will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is conducted and reported.

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

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

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

CHAPTER 6: MANAGEMENT PLAN FOR WIND ENERGY FACILITY - REHABILITATION OF DISTURBED AREAS

6.1. Overall Goal for the Rehabilitation of Disturbed Areas

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

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

6.2. Objectives

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

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

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

OBJECTIVE 1: To ensure rehabilitation of disturbed areas

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

Project component/s	» wind energy facility (including temporary access roads and laydown areas) » substations » temporary laydown areas
Potential Impact	» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention
Activity/risk source	» Temporary laydown areas » Temporary access roads/tracks » Other disturbed areas/footprints
Mitigation: Target/Objective	» To ensure and encourage site rehabilitation of disturbed areas » To ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed

Mitigation: Action/control	Responsibility	Timeframe
A site rehabilitation programme should be compiled and implemented.	Contractor in consultation with Specialist	Duration of contract
All temporary facilities, equipment and waste materials must be removed from site and appropriately disposed of.	Contractor	Following execution of the works
All temporary fencing and danger tape should be removed once the construction phase has been completed.	Contractor	Following completion of construction activities in an area
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following completion of construction activities in an area
Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-use native/indigenous plant species removed from disturbance areas in the rehabilitation phase.	Contractor in consultation with rehabilitation specialist	Following completion of construction activities in an area
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Mainstream in consultation with rehabilitation specialist	Post-rehabilitation
On-going alien plant monitoring and removal should be undertaken on all areas of natural vegetation on an annual basis.	Mainstream in consultation with rehabilitation specialist	Post-rehabilitation

Performance Indicator	» All portions of site, including construction camp and working areas, cleared of equipment and temporary facilities » Topsoil replaced on all areas and stabilised » Disturbed areas rehabilitated and at least 40% plant cover achieved on rehabilitated sites over a period of 2 to 5 years. » Closed site free of erosion and alien invasive plants
Monitoring and Reporting	» On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented. » On-going alien plant monitoring and removal should be undertaken on an annual basis. » An incident reporting system must be used to record non-conformances to the EMPr.

CHAPTER 7: MANAGEMENT PROGRAMME FOR THE WIND ENERGY FACILITY - OPERATION

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

7.1. Overall Goal for Operation

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

7.2. Objectives

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

OBJECTIVE 1: Securing the site

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

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 energy facility 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
Where necessary to control access and secure access to the site and entrances to the site	Mainstream	Operation
Post information boards about public safety hazards and emergency contact information	Mainstream	Operation

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

OBJECTIVE 2: Limit the ecological footprint of the facility

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

Project component/s	» Areas requiring regular maintenance » Route of the security team » 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
Vehicle movements must be restricted to designated roadways.	Mainstream	Operation
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	Mainstream	Operation
Vegetation control within the facility should be by manual clearing and herbicides should not be used except to control alien plants in the prescribed manner	Mainstream / Specialist	Operation
An on-going alien plant monitoring and eradication programme must be implemented, where necessary.	Mainstream	Operation
Annual site inspection for erosion or water flow regulation problems – with follow up remedial action where problems are identified	Mainstream /Specialist	Annual monitoring until successful re-establishment of vegetation in an area

Performance Indicator	» No further disturbance to vegetation or terrestrial faunal habitats » No erosion problems within the facility or along the power line route » Low abundance of alien plants within affected areas » Maintenance of a ground cover of perennial grasses and forbs 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 3: Protection of avifauna, priority bird species and bat species

During operation of the facility, the threat of collision of birds and bats with the turbine blades is a concerning issue. However, the real extent of this threat is not currently well understood within the South African context due to the limited numbers of wind turbines in South Africa with which bird and bat interactions have been monitored. Lighting of turbines and other infrastructure has the potential to attract birds, thereby increasing the risk of collisions with turbines. Bird and bat monitoring is to be undertaken during the operation of the facility in order to monitor impacts on the

facility on these communities and make recommendations for any additional measures which may be required to be implemented to minimise this impact.

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

Mitigation: Action/control	Responsibility	Timeframe
A site monitoring programme must be implemented for surveying bird and bat movements in relation to the wind energy facility and fully documenting all collision and electrocution casualties with the turbines (in line with most recent monitoring guidelines at the time).	Mainstream / environmental manager	Operation
An operational monitoring study to search for bat carcasses (and to record bats using acoustic monitoring, especially at height) must be implemented. This should be undertaken according to the Best Practice Guidelines for bats available at the time.	Qualified bat specialist	According to best practice (i.e., when turbine blades begin spinning and for two years).
If, according to a suitably qualified bat specialist and available guidance, levels of mortality are unacceptable, the following actions apply: » Extending the operational monitoring study » Testing and using ultrasonic deterrent devices to prevent bats entering the airspace of the development. » Turbine blade feathering to reduce the rotation of turbine blades below the candidate turbine cut-in speed, without increasing the cut-in speed. » Increasing the cut-in speed of turbines contributing to mortality (as shown by operational bat monitoring data) to wind speeds when the majority of bat species are not effective. For example, approximately 60% of the bat activity in summer occurred below 6 m/s. The determination	Developer/WEF operator	Duration of operational phase

Mitigation: Action/control	Responsibility	Timeframe
of these exact wind speeds will require detailed analysis of the pre-construction and operational acoustic monitoring data and must be discussed with the WEF operator. » Applying curtailment to turbines contributing to mortality (as shown by operational bat monitoring data) during specific time and seasons. For example, reducing turbine operation when bats are most active (e.g., between 20:00 and 22:00 in January, February, and December. » The above approaches should be used in an adaptive manner, adjusting the degree of mitigation (i.e., curtailment) applied based on mortality data and the success/failure of each type of mitigation. These mitigation measures should not be implemented without first consulting a bat specialist.		
Periodically collate and analyse post-construction monitoring data for bird and bat monitoring and recommend additional mitigation measures for implementation as required.	Advising scientist/biologist	Every 3 months of monitoring
Review bird and bat monitoring report on the full year of post-construction monitoring, and integrate findings into operational EMPr and broader mitigation scheme.	Advising scientist/biologist, monitoring agency	1 year post-construction

Performance Indicator	» Minimal additional disturbance to bird or bat populations on the wind energy facility site. » Continued improvement of bird and bat 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 bats and the proposed/ operating wind energy facility. » Clear and logical recommendations on why, how and when to institute mitigation measures to reduce avian impacts of the development, from pre-construction to operational phase. » A reduction in bat fatalities to acceptable levels (based on specialist expertise and available guidance) as a result of mitigation is the major performance indicator.
Monitoring and Reporting	» Observation of avifaunal populations and incidence of injuries/death from collisions from turbine blades » The monitoring team to monitor turbine field for fatalities. » Review of bird monitoring report on the full year of post-construction monitoring » The analysis of bat fatality data should be undertaken regularly (i.e., as data are collected) by a suitably qualified bat specialist to determine the levels of bat mortality and to ensure this objective is

	met. The operational mitigation plan should be continuously reviewed based on the results.

OBJECTIVE 4: Minimisation of visual impact

The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate to any significant extent within this landscape. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's Marking of Obstacles expressly states, "Wind turbines shall be painted white to provide the maximum daytime conspicuousness". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact. The potential for mitigation is therefore low or non-existent.

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

The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an on-going basis. The operational, security and safety lighting fixtures of the proposed wind energy facility.

Project component/s	» Wind energy facility (including access roads) » Substations
Potential Impact	» Risk to aircraft in terms of the potential for collision » Enhanced visual intrusion
Activity/risk source	» On-site IPP substation and associated lighting » Wind turbines and other infrastructure

Mitigation: Target/Objective	» To minimise potential for visual impact » To ensure that the facility complies with Civil Aviation Authority requirements for turbine visibility to aircraft » Minimise contrast with surrounding environment and visibility of the turbines to humans » The containment of light emitted from the on-site IPP substation in order to eliminate the risk of additional night-time visual impacts

Mitigation: Action/control	Responsibility	Timeframe
Maintain the general appearance of the facility in an aesthetically pleasing way.	Mainstream	Operation and maintenance
Undertake regular maintenance of light fixtures.	Mainstream	Operation and maintenance

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

OBJECTIVE 5: Minimisation of noise impacts from turbines

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

Project component/s	» Wind turbines
Potential Impact	» Increased noise levels at potentially sensitive receptors » Changing ambient sound levels could change the acceptable land use capability » Disturbing character of sound
Activity/risk source	» Wind turbines

Mitigation: Target/Objective	» Ensure that the change in ambient sound levels (measured in L_{Aeq}) as experienced by Potentially Sensitive Receptors is less than 5 dBA; (change from the measured and calculated ambient sound levels for the corresponding wind speed); » Prevent the generation of disturbing noise from the wind turbines; » Ensure acceptable noise levels at surrounding stakeholders and potentially sensitive receptors

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

Performance Indicator	» Change in ambient sound levels (L_{Aeq}) as experienced by Potentially Sensitive Receptors is less than 5 dBA
Monitoring and Reporting	» Noise monitoring programme to be developed and implemented at the start of operation.

OBJECTIVE 6: Appropriate handling and management of hazardous substances and waste

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

Project component/s	» Wind energy turbines » Substations
Potential Impact	» Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices
Activity/risk source	» Generators and gearbox - turbines » Transformers and switchgear - 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.	Mainstream	Operation
Storage areas for hazardous substances must be appropriately sealed and bunded.	Mainstream	Operation
All structures and/or components replaced during maintenance activities must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling.	Mainstream	Operation
Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and bunded area. Should any accidental spillage take place, it must be cleaned up according to specified standards regarding bioremediation.	Mainstream	Operation and maintenance
Waste handling, collection and disposal operations must be managed and controlled by a waste management contractor.	Mainstream / waste management contractor	Operation
Used oils and chemicals: » Where these cannot be recycled, appropriate disposal must be arranged with a licensed facility in consultation with the administering authority. » Waste must be stored and handled according to the relevant legislation and regulations.	Mainstream	Operation
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	Mainstream	Operation
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	Mainstream	Operation
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Mainstream	Operation
No waste may be burned or buried on site.	Mainstream	Operation

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

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

OBJECTIVE 7: Maximise local employment and business opportunities during operation

Based on information provided by Mainstream approximately 20 permanent employment opportunities will be created during the operational phase of the project. The operational phase is expected to last for 20 years.

Project component/s	» Wind energy facility » Day to day operational activities associated with the wind energy facility including maintenance etc.
Potential Impact	» The opportunities and benefits associated with the creation of local employment and business should be maximised.
Activity/risk source	» The operational phase of the wind energy facility will create permanent employment opportunities. » The establishment of a wind energy facility has the potential to create and attraction for visitors to the area. The development also has the potential to promote the benefits of renewable energy projects.
Mitigation: Target/Objective	» Benefit to local tourism by providing the area with a potential additional tourist attraction. » In the medium- to long-term employ as many locals as possible to fill the full time employment opportunities.

Mitigation: Action/control	Responsibility	Timeframe
Identify local members of the community who are suitably qualified or who have the potential to be employed full time.	Mainstream	Prior to commencement of operation
Develop training and skills transfer programme for local personnel.	Mainstream	Prior to commencement of operation

Performance Indicator	» Public exposure to the project. » Meeting with Local Municipality and local tourism organisations during the construction phase.
Monitoring and Reporting	» Indicators listed above must be met for the operational phase.

OBJECTIVE 8: Implement an appropriate fire management plan during the operation phase

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

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

Mitigation: Action/Control	Responsibility	Timeframe
Provide adequate firefighting equipment on site. Apply for membership to local Fire Protection Association, should there be one in existence.	Mainstream	Operation
Provide fire-fighting training to selected operation and maintenance staff.	Mainstream	Operation
Ensure that appropriate communication channels are established to be implemented in the event of a fire.	Mainstream	Operation
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.	Mainstream	Operation
Upon completion of the construction phase, an emergency evacuation plan must be drawn up to ensure the safety of the staff and surrounding land users in the case of an emergency.	Mainstream	Operation
Contact details of emergency services should be prominently displayed on site.	Mainstream	Operation

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

OBJECTIVE 9: Minimise the potential negative impact on farming activities and on the surrounding landowners

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

Some positive impacts will be experienced with farmers gaining more access to land through the high quality site roads. Farmers involved with the project will also receive additional income, which can be invested into farming activities.

Once construction is completed, negative impacts on farming activities on the site must be limited as far as possible.

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

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

Performance Indicator	» No environmental pollution occurs (i.e. waste, water and sanitation). » No intrusion on private properties and on the activities undertaken on the surrounding properties. » Continuation of farming activities on site.
Monitoring and reporting	» Mainstream should be able to demonstrate that facility is well managed without environmental pollution and that the above requirements have been met.

CHAPTER 8: MANAGEMENT PLAN FOR WIND ENERGY FACILITY - DECOMMISSIONING

The turbine infrastructure which will be utilised for the proposed Wind Energy Facility is expected to have a lifespan of 25 to 30 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time. The relevant mitigation measures contained under the construction section should be applied during decommissioning and therefore is not repeated in this section. It must be noted that decommissioning activities will need to be undertaken in accordance with the legislation applicable at that time, which may require this section of the EMPr to be revisited and amended.

8.1. Site Preparation

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

8.2 Disassemble and Remove Existing Components

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

8.2 Rehabilitation of the Site

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

In decommissioning the facility, Mainstream must ensure that:

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

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

CHAPTER 9: REVISION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME

The EMPr is a dynamic document, which must be updated to include any additional specifications as and when required. It is considered critical that this draft EMPr be updated to include site-specific information and specifications following the final walk-through survey by specialists of the development site. This will ensure that the construction and operation activities are planned and implemented considering sensitive environmental features. In addition, the EMPr should be updated throughout the life of the facility in order to ensure that appropriate measure are included for the minimisation of impacts on the environment. Any amendments must be approved by the Competent Authority (i.e. DEA) prior to implementation, unless these are required to address an emergency situation.

APPENDIX A:

PLANT RESCUE AND PROTECTION AND REHABILITATION

METHODS FOR PLANT RESCUE AND HABITAT REHABILITATION

List of Abbreviations

CARA: Conservation of Agricultural Resources Act 43 of 1983
DEA: Department of Environmental Affairs
EA: Environmental Authorisation
ECO: Environmental Control Officer
EMP: Environmental Management Plan
NEMA: National Environmental Management Act 107 of 1998
LFA: Landscape Functional Analysis (Tongway and Hindley 2004)
IAP: Invasive Alien Plant

List of Definitions:

Accelerated soil erosion: Soil erosion induced by human activities.

Acceptable cover: An acceptable cover shall mean that not less than 75% (in an area with rainfall above 400 mm per annum), or 40% (in regions receiving less than 400 mm rain per annum), of the area planted or hydroseeded shall be covered with grass and that there shall be no bare patches of more than 500 mm in maximum dimension.

Alien: originating from another country or continent and originally different environment, commonly used to describe plants that are not indigenous to South Africa and have become problematic (spreading rapidly, threatening existing biodiversity).

Allelopathic components: one or more biochemical compound produced by a plant and released through leaf litter or roots that suppresses the growth, survival, and reproduction of other surrounding vegetation.

Bare soil: Un-vegetated soil surface, unaltered by humans.

Compacted soil surface: A soil surface that has been hardened by an outside source, causing the soil to be more compacted than the surrounding area.

Container plants: Container plants include all vegetation which are bought or supplied in acceptable containers from nurseries or vegetation lifted out of their natural position and placed in containers.

Desirable end state: the future condition or target on which the rehabilitation is designed and that will serve later as a basis for rehabilitation success evaluation. This can be based on a reference site or modelled according to available information on historic vegetation.

Ecological rehabilitation: The process of assisting the recovery of a degraded or damaged ecosystem in a trajectory that renders the ecosystem fully functional, stable, and able to develop further, but not necessarily returning to the original historic state.

Ecological restoration: The process of assisting the recovery of an ecosystem that has been degraded damaged or destroyed, in a trajectory that ultimately returns the ecosystem to its natural successional stage.

Ecosystem: The combination of biota within a given area, together with a suitable environment that sustains the biota and the interactions between biota. It can have a spatial unit of any size, but shows some degree homogeneity as far as structure, function and species composition is concerned. Small-scale ecosystems typically link up to larger scale ecosystems and all contribute to the ecosystem function and services at the landscape-scale.

Environmental Management Plan: an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction and operation, and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced.

Establishment of grass: All procedures necessary to produce an acceptable cover of grass on an area.

Establishment Period: The Establishment Period is defined as the period beginning from the actual planting or placing of vegetation until three months thereafter, unless otherwise specified or unless grass cover is unacceptable or unless plants have not taken.

Extinction debt: is a concept that describes the future extinction of species due to events in the past. Extinction debt occurs because of time delays between impacts on a species, such as destruction of habitat or reduction of population size, and the species' ultimate disappearance.

Geophytic: resprouting during the growing season from an underground storage organ such as bulbs, corms, tubers or rhizomes, and dying back completely during unfavourable seasons.

Hydroseeding: To apply seed in a slurry with water (plus other materials to enhance growth) by means of a spraying device.

Indigenous: refers to a plant or animal that occurs naturally in the place in which it is currently found.

Invasive plant: a kind of plant which has under section 2 (3) of CARA been declared an invader plant, and includes the seed of such plant and any vegetative part of such plant which reproduces itself asexually.

Landscape: Consists of a mosaic of two or more ecosystems that exchange organisms, energy, water, and nutrients.

Nursery conditions: These are the necessary conditions to maintain healthy growth of rescued and/or container plants. This includes protection of such plants against wind, frost, direct sunlight, pests, rodents, diseases, and drought. It also includes the provision of suitable water, fertilizer and any other measures required to maintain the container plants.

Period of Maintaining: The Period of Maintaining is defined as the period following directly after the Establishment Period until the end of the Period

of Maintenance for the whole Contract as defined in the General Conditions of Contract, unless otherwise specified.

Revegetation: The process of establishing a vegetative cover on exposed soils, regardless of species composition or structure, as long as the species are non-invasive and their presence will not impede the gradual process of ecological rehabilitation or –restoration.

Soil Erosion: is a natural process whereby the ground level is lowered by wind or water action and may occur as a result of inter alia chemical processes and or physical transport on the land surface**.**

Scarifying: To roughen the surface of soil as a preparation for seeding or topsoil addition.

Trimming: To neatly round off the levels of existing or previously shaped earthworks to blend in with the levels of other earthworks, constructed works, or natural landforms.

Transformation: The conversion of an ecosystem to a different ecosystem or land use type.

Topsoil: uppermost layer of soil, in natural vegetation maximally 30 cm, in cultivated landscapes the total depth of cultivation, containing the layer with humus, seeds and nutrients. Topsoils that are applied to landscapes to be rehabilitated must be free of refuse, large roots and branches, stones, alien weeds and/or any other agents that would adversely affect the topsoils suitability for re-vegetation.

Weed: a plant that grows where it is not wanted, and can therefore be an indigenous or alien species. An unwanted plant growing in a garden is just called a weed, but the 198 listed IAPs are called "declared weeds and invaders".

1. Purpose

The Plant Rescue and Revegetation Management Plan addresses the need to mitigate all impacts leading to disturbed vegetation, loss of species and/or agricultural potential, disturbed soil surfaces, and generally bare soils prone to erosion and further degradation on the proposed development site. The plan overlaps to some degree with the Storm Water and Erosion Management Plan, and for successful rehabilitation, it is imperative that this plan is at all times used in conjunction with other EMPs mentioned.

The objective of the plan is therefore to provide:

» Protocols for the removal, temporary storage and replanting of plant species of conservation concern
» Protocols for the rehabilitation of vegetative cover across the project area
» Tools for planning the rehabilitation work and responding to unforeseen events
» Guidelines on implementation and post-implementation tasks
» Criteria for evaluating rehabilitation success
» A summary of items to be included in the rehabilitation budget to ensure that there is sufficient allocation of resources on the project budget so that the scale of EMP-related activities is consistent with the significance of project impacts

2. Scope

This document is a plant rescue, rehabilitation, and revegetation plan that provides a guideline to be applied by all contractors on the development site. This plan, as part of the project EMP, is a legally binding document that must be implemented to fullfil the requirements of relevant legislation. However, the management plan is an evolving guideline that needs to be updated or adapted as progress is made with the rehabilitation and revegetation of the project area, and successes and failures of procedures identified.

The objective of rescuing plants, rehabilitation and revegetation on the project area is:

» Preventing the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.
» Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.
» Preserving or re-creating the structural integrity of natural plant communities.
» Actively aid the improvement of indigenous biodiversity according to a desirable end state according to a previously recorded reference state. This reference

state, if healthy, will be dynamic and able to recover after occasional disturbances without returning to a degraded state.

» Improving the ecosystem function of natural landscapes and their associated vegetation.

3. Legislation and Standards

Relevant legislation:

» Conservation of Agricultural Resources Act 43 of 1983
» Environmental Conservation Act 73 of 1989
» National Forestry Act 84 of 1998
» National Environmental Management Act 107 of 1998
» Northern Cape Nature Conservation Act (Act No. 9 of 2009)

4. Effect of clearing alien vegetation

Invasive and Alien Plants (IAPs) gradually displace and suppress indigenous and/or herbaceous vegetation as their stands become bigger and denser. In addition, they use more water, hence desiccate the soil more, and may alter chemical properties of the soil – partially through secondary compounds released from their litter, partially from compounds released from roots. These altered soils suppress the germination and establishment of herbaceous species, leading to bare soil underneath dense IAP canopies.

After clearing dense stands of invasive shrubs, soil surfaces are thus generally bare with topsoil exposed to erosion and often already somewhat capped and eroded.

5. Effect of removing individuals of species of conservation concern

Species of conservation concern are declining either due to overexploitation or because their range of occupancy is limited and further infringed on by development. Most plant populations require a certain minimum number of individuals within a population or metapopulation to allow for sufficient genetic transfer between individuals. This prevents genetic erosion and hence weakening of the ability of individuals to persist in their environments. Similarly, where the distance between metapopulations is significantly increased due to fragmentation and the resultant loss of some populations, populations may suffer genetic decline due to restricted movement of pollen. Pollinators or other species that depend on a particular plant species for a specific microhabitat or food source may be equally affected because of the reduction of available resources. Therefore the aim of plant rescue actions are always to maintain as many individuals of a plant population in as close proximity to the original habitat as possible to minimise loss of individuals and fragmentation of populations to prevent the creation of future extinction debts of the development.

6. General: Plant rescue and protection

Successful plant rescue can only be achieved if:

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

6.1. Time of planting

» All planting shall be carried out as far as is practicable during the period most likely to produce beneficial results (i.e. during the peak growing season), but as soon as possible after completion of a section of earthworks.
» Drainage line rehabilitation preparation must be done during autumn, and planting of appropriate species in these areas should commence during early spring after the first rains.

7. General: IAP removal

Removal of invasive plants should at all time follow the specifications and guidelines of the Working for Water Programme (refer also to invasive plant management plan).

Information can be obtained from the relevant website:
http://www.dwaf.gov.za/wfw

Detailed information on clearing methods is available on the above websites "Alien Invasive Plants" menu (clearing methods, operational standards and species-specific treatment methods).

8. General: Rehabilitation and re-vegetation

Successful rehabilitation can only be achieved with:
» A long-term commitment
» Practical, adaptive management
» Viable goals of desired outcomes

Prior to vegetation rehabilitation, all stakeholders involved should be consulted to determine:

» What the rehabilitation is ultimately aiming for– rehabilitation of cropping/grazing lands or rehabilitation of indigenous vegetation, after soil erosion and storm water management is in place and IAPs have been cleared?
» A clear definition of incompatible and compatible vegetation on and in the immediate surroundings of the development must be defined and maintained as such. No tree or shrubs shall be allowed to grow to a height in excess of the horizontal distance of that tree or shrub from the nearest newly developed structure or to grow in such a manner as to endanger the development or its operation
» Who will take long-term ownership and hence responsibility for the rehabilitation and its subsequent monitoring and management? Continued monitoring of vegetation establishment and composition, as well as erosion detection will have to be coupled with continued follow-up maintenance of rehabilitation and erosion control from commencement of activity up to the decommissioning phase.

The ultimate objective for rehabilitation should focus on the stabilisation of soil erosion, retaining agricultural potential of transformed areas and /or the establishment of a dense and protective plant cover and the maintenance of habitats to enable vegetation to persist and flourish on rehabilitated areas indefinitely, ultimately relying only on environmental resources.

8.1. Map and create management areas

The entire project area must be mapped and divided into management areas indicating:

» Current land cover
  - Roads and residential
  - Areas with IAPs, subdivided further in sparse or dense infestations where applicable
  - Transformed areas
  - Untransformed indigenous vegetation

For every one of the management areas, the project proponent, in consultation with the land users, will have to decide what intervention will be necessary, desirable, and feasible to enable the development of the project and long-term sustainable maintenance of infrastructure. Thus for every management area there must be an operational outline on:

» what will happen there
» what needs to be mitigated – including storm water- and erosion management
» which management units need priority intervention/mitigation
» how will this mitigation / intervention be done (method statements) including schedule of work
» realistic and desirable end states including list of species that should be established to initiate rehabilitation after initial revegetation

» approximate timeframes
» monitoring protocol to evaluate success or failures of interventions
  - establish permanently marked transects and monitor with fixed-point photography
» who will be responsible for doing what
» how will different actions be integrated to achieve and maintain or improve the desirable end state of the environment of that management unit

Special attention will have to be given to drainage zones, as these not only have very active morphodynamics, but are also distributers of seeds – both indigenous and of IAPs. Thus clearing a downstream invasion of aliens to enable maintenance of the development will be futile if the upstream IAPs are not cleared or at least aggressively controlled.

8.2. Setting realistic rehabilitation goals

Rehabilitation efforts typically aim at improving ecosystem function that consists of a series of processes, which can in the end be evaluated against a desired outcome or reference state of the vegetation and environment.

Attainable goals of rehabilitation on the project area should be possible and viable for at least the following:
» Stabilisation of soils
» Stabilisation of riparian areas
» Storm water reduction through management and wetland integrity
» Clearing of IAPs
  - The degree to which IAPs can be cleared from the project area needs to be determined according to desirability, available project funding, personnel and project requirements
» Restoring and/or rehabilitating vegetative cover on non-transformed areas to obtain an acceptable vegetation cover that can be maintained or persists on its own indefinitely

8.3. Remove or ameliorate the cause of degradation

This will include:

» Physical rehabilitation of topsoil where it has been removed.
» Topsoil on areas that have not been cultivated are considered as the upper 20 - 30 cm only. These contain the most important nutrients, micro flora and –fauna essential for nutrient cycling processes. Topsoils are also an important source of seeds.
» Subsoils and overburden substrata lack the above elements and will first have to be used for physical rehabilitation of landscapes as and where necessary, and then overlain with topsoils

» Stabilisation of topsoils and prevention of erosion – refer to the Erosion management pan
» Removal of all invasive vegetation – refer to the Invasive Management Plan
    - Where it is desirable to use brush or logs of the cleared vegetation for soil stabilisation, such material must be free of regenerative material – e.g. seeds or root suckers

8.4. Initial revegetation

Immediately after clearing of vegetation, the soil surface must be inspected for signs of erosion and stabilised as soon as possible. After completion of construction, such erosion stabilisation should preferably be with a cover of vegetation. A dense initial grass or other perennial cover will be desirable. The appropriate seed mix should be determined in consultation with an ecologist familiar with the area. The aim of the first vegetation cover is to form a protective, relatively dense indigenous layer to slow runoff, increase moisture infiltration into the soil, and gradually change the soil nutrient status in order for it to be more favourable for other desirable indigenous vegetation to become established.

8.5. Plant Search and Rescue

Prior to construction, once all the areas where topsoil will be removed or areas will be transformed have been demarcated, the ECO and contractor will be responsible to remove all bulbous species from the topsoil, as well as succulents and small indigenous shrubs that can be transplanted. These are to be kept in a raised, protected position in a designated area until they can be replanted again as part of the rehabilitation process. Further details are listed in the operation standards.

8.6. Natural seed banks and improvement of plant structural and compositional diversity

It is expected that soil seed banks of indigenous vegetation will be present to initiate initial vegetation cover, but may not be sufficient to establish an acceptable cover of desirable species. After deciding which indigenous species should be re-introduced, seed should be ideally collected from site or an environmentally-matched site nearby.

Seed collection may be done throughout the year as seed ripens, but can also be restricted to summer, when a large amount of the perennial seed should have ripened. Seeds should be stored in paper or canvas bags dusted with insecticide, and sown at the onset of the rainy season.

Alternatively, slower-growing perennials may be raised from seed or cuttings in a nursery and then transplanted once established. It will be beneficial to investigate if community members would be able to create and maintain such a nursery, or if there are nurseries in the area, that raise indigenous flora from the area.

The final vegetation cover should resemble the original (non-encroached) vegetation composition and structure as far as practicable possible or permissible within each management unit.

For drainage areas:

» First restore drainage line morphology following the guidelines of the Erosion management plan – without that ecological recovery cannot be initiated
» Determine if natural seed sources may be present further upstream
» If such upstream seed sources are still present, rehabilitation of riparian vegetation after soil erosion management will most likely occur naturally, PROVIDED that follow-up monitoring of the establishment of vegetation is carried out, and all invasive species eradicated as they emerge. This can only be achieved with a long-term commitment (> 5 years minimum)
» Should no upstream seed resources be available, suitable species (as determined in consultation with an ecologist) should be sown or planted.

8.7. 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 ecosystems affected by the development, and remedy these as soon as detected.

During the construction phase, the ECO and contractor will be responsible for initiating and maintaining a suitable monitoring system. Once the development is operational, the project proponent will have 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 should be monitored:
» Composition and density of replanted vegetation, distinguishing between species introduced for initial revegetation only and species that are part of the pre-determined desirable end state
» Associated nature and stability of surface soils
  - It is recommended that permanent transects are marked and surveyed annually according to the LFA technique (Tongway and Hindley 2004), adapted to integrate both surface soil characteristics and the vegetation to be monitored
» Re-emergence of IAPs
  - If noted, remedial action must be taken immediately according to Working for Water specifications
» Nature and dynamics of riparian zones
  - Stability of riparian vegetation
  - Any form of bank erosion, slumping or undercutting

- Stability of channel form and width of streams – if this increases, it shows that vegetation on plains and/or riparian areas and upper drainage lines are not yet in a stable enough state to be fully functional in reducing excess runoff and the ecosystem overall is losing valuable resources

8.8. Timeframes and duration

» Rehabilitation will occur during construction, as areas for the re-application of topsoil and revegetation become available or where revegetation can be initiated after clearing of invasives or to stabilise erosion.
» The initial revegetation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
» The rehabilitation phase (including post seeding maintenance) should be at least 12 months (depending on time of seeding and rainfall) to ensure establishment of an acceptable plant cover is achieved (excluding invasive plant species or weeds).
» If the plants have not established and the acceptable plant cover is not achieved within the specified maintenance period, maintenance of these areas shall continue until at acceptable plant cover is achieved (excluding alien plant species or weeds).
» Additional seeding or planting may be necessary to achieve acceptable plant cover. Hydroseeding may have to be considered as an option in this case.
» Any plants that die, during the maintenance period, shall be replaced by the Horticultural Landscape Contractor (at the Horticultural Landscape Contractor's cost if it was due to insufficient maintenance).
» Succession of natural plant species should be encouraged
» Monitoring of rehabilitation success and follow-up adaptive management, together with clearing of emerging invasives shall be carried on until the decommissioning phase has been completed.

9. Conclusion

The Plant Rescue and Revegetation Management Plan is a document to assist the contractor, the developer, and the ECO with guidelines on how to plan and implement the required work, and understand the concepts behind successful rehabilitation. This plan will have to be implemented in conjunction with erosion-, storm water- and IAP management plans. The exact details of the rehabilitation plan will depend on the determined extent of rehabilitation that will have to be undertaken, available funding, and desirable end state of the vegetation after rehabilitation.

10. References and further reading

Clewell, A., Rieger, J. and Munro, J. (2005). Guidelines *for Developing and Managing Ecological Restoration Projects, 2 Edition*. www.ser.org and Tucson: Society for Ecological Restoration International.

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

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

Society for Ecological Restoration International Science & Policy Working Group. 2004. *The SER International Primer on Ecological Restoration*. www.ser.org & Tucson: Society for Ecological Restoration International.

Tongway, D.J. and Hindley, N.L. (2004) Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes, CSIRO Sustainable Ecosystems, CANBERRA, AUSTRALIA.

Tongway, D.J., Freudenberger, D.O., Noble, J.C., and Hodgkinson, K.C. (Eds). (2003). Landscape Ecology, Function and Management. CSIRO Sustainable Ecosystems, CANBERRA, AUSTRALIA.

A. APPENDIX: RECOMMENDED OPERATIONAL STANDARDS

OBJECTIVE: Revegetate and Rehabilitate disturbed areas

The Contractor must take all reasonable measures to ensure that plant species of conservation concern are rescued and survive indefinitely. Landscaped topsoils as well as areas cleared of IAPs must be adequately rehabilitated and /or revegetated to ensure that the ecosystems affected by the development regain and/or retain their functionality indefinitely.

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of ecosystems affected by the development and remedy these as soon as detected.

Mitigation measures relating to the vegetative cover as part of a healthy ecosystem must be implemented in order to effectively limit and gradually reverse the impact on the environment. The focus of the mitigation measures laid out below relate to project-related disturbances. Where such disturbances are exacerbated by farming-related disturbances or vice versa, mitigation measures must be carried out in consultation with the land-user responsible.

Project component/s	Project components affecting the objective: » Turbines » Access roads and cabling between and to turbine units » Power line » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas) » Substation » All other infrastructure
Potential Impact	» Loss of suitable substrate for a stable vegetation cover » De-stabilisation and/or alteration of substrate and hence degradation of vegetation cover, significant change in species composition or loss of agricultural potential » Loss of suitable habitat for flora and fauna » Leaky ecosystem due to loss of nutrients and moisture from the system, leading to a less resilient vegetation cover and loss of ecosystem function and -services » Degradation and/or loss of riparian areas and wetlands on and beyond the project boundaries » A loss of indigenous vegetation cover and possibly endangered species » Disturbance of fauna species
Activities/risk sources	» Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Existing IAPs as well as clearing thereof » Concentrated discharge of water from construction activity or new

	infrastructure » Storm water run-off from sealed, altered or bare surfaces » Mobile construction equipment movement on site » Cabling and access roads construction activities » Power line construction activities » River/stream/drainage line road crossings » Roadside drainage ditches » Project related infrastructure » Premature abandonment of follow-up monitoring and adaptive management of rehabilitation
Mitigation: Target/ Objective	» To minimise loss of plant species of conservation concern » To minimise unfavourable runoff conditions and loss of resources from the ecosystems » To minimise erosion of soil from site during and after construction » To minimise and mitigate unfavourable alteration to drainage lines, especially incision » To minimise damage to indigenous vegetation during and after construction » No accelerated overland flow related surface erosion as a result of project infrastructure » No reduction in the surface area or general nature and functionality of wetlands (drainage lines and other wetland areas) as a result of the establishment of infrastructure on the project areas and beyond its boundaries » A clear reduction of IAPs on the project area and replacement thereof by indigenous vegetation according to a pre-determined desirable end state

Mitigation: Action/control	**Responsibility**	**Timeframe**
Planning		
Classify the entire project area into management units according to current land cover and state of the environment and map accordingly	Developer / Contractor	Prior to construction
For each management unit » establish what interventions will be necessary relating to IAPs, soil erosion management, topsoil handling, landscape rehabilitation and revegetation » where rehabilitation and revegetation will be necessary, decide on the desired end state of vegetation for that management unit and create a list of species to be established on specific sites » outline the management of construction activities, including topsoils, excavated materials and felled biomass in a manner that will optimise the rehabilitation goals as fast and as effective as possible for that management unit	Developer / Contractor in collaboration with ECO and land-users	Prior to construction
Plant Rescue and indigenous plant materials		
All harvested plant materials shall be labelled with » Genus as minimum, species if known » Habitat from which materials were collected	ECO	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
Indigenous plant materials for re-vegetation: » All plant material shall be obtained from the search-and-rescue operation on the site prior to clearing or from local nurseries or reputable seed providers » Indigenous materials shall only be removed from their habitat with the necessary permits whenever applicable » Each plant removed shall be handled, packed and stored in a manner suitable for that species » Removed plants shall be protected from windburn or other damage during transportation » No plants or plants with exposed roots shall be subjected to excessive exposure to drying winds and sun, or subjected to water logging » All plants shall be kept free from plant diseases and pests and protected from rodents or other damaging agents » All indigenous plants that have been removed prior to clearing shall be returned to conditions resembling their original habitat as close as practically possible	Contractor in collaboration with ECO	Before, during and after construction
Seed stocks for rehabilitation » Seed can be used for cultivation of desirable species for revegetation » Seed shall be utilised for direct sowing or hydroseeding » Seed collected from the site must be dried and stored in a suitable facility under cool (7-10°C), dry, insect free conditions until required for cultivation or seeding. Only viable, ripe seed shall be used » Seed harvested shall be insect- and pathogen free » Seed harvested shall not contain materials of any invasive species » Prior to clearing, seed should be collected from the site on a regular basis as species start to seed to maximise the amount of fully developed seed secured » From sites that will be cleared, 100% of all seeds available may be collected » From sites adjacent to the development, 25% of seeds can be collected for rehabilitation	Contractor and ECO	Before, during and after construction
Site-specific nursery » On-site nursery facilities shall be erected for the holding of rescued plant material and the propagation of appropriate species for re-vegetation » Where nursery facilities can only cater for rescued plants, a suitable (local) nursery shall be identified that will be willing to receive seeds collected and propagate the necessary species for later revegetation » Soil or other propagation media, were used, shall be weed- and pathogen free » Argentine ants shall be controlled at all times » The area where plants are stored shall be kept free of	Contractor, ECO to control	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
weeds » Plants stored in the designated area shall be protected from rodents, excessive sun and wind, and inspected regularly until being planted for pathogens and pests, and then treated accordingly » The nursery shall be adequately secured to prevent loss or theft of species		
Protected flora » Ensure that no indigenous protected flora is removed from its original habitat in the project area without legal documents from the relevant authorities	ECO	Before, during and after construction
Topsoil		
Avoid » Management units that will not be developed or selected elements – trees, rocky outcrops on site shall be maintained in situ and demarcated clearly to prevent any disturbance during construction » These units will be considered as NO-GO areas during construction	Contractor and ECO	Before, during and immediately after construction
Invasives » Remove all invasive shrubs as per the Working for Water specifications	Contractor, ECO to control	Before, during and after construction
Mulch » all trees felled shall be debranched and the logs used in controlling erosion from re-landscaped topsoils and/or adding surface roughness and organic matter to topsoils to be rehabilitated » all cut branches from trees, as well as all shrubs cleared from the construction site shall be shredded to mulch, either by a chipper or by hand to sticks no longer than 10 cm » preparation of mulch shall be done at source » mulched material shall be free of seed-bearing invasive plant material » the mulch shall be suitably stored – bagged if necessary - and will be used in rehabilitation and soil erosion management on the site » should additional mulch be used for rehabilitation, this should be obtained from invasive shrubs of areas not cleared » mulch shall be stored for as short a period as possible	Contractor, ECO to control	Before, during and immediately after construction
Storage of topsoil and subsoil: » topsoils constitute the upper 20 – 30 cm of soil only, lower layers of soil are regarded as subsoil » stockpiling of topsoils and subsoils shall only be done on previously transformed areas, and be kept at least 50 m from any remaining natural vegetation » care shall be taken during stockpiling to prevent the	Contractor, ECO to control	During and immediately after construction

Mitigation: Action/control	Responsibility	Timeframe
mixing of topsoil with subsoil and/or any other material » topsoils shall be stored in heaps no higher than 100 cm, and shall be re-applied as soon as possible » care shall be exercised during stockpiling of topsoils to prevent compaction thereof » topsoils shall be adequately protected from erosion by preventing concentration of surface water and scouring of slopes » erosion of topsoils has to be contained and repaired as soon as it occurs, before large scale erosion and loss of topsoil develops » any logs obtained during clearing operations can be used in continuous rows to curtail erosion where necessary. Geojute (geotextile) shall be used additionally if the logs are not sufficient to remedy any erosion – for details refer to the erosion management plan » where topsoils need to be stored longer than 6 months, such stockpiles shall be revegetated, even if this has to include re-seeding to achieve an acceptable cover of vegetation		
Boulders and rocks » where removed during clearing, should be stored separately and used in the rehabilitation program » boulders and rocks must be partially buried within the topsoil layer wherever practical to provide greater soil-holding stability and reduce water erosion » placement of rocks and boulders shall mimic the natural occurrence of rocks and boulders in the area	Contractor, ECO to control	During and after construction
Rehabilitation of surface		
Prior to the application of topsoil » subsoil shall be shaped and trimmed to blend in with the surrounding landscape or used for erosion mitigation measures » ground surface or shaped subsoil shall be ripped or scarified with a mechanical ripper or by hand to a depth of 15 – 20 cm, » compacted soil shall be ripped to a depth greater than 25 cm and the trimmed by hand to prevent re-compacting the soil » any rubbish, concrete remnants, steel remnants or other objects introduced to the site during the construction process shall be cleared before ripping, or shaping and trimming of any landscapes to be rehabilitated takes place » shaping will be to roughly round off cuts and fills and any other earthworks to stable forms, sympathetic to the natural surrounding landscapes	Contractor, ECO to control	During and after construction

Mitigation: Action/control	Responsibility	Timeframe
Application of topsoil » topsoils shall be spread evenly over the ripped or trimmed surface, if possible not deeper than the topsoil originally removed » the final prepared surface shall not be smooth but furrowed to follow the natural contours of the land » the final prepared surface shall be free of any pollution or any kind of contamination » care shall be taken to prevent the compaction of topsoil » where applicable, the final prepared surface will also contain scattered rocks and/or logs to mimic the natural condition of the original habitat or area and to aid in soil stabilisation and erosion control	Contractor, ECO to control	During and after construction
Soil stabilisation » mulch from brush shall be applied by hand to achieve a layer of uniform thickness » mulch shall be rotovated into the upper 10 cm layer of soil o this operation shall not be attempted if the wind strength is such as to remove the mulch before it can be incorporated into the topsoil » in very rocky areas a layer of mulch shall be applied prior to adding the topsoil » measures shall be taken to protect all areas susceptible to erosion by installing temporary and permanent drainage work as soon as possible o where natural water flow-paths can be identified, subsurface drains or suitable surface drains and chutes need to be installed » additional measures shall be taken to prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas o if mulch is limited, available mulch, together with harvested seeds, should be concentrated in these hollows to promote rapid re-vegetation in them » runnels or erosion channels developing shall be back-filled and restored to a proper condition o such measures shall be effected immediately before erosion develops at a large scale » where erosion cannot be remedied with available mulch, logs or rocks, geojute shall be used to curtail erosion	Contractor, ECO to control	During and after construction
Borrow-pits » shall be shaped to have undulating, low-gradient slopes and surfaces that are rough and irregular, suitable for trapping sediments and facilitation of plant growth » upon completion of rehabilitation these reshaped and revegetated areas shall blend into the natural terrain	Contractor, ECO to control	After construction

Mitigation: Action/control	Responsibility	Timeframe
Revegetation		
Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species » revegetation of the final prepared area is expected to occur spontaneously to some degree where topsoils could be re-applied within 6 months » revegetation will be done according to an approved planting/landscaping plan according to the management units initially delineated and their respective desirable end states and permissible vegetation	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Re-seeding » revegetation can be increased where necessary by hand- seeding indigenous species ○ previously collected and stored seeds shall be sown evenly over the designated areas, and be covered by means of rakes or other hand tools » re-seeding shall occur at the recommended time to take advantage of the growing season » in the absence of sufficient follow-up rains after seeds started germinating, watering of the new vegetation cover until it is established shall become necessary to avoid loss of this vegetative cover and the associated seedbank » where, after initial re-seeding, the no acceptable vegetation cover has established within 12 months, hydroseeding should be considered as an option for follow-up revegetation work » sowing rates of seeds used during hydro-seeding should be obtained from the relevant supplier and in accordance with the existing environment	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Planting of species » species to be planted include all rescued species » the size of planting holes shall be sufficiently large to ensure that the entire root system is well covered with topsoil » soil around the roots of container plants shall not be disturbed » bulbous plants shall be planted in groups or as features in selected areas » before placement of larger plant specimens into prepared holes, the holes shall be watered if not sufficiently moist » during transplanting care shall be taken to limit or	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired end state is

Mitigation: Action/control	Responsibility	Timeframe
prevent damage to roots » plants should be watered immediately after transplanting to help bind soil particles to the roots (or soil-ball around rooted plants) and so facilitate the new growth and functioning of roots		reached
Traffic on revegetated areas » designated tracks shall be created for pedestrian of vehicle traffic where necessary » Disturbance of vegetation and topsoil must be kept to a practical minimum, no unauthorised off road driving will be allowed » All livestock shall be excluded from revegetated areas	Contractor	Before, during and after construction
Establishment » The establishment and new growth of revegetated and replanted species shall be closely monitored » Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created	Contractor	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Monitoring and follow-up treatments		
Monitor success of rehabilitation and revegetation and take remedial actions as needed according to the respective plan » Erosion shall be monitored at all times and measures taken as soon as detected » Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created	ECO during construction, suitable designated person/institution after that	During and after construction, during operational and decommis-sioning phase
Weeding » It can be anticipated that invasive species and weeds will germinate on rehabilitated soils o These need to be hand-pulled before they are fully established and/or reaching a mature stage where they can regenerate o Where invasive shrubs re-grow, they will have to be eradicated according to the Working for Water specifications		

Performance Indicator	» No activity in identified no-go areas » Acceptable level of activity within disturbance areas, as

	determined by ECO » Natural configuration of habitats as part of ecosystems or cultivated land is retained or recreated, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist » The structural integrity and diversity of natural plant communities is recreated or maintained » Indigenous biodiversity continually improves according to the pre-determined desirable end state o This end state, if healthy, will be dynamic and able to recover by itself after occasional natural disturbances without returning to a degraded state » Ecosystem function of natural landscapes and their associated vegetation is improved or maintained
Monitoring	» Fortnightly inspections of the site by ECO during construction » An incident reporting system must record non-conformances to the EMP. » Quarterly inspections and monitoring of the site by the ECO or personnel designated to the rehabilitation process until 80% of the desired plant species have become established o These inspections should be according to the monitoring protocol set out in the rehabilitation plan » Thereafter annual inspections according to the minimal monitoring protocol

B. APPENDIX: CHECKLIST OF ACTIONS FOR REHABILITATION PLANNING

Conceptual Planning	» Identify rehabilitation site locations and its boundaries » Identify ownership of rehabilitation program » Describe improvements that are anticipated following rehabilitation » Identify the kind of ecosystem to be rehabilitated at each site » Identify rehabilitation goals and desirable end state » Identify physical site conditions in need of repair » Identify stressors in need of regulation or re-initiation to maintain the integrity of the ecosystem, such as aliens, erosion, fire-regime » Identify the list and kinds of interventions of abiotic and biotic interventions that are and will be needed » Identify landscape restrictions and whether or not its integrity is dependent on a functioning ecosystem outside the project area » Determine project funding and sources » Identify labour sources and equipment needs » Identify biotic resource needs and sources, e.g. suitable topsoil, seeds » Identify any permit requirements or other legal issues » Determine project duration » Outline adaptable strategies for long-term protection and management
Preliminary Tasks	» Appoint a rehabilitation practitioner who is in charge of all the technical aspects of rehabilitation » Appoint a restoration team and train where necessary to ensure effective implementation » Prepare a budget to accommodate the completion of preliminary tasks » Document existing site conditions, also describing biota » Conduct pre-project monitoring as needed, including soil chemistry, that may affect the success of the rehabilitation program » Establish a reference site or past reference that represents the desired end state of the site » Gather information on key species to be re-introduced » Conduct investigations as needed to assess the effectiveness of restoration methods and strategies used in similar habitats up to date » Decide if rehabilitation goals are realistic or need modification » Prepare a list of objectives that need to be reached to achieve restoration goals » Ensure liaison with affected stakeholders, especially as far as rehabilitation goals are concerned » Investigate available accedes and infrastructure needed to facilitate implementation of rehabilitation
Implementation phase	» Describe the interventions that will be implemented to attain each set objective » Acknowledge potential for passive restoration where viable » Prepare performance standards and monitoring protocols to measure the attainment of each objective » Schedule tasks needed to fulfil each objective

	» Obtain equipment, supplies and biotic resources as needed » Prepare an appropriate budget
Implementation tasks	» Mark boundaries and work areas » Install permanent monitoring fixtures » Implement restoration tasks
Post-implementation tasks	» Protect the rehabilitation site against initial disturbance, including herbivores » Perform post-implementation maintenance, especially continued monitoring and eradication of emerging IAPs » Monitor site at least once per year, using the LFA technique, and identify needs for adaptive management
Evaluation	» Assess monitoring data to determine whether performance standards are met and rehabilitation objectives reached and maintained » Conduct an ecological evaluation of the newly completed rehabilitation

C. APPENDIX: TRANSPLANTING GUIDELINES FOR PLANTS WITH UNDERGROUND STORAGE ORGANS

Many of the plants in harsh environments have underground storage organs from which they resprout every year after sufficient rains, flower and then die back soon after fruiting and remain dormant, out of sight until the next growing season. All species of the families Amaryllidaceae, Iridaceae, Orchidaceae are protected provincially, nationally and/or internationally, as are many species of other monocot species.

Root system: underground storage organs are variable in size, but usually between 15 and 40 cm deep in the soil

Transplanting: success of transplanting is usually very high IF handled correctly

Rescue 101: Plants should be lifted and transplanted after flowering and fruiting, preferably as the leaves start to die back. For lifting, loosen the soil or wedge apart rocks working from a circle of about 20 cm away from the base of the plant, working inwards but not closer than about 5 cm of the plant with a sharp narrow object such as a koevoet. Once the soil is loosened, gently feel by hand where the bulb, corm, or other storage organ is, and wedge out by hand, taking care not to damage it. Remove loose soil, gently cleanse off most of remaining soil, or rinse off the storage organ. Group these according to species and label clearly, keep records of labels to include name if that is known, or a brief description or photo, also the average depth of the organs when they were removed, and the habitat they were removed from. Spread these plants so that the storage organ can dry completely, and then loosely pack into newspaper or paper bag and then store in a shaded, dry position for maximally 3 months. Transplant into soil that is as similar as possible to the original habitat, TAKING CARE that the growing point of the organ points to the top, else the plant will die. Make sure the storage organs are positioned according to the records kept about original depth of the storage organ.

Aftercare: Firm down soil around the base of the plant once it is in a new position. Allow plant to resprout naturally after sufficient rains, do not water. As these plants may not be visible for a while, clearly demarcate the area where these have been planted to avoid disturbing and potentially destroying them later on.

APPENDIX B:

ALIEN INVASIVE MANAGEMENT PLAN

METHODS FOR ALIEN SPECIES REMOVAL

The sections below are taken from the Department of water Affairs: Working for Water Programme, whose guidelines and policies on alien plant species removal should be adhered to.

In general the use of herbicide by is strongly discouraged – unless for direct stump applications in areas at least 30 m from any type of wetland. This is due to the potential for herbicide and related compounds to be distributed into the wetland areas and thus damaging indigenous vegetation all along the watercourses and beyond.

Any control programme for alien vegetation must include the following 3 phases:

- Initial control: drastic reduction of existing population
- Follow-up control: control of seedlings, root suckers, and coppice growth
- Maintenance control: sustain low alien plant numbers with annual control

2.1. Mechanical Clearing

2.1.1. ADULT PLANTS AND SAPLINGS

2.1.1.1. Felling

Consider as first option where possible, but see section 3 regarding kill standing – although this is only mandatory in pristine or near-natural environments, kill standing may have to be considered where the tree to be felled on the project area is very large or tilted and by falling it could significantly damage the surrounding habitat or other structures.

Where trees are to be felled and removed, the stem/trunk shall be cut as close to the ground as possible but not higher than 150mm, using chainsaws, bow saws, brush cutters or cane knives. Where felling is to be followed by herbicide treatment the cut shall either be made by means of a saw, so as to produce a clean, flat and generally horizontal surface or in the case of suitably small, thin barked species, the stem shall be cut with a lopper. A slasher or kapmes should preferably not be used because of the diagonal cut that is produced. This minimises the herbicide absorption and the "sharp sticks" are a Health and Safety risk.

In the case of larger trees, they shall, where possible, be felled to fall uphill in order to reduce breakage and minimise the danger to workmen.

Felled material and other dead material (brush and logs) shall not be allowed to block or impede water courses and must be removed from all water courses, either 30 m away from the river or out of the flood line itself.

Felled material (thicker than 7 cm) shall be debranched and cross cut in manageable logs of not longer than 2,4 m or in lengths as directed and then stacked in windrows (brush lines) with the contour or moved to or from identified locations as directed by Project Management.

The logs and brush shall be stacked separately, at least 3 m apart. Windrows shall be with gaps of 2 m every 15 m and be as narrow as possible but not wider than 3 m. Where windrows are impractical heap stacking may be allowed after approval by the Project Manager. Heaps shall be spaced at a minimum distance of 20 m with a maximum ground cover of 16 m² in other words heaps of maximum 4 X 4 m.

Windrows must be a minimum of 10 meters away from any indigenous forest (10 or more closely spaced indigenous trees). On a slope nothing should be packed below the indigenous forest, because burning of the windrows will cause damaged to the indigenous forest by burning up into it.

2.1.1.2. Ring barking

Where ring barking is directed, the Contractor shall remove all bark (including the inner bark or phloem) from ground level to 50 cm up or such lesser distance as may be specified. All bark must be removed to below ground level for good results. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out.

Bush knives or hatchets should be used for debarking. Herbicide can be applied to the exposed bark except in the case of Wattle spp. In the case of smaller trees and saplings with soft, thin skinned bark (especially *Acacia* and *Hakea* species.) the stem shall be beaten with the back of a hatchet and the bark peeled off.

2.1.1.3. Frilling

Where frilling is directed, the Contractor shall, at a height of approximately 50 cm, using an axe or bush knife, make angled cuts downward into the cambium layer through the bark in a ring. Ensure to affect the cuts around the entire stem and apply herbicide into the cuts.

2.1.1.4. Bark Stripping

Where bark stripping is specified all bark shall be stripped from the trunk between ground level and 1 m above ground level.

2.1.2. SEEDLINGS

2.1.2.1. Manual clearing

Where seedlings are relatively sparse, less than 1 m high and soil suitably soft or where specified in the Project Specification (where seedlings are growing in sensitive areas where chemicals cannot be used due to the risk of contamination or effect on adjacent plant populations or for any other reason), seedlings shall be removed by hand pulling which shall be so carried out as to ensure the removal of the roots. Hand pulled plants shall be left hanging on other vegetation or deposited in a pile to reduce the possibility of re-growth.

Where seedlings are dense or are too well established to be removed by hand and the Project Management has not directed hand pulling or herbicide treatment of the undisturbed plants, the seedlings shall be cut using a lopper or brush cutter (written approval must be obtained) and the stems then treated with herbicide.

It is anticipated that after initial clearing, every year there will be a multitude of seedlings of alien species emerging. Cleared sites will thus have to be constantly monitored, and as soon as a seedling can be identified as alien invasive species, these must be pulled out by hand.

2.2. Chemical Treatment

2.2.1. Foliar spray

(***Not recommended due to potential distribution of poison beyond target plants and thus killing of indigenous species***)

Where foliar spray has been specified, the spray shall be applied as to the leaves of the whole plant to the point of drip-off. Spraying shall not be done when the leaves are wet or in windy conditions. The herbicide shall under all circumstances be mixed with a suitable colour dye (if the product has no built in dye) and a wetting agent if specified on the herbicide label. Where the same herbicide is use for different methods e.g. foliar and cut-stump, different colour dyes must be used to identify the different herbicide mix ratios.

Spraying shall be done using a back-pack spraying system with a solid cone nozzle which allows for consistent, thorough application of the herbicide (e.g. Spraying systems TG 0,5 (or as indicated in the herbicide policy).

2.2.2. Cut-stump treatment

Where stumps are to be treated with herbicide the herbicide shall under all circumstances be mixed with a suitable colour dye (if the product has no built in dye) and a wetting agent if specified on the herbicide label, this shall be applied as soon as possible but not later than 15 minutes after felling, stripping or frilling. In the case of felled stumps all sawdust shall first be brushed off the cut surface.

A knapsack or handheld pressurised spray can, with a narrow angle solid cone nozzle or adjustable nozzle set to a solid spray, should be used. The pressure should be as low as possible to avoid the herbicide from bouncing off the sprayed surface and to minimise contamination; attention must be paid to achieving an even coverage only on the outer rim (Cambium area).

2.2.3. Basal bark application

(Only after written approval has been obtained, due to environmental damage caused by diesel)

Where directed and after written approval, herbicide shall be applied directly to the basal bark of trees. The herbicide shall be applied by knapsack sprayer as a coarse, low

pressure spray, using a narrow angle solid cone nozzle, all around the basal stem or trunk of the plant, from the ground up to the height as specified on the herbicide label, as well as to any exposed roots. The area to be treated shall be thoroughly wetted by the herbicide. Attention shall be paid to ensuring adequate application taking note of the condition and age of the bark.

In the case of multi-stemmed plants, each stem shall be treated.

2.3. Kill Standing vs. Felling

This section is to further explain the National Circular 18 of 2002 under the same heading.

As this National Circular contains a policy clause on the operational approach all WfW projects need to align their operations accordingly as a matter of urgency. The policy should be interpreted as follows (National policy in *Italic* font with interpretation in normal font):

All trees must be killed standing (i.e. NOT felled), except when the following applies: (where cut stump operations are underway on a property this will be allowed to be finished if negotiations for the property has already been concluded and written into the landowner's agreement, negotiations on new areas should thus be adapted accordingly as no further cut stump operations will be allowed except as indicated below):

- *Danger to lives & property and the tree must be removed* (it is the responsibility of Project Management to assess this with the assistance of the landowner. These findings must be recorded in writing and should form part of the landowner's agreement. The person collecting the data for contract generation should be informed accordingly)
- *All alien clearing within two tree lengths of roads, buildings, power lines etc* (fences should be added to the possibilities. It is the responsibility of Project Management to assess this with the assistance of the landowner. These findings must be recorded in writing and should form part of the landowner's agreement. The person collecting the data for contract generation should be informed accordingly)
- *Specific requirement of a partnership to fell* (this will be when the Programme and what it stands for will directly benefit from an operation other than frilling e.g. secondary industry operations, if this is not the case then the landowner must contribute to the price difference due to a change in the preferred operational method)
- *Where required to remove trees for specific flood-control measures* (no frilling should take place within the riparian zone that is the 1:20 year flood level or closer than 30 metres from the natural bank of a river. Trees in these areas should be removed.)
- *Where frilling is not a practical method due to tree growth form, treatment efficacy* (It is the responsibility of Project Management to assess this. If these exceptions

influence the workload then the person collecting the data for contract generation should be informed of such exceptions)

- *Where the frilling of trees increases the fire danger in the area* (where such a scenario is suspected Project Management should liaise with the landowner and also get the opinion of a reputable person, these findings should be recorded in writing and added to the landowner's agreement)

In most cases the resistance towards frilling are based on the aesthetics of the area after the operation. The most economical and effective method of eradicating invasive alien vegetation within the Programme's guidelines should remain the prime objective of efforts. It is the obligation and responsibility of people in all spheres of management to maximise the effect and efficiency of any eradication programme.

2.4. Species-specific clearing methods

Various herbicides have been registered for the control of alien invasive species. The first option though should always be felling the species as low as possible, followed by localised stump treatment and the remaining only as last-resort alternatives or where the alien is a vicious multi-stemmed scrambler, such as the bramble.

Chemicals do not only come at a cost, but will require proper storage, management, and handling. For operation details refer to the Working for Water Operational Standards spreadsheet provided separately.

Information for each invasive alien species as encountered on the project area, as well as alien invasive species that are highly likely to become established after initial clearing, is listed below.

OBJECTIVE: Optimise Operational Standards for Clearing of Invasive Alien Plants

The Contractor must take all reasonable measures to ensure the efficient use of manpower, operational equipment and chemicals for the systematic eradication of alien invasives on site.

Project component/s	Project components affecting the objective: » solar energy turbines » access roads » substation » power line
Potential Impact	» Hazards to landowners, workers and public » Security of materials » Substantially increased damage to adjacent sensitive vegetation and wetland areas
Activities/risk sources	» Operation of equipment » Use of herbicides » Use of fire » Distribution of regenerative material of invasive alien plants
Mitigation: Target/Objective	» To ensure effective systematic removal of invasive alien plants » To prevent additional spreading of invasive alien plants » To maintain low numbers and eventually eradicate unwanted species from the project area » To prevent any spillage of chemicals into the surrounding environment » To prevent and reverse damage to wetlands/pans caused by invasive alien plants » To protect members of the public/landowners/residents
Timeframe	» Training required: training schedule and training opportunities identified and started within three months of commencement of clearing

	» Initial control involving planning and drastic reduction of existing population: during site establishment and construction phase » Follow-up control: control of seedlings, root suckers and coppice growth: during construction and operational phase » Maintenance control: sustain low alien plant numbers with annual control: during operational and decommissioning phase	
Abbreviations	» Working for Water Programme (WfW) » Health and Safety (H&S)	
Responsibility	**RESPONSIBLE PERSON OR UNIT**	
	PROJECT MANAGER	PM
	CONTRACTOR/COMMUNITY WORKER	C
	ENVIRONMENTAL CONTROL OFFICER / COMMUNITY LIASION OFFICER	ECO
	TRAINING UNIT	TU
	PLANNING UNIT	PU

Mitigation: Action/control	**Responsibility**
1. PROJECT OPERATIONAL PLANNING	
1.1. Creation of detailed map of the area: Provides an overview of the project and it must indicate the following:	
• Project boundaries	PU
• Area/s where workers are sourced from	PM
• Other features relevant to project wetlands, invasive thickets, grazing areas, cultivated areas	PM, PU

Mitigation: Action/control	Responsibility
• Clearly indicate areas that need to be cleared and divide into different Management Units according to location and most prevalent invasive	PM, PU
1.2. Strategic plan and safety	
• Project Management to create an Area Strategic Plan / Method Statement for clearing alien invasive vegetation	ECO, PM
• Project Management to be familiar with the Area Strategic Plan	ECO, PM
• Evidence of Rules & Regulations given and explained to Contractor or Community Workers (this should include the Operating Standards)	PM, C
• Emerging and potential weeds reported through agreed communication lines, ecologist can be consulted for proper identification	PM
• A copy of the emergency plan and telephone numbers must be on site, workers must demonstrate knowledge thereof	PM
1.3. Management Unit Clearing Plan (MUCP)	
• It must be up to date	PU, PM
• A clearing strategy must be evident and supported by the planned priorities	PU, PM
• Project Managers must be able to show actual work done vs. planned work, supported by fixed point photographs	PM

2. TOOLS AND EQUIPMENT	
2.1. Hand tools in good condition and used correctly	
• Hand tools(e.g. lopper, pruning saw etc.) must be best suited to the work and the size of plants being cleared	PM, C
• The tools must have correct and properly secured handles and must be in safe working order	C
• A sharpening stone/file, with a hand grip, must be on site	C
• Gloves and goggles must be worn when sharpening tools	C
• The tools must be used in the correct manner; clearing must be done using the correct techniques	C, PM
• Safe working distances of at least two (2) tool-reach lengths apart must be maintained	C, PM
2.2. Chainsaws good condition and used correctly	
• Operators have received certified training in chainsaw operation, felling, cross-cutting and de-branching techniques and have been assessed for competence every six months. For training opportunities contact the regional WfW or otherwise qualified entity	PM, TU
• The chainsaws must be best suited to the clearing work and timber size	PM, C
• There must be a service maintenance schedule for all chainsaws Services (daily, weekly) are done and recorded	PM, C
• Safety and operational features must be in good order as per standard checklist	PM, C
• Chainsaw work is planned and executed for safe and efficient production	PM, C
• Correct felling / clearing techniques are applied	PM, C
• Correct cross-cutting and de-branching techniques are applied.	PM, C

• Correct re-fuelling procedures are followed to prevent spillages	C
• Chain sharpening is correctly done with the correct tools at each refueling	C
2.3. In-field fuel site	
• A cleared area, at least six (6) metres from rest areas, demarcated with hazard tape must be used to store fuel	C
• Fuel and oil containers at the in-field fuel site must be stored on an absorbent drip-mat or drip-tray	C
• A 2 kg dry chemical powder (DCP) fire extinguisher must be at least 3m distant from the fuel site and easily visible	C
3. STORES, WORKSHOPS AND OFFICES	
3.1. Stores, workshops and offices	
• Buildings and containers must be secure and provide safe storage space for equipment and/or supplies	PM
• The office / stores area must show a high standard of housekeeping (A place for everything, everything in its place)	PM
3.2. Herbicide stores	
• The building / container must meet the Herbicide Policy standards	PM
• A Material Safety Data Sheet and Label must be in the store for each stock category of herbicide stored. (Each product.)	PM
• Herbicides must be issued with reference to the WIMS contract number	PM
• There must be stock control of empty containers.	

• Empty containers must be stored until removal by a registered recycling company	ECO
• Excess, undiluted herbicide must be returned to the stores and noted on the stock sheet. Excess, diluted herbicide must be stored in a UV-resistant container and allocated to another treatment within 2 days or returned to a suitable container in the stores	ECO, C
• Burning of empty containers by Project staff or Contractor is prohibited	PM, C
3.3. Fuel and flammable liquids stores	
• The building / container must be suitable for the liquids stored in them	ECO
• Quantities limited to allowed maximum per class where proper storage facilities are not available:	
o Class I – 45L (petrol, thinners)	PM
o Class II – 270L (diesel, lube oils)	PM
• Proper housekeeping and handling procedures must be evident	PM
• Adequate measures to deal with spillage and contamination e.g. spill kit	PM
• Correct signage and fire-fighting equipment e.g. dry chemical powder fire extinguisher of at least 2.25kg	PM
3.4. Storage at contractor stores / houses: Where contractors cannot make use of proper dedicated stores, the following standards apply:	
• All equipment, supplies, herbicides, fuel and oils must be safely and securely stored with controlled access, in a suitable lockable building, container or a lockable trailer	C
• A 1kg dry chemical powder (DCP) fire extinguisher must be available outside the store / container	C

• PM to annually verify and keep record of inspection of compliance regarding storing facilities at contractors store / house	PM
4. HERBICIDES	
4.1. General	
• Workers must be specifically allocated and trained to work with herbicides and demonstrate knowledge of the risk of working with the selected chemicals and how to avoid that risk (NB: only employees with Pest Control Operator (PCO) certificates may administer herbicides and that such a team must work under direct supervision of a person with AVCASA registration in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947))	TU, PM
• Only registered herbicides as detailed in the WfW herbicide policy or on the product label may be used	PM
• A Material Safety Data Sheet (MSDS) and Label must be in the field for each product used	PM, C
• Written approval must be obtained via the approved communication channels from the National Office to use an unregistered herbicide for a particular specie or situation	PM, ECO
• Mix water must be clean & clear (not muddy)	C, PM
• Spray mix adjuvants (e.g. wetters, buffers etc.) must be used according to label instructions	PM, C
• In the absence of a built-in colourant a suitable dye must be used in applications	PM, C
• Contractors and applicators must demonstrate an understanding of why herbicide applications should not be done in unsuitable weather conditions; e.g. foliar application in windy conditions	C
• Quality check records must show that application methods are monitored for targeting, rates and spray drift	C, PM

• Where there is a risk of herbicide applicators entering water, knapsacks should be filled only half full	C, PM
• PM must submit a Herbicide-used sheet for every completed contract, information must be captured	PM, PU
• Herbicide applicators must demonstrate an understanding of spot spray patterns	C
• For cut-stump / frill / ring-barking, coverage must be even and spraying must be monitored to limit excessive run-off	C
4.2. Equipment	
• Equipment must be properly maintained according to regular scheduled services	C
• Equipment must not leak. Faulty equipment must be serviced or decommissioned	C
• Equipment appropriate to the application method and treatment must be used.	PM, C
• When using knapsack sprayers the following apply:	
o Knapsack sprayers must be fitted with pressure regulators set to the correct pressure (1bar / 100Kpa) or fitted with a constant flow valve	PM, C
o Knapsack sprayers must be fitted with the correct nozzle in good condition, appropriate for the application method used (e.g. TG1; FL5VS; TFVS2 or equivalent)	PM, C
• Lances must be secured to prevent damage when transporting.	C
• Washing of equipment must take place in a designated area, using the triple-rinse method	C
4.3. Safe storage and handling in-field	
• In a designated, shaded demarcated area	C
o Away from rest / eating areas	C

○ At least 20m from any water body	C
○ Away from crops, gardens etc.	C
○ Floor area covered suitable absorbent material	C
○ Bucket & spade must be available in case of spills	C
○ Clean water, washing bucket, soap & towel must be available for persons handling the herbicide & equipment	C
• Mixing containers must be UV resistant and leak proof	C
• Mixing containers must be clearly labeled, showing the brand name and concentration of the contents	C
• Refilling, mixing, washing and rinsing should only be done within the demarcated area	C
• Empty product containers must be triple-rinsed and punctured before it is returned to the store	C
• Rinsed water must be recycled for subsequent mixes	C
• Contractors must have proper records of daily herbicide mixtures and issues and actual herbicide use in the contracting teams on-site	C
5. SAFETY	
5.1. Hazard Identification and Risk Assessments (HIRA)	
• The HIRA process to be developed, recorded and available at the project / area and knowledge demonstrated by everyone.	PM,C
• Site Emergency Evacuation Plan must be drafted and communicated to all personnel.	PM,C
• Where relevant, hazards in the working area must be taped off. e.g. trenches, holes, hang-ups etc.	C

• The Written Safe Work Procedures Manual must be available, understood and adhered to by all working staff.	PM, C
5.2. First Aid kit	
• A first aid kit, fully stocked according to the standard stock list, must be easily accessible at all work sites, and regularly inspected by the PM.	PM, C
• All first aid treatment and usage of stock must be recorded in the dressing book kept on site / regional office.	C, PM
• The First Aid kit must be under control of a trained First Aider with a current valid certificate	C, PM
• There must be an alternative trained First Aider of opposite gender in the team	C
• A list of emergency numbers must be kept in the first aid box e.g. ambulance, doctor, hospital, fire brigade, poison info centre	C, PM
• A copy of the competency certificate of the first-aider must be kept on-site in the H&S file.	C, PM
5.3. Personal Protective Equipment and Clothing (PPE)	
• PPE must meet the minimum prescribed standards of quality (EU or SABS).	C, PM
• PPE must be replaced when it becomes ineffective through wear & tear.	C, PM
• PPE must be provided with due consideration to the hazard exposure as well as the PPE requirements as per occupation	C, PM
• A record must be kept of all PPE issued to contractors and workers, and signed for by them, with the acknowledgement to wear the PPE.	PM, C
• Project must conform to acceptable H&S Guidelines	PM, C

5.4. Substance abuse	
• The use of any mind altering substances is not allowed on-site (e.g. alcohol, dagga).	PM, C
• Persons in the WfW programme must demonstrate knowledge of the potential dangers and the workplace policy of drug use	ECO, PM, C
5.5. Extreme Weather Conditions	
• Demonstrate knowledge that no work in / near / on water bodies may take place during rain or lightning.	PM,C
• No felling or spray application of herbicides may take place during high wind conditions	PM,C
• The contractor should be informed of any adverse weather conditions	PM
6. METHOD OF WORK	
6.1. Appropriate clearing methods applied	
• A process of appropriate clearing method selection must be followed and recorded - use the species guide provided	PM
• Handling / processing of cleared material must be kept to a minimum, but due to a potential fire hazard and the allelopathic effect of leaf litter, cleared material must not be left on site. A specific area must be designated to stack and process material to make maximum use of wood for community members, whilst regenerative material must be destroyed by controlled burning.	PM, C
• A copy of the Treatment Methods table must be available in the Project Office	PM
• No frilling / ring barking is allowed within two (2) tree lengths of roads, fences, telephone and power lines, infrastructure (e.g. buildings) or in the **riparian zone of a river**	PM
6.2. Follow-up done timeously	

• An up-to-date follow-up plan must be used to ensure treatment is done on time	PM
• For foliar treatment there must be sufficient newly-growing foliage and plants must not exceed hip height	PM, C
• When follow-up operations are not done at the most cost-efficient stage, there must be specific reasons on record including cost/person day variations between planned and actual follow-up to be recorded	PM
6.3. Efficient team operation	
• Operational planning for the specific site must be evident. Different tasks must be coordinated in an efficient manner for optimum productivity. If possible, every management unit mapped should have its own team allocated.	PM, C
• Tool use and tasks must be in line with the site-specific requirements	C
• Daily or weekly production tasks must be set and actual production must be measured and recorded	C
6.4. Work methods conform to WfW standards	
• Record of inspection of method, quantity and quality according to the contract.	PM, C
• All invasive alien species treated within the contract boundaries	PM, C
7. ENVIRONMENTAL AWARENESS	
7.1. Site clean and free of litter and waste	
• There must be no litter from clearing activities on work sites, at any time and there must be a litter bag on site at the demarcated gathering area, cleared or removed daily and disposed of in an acceptable manner.	C

• Existing litter not cleared in light of possible health risks, that may be associated with certain waste, reported to PM and disposal solution with relevant authority found	PM, C
• Project Manager and contractors to demonstrate knowledge that soil contaminated with oil must be appropriately treated and disposed of at a permitted landfill site.	PM, C
• When loose waste material is transported on vehicles, it must be adequately tied down / covered and contained.	PM, C
7.2. Sanitation	
• As far as practically possible, provide formal sanitation (chemical or water-born). Where this is not possible, a spade and toilet paper must be easily accessible on every site.	C
• Human waste and used toilet paper must be buried at least 20 m distant from any watercourses or bodies and at least 50 cm deep.	C
• In sensitive areas (urban sites, wetlands) a portable toilet must be provided on site and the waste removed and disposed of in an acceptable manner.	C
• Clean water and soap must be provided and used for hand washing.	C
• The workers should be informed of personal hygiene and demonstrate its practice	C, PM
• Where relevant, sufficient toilets per gender need to be available	C, PM
7.3. Access routes	
• Existing access routes must be used. Where new access routes or paths are required, these must be planned and made in co-operation with the landowner / manager and marked with hazard tape	PM, C
7.4. Indigenous plants and animals	
• Indigenous plants should not be damaged where possible and animals must not be harmed.	C

• Alien trees with bird nests must be killed standing where possible. Site records must be kept.	PM, C
• Collection of plant parts of alien plants for medicinal or other purposes, may only take place with the appropriate permission. Collection records must be kept.	C
• Identify and protect indigenous plants and animals, especially:	
○ Red list data species (none recorded)	C
○ Protected plants (see species of conservation concern)	C
○ Sensitive communities (wetlands only, no other recorded on project area)	C
○ Wetlands	C
• No species of animal may be poached, snared, hunted, captured or willfully harmed, damaged or destroyed. Snares must be reported to land owners, PM or conservation authorities and removed immediately.	C
• Snakes and other reptiles that may be encountered on the treatment area must not be killed.	C
• Anthills and/or termite nests that occur must not be disturbed.	C
• Keep the relevant managers informed of dangerous or problem animals. Record sightings and encounters.	PM, C
• Keep food and rubbish out of reach of scavengers, e.g. apes and birds.	C
7.5. Invasive alien plant identification (IAP)	
• Alien invasive plants including aquatic alien plants must be identified, where required expert assistance must be used.	PM, C
• The relevant species to be removed must be pointed out to contractors and workers on site.	PM

• Damage to indigenous / desirable vegetation must be minimised.	C
7.6. Alien invasive dispersal	
• Where cleared material must be moved from the site, measures must be taken to prevent dispersal of reproductive material (e.g. seeds, cuttings).	PM, C
• Chipped plant material must be free of seed if used off-site (e.g. mulch).	PM, C
• Plants which have been removed must not be transported across or near to rivers or dams in which the species is absent.	PM, C
• Removed plants must not be stacked on top of indigenous flora.	PM, C
• Method and specifications chosen with due consideration of impact on the site, natural vegetation & regeneration.	PM
• Methods used must ensure that weeds are not distributed by the contractor and employees	PM, C
7.7. Site stabilisation / anti-erosion / rehabilitation measures	
• **Stack larger cut logs** along the contour and below knee height with 2 m gaps at 10 to 15 m intervals for access, escape, animal movement and to reduce run-off and soil movement where there is an enhanced erosion risk along stream banks or steeper slopes	PM, C
• Preserve indigenous plant cover and adapt treatment methods to allow indigenous plants to colonize the site.	PM, C
• Identify sites requiring additional stabilisation structures / measures / re-vegetation and obtain expert advice & planning to implement.	PM
• Take precautionary measures to protect stabilising plants (planted & natural) during follow-up spraying.	C

7.8. Site stabilisation / anti-erosion / rehabilitation records	
• Sites must be mapped and a unique Treatment Area number must be assigned. Comprehensive planting / maintenance records must be kept; including dates, species and number of plants and follow-up care.	PM
• A record of input costs must be kept, including: materials, plants, seeds, person-days etc.	PM
8. FIRE FIGHTING AND PROTECTION	
8.1. Fire Precautions on work sites	
• Smoking allowed in safe indicated areas, designated by the contractor / manager / landowner.	PM, C
• No fires are allowed on work sites.	PM, C
• Site specific reaction / evacuation rules must be applied in the case of wild fires.	C
• Basic appropriate fire-fighting equipment must be available at each work site; a minimum of five fire beaters and one filled knapsack fire-fighting pump, or alternative suitable equipment.	PM, C
• Where fuels and machines are used on site, a 2 kg dry chemical powder fire extinguisher in working condition must be available.	PM, C
• Fire Fighting & Extinguishing Equipment inspected and recorded.	PM
8.2. Fire Protection	
• The project must be a member of the Fire protection Association (FPA) and attend meetings where applicable	ECO, PM
• In FPA areas, the project must be on their communication network.	ECO, PM

• Fieldwork may not take place during red days or extreme danger rating days. (Contact Working on Fire office)	ECO, PM
9. TRAINING	
9.1. Induction	
• All new workers must receive orientation before starting work.	PM
9.2. Compulsory functional training	
• All training, including refresher courses, is compulsory.	TU, PM
• All training must be provided to workers and contractors within three months of commencement of work	TU, PM
• Project Managers must hold a valid training certificate, on file, for **all** the training courses required in their project. Alternatively, arrangement must be made with the WfW Programme or suitably qualified units to provide such training	PM
• Training must be in line with the latest WFW Training Policy	TU, PM
• Area / Project Managers must pass an Environmental Pest Control Course and apply for PCO Registration with the National Dept. Agric - Registrar.	TU
• Contractors - Limited Pest Control course.	TU
• Herbicide Applicators – WfW Herbicide Applicators course.	TU
• Other workers – Herbicide Awareness training.	TU
• Chain saw operators - chainsaw handling and maintenance, felling, cross-cutting and de-branching techniques.	TU

• Copies of all herbicide training certificates received and Pest Control Licenses must be available with the PM and contractor on-site.	PM, C
9.3. Training Plan & Profiles	
• The Training Annual Plan of Operations must be displayed.	PM
• The plan must be based on the WFW training matrix and policy.	TU, PM
9.4. Training Records	
• All training capture sheets, attendance registers, evaluation forms, and certificates must be filed in the Regional Training Manager's office or Area office.	TU, PM
• All Department of Labour monitoring sheets, correspondence, financial records and training schedules must be filed in the Regional Training Manager's office or Area office.	TU
9.5. Accreditation	
• All training must be aligned to unit standards, where possible.	TU
• All training must be provided by accredited training providers, where possible.	TU

Performance Indicator	» Project area is consistently cleared of invasive alien vegetation » Remnants of alien vegetation removed from where they were cleared to make way for the proposed development and rehabilitation of natural vegetation surrounding the development » No indication of further degradation and/or pollution of the areas surrounding the development » No members of staff/ public/ landowners injured
Monitoring	» Regular visual inspection of cleared areas for signs of resprouting, alien plant seedling emergence, new alien species invasions » An incident reporting system will be used to record non-conformances to the EMP.

	» Public complaints register must be developed and maintained on site. » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager. » ECO to address any infringements with responsible contractors as soon as these are recorded.

APPENDIX C:

EROSION MANAGEMENT PLAN

PRINCIPLES FOR EROSION MANAGEMENT

1. Purpose

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

» A general framework for erosion management, which enables the contractor to identify areas where erosion can be accelerated from their action.
» An outline of general methods to monitor, manage and rehabilitate erosion in ensuring that all erosion caused by this development is addresses.

2. Legislation and Standards

Soil conservation pertaining to erosion has been a topic within legislation form the 1930's till today in South Africa. Relevant legislation:

» Conservation of Agricultural Resources Act No 43 of 1983
» Environmental Conservation Act No 73 of 1989
» National Forestry Act No 84 of 1998
» National Environmental Management Act No 107 of 1998
» The Department of Water Affairs and Forestry, February 2005. Environmental Best Practice Specifications: Construction Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria.

3. Areas with a high soil erodability potential

The following areas are generally associated with high soil erodibility potential:

» Any areas without vegetation cover
» Excavated areas
» Steep areas
» Areas where the soil has been degraded already
» Dispersive, duplexed soil areas
» Areas with fine grained soil material with a low porosity
» Areas which undergo overland flow of water.
» Areas close to water
» Irrigated areas
» Compacted areas
» Rivers
» Drainage lines
» And any areas where developments cause water flow to accelerate on a soil surface.
» Coarsely gravelly covered surfaces

4. Precautionary management activities to avoid erosion

In the assessment process the ECO and the contractor must assess all:

- Infrastructure and equipment placements and function to ensure that the infrastructure or equipment is not causing accelerating soil erosion on the site.
- Construction activities to ensure that no erosion indicators are forming as a result of the construction activities.

5. Monitoring

7.1. General Erosion

The ECO must assess the site for erosion indicators in the monitoring process, which include:

- Bare soil
- Desiccation cracks
- Terracettes
- Sheet erosion
- Rill erosion (small erosion features with the same properties and characteristics as gullies)
- Hammocking (Soil build-up)
- Pedestalling (Exposing plant roots)
- Erosion pavements
- Gullies
- Evidence of Dispersive soils

In the assessment process, the ECO and the contractor must assess all:

- Infrastructure and equipment placements and function to ensure that the infrastructure or equipment is not causing accelerated soil erosion on the site.
- Construction activities to ensure that no erosion indicators are forming as a result of the construction activities.

If any activities or placement of equipment cause pooling on the site, degrade the vegetation, result in removal of the surface or subsurface soil horizons, create compacted surfaces with steep gradients, or minimise runoff areas, the erosion potential on the site will increase.

If any erosion features are begin forming or are present as a result of the activities mentioned above the ECO must:

- Assess the situation.
- Take photographs of the soil degradation.
- Determine the cause of the soil erosion.

» Inform and show the relevant contractors the soil degradation.
» Inform the contractor that rehabilitation must take place and that the contractor is to implement a rehabilitation method statement and management plan.
» Monitor that the contractor is taking action to stop the erosion and assist them where needed.
» Report and monitor the progress of the rehabilitation weekly and recorded all the findings in a site diary.
» All actions with regards to the incidents must be reported on a monthly compliance report which will be submitted to the department.

The contractor/ developer (with the ECO's consultation) must:

» Select a system to treat the erosion
» Design the treatment system
» Implement the system
» Monitor the area to see if the system functions like it should, if the system fails, the method must be adapt or adjust to ensure the accelerated erosion is controlled.
» Monitoring must continue until the area has been stabilised

7.2. Stormwater Management

The ECO is responsible to monitor the site and the activities to ensure that no unnatural soil degradation is taking place.

The ECO must assess the site for erosion indicators such as:

» Bare soil
» Exposed plant roots, pedestalling
» Sheet erosion
» Rill erosion
» Hammocking
» Erosion pavements
» Terracettes
» Gullies

In the assessment process the ECO and the contractor must assess all:

» Disturbed watercourse areas by the development: roads, bridges, river crossings, cabling, permanent laydown areas, crane pads and any other remaining hard surfaces.
» Construction activity limited to specified areas. Stockpiles of aggregate and material will be positioned at least 50m away from drainage lines and wetlands.

If any erosion features are present as a result of the activities mentioned above the ECO must:

» Assess the situation
» Take photographs of the soil degradation.
» Determine the cause of the erosion.
» Inform and show the relevant contractors the soil degradation.
» Inform the contractor that rehabilitation must take place and that the contractor is to implement a rehabilitation method statement and management plan.
» Monitor that the contractor is taking action to stop the erosion and assist them where needed.
» Monitor the rehabilitation weekly and record the findings in a site diary.
» All actions with regards to the incidents must be reported on in the monthly compliance monitoring report.

The contractor/ developer must (with the ECO's consultation):

» Select a system to treat the erosion
» Design the treatment system
» Implement the system
» Monitor the area to ensure that the erosion has been addressed adequately.
» Monitor the erosion until the area has been stabilised.

6. Rehabilitation

The following erosion control measures and rehabilitation specifications must be implemented to ensure that good environmental practice is conducted and environmental compliance is achieved.

6.1. General Erosion Management

In this section the equipment needed to remediate erosion, the precautionary measures which must be taken to avoid erosion and mitigation requirements for already degraded areas.

6.1.1. Equipment

The civil works contractor may use the following instruments to combat erosion when necessary:

» Reno mattresses
» Slope attenuation
» Hessian material
» Shade catch nets
» Gabion baskets

» Mulching Run-off control (increase the amounts of runoff areas to disperse the water)
» Silt fences
» Storm water channels and catch pits
» Shade / catch nets
» Soil bindings
» Geofabrics
» Hydroseeding and/or re-vegetating
» Mulching over cleared areas
» Stone packing
» Tilling (roughing the surface)

6.1.2. Methods to prevent accelerated erosion

The following practises should be considered and adhered to:

» Ensure steep slopes are stabilised.
» Ensure that steep slopes are not stripped of vegetation and left to dry out and become water repellent (which will case increased runoff and a decreased infiltration rate) increasing the erosion potential.
» Ensure that all water on site (rain water or water wastage from the construction process) does not result in any surface flow (increase velocity and capacity of water) as a result of the poor drainage systems.
» Ensure that pooling of water on site is avoided, as the site and the general area consists of dispersive soils, pooling will cause an increase of infiltration on one area, causing the subsurface to begin eroding.
» Ensure that heavy machinery does not compact those areas which are not intended to be compacted (i.e. areas intended to be managed), as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area. where compaction does occur, the areas should be ripped.
» Ensure that compacted areas have adequate drainage systems to avoid pooling and surface flow.
» Prevent the concentration or flow of surface water or stormwater down cut or fill slopes, or along pipeline routes or roads, and ensure measures to prevent erosion are in place prior to construction.
» Ensure that stormwater and any runoff generated by hard surfaces should be discharged into retention swales or areas with rock rip-rap. These areas should be grassed with indigenous vegetation. These energy dissipation structures should be placed in a manner that surface flows are managed prior to being discharged back into a natural watercourse to support the maintenance of natural base flows within the ecological systems and prevent erosion, i.e. hydrological regime (water quantity and quality) is maintained.
» Ensure siltation and sedimentation through the use of the erosion equipment mentioned structures.

» Ensure that all stormwater control features have soft engineered areas that attenuate flows, allowing for water to percolate into the local ground watertable in low quantities (to reduce runoff but prevent subsurface erosion).
» Minimise and restrict site clearing to areas required for construction purposes only and restrict disturbance to adjacent undisturbed natural vegetation.
» Ensure that vegetation clearing is conducted in parallel with the construction progress across the site to minimise erosion and/or run-off.
» Ensure that large tracts of bare soil which would cause dust pollution in high winds, or have high erosion susceptibility and increase sedimentation in the lower portions of the catchment are controlled through temporary surface covering.
» Ensure no diversion of water flows in catchment occurs.
» Ensure that dust control measures are implemented, but prevent over-wetting/ saturating the area (to cause pooling) and run-off (that may cause erosion and sedimentation).
» Watercourse (stream) crossings should not trap any run-off, thereby creating inundated areas, but allow for free flowing watercourses.

6.1.3. Mitigation for previously degraded areas

Previously degraded areas could pose a threat to construction activities in the area and must therefore be stabilised, then remediated and rehabilitated through:

» Protecting, stabilise and isolate the degraded areas to ensure no further damage is caused by erosion due to construction activities.
» Increase the drainage in the area but avoid pooling.
» Prevent increasing sedimentation in areas that have been chocked by soils from degraded areas.
» Once construction has been completed, a method statement must be drafted for the rehabilitation of the previously degraded areas, using equipment mentioned above and implemented.
» Stabilisation of steep slopes must be undertaken.
» Ensure that bare soil is covered and hydro seeded to reduce topsoil loss.

6.2. Methodologies

The following erosion control measures and rehabilitation specifications may be required to be implemented to ensure that good environmental practice is conducted and environmental compliance is achieved.

» Topsoil covered with a geotextile or hessian material and a grass seed mixture (see Rehabilitation Specifications).
» Logging or stepping following the contours of the slope, to reduce surface runoff.
» Earth or rock-pack cut-off berms.
» Packed branches to roughen the surface and promote infiltration.
» Benches (sand bags).

» Stabilisation of near vertical slopes (1:1 – 1:2), if created during construction, will be required to utilise hard structures that have a natural look. The following methods may be considered:
  - Gabions (preferred method with geotextile material).
  - Retaining walls.
  - Stone pitching.
» The slopes of all stream diversions must be protected. The following methods may be considered:
  - Reno mattresses (preferred method), ensure that the reno mattresses are buried deep into the subsurface, to avoid undercutting from the water.
  - Coarse rock (undersize rip-rap)
  - Sandbags.
  - Stone packing with geotextile
» Where feasible use rubber dams as stream diversions when establishing water course crossings. Although (and considering that these are non-perennial watercourses) the recommendation is to construct watercourse crossings during dry periods (or no flow periods), where possible.
» Any concentration of natural water flow caused by road works or hardstands areas will be treated as follows:
  - if water flow is sub-critical, nothing is required
  - if water flow is supercritical, the outlets will be provided with protection (either gabions or stone pitching – depending on the flows) to release water subcritical back into the watercourse at a low velocity.

6.3. Engineering Specifications

A detailed Stormwater Management Plan describing and illustrating the proposed stormwater control measures must be prepared by the Civil Engineers and this includes erosion control.

Requirements for project design:

» Erosion control measures to be implemented before and during the construction period, including the final stormwater control measures (post construction).
» The location, area/extent (m^2/ha) and specifications of all temporary and permanent water management structures or stabilisation methods.
» A resident Engineer to be responsible for ensuring implementation of the erosion control measures on site during the construction period.
» The Developer holds ultimate responsibility for remedial action in the event that the approved stormwater plan is not correctly or appropriately implemented and damage to the environment is caused.
» Concrete lined drains placed adjacent to road to transfer the water to the existing water courses.
» Frequent gravel drains hydroseeded placed on permanent roadway edges.

» At the point where stormwater is discharged, energy dissipaters to be constructed to reduce the flow rate of run-off.
» All cut and fill banks will be seeded with an approved seed mix (as per the rehabilitation specifications) to ensure bank stabilisation and the elimination of potential erosion. Reno mattresses may be used to ensure that the area remains stable.

6.4. Rehabilitation Specifications

» Employ a Horticultural Landscape Contractor to fulfil the rehabilitation of disturbed areas post-construction.
» A detailed Rehabilitation Plan describing and illustrating the proposed rehabilitation activities on site must be prepared i.e. areas of top soiling, seeding and replanting of vegetation; species mix; requirements for fertilisation; seed sowing rates; watering etc. (i.e. bill of quantities).
» The following document should be consulted for further support with respect to information regarding rehabilitation, namely: The Department of Water Affairs and Forestry, February 2005. Environmental Best Practice Specifications: Construction Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria.
» These specifications may be modified by the Horticultural Landscape Contractor on consideration of site conditions.

6.5. Post- and during construction rehabilitation activities

» Correct and appropriate stockpile management of topsoil will be required during the construction phase.
» Rehabilitation of disturbed areas will be implemented as these areas become available for rehabilitation.
» Disturbed areas will include, for example: construction camp site, areas where underground cabling has been layed/buried, roadsides of new access roads.

7. Rehabilitation steps to mitigate the eroded area

» Stockpiled topsoil must be spread over disturbed areas (150 – 200mm thick) just prior to planting/seeding.
» Rip and scarify along the contours of the newly spread topsoil prior to watering and seeding.
» Organic fertilizers or compost shall be used if site conditions require it and can be applied as part of hydro-seeding applications.
» Seed should be sown into weed-free topsoil that has been stockpiled (i.e. original topsoil from the site).
» Indigenous plants (e.g. grass species such as *Cynodon dactylon*, *Eragrostis curvula*) shall be used to rehabilitate disturbed areas.

» Applying the seed through hydromulching (hydro-seeding) is advantageous (or organic mulching after seeding).
» Watering is essential and rehabilitation should ideally occur during the wet season.
» The topsoil in the area is vulnerable to erosion therefore the hydro-seeded surfaces must be covered with a shade cloth material or natural fibre (hessian material) to reduce the loss of soil while the plants establish.

7.1. 'Watering' to avoid erosion

» Movement of livestock in newly rehabilitated areas must be restricted, where possible, while taking into consideration drinking areas/paths.
» Watering the rehabilitated areas should be undertaken in the wet/rainy season essential but if this is not possible, an initial watering period (supplemental irrigation) will be required to ensure plant establishment (germination and established growth).
» Generous watering during the first two weeks, or until the seeds have germinated, is required (unless adequate rainfall occurs) i.e. seed beds will need to be kept moist for germination to occur.
» For grass to establish (once germination has occurred), rainfall or irrigation is needed at regular intervals, ideally every few days and possibly every day if weather conditions require it.
» During dry periods, with no rainfall, 100 litres per m^2 (or 100mm of rain) over a month or more, may be necessary to establish plants capable of surviving dry weather (or otherwise specified by the Horticultural Landscape Contractor).

7.2. Seeding

The developer should make use of an appropriate mix of grass species for rehabilitation 9to be determined in consultation with a suitably qualified ecologist) and they must be mixed for sowing either in summer or in winter. Grass species application (Rutherford, 2006) is at the rate secified as kg/ha.

7.3. Steep slopes

» Areas that have a steep gradient and require seeding for rehabilitation purposes should be adequately protected against potential run-off erosion e.g. with coir geotextile netting or other appropriate methodology.
» Provision for wind should also be made on these slopes to ensure the fine grained soil is not removed.

7.4. Maintenance and duration

» Rehabilitation will occur during construction, as areas for plant rehabilitation become available.
» The rehabilitation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
» The rehabilitation phase (including post seeding maintenance) should be at least 6 months (depending on time of seeding and rainfall) to ensure establishment of plants with a minimum 80% cover achieved (excluding alien plant species).
» If the plants have not established and the 80% is not achieved within the specified maintenance period, maintenance of these areas shall continue until at least 80% cover is achieved (excluding alien plant species).
» Additional seeding may be necessary to achieve 80% cover.
» Any plants that die during the maintenance period must be replaced.
» Succession of natural plant species should be encouraged.

8. Conclusion

The Erosion Management Plan is a document to assist the contractor, the Developer and the ECO with guidelines on how to manage erosion. The implementation of management measures is not only good practice to ensure minimisation of degradation, but also necessary to ensure comply with legislative requirements. This document forms part of the EMP, and is required to be considered and adhered to during the design, construction, operation and decommissioning phases of the project.

9. References

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

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

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

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

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

APPENDIX D:

CONSTRUCTION WASTE GUIDELINE

ENVIRONMENT PROCEDURE

Waste Management Plan

Table of Contents

Introduction

Sound waste management is better achieved when an Integrated Waste Management System is implemented. This is more evident on sites or in areas where different parties and aspects are involved. Integrated Waste Management is better achieved when system is underlined by sound environmental principles. These principles derived from section 2 of the National Environmental Management Act (Act 107 of 1998). The following principles apply to waste management.

A **Precautionary approach** will be followed in the sense that harm to health and the environment is prevented when waste is generated, treated and disposed off. The contractor as the generator of waste have to abide by the **Duty of Care** principle by ensuring that waste is disposed off in a manner that is environmentally sound and responsible. Management of waste must also follow an **Integrated and Holistic Approach** integrating health, safety and the environment in to the management approach and managing all aspects as a whole. By following the Best Practical Environmental Option one selects and implements the most sustainable management option in terms of the environment and the people surrounding it. The last principle that has to be considered in waste management is the **Polluter Pays** principle. This principle indicates that the costs for remediation and prevention of further pollution will fall on the responsible party.

Purpose of this document

A Waste Management Plan plays a key role in achieving sustainable waste management. This document is set to indicate the procedure that has to be followed during the handling, storage, transportation and disposal of waste that is generated from the activities on site.

Scope

The Waste Management Plan Procedure provides guidelines for waste management and applicable to employees, sub-contractors working on behalf of the Developer.

Waste Management Strategy

Waste will be managed according to the waste hierarchy as set in the National Environmental Management: Waste Act (Act 59 of 2008).The waste hierarchy dictates that the generation of waste should be avoided and minimised. If this is not possible the most desirable options will be reuse, recycle and recover waste. The last option will be disposal.

When waste is disposed it must be done in an environmentally safe manner and at a disposal site that is permitted and authorised to dispose of that waste. It is the generators duty to ensure that such disposal sites have sound and responsible management practices.

Waste will be segregated at source to facilitate re-use, recycling, and recovery. Segregation of waste will be made possible by means of waste containers that are allocated and marked for different waste streams that are identified within the content of this document.

Emergency Procedures will be followed in the unforeseen event of a spill or if waste burns on site.

All employees will receive training on waste management issues by means of induction training and toolbox talks that will take place once per week. Littering on site is prohibited. No person is allowed to discard of any litter on site expect in bins provided for that purpose.

Waste generation

Daily operational activities will generate general waste, metal waste as well as hazardous waste on monthly basis. Figures of these wastes are not yet known and will vary within project cycles as there will be times of acceleration in activity and times decreased activity.

Sources of waste will include: empty containers, office paper, plastic water bottles, and food waste canteens, printer cartridges, and used vehicle oil from workshops

Legal Requirements

The following sources of South African Law have been identified and will form the basis of the (WMP). Developer will comply with all environmental policies or Acts that apply to the Project, and the Project Manager should familiarize himself with, and have access to, the following pieces of legislation as a minimum:

- Constitution of South Africa (Act No. 108 of 1996);
- National Environmental Management Act (Act 107 of 1998);
- National Environmental: Waste Act (Act No. 59 of 2008);
- Hazardous Substances Act (Act No. 15 of 1973);
- Impacts and Aspects Register;
- Environmental Management Plan (EMPr)
- Environmental Authorisation
- Minimum Requirements for the Disposal of Waste by Landfill, Edition 3 (2005); and
- Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Edition 3 (2005).

Definations and Abbreviations

a. **Defination of waste relevant to operations**

Environment Surroundings within which human exists and that are made up of:

- The land, water and atmosphere of the earth;
- Micro- organisms, plant and animal life;

- Any part or combination of the above and the interrelationships among and between them; and
- The physical, chemical, aesthetic and cultural properties and conditions of foregoing that influence human health and well-being. (NEMA Act, Act No. 107 of 1998).

Waste means any substance, whether or not that substance can be reduced, re-used, recycled or recovered:

a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;
b) which the generator has no further use of for the purposes of production;
c) that must be treated or disposed of; or
d) that is identified as a waste by the minister, by notice in the Gazette, but:
   i) a by-product is not considered waste; and
   ii) any portion of waste, once re-used, recycled and recovered, ceases waste.

Hazardous Means a source of or exposure to danger (NEMA, 1998)

Recovery Means the controlled extraction of a material or the retrieval of energy from waste to produce a product

Recycle a process where waste is reclaimed for further use, which process involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.

Re-use to utilise articles from the waste stream again for a similar or different purpose without changing the form or properties of the articles

Container means a disposable or re-usable vessel in which waste is placed for the purposes of storing, accumulating, handling, transporting, treating or disposing of that waste, and includes bins, bin –liners and skips

Disposal Means the burial, deposit, discharge, abandoning, dumping, placing or release of any waste into air or any land.

Hazardous Waste

Waste that has the potential to cause a negative threat/impact to humans and/or the environment. It includes, but is not limited to, batteries, neon lights, fluorescent lights, printer cartridges, oil, paint, paint containers, oil filters, IT equipment etc.

General waste Waste which does not pose an immediate hazard or threat to health or to the environment' and includes the following waste flows: domestic waste, construction and demolition waste, business waste, insert waste.

EMP	Environmental Management Plan. A detailed plan of action prepared to ensure that recommendations for preventing the negative environmental Impacts and where possible improving the environment are implemented during the life cycle of the project. (Project EMP).

b. Abbreviations

ECO	Environmental Control Officer
EMP	Environmental Management Plan
WMP	Waste Management Plan
NEM: WA	National Environmental Management: Waste
(Act 59 of 2009)	
DWA	Department of Water Affairs
I&AP	Interested and Affected Parties/Person

Responsibilities

i) The Developer Environmental Officer shall be responsible for compliance with this waste management plan and ensure that all waste generated during construction activities on site is managed in safely and in accordance with legislations..

ii) Developer EO shall provide the Team HSE and ECO with a written monthly waste report, detailing both compliance with the environmental Specifications as well as Environmental Performance;

iii) It is the responsibility of all employees to segregate at source and store waste in the appropriate bins and in designated areas and to ensure that waste is kept to a minimum and environment is not polluted and contaminated.

General waste

a. Management of general waste

General waste will be segregated at source and place in the correct waste bins designated for each waste stream. General waste will not be stored on site for longer than 30 days and will be collected and emptied on a weekly basis by waste management company for disposal.

b. General waste stream

This is waste that does not pose an immediate threat to health or the environment. Most of these waste streams will be designated to be re-used, recycle and recovered.

i) Compactable General waste

This is any waste type that are small in size and that can be compacted

- General waste: waste that does not fall within the defined waste streams that will be disposed of in landfill. Domestic waste will be discarded in waste bins that are labelled "General Waste". Source of this waste will be kitchen, beverage cans, plastic waste and carteens.
- Waste papers: These are waste paper boxes that are unwanted. This waste will be discarded in waste bins labelled "Waste paper, Boxes"

ii) Un-compactable general waste

This is waste that is large in size that cannot be disposed of in normal waste bins or skip. Most of the waste types in this category can be recycled or re-used within the operations on a construction site or can be recycled in to the local community.

- Scrap metals: all metal or steel that is discarded or termed off-cuts will form the bulk of the scrap metal waste stream. These metals will be placed in waste bins labelled "Metal Waste"

c. Recycling Procedure

All scrap/metal waste generated will be collected and sent to the recycling facilities for recycling purpose. Used oil shall be collected by recycling companies where applicable.

Hazardous waste

a. Management of hazardous waste

Hazardous waste will be stored in a safe and responsible manner. Hazardous waste will not be stored on site for more than 30 days. This hazardous waste will be placed in a waste bin labelled 'Hazardous Waste" and will be collected and disposed of as Hazardous waste at approved landfill site. All hazardous waste types will be identifiable at all times. Incompatible waste type will be stored separately.

b. Hazardous waste types

- Hydrocarbon contaminated materials: such as soil due to spills and oil leaks;
- Used equipments/vehicles oils: from vehicles being serviced at workshop;
- Printing cartridges; and
- Chemical waste (such as used oil, paint, insecticide).

Waste bins

a. Waste bins conditions

Developer will ensure that the waste bins used are suitable for the waste that is to be stored within. The waste bins will be in a good condition, not be corroded and may not permit leachate or be otherwise unfit for the safe storage of waste designated to that container. Bins will have mechanisms in place to prevent waste from becoming wind blow litter and it must be scavenger proof. Hazardous waste bins will be sealed to ensure that no spillages can occur. These bins will be also be labelled so as to identify type of waste, date of storage commencement and generator details.

b. Inspections of waste bins

Waste bins will be inspected on a daily basis to ensure that they remain in an acceptable condition for safe storage of waste. These inspections will be documented and records will be kept for future references.

c. Placement of waste bins

The bins will be placed in centralised locations in order to ensure that it is accessible to all employees. The waste bins will be emptied and the waste will be taken to the relevant designated areas (the central storage area or the waste transfer station) awaiting collection by waste removal companies.

Waste storage areas and collecion points

a. Specifications of waste storage areas

Waste will be managed in such a way as to prevent it from becoming a nuisance such as odour and to prevent the breeding of vermin and vectors. Management practices will ensure that no environmental harm is caused. All waste area will be clearly marked with signs to specify that waste is being stored in that area and to indicate what the nature of waste is. Storage areas will be fenced with access control to prevent unauthorised access.

i) General waste storage areas

Storage areas for general waste will be kept clean and neat, with a high level of housekeeping.

ii) Hazardous waste storage areas

Storage areas for hazardous waste will be having a roof to divert rain water from waste containers and must be fully bunded (110%) with pollution collection measurements in place in case of any spills or leakages. A high level of house keeping must be maintained in and around the storage. A file with (MSDS) documents and waste acceptance forms must be kept on site.

b. Requirements of collection points

Points from which waste is collected to be taken to the storage areas or the transfer stations will be clearly accessible for vehicles.

d. Waste removal schedule

Waste bins will be emptied on a regular basis. This will either be daily, weekly or when bins have reached their capacity. A call for service will be issued to the waste removal company when bins are full.

General rules

a. Records

All waste removal records will be maintained on site where it is accessible to all interested and affected parties. These records will include an updated list of the waste streams and volumes generated and disposed of, all collection certificates and disposal certificate and all material recycled or re-used and the volume thereof.

b. Review

Developer Project Manager and Developer Environmental Officer will review this Waste Management Plan on a monthly basis.

c. Reporting

Waste disposal figures will be reported on a monthly basis to the HSE and ECO.

Conclusion

Compliance and implementation of this procedure will ensure effective management of waste on site. Developer and their sub-contractors will comply with the requirements of the EMP, the project RoD and other legislative requirements that may have an impact on waste management in general.

References

- (Emergency preparedness and Response Plan
- ISO 14001:2004;

APPENDIX E:

GRIEVANCE MECHANISM FOR PUBLIC COMPLAINTS AND ISSUES

GRIEVANCE MECHANISM / PROCESS

AIM

The aim of the grievance mechanism is to ensure that grievances / concerns raised by local landowners and or communities are addressed in a manner that is:

- Fair and equitable;
- Open and transparent;
- Accountable and efficient.

It should be noted that the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. However, the aim should be to address grievances in a manner that does not require a potentially costly and time consuming legal process.

Proposed generic grievance process

- Local landowners, communities and authorities will be informed in writing by the proponent (the renewable energy company) of the grievance mechanism and the process by which grievances can be brought to the attention of the proponent.
- A company representative will be appointed as the contact person for grievances to be addressed to. The name and contact details of the contact person will be provided to local landowners, communities and authorities.
- Project related grievances relating to the construction, operational and or decommissioning phase must be addressed in writing to the contact person. The contact person should assist local landowners and or communities who may lack resources to submit/prepare written grievances.
- The grievance will be registered with the contact person who, within 2 working days of receipt of the grievance, will contact the Complainant to discuss the grievance and agree on suitable date and venue for a meeting. Unless otherwise agreed, the meeting will be held within 2 weeks of receipt of the grievance.
- The contact person will 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.
- Prior to the meeting being held the contact person will contact the Complainant to discuss and agree on who should attend the meeting. The people who will be required to attend the meeting will depend on the nature of the grievance. While the Complainant and or proponent are entitled to invite their legal representatives to attend the meeting/s, it should be made clear that to all the parties involved in the process that the grievance mechanism process is not a legal process. It is therefore recommended that the involvement of legal representatives be limited.

- The meeting will be chaired by the company representative appointed to address grievances. The proponent will provide a person to take minutes of and record the meeting/s. The costs associated with hiring venues will be covered by the proponent. The proponent will also cover travel costs incurred by the Complainant, specifically in the case of local, resource poor communities.
- Draft copies of the minutes will be made available to the Complainant and the proponent within 4 working days of the meeting being held. Unless otherwise agreed, comments on the Draft Minutes must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days of receipt of the draft minutes.
- In the event of the grievance being resolved to the satisfaction of all the parties concerned, the outcome will recorded and signed off by the relevant parties. The record should provide details of the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of a dispute between the Complainant and the proponent regarding the grievance, the option of appointing an independent mediator to assist with resolving the issue should be discussed. The record of the meeting/s will note that a dispute has arisen and that the grievance has not been resolved to the satisfaction of all the parties concerned;
- In the event that the parties agree to appoint a mediator, the proponent will be required to identify three (3) mediators and forward the names and CVs to the Complainant within 2 weeks of the dispute being declared. The Complainant, in consultation with the proponent, will identify the preferred mediator and agree on a date for the next meeting. The cost of the mediator will be borne by the proponent. The proponent will provide a person to take minutes of and record the meeting/s.
- In the event of the grievance, with the assistance of the mediator, being resolved to the satisfaction of all the parties concerned, the outcome will 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 will 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 will be made available to the Complainant and the proponent for comment before being finalised and signed by all parties. Unless otherwise agreed, comments on the draft report must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days.

The way forward will be informed by the recommendations of the mediator and the nature of the grievance. As indicated above, the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. In the event of the grievance not being resolved to the satisfaction of Complainant and or the proponent, either party may be of the opinion that legal action may be the most appropriate option.

APPENDIX F:

TRAFFIC MANAGEMENT PLAN

MAINSTREAM RENEWABLE POWER SOUTH AFRICA (PTY) LTD

PROPOSED CONSTRUCTION OF THREE WIND FACILITIES AND ONE SOLAR ENERGY FACILITY NEAR AGGENEYS IN THE NORTHERN CAPE, SOUTH AFRICA

(30985.00-REP-002 REV 1)

PRELIMINARY TRAFFIC MANAGEMENT STUDY

NOVEMBER 2014

PREPARED FOR:

PREPARED BY:

MAINSTREAM RENEWABLE POWER SOUTH AFRICA
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CENTURY CITY
7441

ISSUE & REVISION RECORD

QUALITY APPROVAL

	Capacity	Name	Signature	Date
By Author	Project Manager	Andrew Geel		13/11/2014
Approved by Design Centre Leader	Project Director	André Greyling		13/11/2014

This report has been prepared in accordance with BVi Consulting Engineers Quality Management System. BVi Consulting Engineers is ISO 9001: 2008 registered and certified by NQA Africa.

REVISION RECORD

Revision Number	Objective	Change	Date
0	Issue to Client for comments and work approval	None	14/11/2014
1	Issue to Client for approval	As proposed by Client	18/11/2014

CLIENT APPROVAL RECORD

	Capacity	Name	Signature	Date
Mainstream Renewable Power				

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1 INTRODUCTION

1.1 TERMS OF REFERENCE

Mainstream Renewable Power South Africa (Pty) Ltd has identified the need for Civil and Electrical Engineering inputs during the feasibility stages of a proposed renewable energy project. BVi Consulting Engineers (Pty) Ltd was appointed to prepare a *Preliminary Engineering Services Report* that will aim to address this need. Submission of a *Preliminary Traffic Management Report* forms part of the scope, and is the subject of this report.

1.2 APPOINTMENT

Mainstream appointed BVi Consulting Engineers to do a desktop study of the available routes, legislation on and regulations including potential access routes to the proposed wind and solar farm facility.

1.3 OBJECTIVES AND STRATEGIES

1.3.1 Strategy Followed

The proposed development was assessed to determine the specific *traffic* needs during the different phases of implementation, specifically construction and installation, operation and decommissioning.

A desktop study was performed using the information made available by Mainstream and relevant authorities, utilising engineering judgement and by studying the relevant guidelines that are available.

1.3.2 Purpose of the project

The purpose of the project is to investigate possible locations for the generation of wind and solar energy.

1.3.3 Purpose of the report

The purpose of the report is to conduct a preliminary traffic management plan for the wind and solar farm site and related transportation routes. The following two main transportation activities will be investigated:

- Transportation by means of abnormal vehicles for the delivery of the wind turbine components to the site.

- Transportation of materials, equipment and people to and from the site from the surrounding areas.

The preliminary traffic management study will aim to provide the following objectives:

- Identify envisaged activities related to traffic movement for the construction, operation and commissioning of the wind and solar energy facility.
- Provide a Main Route for the transportation of the wind turbine components from the entry point to the proposed site.
- Provide a preliminary transportation route for the transportation of materials, equipment and people to site.
- Estimate the daily traffic generated for the envisaged transportation activities.
- Outline traffic management issues for the proposed development.

1.4 AVAILABLE INFORMATION

The following sources of reference were studied:

- Technical Recommendations for Highways (TRH 11): *Draft Guidelines for Granting Exemption Permits for the Conveyance of Abnormal Loads and for Other Events on Public Roads.* March 2000.
- *Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads"* 1st Edition, July 2009
- *Preliminary Transport Risk Assessment Report,* as completed by ALE Heavylift (South Africa) for Mainstream Renewable Power South Africa (Pty) Ltd. November 2012.

2 DESCRIPTION OF THE PROJECT

Mainstream Renewable Power is proposing the development of three wind farms and a solar energy facility near Aggeneys in the Northern Cape Province.

The proposed facilities are located on portions of the following farms:

- Portions 1 and Remaining Extent of Farm 209 (Poortje); and
- Portion 1 and 2 of Farm 212 (Namies Suid)

The extent of the site identified for this development includes an area of approximately 17 500 hectares with a perimeter of 55km, and is subject to refinement based on detailed design investigations.

The proposed location falls within the Department of Water Affairs defined quaternary catchment D81G and the site is bounded by National Route 14 to the north and Regional Road 358 to the south. Access to the site will be off National Route 14 via a proposed new formal intersection, located at an existing at-grade intersection leading to an unsurfaced road.

2.1 SITE LOCATION

The extent of the investigation is based on the provisional distribution of wind turbines and solar panels as indicated on the 20140930-EM-Khai, 20140930-EM-Korana and 20140930-EM-Poortjies kmz files provided by Mainstream. This area is based on boundaries determined by Mainstream and based on project requirements.

The area of investigation is located approximately 30km south of Pofadder in the Northern Cape Province, as indicated on the attached Annexure 1: Locality Plan.

2.2 IDENTIFICATION OF ENVISAGED ACTIVITIES RELATED TO TRAFFIC MOVEMENT

The traffic generated by the wind energy facilities can be divided into three phases as outlined below:

2.2.1 Construction Phase

This phase includes the transport of people, materials and equipment to site. This phase also includes civil works for internal roads construction, excavations of footings and trenching for electrical cables. It is envisaged that this phase will generate the largest traffic.

2.2.2 Operation and Maintenance Phase

This phase involves the operation and maintenance of the wind and solar energy facility estimated over a period of 25 years. The replacement of the wind turbine components would require a crane

and abnormal vehicles that will require access to the site via the public road network. This phase is expected to generate less traffic than the construction and decommissioning phase.

2.2.3 Decommissioning Phase

At the end of the operational lifetime the decommissioning phase will again require access for large cranes and transport vehicles. These vehicles will be necessary to dismantle and remove the energy infrastructure and it would involve similar traffic flow arrangements as during the construction phase.

2.3 PORT OF ENTRY FOR THE WIND TURBINE AND SOLAR COMPONENTS

2.3.1 General

It is assumed that the wind turbine towers will be sourced locally and the rest of the turbine components will be imported from international suppliers. Due to the size and weight it is accepted that delivery and transport will be done by ship. Two suitable harbours were identified as possible points of entry for importing the wind turbine components, namely Cape Town and Saldanha Bay Harbour.

The Saldanha Bay Harbour is situated approximately 650km from the site and approximately 140km closer to the site than the Cape Town Harbour. Both these harbour prove feasible as entry points. It is proposed that Saldanha Harbour be used as the preferred point for importing the wind turbines, due to its proximity to site.

2.3.2 Contact Information for the Port of Saldanha

The following information may be used for future reference.

Port Manager: Sipho Nzuza
Tel: (27) 022 703 4420
E-mail: William.Roux@transnet.net
Website: http://www.transnetnationalportsauthority.net/

2.3.3 Brief Technical Description of Saldanha Bay Harbour

The harbour is situated within the natural Saldanha Bay and the bay is protected by a 3.1km long artificial breakwater. The port has developed into a modern harbour when it became necessary to facilitate the export of iron ore from the Northern Cape. The construction of the deep water jetty in Saldanha Bay made it possible to accommodate large ore carriers and other ships.

The port has a 990m long jetty containing two iron ore berths linked to the shore along a 3.1km long causeway. There is an 874m multipurpose quay for the handling of break-bulk cargo and a 365m tank berth at the end of the ore jetty with a permitted draught of 21.25m alongside. The

multipurpose quays (berths 201-203) are a total of 874m long with a draught permitted between 12m and 13.4m. The Port operates for 24 hours a day and there are no bunkering facilities along Saldanha Bay. Wind turbine moulds manufactured in China were previously imported and off-loaded at this Port with success. The moulds were used to manufacture 50 meter long rotor blades that were used in earlier wind farm developments.

2.4 MAIN ROUTE FOR THE TRANSPORTATION OF LARGE/ ABNORMAL LOADS

A preliminary investigation showed that it will be possible to transport the imported wind turbine and solar array components by road to Namies. The proposed route will include the following sections of road:

- R399 (Saldanha Town to Piketberg) - Approximately 98km.
- N7 (Piketberg to Vredendal) - Approximately 151 km.
- R363 (Vredendal to N7) - Approximately 100km.
- N7 to Springbok - Approximately 200km.
- N14 (Springbok to Namies Site) – Approximately 142km.

Figure 3-1 below shows the proposed main transport route from Saldanha Harbour to the Namies Suid/ Poortjies site.

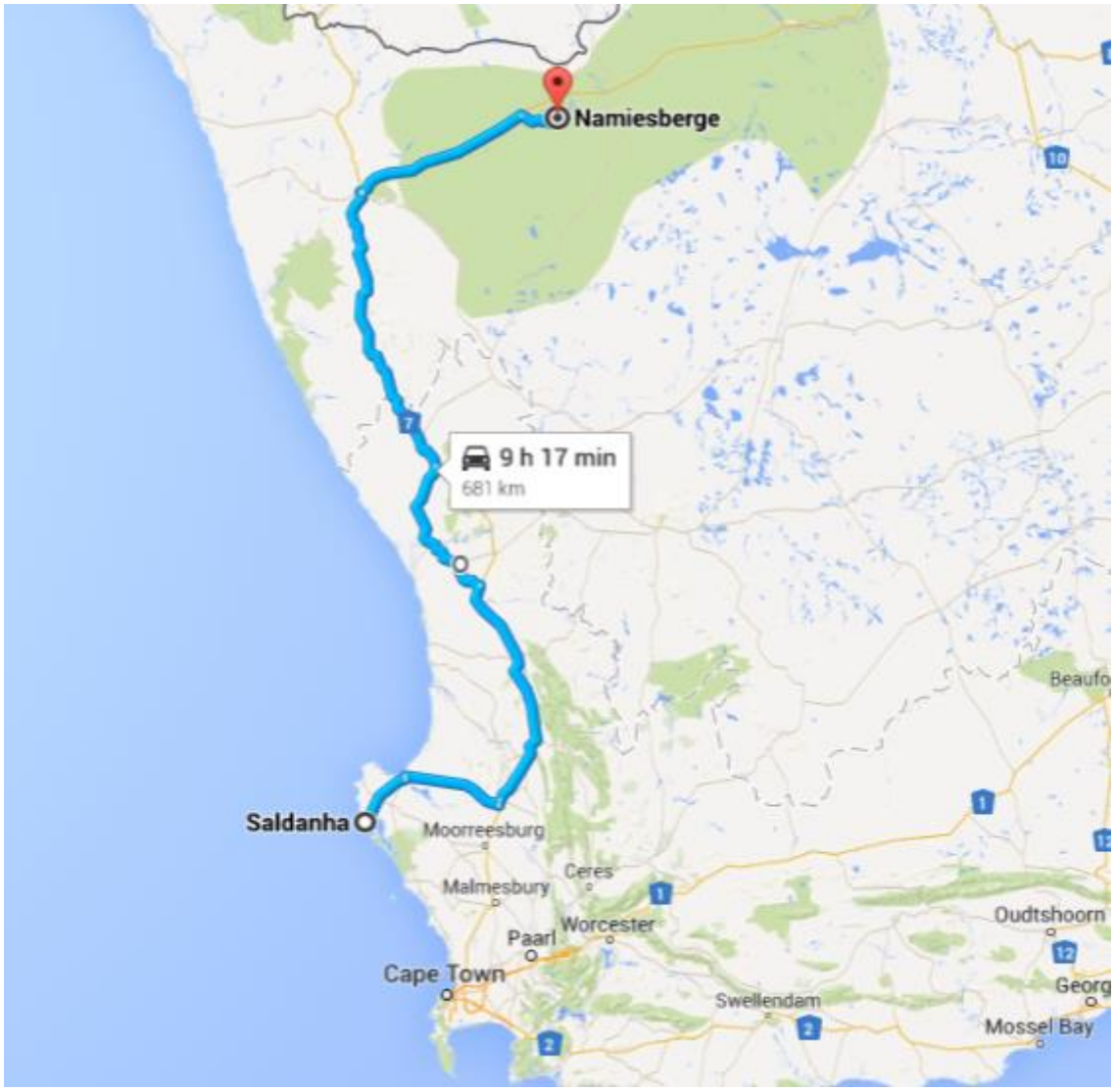


Figure 2-1: Main Transport Route from Saldanha Harbour to Namies Suid/ Poortjies site

2.4.1 Description of the Main Route

The route from Saldanha to Springbok outlined above consists of a single lane road with paved shoulders for the entire 591km. The road condition is generally good and will be able to withstand the increase in traffic loading caused by the transportation of the wind turbine and solar array components. Large sections of the N7 are currently being upgraded by SANRAL.

A detour off the N7 will be required at Vredenburg due to height limitation on a section of the N7 where the Sishen Saldanha railway line crosses via an overhead bridge. A preliminary Transport Risk Assessment Report was completed by ALE Heavylift (South Africa) for a similar project entitled "*Proposed Construction of a Wind and Solar Energy Facility on Kangnas Farm near Springbok in the Northern Cape South Africa - Preliminary Engineering Services Report.*" This report should be referred to for any Abnormal Transport requirements, and is included in *Annexure 2.*

2.4.2 Access to Namies Suid/ Poortjies Site

Access to the site is currently obtained via an unsurfaced road, utilising an at-grade intersection. The intersection is below the standard required for the transportation of equipment, materials and people. Mainstream will therefore require a new intersection off the N14 to deliver access to site. The preferred access point is approximately 111km from Springbok.

Approval for the proposed access will require an application and approval process through SANRAL that should be addressed timeously. *Figure 2-2* and *Figure 2-3* below shows the proposed position of the intersection for the access road to site. The intersection will have to be constructed per SANRAL geometric design standards and will be owned and operated by SANRAL. A typical layout of such an intersection is included in *Figure 2-4* below:

No sight distance or safety problems are envisaged at the existing intersection. It is therefore assumed after a preliminary investigation that SANRAL will not have reason to reject the request to upgrade the intersection to the required standard.

Further upgrades to the unsurfaced road that accesses the northern boundary of the site will be required in order to meet the standards required for the conveyance of abnormal loads. The upgrades will take the form of vertical and horizontal re-alignments in order to ensure that abnormal loads can be transported safely. Vertical re-alignment will be undertaken by means of additional fill where required. Horizontal re-alignment may be required to increase the radius of certain curves.

The access road to the site will also require periodic maintenance during the construction period, as the unsurfaced gravel roads are prone to forming corrugations under heavy traffic. For this reason, and due to the fact that the access route to site from the N14 was not designed for such traffic, it is recommended that permission be sought from the relevant road authority before construction commences. These recommendations will be pursued during the design phase of the project.

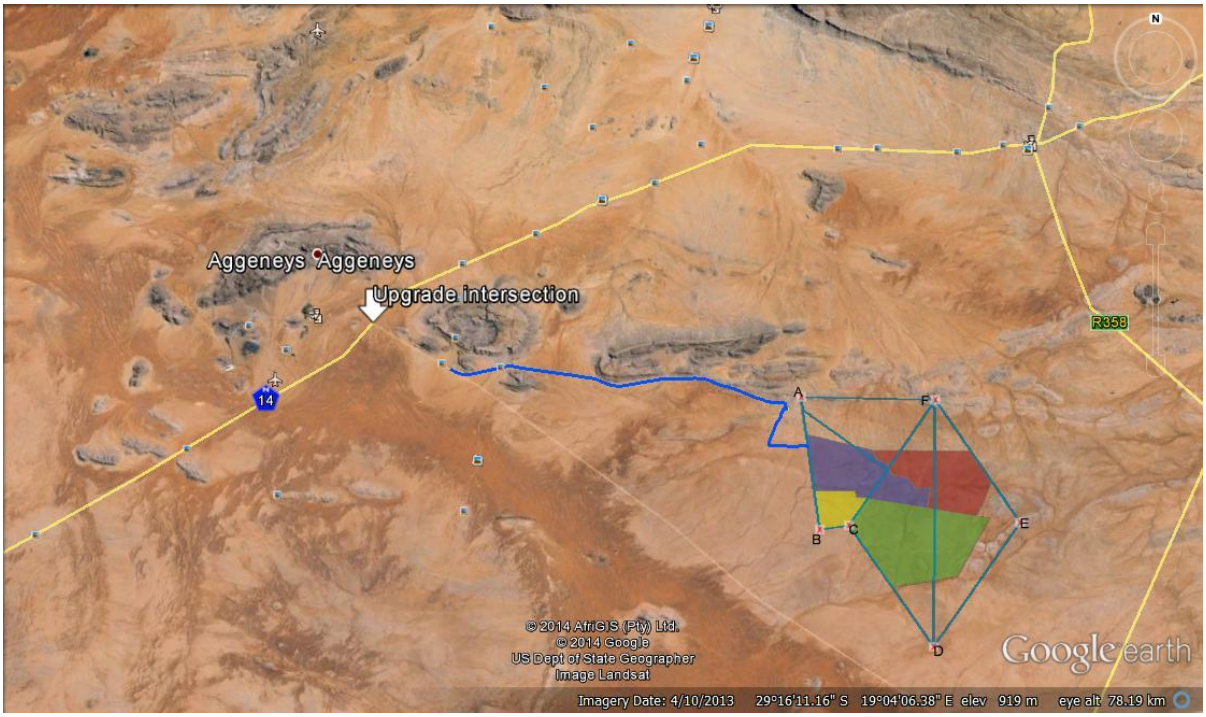


Figure 2-2- Proposed New Accesses to Namies Suid/ Poortjies – plan view

Figure 2-3: Proposed access point to Namies Suid/ Poortjies site adjacent to N14 – street view

The design and layout of the intersection at the access point to the site will be per SANRAL standards. The proposed typical access layout is shown in *Figure 2-4* below.

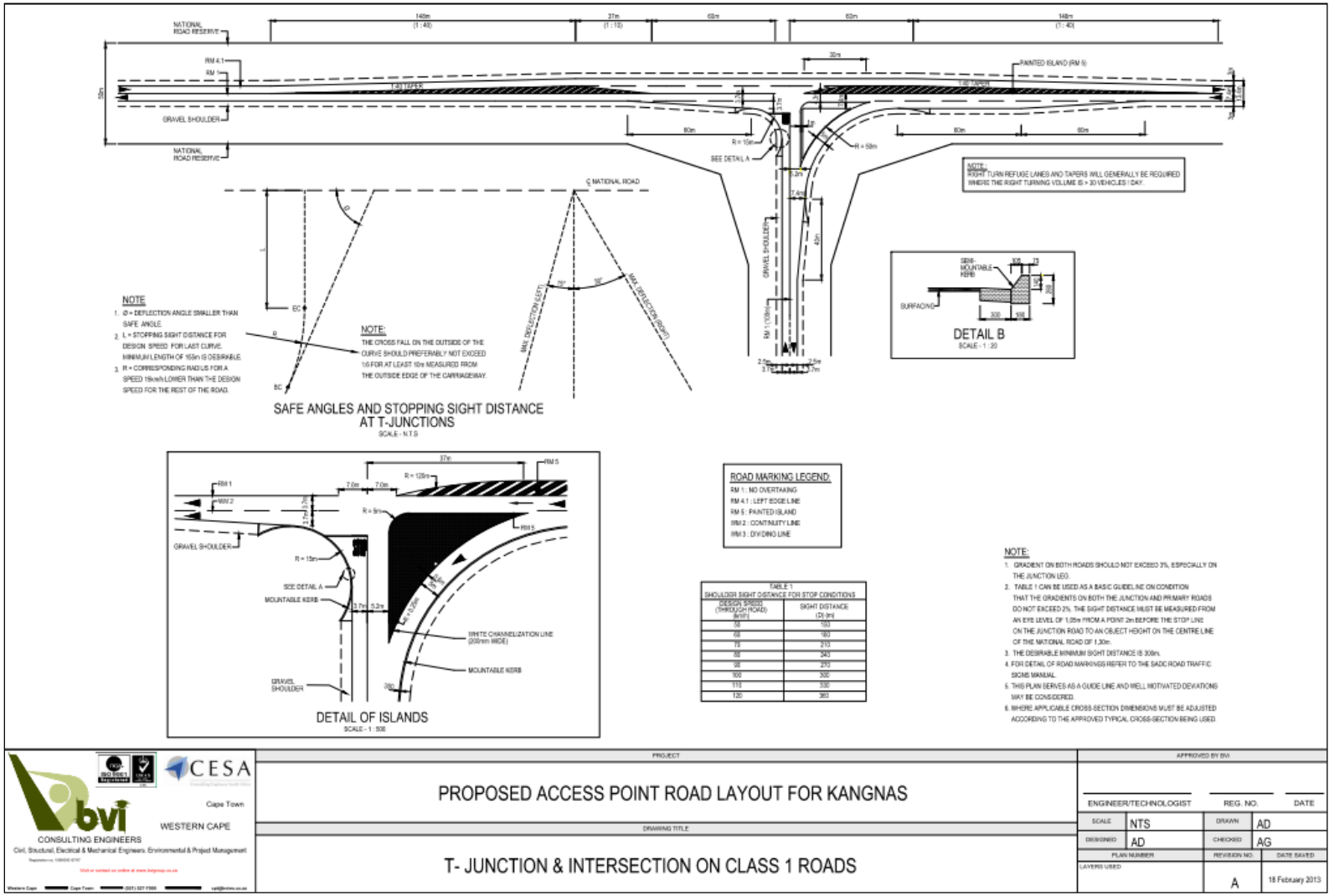


Figure 2-4: Proposed Access Road Layout for wind and solar facility

2.5 MAIN ROUTE FOR THE TRANSPORTATION OF MATERIALS, PLANT AND PEOPLE

Figure 2-5 below shows the location of the site in relation to the closest large town, Springbok, which is situated approximately 142km from site. It is envisaged that most materials, plant, services and people will be procured in and require transportations from Springbok. Additional resources will also be sourced from Pofadder, although it is assumed that due to the relative size of the towns, Springbok will be the primary source of materials, labour and resources.

Figure 2-5: Main route for the transportation of resources to Namies Suid/ Poortjies Site

2.6 EXISTING TRAFFIC

The proposed construction and development of this site will generate traffic that will need to be accommodated on the current road infrastructure

The increase in traffic caused by the transportation of the wind turbine components from Saldanha Bay to Springbok is assumed to be negligible as it will take place under the regulation and requirements of the Abnormal Permit authorities. During the permit process actions will be taken to ensure minimal disruptions to the existing road users. The largest increase in traffic will be along the N14 between Springbok and the site and it will have to accommodate the majority of the traffic generated by the two main transportation activities.

To understand the impact the historic traffic data for the N14 between Springbok and Pofadder was obtained. Pofadder is situated approximately 162km north east from Springbok and 30km north of the Namies Suid/ Poortjies site. The historic traffic data is shown in the table below:

Table 2.1- Historic Trip Generation between Springbok and Pofadder

Historic Traffic Trip Generation of N14 between Springbok and Pofadder for Year 2011		
Section	**Springbok and Pofadder**	
	No.	**%**
Average Daily Traffic (ADT)	608	
Average Daily Truck Traffic (ADTT)	44	7.2

Table 2.1 shows that the Average Daily Traffic (ADT) between Springbok and Pofadder is generally in the order of 600 vehicles of which the Average Daily Truck Traffic (ADTT) consist of 44 vehicles. Based on the Cross Section width of 12.0m, it can be assumed that this road was constructed as PGWC Class 1 Cross Section capable of carrying in excess of 2000 vehicles a day. The road is therefore not currently close to its original design capacity. This information will form the basis to assess the traffic impact resulting from the two main transportation activities.

2.7 TRAFFIC GENERATION DURING THE CONSTRUCTION PHASE

During the construction phase the following activities will generate additional traffic:

- The transportation and delivery of the wind turbine and solar components.
- The transport of water and materials.
- The transport of equipment and people.

The estimated trip generation rates are discussed in the section below.

2.7.1 Traffic Generation for the Delivery of the Wind Turbine Components

Table 2.2 below shows the estimated daily traffic that can occur during the delivery of the wind turbine components to site. The calculations are based on the delivery of six complete turbines per week.

Table 2.2- Traffic Generation Rates for the Delivery of Wind Turbine Components

GENERATED TRAFFIC FOR THE DELIVERY OF THE WIND TURBINE COMPONENTS				
Activity	**Assumptions**	**Trips/ Week***	**No. Used**	**Trips /Day**
Turbine Components	3xTower sections per turbine =1 Tower/truck (AV)	18	3	3
	1xNacelle (hub) per turbine = 1 Nacelle/truck (AV)	6	1	1
	3xBlades per turbine= 1 Blade per truck (AV)	18	3	3
Estimated Abnormal Truck per day				**7**

From *Table 2.2* it can be seen that 7 Abnormal Vehicles (AV) will be required for the delivery of one complete wind turbine.

Based on the assumption that six completed turbines will be delivered to site per week, the ADT will increase from 608 to 615 and the ADTT will increase from 44 to 51 vehicles. It can therefore be

assumed that the transportation of the wind turbines will increase the ADT and ADTT by 1.1% and 15% respectively. Due to the fact that abnormal permit regulations will apply and due to the low increase in traffic it is assumed that the effect on the existing traffic will be negligible.

2.7.2 Traffic Generation for the Delivery of the Solar Array Components

Table 2.3 below shows the estimated daily traffic that may be assumed to occur during the delivery components for the collar panel array. The calculations are based on the delivery of a total of 2400 panels per week.

Table 2.3- Traffic Generation Rates for the Delivery of Solar Panel Components

GENERATED TRAFFIC FOR THE DELIVERY OF THE SOLAR PANEL COMPONENTS				
Activity	**Assumptions**	**Trips/ Week***	**No. Used**	**Trips /Day**
Solar (PV) Components	40 solar (PV) panels per truck (1x2m panels)	60	5	12
	50 columns (2 per panel) per truck	20	5	4
Estimated Super-link Truck per day				**16**

Based on Table 2.3 it can be seen that 16 super-link trucks per day will be used to deliver the solar PV panels and associated fittings to site. The Average Daily Traffic (ADT) will therefore increase from 608 to 624 (2.6% increase) and the Average Daily Truck Traffic will increase from 44 to 60 trucks (36% increase). The increase due to solar PV panel transport on ADT and ADTT is therefore negligible in terms of the design traffic of 2000 vehicles per day.

2.7.3 Traffic Generation for the Transportation of Materials, Equipment and People

To make it possible to calculate the amount of traffic generated during this phase a certain number of assumptions were made as the project is still in the planning phases.

It is estimated that a total of 1200 jobs can be created during the construction of the wind and solar farm. Not all the jobs will be created at once since the project will be constructed in four phases and it is also assumed that all employees will reside in Springbok. Based on this it can be assumed that approximately 49 vehicle trips will be generated during the peak hours of 07:00 – 08:30 and 16:00 – 17:30. The details used to calculate the total labour during the construction of the project is shown in *Table 2.4* below.

Table 2.4- Estimated Labour Opportunities

CONSTRUCTION LABOUR REQUIREMENTS				
Construction Phase	**Technical Staff**	**Skilled Labour**	**Unskilled Labour**	**TOTALS**
Road Construction	3	15	25	43
Foundation Construction	9	45	100	154

Electrical System Construction	5	15	20	40
Substation Construction	5	10	15	35
Wind Turbine Assembly and Installation	10	25	30	65
Solar Array Assembly and Installation	8	30	25	63
TOTALS	**40**	**140**	**125**	**407**
Vehicle Trips/Day	35	10	4	49

Table 2.5 below combines this data as well as further assumptions to predict the expected daily traffic that will be generated by the transportation of materials, equipment and people. It must be noted that a worst case scenario was used as it was assumed that all the materials required for construction will be obtained from suppliers off-site. The estimated generated traffic can therefore be seen as a maximum and will likely be much less than anticipated.

Table 2.5- Traffic Generation Rates for During Construction

GENERATED TRAFFIC FOR THE TRANSPORTATION OF PEOPLE, MATERIALS AND EQUIPMENT			
Activity		**Assumptions**	**Trips/day**
People	Technical and Non-technical Staff	See *Table 2.4* above	49
Material	Crushed Rock	About 292 m^3 of crushed rock will be required for the construction of one foundation. The volume of concrete required per foundation was estimated to be 460 m^3 It is assumed that two turbine bases will be constructed per week and this will generate the following number of daily truck trips.	30
	Sand	About 206 m^3 of sand will be required for the construction of one foundation. It is assumed that two turbine based will be constructed per week and this will generate the following number of daily truck trips.	8
	Natural Gravel	It is assumed that 1.2km of natural gravel roads will be constructed every week in 150mm layers @ 0.2km/day using tipper trucks @ 10m^3/truck to import material. This action will generate the following amount of truck traffic per day.	30
	Water	Based on preliminary water use calculation elsewhere it is assumed that the following number of 32 000 litre water trucks will be required per day.	8
Electrical	Substations, cables, overhead cables and transmission poles	200 transmission poles (30 poles/week) using an interlink truck	1
		Trucks for carting electrical equipment using an interlink truck.	1
Total Light Motor Vehicles			**45**
Total Heavy Motor Vehicles			**82**
TOTAL DAILY TRAFFIC			**127**

From *Table 2.4* it can be seen that the total daily traffic generated by the transport of people, materials and equipment is estimated at approximately 127 vehicles per day per project.

In summary, the total daily traffic generated during the construction phase is as follows:

Total light motor vehicles:	**45**
Heavy motor vehicles:	
Wind:	7
Solar:	16
Construction:	86
Total Heavy Vehicles:	**109**
TOTAL:	**154**

The expected increase therefore between Springbok and the site is from 608 to 762 vehicles per day for an estimated period of 18 months per project. The traffic increase is approximately 25% but does not increase the expected ADTT to close to the 2000 vehicles a day design capacity. The management of the traffic at the proposed new access should however receive special attention during the implementation phase of the project.

2.7.4 Traffic Generation for the Operation and Maintenance Phase

It is assumed that a maximum of 20 permanent employees will be employed per phase to oversee the operation and maintenance of the wind farm. It is therefore assumed that a total of 80 persons will be employed once all the phases are operational. Assuming 2 workers per vehicle, the increase in traffic after construction is estimated at 40 vehicles per day for a period of 25 years. This is an insignificant impact on the current road traffic and will require no special attention.

2.7.5 Traffic Generation for the Decommissioning Phase

Depending on the maintenance period, access for large cranes and transport vehicles would be necessary to dismantle and remove the turbines. The traffic generated would be the same as discussed in the delivering of the wind turbine components in *Section 2.7.1* on *Page 10.* The operation of the proposed development is assumed to be 25 years after which it will be decommissioned.

2.8 TRAFFIC MANAGEMENT ISSUES

2.8.1 Objectives

The purpose of this section is to ensure the following three goals are achieved:

- To ensure that all traffic generated by the site will not impact the safety of the general public.
- To reduce potential conflicts that may result from commuters and the construction traffic.

- To identify any issues that may impact on the successful transportation of the required resources.
- To note important requirements for future consideration.

2.8.2 Risks

The risks involved with the proposed project include the following:

- Damage to existing infrastructure by construction vehicles
- Accidents caused by construction vehicles

In order to eliminate the potential of injury to persons and/or property a traffic plan is required to ensure that all activities are performed in a safe manner.

2.8.3 Legal Requirements

All vehicles used during the transportation of materials and construction activities for the proposed wind farm is required to be roadworthy per the National Road Traffic Act (NRTA).
For any vehicles that operate under an exemption permit (Abnormal Loads), a roadworthy certificate may not be required. However the exemption permit will require that the vehicle is fit for operation on public roadways.

The documents referenced for acquiring the exemption permit are the *"Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads"* 1st Edition, July 2009, and *"TRH 11: Dimensional and Mass Limitations and Other Requirements for Abnormal Load Vehicles"* 8th Edition, March 2010.

Both the NRTA and the National Road Traffic Regulations, 2000 (NRTR) prescribe limitations on vehicle dimensions, limitations on axle and vehicle masses that a vehicle using a public road must comply with.

2.8.4 Abnormal Loads

Each wind turbine will require at least 7 abnormal loads to transport the separate components.

2.9 PRELIMINARY TRANSPORTATION MANAGEMENT PLAN

2.9.1 Envisaged Transport Requirements

The majority of the traffic being generated by the proposed development will take place during the delivering of the wind turbine components and subsequently the construction of the access roads and wind turbines foundations. The requirements for transporting abnormal vehicles/loads are specified in TRH 11.

Once the wind farm is fully functional, the day-to-day operations will generate very little additional traffic. The majority of this traffic will be travelling along the N14 to and from Springbok.

2.9.2 Traffic Communication and Management

A full-time designated transport coordination manager should be appointed to oversee and manage the traffic safety officers. Additionally, the designated transport coordination manager should inform and keep up-to-date the interested and affected parties of all the activities taking place that may have a direct impact on them.

A traffic safety officer shall be nominated to make all the necessary arrangements to maintain the required traffic measures for the duration of the project as outlined in the "*Standard Specifications for Road and Bridge Works for State Road Authorities*,"1998 edition. The safety officer shall liaise daily with the transportation coordination manager to keep them updated with the state of all the traffic arrangements.

For each convoy of abnormal vehicles/loads a designated safety officer shall be appointed. During the delivery of the wind turbine components, the person in charge shall be in communication with the transport coordination manager.

The transport co-ordination manager should document the progress of the vehicles to mitigate any issues that may arise during the transportation phase.

If an escort vehicle is required by the exemption permit and if the abnormal vehicle needs to travel through an urban area, the local authority's Chief Traffic Officer shall be informed at least 2 hours before the arrival of the vehicles. All construction vehicles entering the site shall also be available via radio or telephone communication to the transport coordination manager.

2.9.3 Law Enforcement

All vehicles travelling to and from the site shall adhere to all laws imposed by the law enforcement agencies, and shall comply with any requests made by the law enforcement officials. During the transportation of abnormal loads/vehicles, the exemption permit may require that the vehicle(s) be escorted by a traffic officer. The traffic officer escort will be provided by the relevant road authority.

2.9.4 Adherence to Posted Speed Limits

All vehicles shall comply with the posted speed limits on public roads as well as a proposed 20km/h speed limit within the development. For additional speed limits that are imposed on the construction traffic using public roads, refer to the South African Road Traffic Signs Manual (SARTSM), Volume 2, June 1999 for the restrictions.

For the transportation of abnormal loads/vehicles, the speed restrictions placed on the vehicles must be in compliance with the *TRH 11: Dimensional and Mass Limitations and other Requirements for Abnormal Load Vehicles*.

The maximum allowable speed that an abnormal vehicle is permitted to travel on public roads is the more stringent of factors dependent on either the load on the tyres, the load on bridges or the dimensions of the vehicle.

The speed restrictions for a mobile crane (cranes mounted on truck type chassis and all terrain cranes) are limited to 60km/h. Centre mounted cranes are not allowed to operate on public roads.

2.9.5 Abnormal Vehicles and Transport Loads

All construction traffic shall comply with the legal load requirements as outlined in the National Road Traffic Act and National Road Traffic Regulations.

All abnormal vehicles and loads to be transported are required to have a valid permit before any trip is begun. When the vehicle exceeds the mass limitations the vehicle or combination of vehicles will need to be registered with the Abnormal Vehicle Registration (AVR) and provided an AVR Number.

An abnormal load permit is acquired by completing a permit application issued by the relevant permitting office. Additionally, supporting documentation such as route clearances, stability calculations, etc. must be supplied as part of the application.

2.9.6 Safety and Visibility of Vehicles

As per the exemption permit for abnormal vehicles/loads, an escort is required to accompany the abnormal vehicle to warn the normal travelling public and to promote safe flow of traffic if the normal flow of traffic is disrupted by the abnormal vehicle. The permit will state whether an own escort or traffic officer escort is required.

In order to transport abnormal loads safely, it is required that adequate warning devices be used. These consist of flags, boards, and lights. Refer to TRH 11 for the requirements of these warning devices.

2.9.7 Travelling During Sensitive Periods

2.9.7.1 *Construction Traffic*

Construction traffic entering the site along public roads should be limited to times when peak hour traffic can be avoided where possible. The peak traffic occurs during 7h00 to 8h30, and 16h00 to 17h30. Construction traffic will also not be permitted to travel at night or during embargo periods such as public holidays or long weekends by the permit issuing authority.

2.9.7.2 *Abnormal Vehicles*

For abnormal vehicles/loads, travel can be restricted to the following times of the day and/or year:

2.9.7.3 *Embargo Days*

An embargo may be placed on travelling of abnormal vehicles/loads during certain periods such as public holidays, school holidays or long weekends. Additionally a municipality along the route may place a restriction on travel times to avoid the peak travel times in the mornings and evenings.

2.9.7.4 *Weekend Travel*

Depending on the dual classification of the abnormal load and route, as defined by TRH 11, the requirement for loads to travel on Saturdays and up to 14:00 on Sundays are as follows:

- On Category A routes: Classes D1 and D2 loads
- On Category B routes: Class D1 loads

This is only applicable if the overall height of the load does not exceed 4.6m and no mass exemptions exist.

2.9.7.5 *Night Travel*

In general travelling at night (after sunset and before sunrise) is not allowed for abnormal loads. However night travel may be permitted at the discretion of the issuing authority under specific conditions which will be stated on the exemption permit.

2.9.8 Phasing of Deliveries

A safe holding area should be available for the storage of the turbine components at the port of arrival (i.e. Saldanha Port). The exemption permit will state the number of abnormal vehicles/loads that can be travelling at once. This is to avoid any congestion along the public roads.

2.9.9 Sign Posting

The South African Road Traffic Signs Manual (SARTSM), Volume 2, June 1999 is to be used for all traffic during the construction activities of the proposed project. Signage will be required along the N14 before the proposed access point of the construction area to warn the public of the activities.

During periods of high construction traffic entering and exiting the site, it is recommended that flagmen help direct the traffic. This will enable the safe movement of construction and public traffic at the entrance and reduce the number of potential conflicts.

2.9.10 Road Infrastructure Upgrading

The access route to the proposed site requires upgrading to a standard that can be utilised by construction traffic and abnormal loads. Geometric alterations to the road and intersections will be required in the form of increasing of curve radii, the widening of roads where required and

alterations to vertical alignment to accommodate design abnormal load trailer. Additional road layer-works may have to be imported if the existing gravel wearing course is found to be unsuitable for the design traffic.

2.9.11 Pavement Deterioration

Any damage caused by the construction vehicles to the existing road infrastructure shall be repaired, prior to the completion of the project. To determine and recover the damage caused by abnormal vehicles, a mass fee in R/km is calculated and then multiplied by the distance to be travelled to determine an amount payable. There are several methods used to calculate this in a way that converts the various arrangements of wheels and axles into a measure that allows a comparison of the arrangements. These are the Equivalent Standard Axle concept, the Equivalent Single Wheel Mass method, and a method based on the South African mechanistic-empirical pavement design methodology.

The exemption permit will require that this fee be calculated and paid before the permit is issued, therefore no further provisions need to be made.

2.9.12 Traffic Impact on the Environment

All vehicles utilised during the delivery of materials and construction activities on the site shall be deemed roadworthy.

This includes being in compliance with the environmental guidelines in reference to the allowable emissions that may be emitted from the vehicles. In the event that an oil or petrol leak occurs, the spillage should be cleaned up and disposed of per the environmental guidelines. Construction vehicles delivering raw materials to the site shall be covered to prevent any debris from falling on the road.

2.9.13 Conclusion and Recommendation

It is recommended that a detailed traffic management plan be completed once the project details are finalised and before construction can commence.

3 REFERENCES

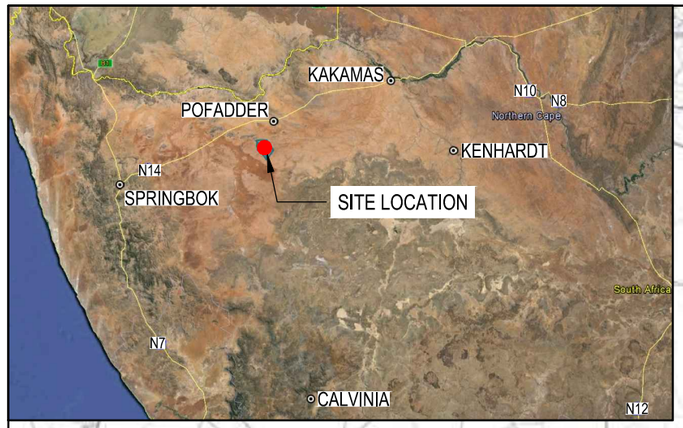
Technical Recommendations for Highways (TRH 11): *Draft Guidelines for Granting Exemption Permits for the Conveyance of Abnormal Loads and for Other Events on Public Roads.* March 2000.

Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads" 1st Edition, July 2009

Preliminary Transport Risk Assessment Report, as completed by ALE Heavylift (South Africa) for Mainstream Renewable Power South Africa (Pty) Ltd. November 2012.

ANNEXURE 1 – Locality Plan

13 November 2014 04:37:00 PM



NAMIES SUID 212

POORTJIE 209

LEGEND

- WATERCOURSES
- PROPOSED SOLAR AREA
- PROPOSED WIND TURBINE AREA

DATE	INITIAL	No./CODE	REVISION DESCRIPTION
13/11/2014	B.V.W	1/D	FOR REPORT

CLIENT: MAINSTREAM RENEWABLE POWER

ISO 9001 Registered | UKAS | CESA Consulting Engineers South Africa
bvi ENGINEERING PROCUREMENT MANAGEMENT
Western Cape — Cape Town — (021) 527-7000 — cpt@bviwc.co.za
Registration no. 1998/000157/07

PROJECT: POFADDER WIND AND SOLAR ENERGY FACILITY

DRAWING TITLE: LOCALITY PLAN

APPROVED BY BVi

ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	N.T.S	DRAWN	BVW
DESIGNED	AFG	CHECKED	AFG

PLAN NUMBER	REVISION NO.	DATE SAVED
C2438c-001-01	A	13 November 2014

N:\PROJECTS\PROJECT_DRAWINGS\C2400 - C2499\C2438\CIVIL\DRAWINGS DATA\C2438 LOCALITY PLAN FOR REPORT.DWG

C2438 LOCALITY PLAN FOR REPORT.DWG

ANNEXURE 2 – Preliminary Transport Risk Assessment Report

WORLDWIDE HEAVY TRANSPORTATION AND LIFTING

ALE

SMARTER, SAFER, STRONGER

Port of Ngqura N10 North Loop
Port of Saldanha N1 North East Loop
Port of Saldanha N7 North Loop

PRELIMINARY TRANSPORT RISK ASSESSMENT REPORT

Client:	Mainstream Renewable Power South Africa		
Contact Person:	Hein Reyneke	Email:	Hendrik.Reyneke@mainstreamrp.com
Prepared by:	Johann van Zyl	Email:	j.vanzyl@ale-heavylift.com
Date:	2012.11.08	Pages:	
Our ref:	RSU-12- 175-01	Revisions:	01

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CONTENTS

1. INTRODUCTION

1.1. SUMMARY

The aim of this preliminary transport risk assessment report is to fulfil the scope of work and to summarize the deliverables per route surveyed as defined in section 1.2. and 1.3. below.

The report is structured into the three main routes as defined in section 1.4. below. The secondary routes to the respective sites as defined in section 1.5. below are structured under the applicable main routes.

1.2. SCOPE OF WORK

1. A preliminary transport risk assessment report for the main routes and secondary routes to the respective sites.
2. Identify suitable port of entry
3. Identify best route to respective sites
4. Define any known risks and issues on the routes identified

1.3. DELIVERABLES PER ROUTE SURVEYED

1. Route introduction
2. Photographic record of recorded data
3. Route risk register
4. Route conclusion
5. Google Earth KMZ routes for main and secondary routes

1.4. MAIN ROUTES:

1. Route 1: Port of Ngqura N10 North Loop
2. Route 2: Port of Saldanha N1 North East Loop
3. Route 3: Port of Saldanha N7 North Loop

Refer to Appendix 'A': Google Earth KMZ Routes for Main and Secondary Routes

1.5. SITES:

1.	Springfontein	S30 21.158 E25 40.910
2.	Victoria West 1	S31 39.667 E23 28.150
3.	Victoria West 2	S31 36.765 E23 17.920
4.	Nooitgedacht	S32 49.912 E18 05.710
5.	Perdekraal	S33 04.380 E20 04.344
6.	Sutherland	S32 43.800 E20 44.143
7.	Beaufort West 1	S32 45.885 E22 30.689
8.	Beaufort West 2	S32 56.381 E22 32.668
9.	Kangnas	S29 30.461 E18 17.408
10.	Pofadder	S29 17.954 E19 12.437

Refer to Appendix 'B': Google Earth KMZ Waypoints for Sites

2. PORT OF ENTRY

2.1. BACKGROUND INFORMATION ON PORT OF NGQURA:

Acting Port Manager & Harbor Master: Captain Neil Chetty
Tel: +27 41 507 1900
Email: neil.chetty@transnet.net

Website: www.transnetnationalportsauthority.net

The Port of Ngqura // Coega which began commercial ship operations (Containers) in October 2009, lies some 20km North East of Port Elizabeth and is South Africa's 8th and latest commercial port development, situated at the mouth of the Coega River in Nelson Mandela Bay. Transnet National Port Authority of SA is responsible for developing the deep-water port; white Transnet Port Terminal (TPT) has been appointed to handle all terminal operations.

An Industrial Development Zone, knows as the Coega IDZ, has been developed over the 12,000-hectare site in the area including the river and port, with a 4,500 ha core development immediately identified. The IDZ will serve as a primary location for new industrial development for export driven industries.

The Port is of deep-water construction capable of serving post-Panamax dry and liquid bulkers and the new generation of cellular container ships.

The design vessels for the port are:

Dry Bulk Carriers
Dead Weight Tonnage: 80,000DWT
Length OA: 250m
Beam: 36.5m
Loaded Draught: 14.0m

Cellular Container Vessels
TEU: 4,500
Deadweight Tonnage: 70,000 DWT
Length OA: 300m
Beam: 40m
Loaded Draught: 14m

The horizontal geometry of the port is such that 150,000DWT bulkers and 6,500TEU cellular container ships can maneuver within the port, although initial dredging is being limited to accommodate the design vessels only.

Levels of storage within the port:

The port will allow temporary storage of WTG components in the port. The area available is + - 20.000m²
ALE also has access to additional storage area close to the finger jetty.

Port Handling:

The WTG components will arrive on a geared vessel, i.e. a vessel with its own cranes to offload.

The components will be received Free Alongside Ship (FAS) onto suitable transport combinations for transport to the laydown area.

The components will be offloaded // loaded onto transporters with either // or // and mobile cranes, forklifts, crane trucks, reach stackers.

The Additional WTG pieces can be stooled off (staged) in the Laydown Area.

2.2. BACKGROUND INFORMATION ON PORT OF SALDANHA:

NOTE: HeavyLift Vessels (HL V) // Project Vessels do not call this port, unless chartered.

Port of Saldanha
Private Bag X 1
7395 SALDANHA

Tel: + 27 22 701 4302 / 4
Fax: + 27 22 714 4236

Tel: + 27 22 703 4420 (Port Manager)
Email: eugene.kearns@transnet.net

Tel: + 27 22 703 4100 (Harbor Master)
Email: peter.stow@transnet.net

Tel: + 27 22 701 4344 / 5 (Marine Security Department)
Website: www.transnetnationalportsauthority.net

Saldanha MPT (Multi Purpose Terminal)
Tel: + 27 22 703 4934

The Port of Saldanha Bay, South Africa's largest natural anchorage and port with the deepest water is 60 nautical miles northwest of Cape Town.

Situated at Longitude 17º 58' E and Latitude 33º 02' S, Saldanha Bay is partly protected by a 3.1km long artificial breakwater.

The port has developed into a modern harbor only recently, when it became necessary to facilitate the export of iron ore from the Northern Cape. This required the construction of a railway more than 800km to the mines at Sishen in the Northern Cape and the construction of a deep-water jetty in Saldanha Bay to accommodate the Capsize ore carriers.

The total area occupied by the port (land and water areas) is 18,300 ha with an outer boundary of 91km.

Port Limitations:
The port of Saldanha Bay accepts vessels of up to 20.5m draught although the harbor master conditionally accepts vessels with a draught of 21.5m. The port entrance channel is dredged to a depth of -23m Chart Datum and -23.7m CD at the commencing of the entrance channel. The entrance channel has a minimum width of 400m. The turning basin seaward of the jetty has a diameter of 580m and a depth of -23.2m CD.

The draught at the multipurpose quays is 12m for berth 201 and 13.5m for berths 202 and 203. Pilotage is compulsory and tugs are required for ship working.

Marine Craft:
Saldanha Bay is served by a fleet of three tugs assisted by a fourth sent from Cape Town when required (vessels exceeding a draught of 19m require four tugs). The Saldanha based tugs are named Jutten, Marcus and Meeuw and are 1976-built Voith Schneider tractor tugs each with a bollard pull of 43 tons.

Pilotage service is compulsory and is provided by a diesel-powered pilot boat named Ivubu. The port has two launches named Sysie and Dikkop.

Port Volumes:
During the financial year 2008/09 ended 31 March 2009 the Port of Saldanha Bay handled a total of 452 ships with a total gross tonnage of 25,423,117-gt.

In 2008/09 cargo handled by the port totaled 50,282,909 tons, including oil. Of this total 49,632,380t was bulk cargo (33,958,761t exports; 13,966,243t imports; and 1,707,376t transshipped), and 650,529t break-bulk (603,115t exports and 47,414t imports). The port handled no containers during 2008.

Port Facilities:
Saldanha Bay is a common user port. The port has a 990m long jetty containing two iron ore berths linked to the shore along a 3.1km long causeway/breakwater. There is also an 874m long multipurpose quay for the handling of break-bulk cargo and a 365m tanker berth at the end of the ore jetty with a permitted draught of 21.25m alongside.

The iron ore jetty is 630m long with a permitted draught of 21.25m alongside. The multipurpose quays (berths 201-203) are a total of 874 long with a max draught permitted between 12m and 13.4m. Cargo handled at the multipurpose terminal includes various mineral exports, steel coils and pig iron. Imports include anthracite, coking coal and steel pellets.

Port control operates 24 hours a day. There are no bunkering facilities at Saldanha Bay. A full diving service is available for ship inspection and other services but ship repair is limited mainly to the fishing industry. Large ship repairs can however be carried out by services provided from Cape Town.

The port has a full chandling and stevedore service available. Saldanha Bay has yachting marina facilities and a NSRI base for sea rescue.

Port Handling:

The WTG components will arrive on a geared vessel, i.e. a vessel with its own cranes to offload.

The components will be received free Alongside Ship (FAS) onto suitable transport combinations for transport to the laydown area.

The components will be offloaded // loaded onto transporters with either // or // and mobile cranes, forklifts, crane trucks, reach stackers.

The HeavyLift pieces can be stooled off (staged) in the Laydown Area.

3. ROUTE 1: PORT OF NGQURA N10 NORTH LOOP

3.1. ROUTE INTRODUCTION:

Route 1 is the preferred route for most of the wind energy sites in the Eastern Cape during phase 1. The route is not an established abnormal route, but has the potential to be developed into an established abnormal route. The Olifantskop Pass which has to be negotiated poses a risk. Traffic control points would have to be introduced at the start and end of the 3.4km long pass which would take approximately 15min for a convoy of abnormal combinations to cross. The route also passes through the centre of many towns which is a risk to be taken into consideration.

The route starts in Port Elizabeth at the exit from Port of Ngqura and roughly follows the N2, N10 and R390 and ends at the R701 and R715 junction near Bethulie. The total distance of route 1 is 466km.

3.1.1. Map of Route 1: Port of Ngqura N10 North Loop (Gamin BaseCamp format):

Refer to Appendix 'C': Garmin BaseCamp Map of Routes

3.1.2. Route Description

	Start of Route 1	
	Port Elizabeth	
1.	Drive northwest on Neptune Road	4.3km
2.	Turn right onto R102	12.4km
3.	Turn left onto N2 towards Grahamstown	20.5km
	Cannonville, Colchester	
4.	Take exit 797 to the left onto N2 towards Grahamstown/R72/Port Alfred	1.6km
5.	Take exit 798 to the left onto R72 towards Port Alfred	286m
6.	Take ramp to the left towards N10/Cradock	26m
7.	Turn left onto R72	613m
8.	Turn right onto N10	194km
	Paterson, Olifantskop Pass, Cookhouse, Cradock	
9.	Turn left onto Voortrekker Street (N10)	454m
10.	Turn right onto J.A. Calata Street (N10)	1.7km
11.	Turn right onto Ziervogel Way	345m
12.	Turn left onto Hofmeyer Way (R390)	61.4km
	Hofmeyer	
13.	Turn right onto R401	327m
14.	Turn left onto R390	34.3km
15.	Turn right onto R56	10.2km
	Steynsburg	
16.	Turn left onto R56	1.2km
17.	Turn left onto R390	65.5km
	Venterstad	
18.	Turn right onto R58	37.8km
19.	Turn left onto R390	15.4km
20.	Turn left onto R701	4.1km
	Bethulie	
	Arrive at end of Route 1	

3.2. PHOTOGRAPHIC RECORD OF ROUTE

Overhead bridge on the N2 at Cannonville, just past the Sondags River

Olifantskop Pass

Olifantskop Pass

Turn left onto Voortrekker Street (N10)

Turn left onto Hofmeyer Way (R390)

Steynsburg, Turn right onto R56

Steynsburg, Turn left onto R56

Steynsburg, Turn left onto R390

3.3. ROUTE RISKS REGISTER:

The following risks have been identified.

No.	Risk	Category	Restriction	Solution / Mitigation
1	Overhead bridge on the N2 at Cannonville, just past the Sondags River	Obstruction	Clearance = 5.8m Typical trailer height = 1.05m Max laden height: 1.05 + 4.3 = 5.35m OK	Constructing a bypass *or* Use of specialized nacelle and tower adaptors which would reduce the laden height of the abnormal combinations
2	Olifantskop Pass	High risk	Road width; Blind corners; Traffic	Traffic accommodation plan to be compiled
	Due to the volume of abnormal combinations that will transport WTG components through the pass, the chance of an accident taking place is classified as high risk. A traffic accommodation plan has to be compiled to thoroughly assess the risk.			
3	Tracking	Medium	Road width; Turning radius; Street furniture	Tracking drawings to be constructed
	It can be expected that some of the turns on route 1 would require works and/or removal of street furniture in order to accommodate the abnormal combinations transporting tower and blade sections. Tracking drawings will have to be constructed to thoroughly assess the risk.			
4	Disruption to local municipalities and public when passing through towns	Medium	Rate of delivery to wind energy sites	local municipalities and public to be approached to participate in finding a common solution
	Due to the volume of abnormal combinations that will transport WTG components through the towns, it can be expected that the local municipalities and public will object to the disruption. It is suggested that the local municipalities and public be approached to participate in finding a common solution.			
5	Overpass bridges	Low	Gross combination mass; Ground bearing pressure	Route clearance by consulting bridge engineers to be compiled
	All the overpass bridges on route 1 have either been constructed according to the 1931 MOT (Military of Transport) system, or the 1981 NC30 system which was implemented from 1984 onwards. The chance that any of the overpass bridges on route 1 will not be able to carry the gross combination mass or ground bearing pressure of the abnormal combinations is classified as low risk.			

3.4. ROUTE CONCLUSION

Route 1 is the best route from port of Ngqura to reach the Springfontein, Noupoort and Victoria West wind energy sites. Being the preferred route for most of the wind energy sites in the Eastern Cape during phase 1, the route will be developed to become an established abnormal route.

3.5. SECONDARY ROUTE: SPRINGFONTEIN

3.5.1. Route Description

Start of Secondary Route: Springfontein
Bethulie

1. Drive north on R715
2. Cross N1 and continue to drive north on S1475
3. Turn left onto S139

Arrive at Springfontein wind energy site

3.5.2. Route Conclusion

The R715 and S1475 does not pose any risk. The 9.2km gravel section on the S139 would require regular maintenance and might restrict delivery of WTG components to site during heavy rains.

3.1. SECONDARY ROUTE: VICTORIA WEST

3.1.1. Route Description

Start of Secondary Route: Victoria West
Bethulie

1.	Drive southwest on R715	47.4km
2.	Turn right towards N1 ramp	402m
3.	Turn left onto N1	119km
	Colesberg, Hanover	
4.	Turn right onto N10 ramp	380m
5.	Turn right onto N10	300m
6.	Turn left onto road	300m
7.	Turn left onto road	700m
8.	Turn right onto N1	116km

Richmond
Arrive at Victoria West wind energy site

3.1.2. Route Conclusion

An overhead bridge on the N1 in Hanover with a clearance of 5.15m obstructs the route. An existing bypass could be developed to accommodate the WTG components with a height in excess of 4m (assuming a safe clearance of 0.1m), i.e. the tower-middle section and tower-lower section.

Picture 1: Hanover bypass

4. ROUTE 2: PORT OF SALDANHA N1 NORTH EAST LOOP

4.1. ROUTE INTRODUCTION:

Route 2 is an established superload route from the OP599 ("Die Verbindings Pad"), Port of Saldanha to the N1, Worcester. High voltage overhead cables originating from a substation next to the R45 that may have to be permanently raised depending on the required clearance above the laden WTG components. The route also passes through the centre of Worcester and De Doorns to bypass overhead bridges on the N1. Two passes, the Nuwekloof Pass and the Hex Pass, has to be negotiated. Traffic control points might have to be introduced at the start and end of these two passes.

The route starts at the exit from the Port of Saldanha and roughly follows the OP599 ("Die Verbindings Pad"), R27, R45, N7, R311, R46, R44, R303, R43 and N1 and ends at the N1 and N9 junction near Colesburg from where the route 1 sites could also be accessed. The total distance of route 2 is 932km.

4.1.1. Map of Route 2: Port of Saldanha N1 North East Loop (Gamin BaseCamp format):

Refer to Appendix 'C': Garmin BaseCamp Map of Routes

4.1.2. Route Description

	Start of Route 2	
	Saldanha	
1.	Drive east on the OP599 (‘Die Verbindings Pad’)	2.66km
2.	Turn right onto gravel ramp	300m
3.	Turn right onto the MR559 (Camp Road)	3.5km
4.	Turn left onto the OP538	3.6km
5.	Turn right onto the OP599 (‘Die Verbindings Pad’)	4.2km
6.	Turn left onto the R27	4.8km
7.	Turn right onto R45	82.4km
	Langebaanweg, Hopefield	
8.	Turn left onto N7	27.5km
	Mooreesburg	
9.	Turn right onto R311	32.2km
	Ongegund, Riebeek Wes, Riebeek Kasteel	
10.	Turn left onto R46	9.9km
11.	Turn left onto R44	38km
	Gouda	
12.	Turn right onto Voortrekker Street (R46)	7km
	Wolseley	
13.	Turn right onto R303	7km
14.	Turn left onto R43	24.5km
15.	Turn left onto N1	5.4km
	Worcester	
16.	Turn right onto Hoog Street	2km
17.	Turn left onto Robertson Road (R60)	8.8km
18.	Turn left onto road	5km
19.	Turn left onto road	4.4km
20.	Turn left onto N1 towards De Doorns	21.1km
	De Doorns	
21.	Turn left onto Voortrekker Road	4.8km
22.	Turn left onto N1 towards Beaufort West	315km
	Touwsrivier, Laingsburg, Beaufort West	
23.	Enter roundabout traffic circle	131m
24.	Take the third left onto Donkin Street (N1)	312km
	Richmond, Hanover, Colesberg	
	Arrive at end of Route 2	

4.2. PHOTOGRAPHIC RECORD OF ROUTE

Overview gravel ramp onto MR559 (Camp Road)

NOTES:

km Reading: 0.0km

Turn left from the OP599 ('Die Verbindings Pad') road onto gravel ramp

NOTES:

km Reading: 0.3km

Turn right from the gravel bypass onto the MR559 (Camp Road)

NOTES:

km Reading: 3.8km

Turn left from the MR559 (Camp Road) onto the OP538

	NOTES: km Reading: 7.2km
Turn right from the OP538 Vredenburg Road onto the OP599 (“Die Verbindings Pad”) Town	
	NOTES: km Reading: 8km
Turn left from the OP599 (‘Die Verbindings Pad’) onto the R27	

	NOTES: km Reading:14.8km
Turn right from the R27 onto the R45	
	NOTES: Headroom = 6.4m km Reading: 23.9km
Substation on left hand side of the R45	

NOTES:

km Reading: 109km

Turn left from the R45 onto the N7

NOTES:

km Reading: 167.8km

Turn left from the R311 onto the R46

NOTES:

km Reading: 177.6km

Turn left from the R46 onto the R45

NOTES:

km Reading: 206.9km

Turn right from the R46 onto the R46

NOTES:

km Reading: 207.2km

Turn right from the R45 onto the R303

NOTES:

km Reading: 225km

Turn right from the R303 onto the R43

NOTES:

km Reading: 231.9km

Turn left from the R43 onto the R46

NOTES:

km Reading: 248.1km

Turn left from the R46 onto the N1

NOTES:

Headroom = 5.81m.

km Reading:252.2km

Use off ramp 108 on the N1 to avoid the overhead bridge over the N1, Worcester

NOTES:

Headroom = 5.3m

Use bypass route

km Reading: 252.2km

Overhead bridge no. 5009 over the N1, Worcester

NOTES:

Headroom = 5.4m

Use bypass route

km Reading: 275km

Overhead bridge over the N1, De Doorns

NOTES:

Headroom = 6.1m.

Use bypass route

km Reading: 276.2km

Overhead pedestrian bridge over the N1, De Doorns

NOTES:

7.4% Inclines

Tracking drawings to be constructed

km Reading: 285.7km

Hex River Pass

Road conditions on top of the Hex River Pass

Bridge 4918 over the Leeu River on the N1 (Typical)

N1, Beaufort West

Enter roundabout and take the 3rd exit in the direction of Johannesburg on the N1.

4.3. ROUTE RISKS REGISTER:

The following risks have been identified.

No.	Risk	Category	Restriction	Solution / Mitigation
1	Nuwekloof Pass	High risk	Road width; Blind corners; Traffic	Tracking drawings to be constructed . Traffic accommodation plan to be compiled
	Due to the volume of abnormal combinations that will transport WTG components through the pass, the chance of an accident taking place is classified as high risk. A traffic accommodation plan has to be compiled to thoroughly assess the risk.			
2	Bypass route through the centre of Worcester	High	Congestion; Road width; Turning radius; Street furniture	Tracking drawings to be constructed and local municipalities and public to be approached to participate in finding a common solution
	Navigating through the city centre will is classified as high risk. Tracking drawings will have to be constructed to thoroughly assess the risk. Due to the volume of abnormal combinations that will transport WTG components through the towns, it can be expected that the local municipalities and public will object to the disruption. It is suggested that the local municipalities and public be approached to participate in finding a common solution.			
3	Tracking around traffic circle in Beaufort West	Medium	Road width; Turning radius; Street furniture	Tracking drawings to be constructed
	Tracking drawings will have to be constructed to thoroughly assess the risk.			
4	Disruption to local municipalities and public when passing through towns	Medium	Rate of delivery to wind energy sites	local municipalities and public to be approached to participate in finding a common solution
	Due to the volume of abnormal combinations that will transport WTG components through the towns, it can be expected that the local municipalities and public will object to the disruption. It is suggested that the local municipalities and public be approached to participate in finding a common solution.			
5	High voltage overhead cables	Medium	Headroom	Further investigation with responsible regional department of Eskom to ascertain the required clearance above laden height of WTG components

6	Overpass bridges	Low	Gross combination mass; Ground bearing pressure	Route clearance by consulting bridge engineers to be compiled
	All the overpass bridges on route 2 have either been constructed according to the 1931 MOT (Military of Transport) system, or the 1981 NC30 system which was implemented from 1984 onwards. The chance that any of the overpass bridges on route 1 will not be able to carry the gross combination mass or ground bearing pressure of the abnormal combinations is classified as low risk.			

4.4. ROUTE CONCLUSION

Route 2 is the best route from port of Saldanha to reach the Nooitgedacht, Perdekraal, Sutherland and Beaufort West wind energy sites. Route 2 is an established superload route from the OP599 ("Die Verbindings Pad"), Port of Saldanha to the N1, Worcester. The N1 onwards frequently carries smaller abnormal loads. However, the route has never accommodated loads equal to the blade lengths and for this reason tracking is highlighted as one of the high risks. As opposed to the N2, N10 and R390 on route 1, most of route 2 is on the N1 which is straight, open and flat for the most part. Well suited for abnormal combinations with only focussed areas that hold risks.

4.5. SECONDARY ROUTE: NOOITGEDACHT

4.5.1. Route Description

Start of Secondary Route: Nooitgedacht
Vredenburg

1.	Drive north on the R27	6.9km
2.	Turn left onto road	5.7km
3.	Turn right onto R399	2.6km

Arrive at Nooitgedacht wind energy site

4.5.2. Route Conclusion

The secondary road to Nooitgedacht diverts from route 2 at the intersection with the R27 and the R45. Nooitgedacht wind energy site is only a stone throw away and holds low risk.

4.6. SECONDARY ROUTE: PERDEKRAAL

4.6.1. Route Description

Start of Secondary Route: Perdekraal
De Doorns

1.	Drive northwest on the R46	31.7km
2.	Turn right onto R355	5.9km
3.	Turn right onto road	7.2km
4.	Turn right onto road	29.2km

Arrive at Perdekraal wind energy site

4.6.2. Route Conclusion

The R46 does not pose any risk. The 36.4km gravel section on the would require regular maintenance and might restrict delivery of WTG components to site during heavy rains.

4.7. SECONDARY ROUTE: SUTHERLAND

4.7.1. Route Description

Start of Secondary Route: Sutherland
Matjiesfontein

5. Drive north on R354 — 33.6km
6. Turn right onto Komsberg/Kareedoringkraal road — 34.6km

Arrive at Sutherland wind energy site

4.7.2. Route Conclusion

The R354 is a narrow winding road with many blind turns. It might not be commercially viable to deploy traffic control points on all the various sections of the road. Escort vehicles could be specifically trained for this section of road in order to anticipate problem areas and safely escort the combinations through. The 36.6km Komsberg/Kareedoringkraal gravel section would require regular maintenance and might restrict delivery of WTG components to site during heavy rains. It is said to often flood during heavy rains and is classified as high risk for the transportation of WTG components.

4.8. SECONDARY ROUTE: BEAUFORT WEST

4.8.1. Route Description

Start of Secondary Route: Beaufort West
Beaufort West

1. Drive south on the N12 — 64.3km

Arrive at Beaufort West wind energy site

4.8.2. Route Conclusion

The 64.3km tarred section on the N12 holds only low risk.

5. ROUTE 3: PORT OF SALDANHA N7 NORTH LOOP

5.1. ROUTE INTRODUCTION:

Route 3 is an established abnormal route. However, the route has never accommodated abnormal combinations with the length of the tower and blade sections or the volume of components. The bypass route from Klawer via Vredendal and Lutzville to Nuwerus has some sharp turns and gravel sections that have to be investigated further to establish the impact that high volumes of abnormal combinations will have.

The route splinters off from route 2 and starts at the junction between the N7 and the R311 just before passing through Moorreesburg. It follows the N7 and N14 with a bypass route from Klawer to Nuwerus on the R362 and R363. The total distance of route 3 is 586m.

5.1.1. Map of Route 3: Port of Saldanha N7 North Loop (Gamin BaseCamp format):

Refer to Appendix 'C': Garmin BaseCamp Map of Routes

5.1.2. Route Description

	Start of Route 3	
	Moorreesburg	
1.	Drive north on the N7	183km
	De Hoek, Piketberg, Nieuwoud, Clanwilliam, Klawer	
2.	Turn left onto Church Street (R363)	821m
3.	Turn right onto Niewoudt Street (R362)	17.2km
4.	Turn right onto R27	21m
5.	Turn right onto R27	3.4km
	Vredendal	
6.	Turn right onto R362	16.6km
7.	Bear right onto R363	6.6km
	Lutzville	
8.	Turn left onto Stasie Road (R362)	535m
9.	Bear left onto R363	27.8km
	Koekenaap	
10.	Turn right onto R363	27.5km
	Nuwerus	
11.	Turn left onto N7	192km
	Bitterfontein, Garies, Karkams, Kamieskroon, Springbok	
12.	Take exit 549 to the left onto R355 towards N14/Pofadder	565m
13.	Turn right onto R355 towards N14/Pofadder	324m
14.	Turn left onto R355	383m
15.	Turn right onto N14	110km
	Carolusberg, Aggeneys	
	Arrive at end of Route 3	

5.2. PHOTOGRAPHIC RECORD OF ROUTE

Headroom = 5.3m

Use bypass route from Klawer to Nuwerus via Vredendal, Lutzville and Koekenaap

Overhead Railway Bridge on N7, Vanrhynsdorp

Klawer, turn left onto R363 to bypass route

Klawer, turn right onto R362

Tracking drawings to be constructed

Vredendal, turn right onto R362

5.3. ROUTE RISKS REGISTER:

The following risks have been identified.

No.	Risk	Category	Restriction	Solution / Mitigation
1	Bypass route from Klawer to Nuwerus via Vredendal, Lutzville and Koekenaap	High	Congestion; Road width; Turning radius; Street furniture	Tracking drawings to be constructed and local municipalities and public to be approached to participate in finding a common solution
	Navigating through the bypass route is classified as high risk. Tracking drawings will have to be constructed to thoroughly assess the risk. Due to the volume of abnormal combinations on the sections of gravel road and within town centres during the transport WTG components, it can be expected that road conditions will deteriorate and the local municipalities and public will object to the disruption. It is suggested that the condition of the gravel sections be investigated further and that local municipalities and public be approached to participate in finding a common solution.			
2	Piekenierskloof Pass	High	Road width; Blind corners; Traffic	Traffic accommodation plan to be compiled
	Due to the volume of abnormal combinations that will transport WTG components through the pass, the chance of an accident taking place is classified as high risk. A traffic accommodation plan has to be compiled to thoroughly assess the risk.			
3	Tracking	Medium	Road width; Turning radius; Street furniture	Tracking drawings to be constructed
	It can be expected that some of the turns on route 3, especially on the bypass route, would require works and/or removal of street furniture in order to accommodate the abnormal combinations transporting tower and blade sections. Tracking drawings will have to be constructed to thoroughly assess the risk.			
4	Disruption to local municipalities and public when passing through towns	Low	Rate of delivery to wind energy sites	local municipalities and public to be approached to participate in finding a common solution
	Most towns located on route 3, with the exception of the bypass route, are not on the N7/N14 but located off the main roadways. For this reason disruption to local municipalities and public is classified as low risk.			
5	Overpass bridges	Low	Gross combination mass; Ground bearing pressure	Route clearance by consulting bridge engineers to be compiled
	All the overpass bridges on route 2 have either been constructed according to the 1931 MOT (Military of Transport) system, or the 1981 NC30 system which was implemented from 1984 onwards. The chance that any of the overpass bridges on route 1 will not be able to carry the gross combination mass or ground bearing pressure of the abnormal combinations is classified as low risk.			

5.4. ROUTE CONCLUSION

Route 3 is the best route from port of Saldanha to reach the Kangnas and Pofadder wind energy sites.

5.5. SECONDARY ROUTE: KANGNAS

Kangnas is located on route 3, approximately 45km past Springbok on the N14.

5.6. SECONDARY ROUTE: POFADDER

5.6.1. Route Description

	Start of Secondary Route: Pofadder	
1.	Drive southeast on road	8km
2.	Turn left on road	24.3m
	Arrive at Pofadder wind energy site	

5.6.2. Route Conclusion

The 32.3km gravel section climbs gradually towards the Pofadder wind energy site. It would require regular maintenance and might restrict delivery of WTG components to site during heavy rains.

6. PROJECT DRAWINGS AND REFERENCE DOCUMENTS

56 SETS 106/2500kW WTG 80m TOWER					
DESCRIPTION OF GOODS	**LENGTH**	**WIDTH**	**HEIGHT**	**kgs/unit**	**CBM/unit**
Blade	52,000	3,400	2,850	10,127	503.880
Hub	4,400	4,930	3,700	26,300	80.260
Spinner (stackable of 3 tiers)	1,860	1,860	930	706	3.217
Nacelle	8,450	4,310	3,870	32,320	140.943
Nacelle-Cap (stackable of 3 tiers)	2,960	2,650	2,760	877	21.649
Generator	4,940	4,940	2,410	58,209	58.813
Tower-upper section	27,490	3,276	3,767	37,977	339.246
Tower-middle section	27,860	3,767	4,300	53,537	451.279
Tower-lower section	22,320	4,300	4,300	69,639	412.697
Foundation ring	4,300	4,300	1,800	10,878	33.282
Containers	12,090	2,350	2,690	12,000	76.427

7. APPENDICES

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- 7.1.1. ROUTE 1: PORT OF NGQURA N10 NORTH LOOP
- 7.1.2. ROUTE 2: PORT OF SALDANHA N1 NORTH EAST LOOP
- 7.1.3. ROUTE 3: PORT OF SALDANHA N7 NORTH LOOP

7.2. APPENDIX 'B' – GOOGLE EARTH KMZ WAYPOINTS FOR SITES

7.2.1.	SPRINGFONTEIN	S30 21.158 E25 40.910
7.2.2.	NOUPOORT	S31 12.293 E25 03.030
7.2.3.	VICTORIA WEST 1	S31 39.667 E23 28.150
7.2.4.	VICTORIA WEST 2	S31 36.765 E23 17.920
7.2.5.	NOOITGEDACHT	S32 49.912 E18 05.710
7.2.6.	PERDEKRAAL	S33 04.380 E20 04.344
7.2.7.	SUTHERLAND	S32 43.800 E20 44.143
7.2.8.	BEAUFORT WEST 1	S32 45.885 E22 30.689
7.2.9.	BEAUFORT WEST 2	S32 56.381 E22 32.668
7.2.10.	LOERIESFONTEIN	S30 28.369 E19 33.351
7.2.11.	KANGNAS	S29 30.461 E18 17.408
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APPENDIX G:

STORMWATER MANAGEMENT PLAN

MAISTREAM RENEWABLE POWER SOUTH AFRICA (PTY) LTD

PROPOSED CONSTRUCTION OF THREE WIND FACILITIES AND ONE SOLAR ENERGY FACILITY NEAR AGGENEYS IN THE NORTHERN CAPE, SOUTH AFRICA

(30985.00-REP-003 REV 1)

PRELIMINARY STORM-WATER MANAGEMENT REPORT

NOVEMBER 2014

PREPARED FOR:

PREPARED BY:

MAINSTREAM RENEWABLE POWER SOUTH AFRICA
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ISSUE & REVISION RECORD

QUALITY APPROVAL

	Capacity	Name	Signature	Date
By Author	Project Manager	Andrew Geel		13/11/2014
Approved by Design Centre Leader	Project Director	André Greyling		13/11/2014

This report has been prepared in accordance with BVi Consulting Engineers Quality Management System. BVi Consulting Engineers is ISO 9001: 2008 registered and certified by NQA Africa.

REVISION RECORD

Revision Number	Objective	Change	Date
0	Issue to Client for comments and work approval	None	14/11/2014
1	Issue to Client for approval	As proposed by Client	18/11/2014

CLIENT APPROVAL RECORD

	Capacity	Name	Signature	Date
Mainstream Renewable Power				

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LIST OF FIGURES

1 INTRODUCTION

1.1 TERMS OF REFERENCE

Mainstream Renewable Power South Africa (Pty) Ltd has identified the need for Civil and Electrical Engineering inputs during the feasibility stages of a proposed renewable energy project. BVi Consulting Engineers (Pty) Ltd was appointed to prepare a *Preliminary Engineering Services Report* that will aim to address this need. Submission of a *Preliminary Storm-water Management Report* forms part of the scope, and is the subject of this report.

1.2 APPOINTMENT

Mainstream appointed BVi Consulting Engineers to do a desktop study of the potential for environmental damage due to increased runoff as a result of construction of the proposed renewable energy project, including review of relevant legislation and regulations pertaining to storm-water management.

1.3 OBJECTIVES AND STRATEGIES

1.3.1 Strategy Followed

The proposed development was assessed to determine the specific *storm-water* needs during the different phases of implementation, specifically construction and installation, operation and decommissioning.

A desktop study was performed using the information made available by Mainstream and relevant authorities, utilising engineering judgement and by studying the relevant guidelines that are available.

1.3.2 Purpose of the project

The purpose of the project is to investigate possible locations for the generation of wind and solar energy.

1.3.3 Purpose of the report

The purpose of the report is to conduct a preliminary storm-water management investigation for the wind and solar farm site and related local transportation routes.

The following objectives will be outlined in this preliminary study:

- Storm-water considerations
- Storm-water drainage features
- Storm-water management plan

1.4 AVAILABLE INFORMATION

The following sources of reference were studied:

- The 1:50 000 scale topographical maps 2919AC Namies and 2919AD Samoep, both published in 2003.

2 DESCRIPTION OF THE PROJECT

Mainstream Renewable Power is proposing the development of three wind farms and a solar energy facility near Aggeneys in the Northern Cape Province.

The proposed facilities are located on portions of the following farms:

- Portions 1 and Remaining Extent of Farm 209 (Poortje); and
- Portion 1 and 2 of Farm 212 (Namies Suid)

The extent of the site identified for this development includes an area of approximately 17 500 hectares with a perimeter of 55km, and is subject to refinement based on detailed design investigations.

The proposed location falls within the Department of Water Affairs defined quaternary catchment D81G and the site is bounded by National Route 14 to the north and Regional Road 358 to the south. Access to the site will be off National Route 14 via a proposed new formal intersection, located at an existing at-grade intersection leading to an unsurfaced road.

2.1 SITE LOCATION

The extent of the investigation is based on the provisional distribution of wind turbines and solar panels as indicated on the 20140930-EM-Khai, 20140930-EM-Korana and 20140930-EM-Poortjies kmz files provided by Mainstream. This area is based on boundaries determined by Mainstream and based on project requirements.

The area of investigation is located approximately 30km south of Pofadder in the Northern Cape Province, as indicated on the attached Annexure 1: Locality Plan.

2.2 STORM-WATER CONSIDERATIONS

2.2.1 Construction of the Internal Roads

The construction of the internal roads will involve earthworks where undisturbed soils would be exposed which may lead to erosion. These exposed areas tend to form channels and will collect rain water. It is therefore important that all storm-water runoff be directed to the lower side of the gravel roads. At this point it should then be collected in side drains and disposed of in designated places by means of suitable outlet structures and berms. All roads should therefore be carefully designed and constructed to make the handling of storm-water possible.

2.2.2 Existing Drainage Features

A topographical map and *Google Earth* was used to identify existing drainage features on Namies Suid and Poortjies. A list of the existing drainage features is shown below:

- Non-perennial rivers
- Jeep tracks and Secondary roads

As a rule all rivers and drainage channels should be kept untouched so that the existing hydrology is not disturbed. No rivers will be diverted due to the construction of the internal roads. The natural drainage channels that collect water from the existing jeep tracks and secondary roads will be upgraded and should be used as drainage channels as far as possible. It is proposed that the drainage channels for the new internal roads should follow natural drainage lines. These drainage channels should then ultimately link up with the existing drainage routes on site.

2.2.3 Construction of the Wind Turbine Foundations

The wind turbine foundations will be constructed on dense pedocretes or on in-situ bedrock (refer *Preliminary Geotechnical Report*), and therefore deep excavations will be required. *Figure 2-1* below shows a typical layout of the construction envisaged for the turbine foundations on the renewable energy site.

Figure 2-1: Typical Layout for the Construction of the Wind Turbine Foundations

The deep excavations necessitate that cut-off drains be constructed on the high side of the excavations. The cut-off drains prevent surface water run-off from entering the excavation. The fresh excavations have a high risk of erosion and all water channels need to be kept away from the construction of the foundations. Emergency pumps should be in place to remove any water at the bottom of the foundations in case of need.

2.2.4 Construction of the Solar Panel Foundations

Solar panel arrays are required to be installed on level ground, which will necessitate mass earthworks to be undertaken before installation of the foundations. Ground conditions may determine that the solar panel foundations be founded on the very dense pedocretes, located beneath the overlying soils, or on the existing bedrock, as per the *Preliminary Geotechnical Report.* The mass earthworks will however facilitate storm-water drainage, specifically overland flow, which will be catered for in the design. An unlined side-drain will be utilised to collect run-off from the solar panel array site for discharge in a natural watercourse. The design and location of the drainage system for the solar portion of the facility will form part of the Detailed Design Report, before construction commences.

2.2.5 Construction Camp

The laydown area, operation and maintenance building, site compound and concrete batch plant will be founded on levelled, compacted and sloped natural gravel. Cut-off drains must be constructed around the construction camp which must then be channelled to existing drainage channels.

2.3 STORM-WATER DRAINAGE STRUCTURES

2.3.1 Drainage Channels

Drainage channels should be constructed adjacent to the internal roads under construction. The drainage channels should follow the natural flow of the ground with a constant depth to ditch invert. The objective is to allow storm-water from the roads to be discharged into natural drainage structures and then discharge it into the veld at suitable drainage locations.

Figure 2-2 below shows the drainage trench envisaged during the construction of the internal roads.

Figure 2-2: Typical Construction of a Drainage Channel adjacent to the Internal Roads

Figure 2-2 shows the drainage channel adjacent to the internal road under construction. The depth and type of trench can be established at the design stage. The drainage channel can be left in place as permanent installations on completion of the works or in filled and reinstated to the existing areas natural vegetation.

2.3.2 Intermediate Cross-Drains

If required, intermediate cross-drains should be built under the internal roads to make water crossings possible. A long gradient profile of a road has the risk of surface water accumulating at the lowest point.

The risk for large volumes of flow on the internal roads can lead to scouring of the road surface, causing erosion to form. *Figure 2-3* below shows the envisaged intermediate cross drain to be constructed under the internal roads.

Figure 2-3: Cross drains under the Internal Roads

2.4 STORMWATER MANAGEMENT PLAN

Based on the storm-water considerations for the renewable energy site located on Namies Suid and Poortjies, the following points should be considered for the development of a detailed storm-water management plan.

- Natural drainage paths should be maintained and utilised as far as possible.
- In-situ soils are highly permeable with relatively low run-offs generated.
- Natural flora should be disturbed as little as possible.
- No large amounts of water should be allowed to dam on site.
- A maintenance plan should be developed for any installed storm-water systems.
- Pollution prevention and environmental protection legislation should be adhered to.

3 PRELIMINARY 1:100 FLOOD LINE OPINIONS AND RISK ASSESSMENTS

3.1 INTRODUCTION

Due to the location of the proposed development it can be expected that a 1:100 year flood for the wind energy facility will not be a limiting factor. For accurate flood line calculations a detailed topographical survey of the area is required prior to construction commencing. To determine where existing watercourses are crossed by either new or existing roads a 1:50 000 topographical map of the site was used to overlay the positions of the turbines, roads, substations and associated infrastructure. Recommendations have been made such that no infrastructure will be located in

possible flood areas, low points or close to watercourses. If it is not possible to relocate infrastructure then the design thereof must be amended to

3.2 IDENTIFICATION OF EXISTING RIVERS WITHIN NAMIES SUID AND POORTJIES

Various watercourse have been identified using 1:50 000 topographical maps of the proposed site as shown in *Figure 2-2 below*. The proposed road network which will be utilised during construction and operations and maintenance will cross various watercourses as identified on the 1:50 000 topographical map of the area.

The chosen access route to the site is indicated in *Figure 2.1* below. The access route traverses approximately 7 minor watercourses, which do not pose a major risk to the project. As there is only one existing road within the site, a new network of internal roads will have to be constructed. These roads will be required to be designed in such a manner that watercourse crossings are minimised as far as possible. Storm-water management of the new road network will take cognisance of the topography, soil conditions and proposed road network and infrastructure layout. It is not recommended that watercourses be diverted and therefore infrastructure should not be located in close proximity to the major watercourses, as indicated in *Figure 3-1* below.

The internal road network will be designed as part of the *Preliminary Engineering Services Report* taking the above considerations into account.

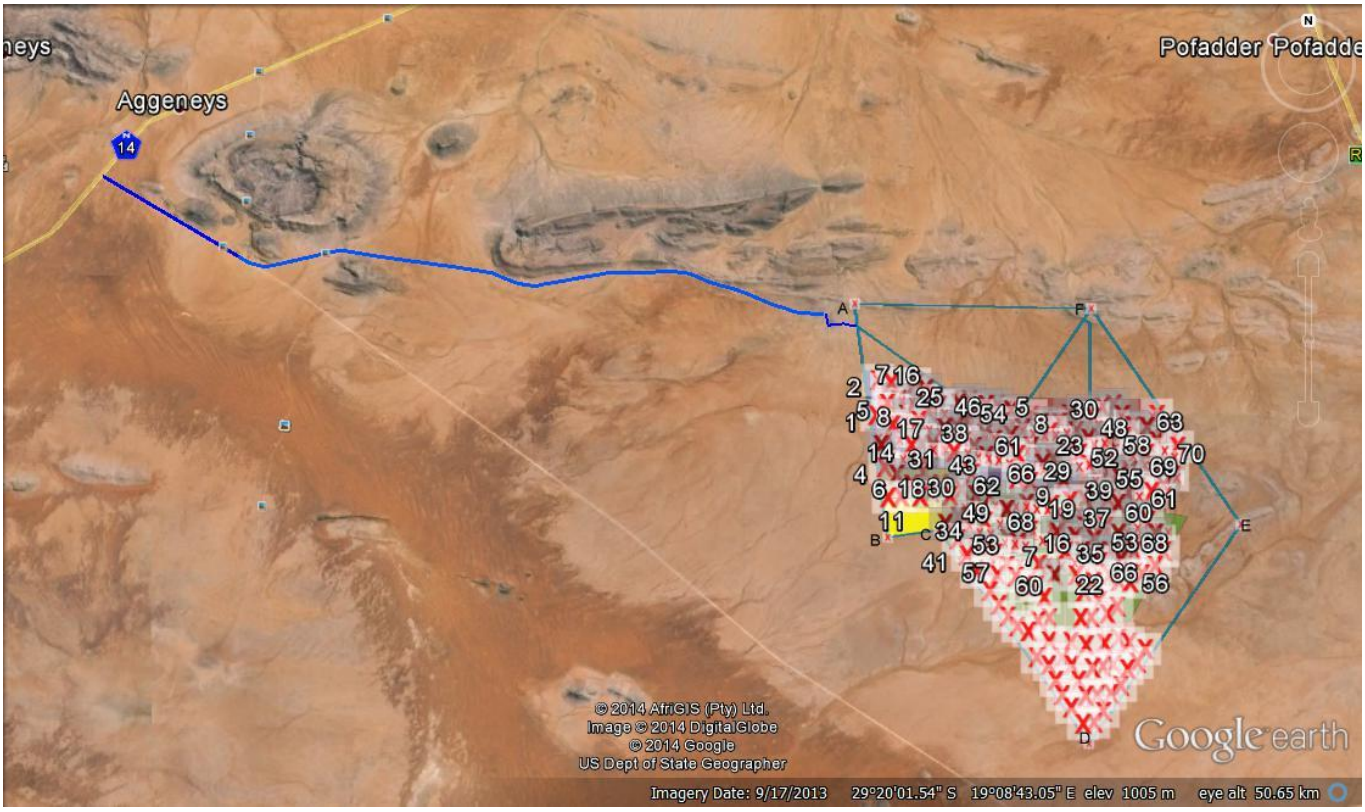


Figure 3-1: Wind and solar site access road

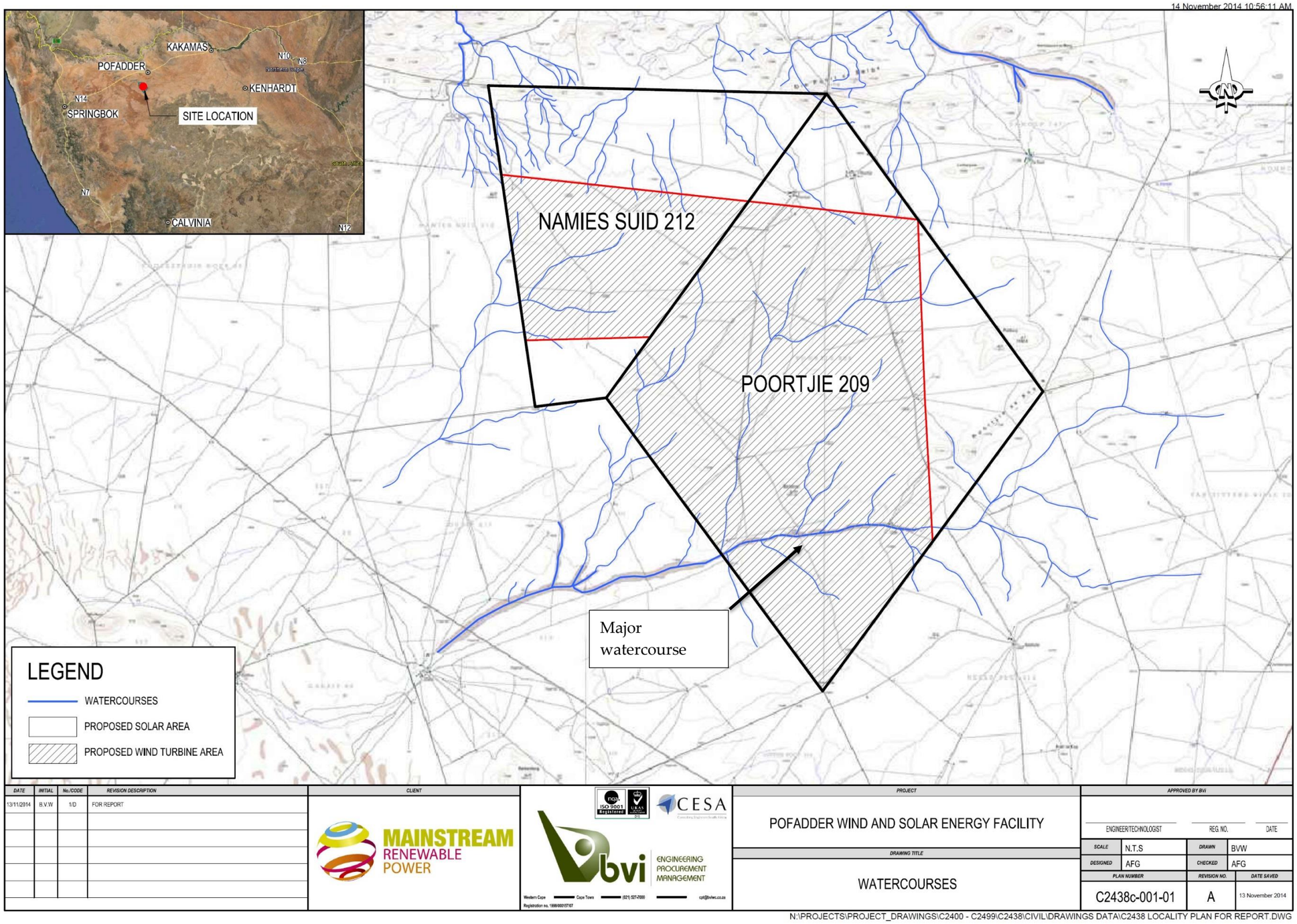


Figure 3-2: Namies Suid/ Poortjies watercourses

3.2.1 Conclusion and Recommendation

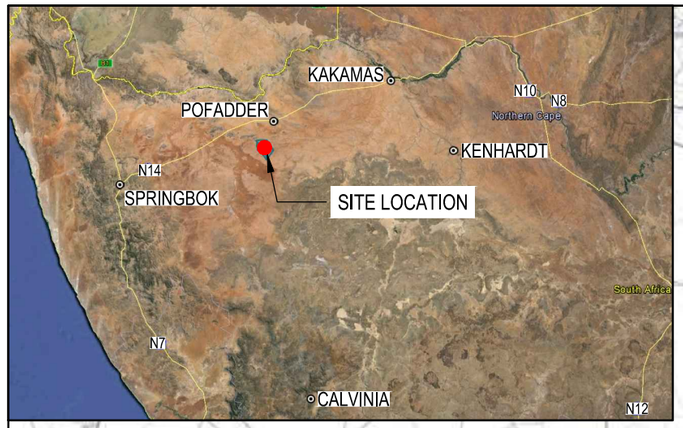
It is recommended that a detailed storm-water management plan be completed once the project details are finalised and before construction commences. Development and design of an internal road network will take place as part of the *Preliminary Engineering Services Report*, taking into account the recommendation that the path of natural watercourses not be adjusted. Infrastructure constructed as part of the renewable energy project should be designed to accommodate the natural watercourses.

4 REFERENCES

The 1:50 000 scale topographical maps 2919AC Namies and 2919AD Samoep, both published in 2003.

ANNEXURE 1 – Locality Plan

13 November 2014 04:37:00 PM



NAMIES SUID 212

POORTJIE 209

LEGEND

- WATERCOURSES
- PROPOSED SOLAR AREA
- PROPOSED WIND TURBINE AREA

DATE	INITIAL	No./CODE	REVISION DESCRIPTION
13/11/2014	B.V.W	1/D	FOR REPORT

CLIENT: MAINSTREAM RENEWABLE POWER

ISO 9001 Registered | UKAS | CESA Consulting Engineers South Africa
bvi ENGINEERING PROCUREMENT MANAGEMENT
Western Cape — Cape Town — (021) 527-7000 — cpt@bviwc.co.za
Registration no. 1998/000157/07

PROJECT: POFADDER WIND AND SOLAR ENERGY FACILITY

DRAWING TITLE: LOCALITY PLAN

APPROVED BY BVi

ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	N.T.S	DRAWN	BVW
DESIGNED	AFG	CHECKED	AFG

PLAN NUMBER	REVISION NO.	DATE SAVED
C2438c-001-01	A	13 November 2014

N:\PROJECTS\PROJECT_DRAWINGS\C2400 - C2499\C2438\CIVIL\DRAWINGS DATA\C2438 LOCALITY PLAN FOR REPORT.DWG

C2438 LOCALITY PLAN FOR REPORT.DWG

APPENDIX H:

OPERATIONAL BIRD MONITORING PROGRAMME

APPENDIX H

Avifaunal pre-construction monitoring at the proposed Mainstream Pofadder Wind Energy Facilities:

Overview of methodology

1. Introduction

The pre-construction monitoring protocol was designed in accordance with the *"Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa"* (Jenkins *et al.* 2011) which was published by the Endangered Wildlife Trust (EWT) and BirdLife South Africa (BLSA) in March 2011, and subsequently revised in August 2011 and July 2012.

2. Objectives

The objectives of the avifaunal pre-construction monitoring programme were as follows:

- To establish which species regularly occur at the development site;
- To gather baseline data on the diversity of avifauna and specifically abundance of priority species within the development area to measure potential **displacement** due to the construction and operation of the wind farm. This is primarily done through transect surveys (see 4.1 below).
- To record flight behaviour of priority species to assess the risk of potential mortality due to **collision** with the turbines. This is primarily done through vantage point counts (see 4.2 below).

3. Assumptions and limitations

The basic assumption is that the sources of information used are reliable enough to allow for meaningful interpretation. However, it must be noted that there are certain limitations:

- It is inevitable that observations at vantage points are biased towards those species that are more visible (i.e. larger species), and flights that are closer to the observer. It must therefore be accepted that both the accuracy and frequency of observations decrease with distance from the observer. It should also be noted that the survey method i.e. an observer using binoculars is inherently not very accurate when it comes to judging flight height, therefore flight height should be seen as an approximation only.
- The best practice guidelines state that "monitoring data should be collected over at least a 12 month period (at both WEF and control sites), and include sample counts representative of the full spectrum of prevailing environmental conditions likely to occur on each site in a year". Whereas the sampling periods in this study aim to be broadly representative of seasonal environmental conditions which prevailed during the monitoring period, it must be borne in mind that environmental conditions may vary significantly on an annual basis, especially in an arid environment like Bushmanland. Furthermore, it is not

always realistically possible to schedule monitoring to coincide with the full spectrum of environmental conditions, due to practical constraints.
- In circumstances where there is uncertainty and the precautionary principle may be relevant, evidence, expert opinion, best practice guidance and professional judgment were applied.
- For purposes of monitoring, priority species were defined as species included on the list of priority species of the Avian Wind Farm Sensitivity Map of South Africa compiled by Birdlife South Africa (Retief *et al.* 2012).

4. Methods

Data were gathered in four sampling seasons at the turbine site and a control site. The seasonal windows are defined as follows:

- Spring: Mid-August to Mid – November.
- Summer: Mid - November to Mid - March.
- Autumn: Mid - March to Mid-May
- Winter: Mid-May to Mid-August

Monitoring was implemented during the following periods:

- Winter: 2 – 8 July 2013
- Spring: 29 October – 4 November 2013
- Summer: 26 February - 4 March 2014
- Autumn: 20 – 28 April 2014

4.1 Transects and vantage points

The monitoring protocol for the site is designed according to the latest version (2012) of *Jenkins A R; Van Rooyen C S; Smallie J J; Anderson M D & Smit H A. 2011. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Endangered Wildlife Trust and Birdlife South Africa.*

The monitoring was conducted at the proposed turbine site and a control site by three field monitors.

Monitoring is conducted in the following manner:
- One drive transect in representative habitat was identified totalling 20.4km on the turbine site and one drive transect in the control site with a total length of 8.05km.
- Two observers travelling slowly (± 10km/h) in a vehicle records all priority species on both sides of the transect. The observers stop at regular intervals (every 500 m) to scan the environment with binoculars. Transects are counted three times per seasonal sampling session.
- In addition, three walk transects of 1km each in representative habitat were identified at the turbine site, and two at the control site. All birds are recorded during walk transects, not only priority species.
- The following variables are recorded:

    - Species;
    - Number of birds;
    - Date;
    - Start time and end time;
    - Distance from transect (0-50 m, 50-100 m, >100 m);
    - Wind direction;
    - Wind strength (calm; moderate; strong);
    - Weather (sunny; cloudy; partly cloudy; rain; mist);
    - Temperature (cold; mild; warm; hot);
    - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground); and
    - Co-ordinates (priority species only).

- Six vantage points (VPs) were selected from which the majority of the proposed turbine area can be observed (the "VP area"), to record the flight altitude and patterns of priority species. The following variables were recorded for each flight:
    - Species;
    - Number of birds;
    - Date;
    - Start time and end time;
    - Wind direction;
    - Wind strength (estimated Beaufort scale 1-7);
    - Weather (sunny; cloudy; partly cloudy; rain; mist);
    - Temperature (cold; mild; warm; hot);
    - Flight altitude (high i.e. >180 m; medium i.e. 40-180 m; low i.e. <40 m)
    - Flight mode (soar; flap; glide ; kite; hover); and
    - Flight time (in 15 second-intervals).

The aim with drive transects is primarily to record large priority species (i.e. raptors and large terrestrial species), while walk transects are primarily aimed at recording small passerines. The objective of the transect monitoring is to gather baseline data on the use of the site by birds in order to measure potential displacement by the wind farm activities. The objective of vantage point counts is to measure the potential collision risk with the turbines. Priority species were identified using the January 2012 BLSA list of priority species for wind farms.

Figures 1 the location of the VPs, transects, focal points and the proposed turbine lay-out.

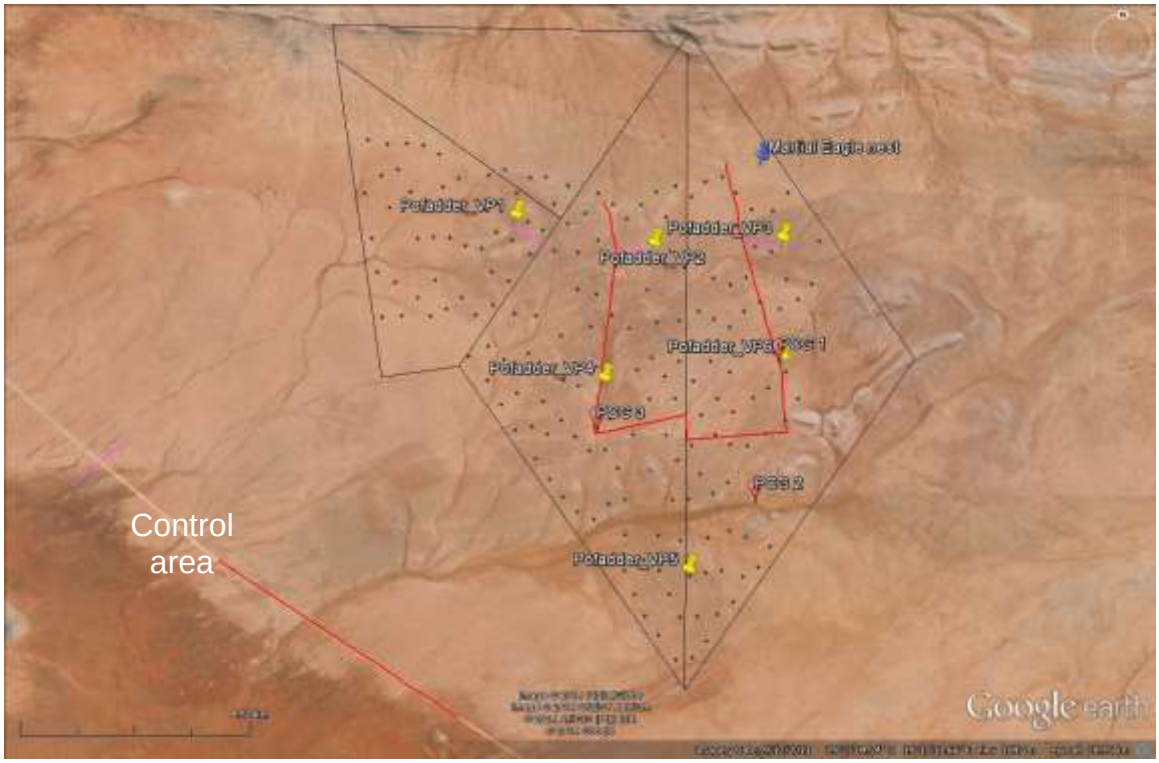


Figure 1: Turbine site indicating the turbine site drive transects (red line), turbine vantage points (VPs) (yellow placemarks), walk transects (purple lines), turbine positions (dots) and focal points (Martial Eagle and Southern Pale Chanting Goshawk nests).

4.2 Focal point counts

A Martial Eagle nest and three Southern Pale Chanting Goshawk nests were recorded during the monitoring (see Figure 1). All nests were monitored once every season to establish the status of the nests.

APPENDIX B: BIRD HABITAT

Figure1: An example of Bushmanland Arid Grassland at the site. This is the typical habitat in the majority of the site.

Figure 2: The inactive Martial Eagle nest at the site on tower 147 of the Aggeneys – Aries 400kV.

Figure 3: A drainage line in the WEF site showing habitat where Red Lark was mostly recorded.

Figure 4: A water point in the WEF site. Note the small trees which are used by Southern Pale Chanting Goshawk as nesting sites.

Figure 5: A cobble-strewn ridge with Bushmanland Inselberg Shrubland.

Figure 6: The nest of a Southern Pale Chanting Goshawk at one of the water points.

APPENDIX C: STATISTICAL ANALYSIS

5. Introduction

The data on which this report is based are contained in the MS Excel file "*Pofadder VP Data Wi Sp Su Au 20141010_v1.xls*". This file contains records for each individual flight of priority species birds that were recorded at each of six vantage points and for every two-hour watch period during the survey. The survey covers four seasons of the year and took place during the dates indicated in Table 1. Environmental and other relevant information were also recorded, including watch periods where no birds were recorded.

Table *1*. The survey dates.

Start Date	End Date	Season	Number of Days
2013-07-02	2013-07-07	Winter 2013	6
2013-10-29	2013-11-03	Spring 2013	6
2014-02-23	2014-03-04	Summer 2014	10
2014-04-20	2014-04-28	Autumn 2014	9

There were 36 watch periods of two hours each allocated to every season and spread over the six vantage points from where the observations were made.

Some basic statistics concerning the data set are investigated and reported here, including the matter of the extent to which the data obtained are representative of the true occurrence of those birds identified as priority species in the area.

6. Descriptive statistics

A count of the total number of individual birds observed during the survey against the *Height* at which they flew are extracted (by species) and presented in Table A in the *Appendix*. Table B shows the times that the soaring and terrestrial birds flew at medium height and at all heights. Tables C – F (also in the Appendix) provide summary statistics that give insight into the behaviour of the species observed w.r.t. their presence according to season and their occurrence profiles during various weather conditions such as temperature, wind direction and wind speed.

The counts observed during consecutive watch periods, also identified by season and by vantage point, are listed separately in Tables H and I in the *Appendix* for *Soaring* and *Terrestrial* birds separately and with calculations of updated average counts for consecutive watch periods.

The computations were done using STATISTICA statistical software (see StatSoft Inc., 2013) and with routines developed for this purpose in "Statistica Visual Basic", the programming language of STATISTICA.

Averages & variability of counts

The descriptive statistics of average counts, standard deviations (Std.Dev.) and 95% lower and upper confidence intervals (LCL and UCL) for the mean count per watch period for the data in each of the four seasons are computed from the data leading to Tables G and H and the results are listed in Tables 2 – 4. The number of individual birds are recorded for each flight ("*flight"* being used here for a group of birds flying or associating together). Thus Tables *2* and *4* report the statistics for the number of *flights* recorded over all watch periods. Tables *3* and *5* report the statistics for the total number of individual birds per watch period.

Table *2*. Soaring birds, Flights: average, SD and 95% lower and upper confidence limits for the number of Flights per watch period.

Season	Watch periods	Soaring birds: Flights				
		Count	Avge	Std.Dev.	95% LCL	95% UCL
Winter	36	7	0.19	0.58	-0.00	0.39
Spring	36	27	0.75	1.76	0.15	1.35
Summer	36	20	0.56	0.91	0.25	0.86
Autumn	36	13	0.36	0.87	0.07	0.65
All Grps	144	67	0.47	1.13	0.28	0.65

Table *2*, for example, shows that *67* flights of soaring birds were counted during the *144* watch periods, leading to an estimated average of *0.47* flights per *2*h watch period with a *95%* confidence interval of *0.28 – 0.65*. The data for the seasons are similarly interpreted.

Tables *3 – 5* are interpreted in the same way as in the examples just described.

Table *3*. Soaring birds, Individuals: average, SD and 95% lower and upper confidence limits for the number of Individuals per watch period.

Season	Watch periods	Soaring: Individuals				
		Count	Avge	Std.Dev.	95% LCL	95% UCL
Winter	36	7	0.19	0.58	-0.00	0.39
Spring	36	32	0.89	2.48	0.05	1.73
Summer	36	21	0.58	1.00	0.25	0.92
Autumn	36	15	0.42	1.02	0.07	0.76
All Grps	144	75	0.52	1.47	0.28	0.76

Table *4*. Terrestrial birds, Flights: average, SD and 95% lower and upper confidence limits for the number of Flights per watch period.

Season	Watch periods	Terrestrial: Flights				
		Count	Avge	Std.Dev.	95% LCL	95% UCL
Winter	36	28	0.78	1.71	0.20	1.36
Spring	36	22	0.61	1.76	0.02	1.21
Summer	36	20	0.56	1.16	0.16	0.95
Autumn	36	32	0.89	1.51	0.38	1.40
All Grps	144	102	0.71	1.54	0.45	0.96

Table *5*. Terrestrial birds, Individuals: average, SD and 95% lower and upper confidence limits for the number of Individuals per watch period.

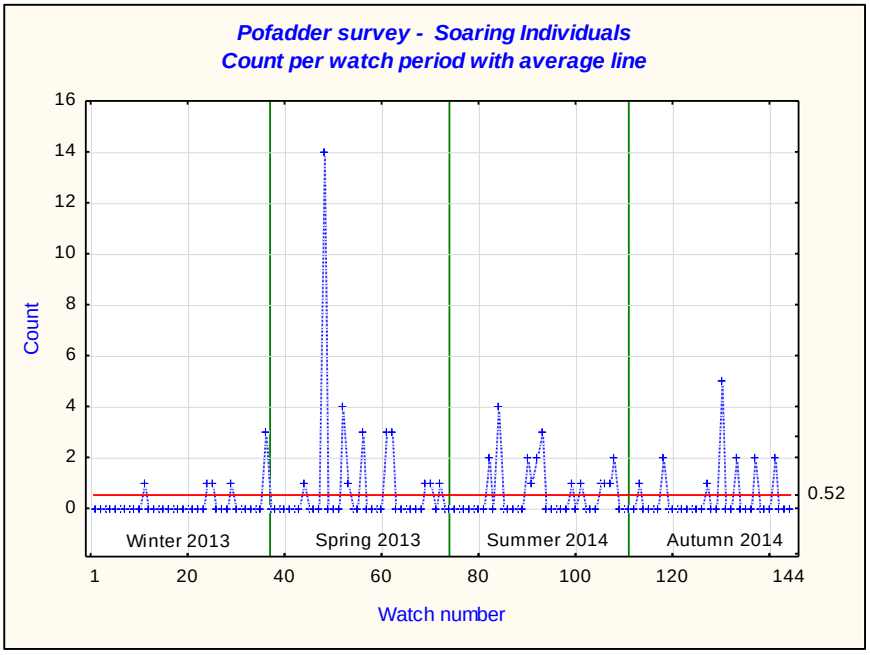
Season	Watch periods	Terrestrial: Individuals				
		Count	Avge	Std.Dev.	95% LCL	95% UCL
Winter	36	89	2.47	6.41	0.30	4.64
Spring	36	63	1.75	6.38	0.00	3.91
Summer	36	27	0.75	1.59	0.21	1.29
Autumn	36	78	2.17	3.82	0.87	3.46
All Grps	144	257	1.78	4.96	0.97	2.60

Tables *5* shows that individual terrestrial birds showed an average count of *1.78* individuals per *2*h watch period with an estimated *95*% confidence interval of *1.78 ± 0.81* for individuals per *2*h watch period.

Stability and Representativeness

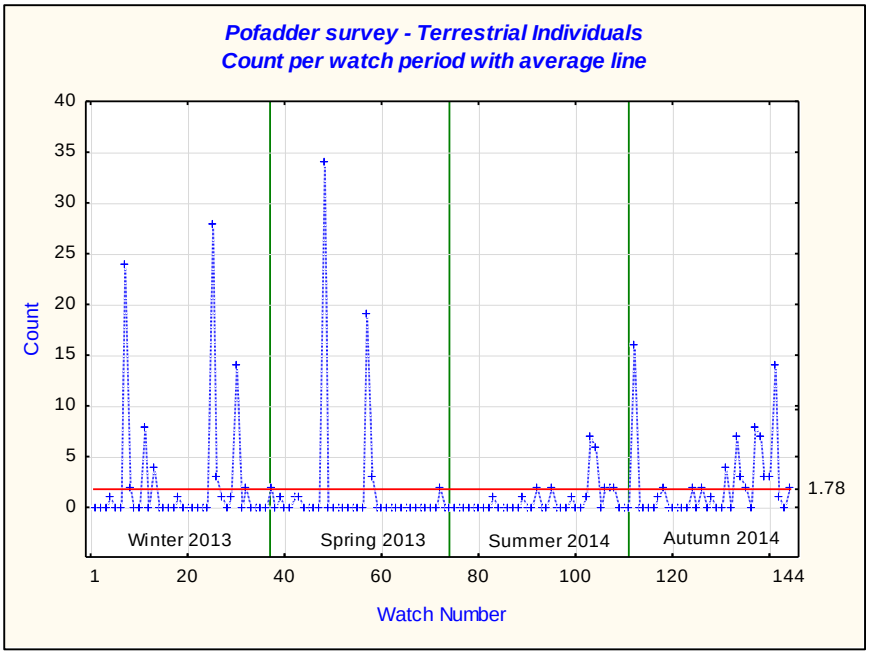
The standard deviations given in Tables *2 – 5* are measures of the variability that exists in the counts observed. The variability of the counts are visualised for individual counts in Figures *1* (Soaring *individuals*) and *2* (Terrestrial *individuals*).

Figure *1*: Soaring birds: sequential time plot of individual soaring bird counts.



It has to be noted that many runs of zero counts were encountered during all seasons. Figure *1* visually confirms the result in Table *3* that the standard deviation in Spring could be more than four times as large as in Winter.

Figure *2*: Terrestrial birds: sequential time plot of individual terrestrial bird counts.



Insight into the representativeness and stability of the counting process may also be obtained in another way. As the data are gathered watch period by watch period an improved estimate of the average number of birds that occur in the area will be achieved. As more data are gathered the more accurate the estimate will become. The issue is to determine if the updated average count begins to stabilise towards the end (or better still, before the end) of the survey (and thus the conclusion that a representative sample has been achieved).

To achieve this, the average number of flights (as well as for individual birds) is computed from all preceding data as the data become available in consecutive watch periods (day after day and from the different vantage points). These updated averages are expected to vary to a large extent in the initial stages of sampling and to stabilise as more data come in. Since the counts vary (in principle) substantially over the seasons (especially for individual counts) the updated averages are determined separately for each season and are listed in Tables H and I in the Appendix.

Figure 3 plots these updated averages for Soaring birds (the number of flights as well as a count of the total number of individual birds). Figure 4 does the same for Terrestrial birds.

Figure *3*. Soaring birds: updated average for *Flight* and *Individual* counts, separately by season.

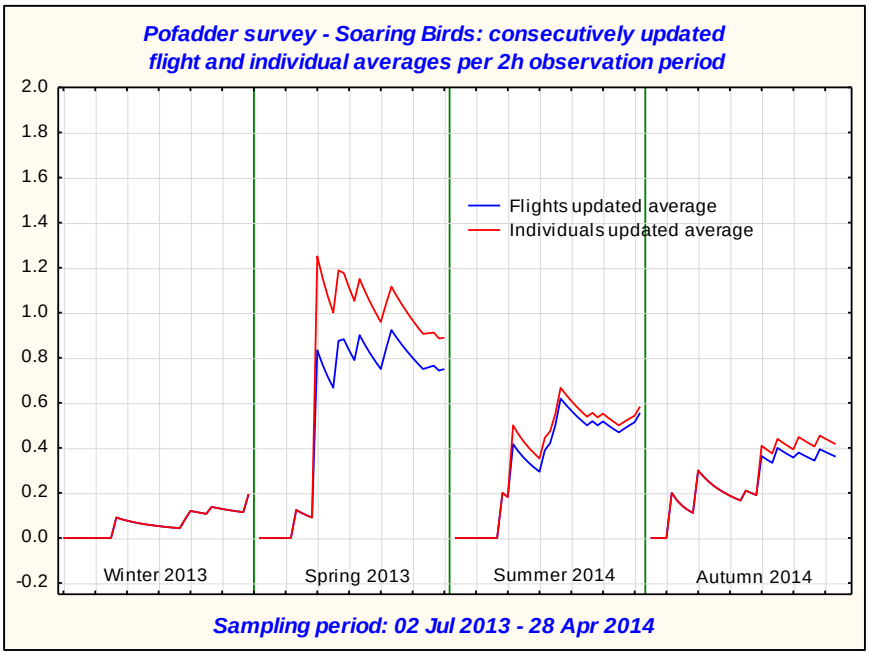


Figure *3* shows that the updated averages stabilise well towards the end of Winter, Spring, Autumn but shows a small but possibly insignificant) upward trend towards the end of Summer which does not seem to be a seriously bothersome trend.

Figure *4*. Terrestrial birds: updated average for *Flight* and *Individual* counts, separately by season.

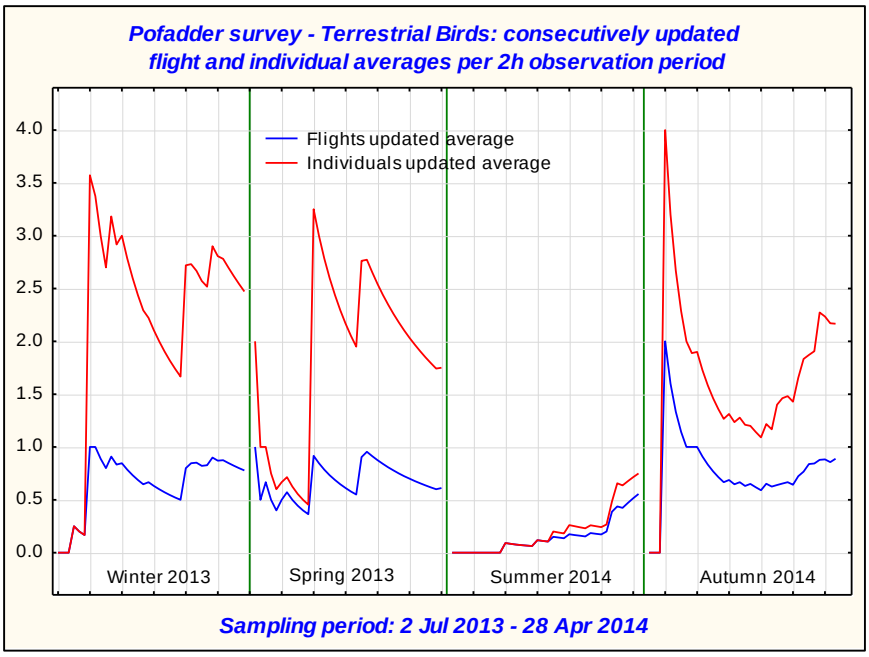
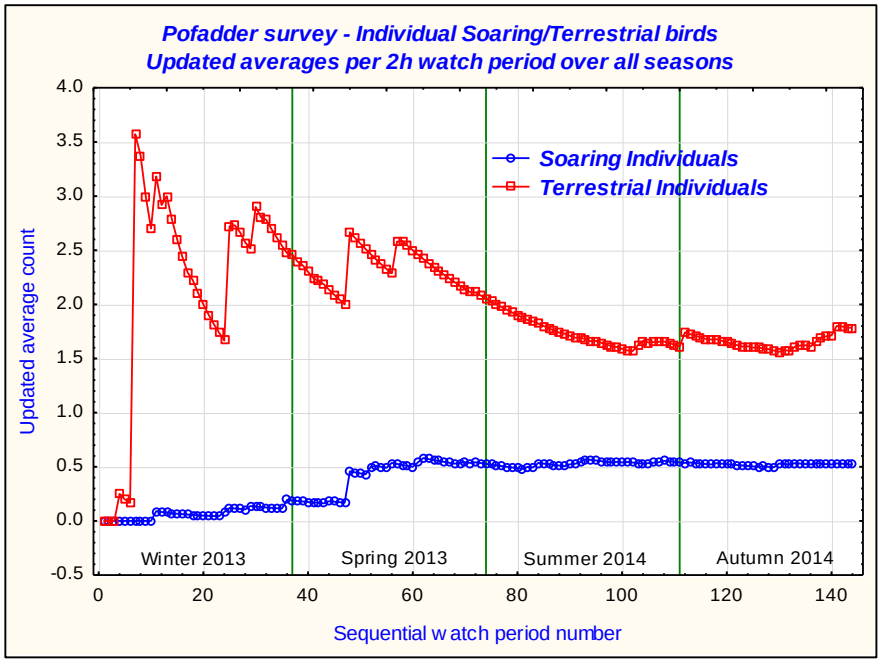


Figure *4* shows that the updated averages stabilise well towards the end for the Winter and Spring 2013 seasons. Even though there are quite small number of birds observed it appears as if there is still an increase in counts at the end of the Summer and Autumn 2014 seasons.

When the updated averages are computed, not separately for each season, but continuously over all consecutive watch periods over all four seasons, the picture becomes much clearer as shown in Figure *5*. This is done for individual counts only.

Figure *5* shows how the updated average counts are on a stabilising trend towards the end of a year of counts over all four seasons. It is thus not expected that further sampling will succeed in changing the estimated average number of individual birds in the area in a substantial way.

Figure *5*. Soaring and Terrestrial birds: updated average for *Individual* counts.



Sample size

There is another way to consider if the sample size is sufficient for the intended purpose namely to estimate the average number of birds with acceptable precision. The standard deviations given in Tables *2 – 5* are measures of the variability that exists in the counts observed. To achieve a computation for sample size we consider the variabilities for soaring individuals only.

The technical question is: how many watch periods (*n*) must be sampled in order to be *95%* certain of obtaining an estimate of the mean that is within a precision of "*d*" units (counts) from the true mean value, i.e. to say with *95%* certainty that the true mean count per observation period lies in an interval of $\bar{x} \pm d$ where $\bar{x}$ is the sample estimate of the true mean value. A practical approximation to an appropriate sample size for this requirement may be obtained from the formula:

(*1*) $$n = (s * t_{\alpha/2}(n-1) / d)^2,$$

where $t_{\alpha/2}(n-1)$ is the upper $\alpha/2$ = 2.5% point of Student's *t* distribution with $n - 1$ degrees of freedom (*n* the sample size) and *s* is an estimate of the true standard deviation of the counts (see Zar, *2010*, page *115*).

The Spring counts for soaring individuals, with an average of *0.89* and standard deviation of *2.48* are meaningfully different from those of the other three seasons. This is the worst case scenario since that season has the largest variance. If the sample size of $n = 36$ is sufficient to guarantee a certain precision then the other sample sizes (at seasons with smaller variances) will also be sufficiently large.

If a value of $d = 1$ is considered to be adequate precision for the Spring counts, then, by applying formula (1) with $s = 2.48$ (see Table 3), a sample size of $n \approx 26$ will achieve this. The $n = 36$ that were used during the survey is thus sufficient for this precision. Note that the achieved precision, using a sample size of $n = 36$ and the width of the listed confidence interval is $d = (1.73 - 0.05)/2 = 0.84$ which is a precision better than the proposed $d = 1$.

When the terrestrial birds (individual counts) are considered, Table *5* shows $s = 6.41$ to be the largest standard deviation. The sample size of $n = 36$ achieved a precision of $d = (4.64 - 0.30)/2 = 2.17$ using the confidence interval (on which formula *(1)* is based). If a precision of $d = 1$ is required, formula (*1*) shows the minimum sample size has to be $n \approx 170$. This is impractical and it has to be accepted that a precision of $d \approx 2$ will have to suffice. However, to estimate the average number of birds to be within ± 2 where the average count per watch period is low (± 2.5) is probably as precise as may be expected.

All told we may conclude that the sample sizes used during the survey would provide information sufficient to characterise the average number of birds in the area with reasonable certainty.

The use of formula (*1*), and equivalently the computation of the confidence interval, is dependent on certain assumptions (e.g. normality of the counts distribution) that are perhaps not met. However, it should provide a reasonable indication of the validity of the estimates based on the achieved sample sizes.

7. Conclusion

The computations and the way the data were exhibited in the tables and graphs in this report show that the survey may be taken to be statistically representative of the soaring and terrestrial priority species of birds that occur in the area and that more data would not succeed in improving the estimates in a substantial way.

8. References

StatSoft, Inc., (2013), STATISTICA (data analysis software system), Version 12. www.Statsoft.com.

Zar, J.H., (2010), *Biostatistical Analysis* (5th ed.), Prentice-Hall, Inc., Upper Saddle River: NJ 07458.

APPENDIX

Table A. Number of individual priority species birds recorded during the survey by Species, Flight Class and Flying Height distribution.

Species	Flight Class	Flying Height			Row Totals
		Low	Medium	High	
Southern Pale Chanting Goshawk	Soaring	56	6	0	62
Greater Kestrel	Soaring	10	2	0	12
Black-Chested Snake-Eagle	Soaring	0	0	1	1
Count (Soaring)		66	8 (10.7%)	1	75
Ludwig's Bustard	Terrestrial	28	26	8	62
Northern Black Korhaan	Terrestrial	18	5	0	23
Sclater's Lark	Terrestrial	145	0	0	145
Karoo Korhaan	Terrestrial	26	0	0	26
Red Lark	Terrestrial	1	0	0	1
Count (Terrestrial)		218	31	8	257
Total count (Overall)		284	39 (11.7%)	9	332

Table B. Number of individual priority species birds recorded during the survey by Species, Flight Class, Flight Duration (seconds) at Medium Height and the latter as a percentage of total Flight Duration at all heights.

Species	Flight Class	Valid N and Flight Duration (seconds)				
		At Medium Height		At All Heights		Time at Medium Ht
		N	Time (sec)	N	Time (sec)	
Southern Pale Chanting Goshawk	Soaring	6	525	62	4200	12.5%
Greater Kestrel	Soaring	2	195	12	1065	18.3%
Black-Chested Snake-Eagle	Soaring	0	0	1	150	0.0%
Count (Soaring)		8	720	75	5415	13.3%
Ludwig's Bustard	Terrestrial	26	2820	62	5925	47.6%
Northern Black Korhaan	Terrestrial	5	615	23	1665	36.9%
Sclater's Lark	Terrestrial	0	0	145	5790	1.6%
Karoo Korhaan	Terrestrial	0	0	26	2040	0.0%
Red Lark	Terrestrial	0	0	1	45	0.0%

Count (Terrestrial)	31	3435	257	15465	22.2%
Total count (Overall)	39	4155	332	20880	19.9%

Table C: Number of individual priority species birds recorded by Species, Flight Class and Season.

Species	Flight Class	Season				Row Totals
		Winter	Spring	Summer	Autumn	
Southern Pale Chanting Goshawk	Soaring	7	27	17	11	62
Greater Kestrel	Soaring	0	5	3	4	12
Black-Chested Snake-Eagle	Soaring	0	0	1	0	1
Count (Soaring)		7	32	21	15	75
Northern Black Korhaan	Terrestrial	1	2	16	4	23
Sclater's Lark	Terrestrial	74	53	6	12	145
Karoo Korhaan	Terrestrial	11	6	4	5	26
Ludwig's Bustard	Terrestrial	3	2	1	56	62
Red Lark	Terrestrial	0	0	0	1	1
Count (Terrestrial)		89	63	27	78	257
Total count (Overall)		96	95	48	93	332

Table D: Number of individual priority species birds recorded by Species, Flight Class and Temperature.

Species	Flight Class	Temperature				Row Totals
		Cold	Mild	Warm	Hot	
Southern Pale Chanting Goshawk	Soaring	28	17	9	8	62
Greater Kestrel	Soaring	0	9	1	2	12
Black-Chested Snake-Eagle	Soaring	0	1	0	0	1
Count (Soaring)		28	27	10	10	75
Northern Black Korhaan	Terrestrial	3	14	4	2	23
Sclater's Lark	Terrestrial	129	6	10	0	145
Karoo Korhaan	Terrestrial	19	5	2	0	26
Ludwig's Bustard	Terrestrial	46	3	13	0	62

Red Lark	Terrestrial	1	0	0	0	1
Count (Terrestrial)		198	28	29	2	257
Total count (Overall)		226	55	39	12	332

Table E: Number of individual priority species birds, by Species, Flight Class and Weather Condition

Species	Flight Class	Weather condition			
		Cloudy	Partly Cloudy	Sunny	Row Totals
Southern Pale Chanting Goshawk	Soaring	2	49	11	62
Greater Kestrel	Soaring	0	7	5	12
Black-Chested Snake-Eagle	Soaring	0	1	0	1
Count (Soaring)		2	57	16	75
Northern Black Korhaan	Terrestrial	0	22	1	23
Sclater's Lark	Terrestrial	19	94	32	145
Karoo Korhaan	Terrestrial	4	7	15	26
Ludwig's Bustard	Terrestrial	2	50	10	62
Red Lark	Terrestrial	0	1	0	1
Count (Terrestrial)		25	174	58	257
Total count (Overall)		27	231	74	332

Table F: Number of individual priority species birds recorded by Species and Wind Direction.										
Species	Flight Class	Wind Direction								Row Totals
		N	NE	E	SE	S	SW	W	NW	
Southern Pale Chanting Goshawk	Soaring	1	2	8	3	6	19	14	9	62
Greater Kestrel	Soaring	0	0	0	1	0	8	2	1	12
Black-Chested Snake-Eagle	Soaring	0	1	0	0	0	0	0	0	1
Count (Soaring)		1	3	8	4	6	27	16	10	75
Northern Black Korhaan	Terrestrial	2	0	3	9	1	2	5	1	23
Sclater's Lark	Terrestrial	0	6	2	60	0	53	0	24	145
Karoo Korhaan	Terrestrial	0	4	5	6	0	6	0	5	26
Ludwig's Bustard	Terrestrial	3	11	30	1	0	3	2	12	62
Red Lark	Terrestrial	0	0	1	0	0	0	0	0	1
Count (Terrestrial)		5	21	41	76	1	64	7	42	257
Total count (Overall)		6	24	49	80	7	91	23	52	332

Table G: Number of individual priority species birds recorded by Species, Flight Class and Wind Strength (Beaufort scale).							
Species	Flight Class	Beaufort scale					Row Totals
		Light Air	Light Breeze	Gentle Breeze	Moderate Breeze	Strong Breeze	
Southern Pale Chanting Goshawk	Soaring	4	16	29	12	1	62
Greater Kestrel	Soaring	0	0	2	10	0	12
Black-Chested Snake-Eagle	Soaring	0	1	0	0	0	1
Count (Soaring)		4	17	31	22	1	75
Northern Black Korhaan	Terrestrial	8	5	5	5	0	23
Sclater's Lark	Terrestrial	0	79	66	0	0	145
Karoo Korhaan	Terrestrial	2	9	11	4	0	26
Ludwig's Bustard	Terrestrial	0	26	30	6	0	62
Red Lark	Terrestrial	0	1	0	0	0	1
Count (Terrestrial)		10	120	112	15	1	257
Total count (Overall)		14	137	143	37	1	332

Table H: ***Soaring Birds*: Flights and Individuals for priority species per watch period and by vantage point over time with updated averages per consecutive watch period.**

Watch Number	Date	Season	VP	Flights count	Flights Updated Avge	Individuals count	Individuals Updated Avge
1	2013-07-02	Winter	VP1	0.0	0.00	0.0	0.00
2	2013-07-02	Winter	VP2	0.0	0.00	0.0	0.00
3	2013-07-02	Winter	VP4	0.0	0.00	0.0	0.00
4	2013-07-02	Winter	VP4	0.0	0.00	0.0	0.00
5	2013-07-02	Winter	VP1	0.0	0.00	0.0	0.00
6	2013-07-02	Winter	VP2	0.0	0.00	0.0	0.00
7	2013-07-03	Winter	VP6	0.0	0.00	0.0	0.00
8	2013-07-03	Winter	VP5	0.0	0.00	0.0	0.00
9	2013-07-03	Winter	VP3	0.0	0.00	0.0	0.00
10	2013-07-03	Winter	VP5	0.0	0.00	0.0	0.00
11	2013-07-03	Winter	VP6	1.0	0.09	1.0	0.09
12	2013-07-03	Winter	VP3	0.0	0.08	0.0	0.08
13	2013-07-03	Winter	VP1	0.0	0.08	0.0	0.08
14	2013-07-03	Winter	VP2	0.0	0.07	0.0	0.07
15	2013-07-03	Winter	VP4	0.0	0.07	0.0	0.07
16	2013-07-04	Winter	VP4	0.0	0.06	0.0	0.06
17	2013-07-04	Winter	VP1	0.0	0.06	0.0	0.06
18	2013-07-04	Winter	VP2	0.0	0.06	0.0	0.06
19	2013-07-04	Winter	VP4	0.0	0.05	0.0	0.05
20	2013-07-04	Winter	VP1	0.0	0.05	0.0	0.05
21	2013-07-04	Winter	VP2	0.0	0.05	0.0	0.05
22	2013-07-04	Winter	VP5	0.0	0.05	0.0	0.05
23	2013-07-04	Winter	VP3	0.0	0.04	0.0	0.04
24	2013-07-04	Winter	VP6	1.0	0.08	1.0	0.08
25	2013-07-05	Winter	VP6	1.0	0.12	1.0	0.12
26	2013-07-05	Winter	VP5	0.0	0.12	0.0	0.12
27	2013-07-05	Winter	VP3	0.0	0.11	0.0	0.11
28	2013-07-05	Winter	VP3	0.0	0.11	0.0	0.11
29	2013-07-05	Winter	VP5	1.0	0.14	1.0	0.14
30	2013-07-05	Winter	VP6	0.0	0.13	0.0	0.13
31	2013-07-06	Winter	VP4	0.0	0.13	0.0	0.13
32	2013-07-06	Winter	VP1	0.0	0.13	0.0	0.13
33	2013-07-06	Winter	VP2	0.0	0.12	0.0	0.12
34	2013-07-07	Winter	VP3	0.0	0.12	0.0	0.12

35	2013-07-07	Winter	VP5	0.0	0.11	0.0	0.11
36	2013-07-07	Winter	VP6	3.0	0.19	3.0	0.19
37	2013-10-29	Spring	VP3	0.0	0.00	0.0	0.00
38	2013-10-29	Spring	VP1	0.0	0.00	0.0	0.00
39	2013-10-29	Spring	VP1	0.0	0.00	0.0	0.00
40	2013-10-30	Spring	VP1	0.0	0.00	0.0	0.00
41	2013-10-30	Spring	VP2	0.0	0.00	0.0	0.00
42	2013-10-30	Spring	VP3	0.0	0.00	0.0	0.00
43	2013-10-30	Spring	VP1	0.0	0.00	0.0	0.00
44	2013-10-30	Spring	VP6	1.0	0.13	1.0	0.13
45	2013-10-30	Spring	VP2	0.0	0.11	0.0	0.11
46	2013-10-30	Spring	VP3	0.0	0.10	0.0	0.10
47	2013-10-30	Spring	VP4	0.0	0.09	0.0	0.09
48	2013-10-31	Spring	VP6	9.0	0.83	14.0	1.25
49	2013-10-31	Spring	VP5	0.0	0.77	0.0	1.15
50	2013-10-31	Spring	VP2	0.0	0.71	0.0	1.07
51	2013-10-31	Spring	VP6	0.0	0.67	0.0	1.00
52	2013-10-31	Spring	VP5	4.0	0.88	4.0	1.19
53	2013-10-31	Spring	VP4	1.0	0.88	1.0	1.18
54	2013-10-31	Spring	VP2	0.0	0.83	0.0	1.11
55	2013-10-31	Spring	VP1	0.0	0.79	0.0	1.05
56	2013-10-31	Spring	VP3	3.0	0.90	3.0	1.15
57	2013-11-01	Spring	VP6	0.0	0.86	0.0	1.10
58	2013-11-01	Spring	VP5	0.0	0.82	0.0	1.05
59	2013-11-01	Spring	VP1	0.0	0.78	0.0	1.00
60	2013-11-01	Spring	VP3	0.0	0.75	0.0	0.96
61	2013-11-01	Spring	VP4	3.0	0.84	3.0	1.04
62	2013-11-01	Spring	VP4	3.0	0.92	3.0	1.12
63	2013-11-01	Spring	VP5	0.0	0.89	0.0	1.07
64	2013-11-01	Spring	VP6	0.0	0.86	0.0	1.04
65	2013-11-02	Spring	VP4	0.0	0.83	0.0	1.00
66	2013-11-02	Spring	VP5	0.0	0.80	0.0	0.97
67	2013-11-02	Spring	VP3	0.0	0.77	0.0	0.94
68	2013-11-02	Spring	VP2	0.0	0.75	0.0	0.91
69	2013-11-03	Spring	VP4	1.0	0.76	1.0	0.91
70	2013-11-03	Spring	VP2	1.0	0.76	1.0	0.91
71	2013-11-03	Spring	VP5	0.0	0.74	0.0	0.89
72	2013-11-03	Spring	VP6	1.0	0.75	1.0	0.89

73	2014-02-23	Summer	VP1	0.0	0.00	0.0	0.00
74	2014-02-23	Summer	VP2	0.0	0.00	0.0	0.00
75	2014-02-23	Summer	VP2	0.0	0.00	0.0	0.00
76	2014-02-23	Summer	VP1	0.0	0.00	0.0	0.00
77	2014-02-24	Summer	VP1	0.0	0.00	0.0	0.00
78	2014-02-24	Summer	VP2	0.0	0.00	0.0	0.00
79	2014-02-24	Summer	VP1	0.0	0.00	0.0	0.00
80	2014-02-24	Summer	VP2	0.0	0.00	0.0	0.00
81	2014-02-26	Summer	VP3	0.0	0.00	0.0	0.00
82	2014-02-26	Summer	VP6	2.0	0.20	2.0	0.20
83	2014-02-26	Summer	VP3	0.0	0.18	0.0	0.18
84	2014-02-26	Summer	VP6	3.0	0.42	4.0	0.50
85	2014-02-27	Summer	VP1	0.0	0.38	0.0	0.46
86	2014-02-27	Summer	VP2	0.0	0.36	0.0	0.43
87	2014-02-27	Summer	VP4	0.0	0.33	0.0	0.40
88	2014-02-27	Summer	VP5	0.0	0.31	0.0	0.38
89	2014-02-27	Summer	VP3	0.0	0.29	0.0	0.35
90	2014-02-27	Summer	VP4	2.0	0.39	2.0	0.44
91	2014-02-27	Summer	VP5	1.0	0.42	1.0	0.47
92	2014-02-27	Summer	VP6	2.0	0.50	2.0	0.55
93	2014-02-28	Summer	VP6	3.0	0.62	3.0	0.67
94	2014-02-28	Summer	VP2	0.0	0.59	0.0	0.64
95	2014-02-28	Summer	VP1	0.0	0.57	0.0	0.61
96	2014-02-28	Summer	VP3	0.0	0.54	0.0	0.58
97	2014-02-28	Summer	VP3	0.0	0.52	0.0	0.56
98	2014-02-28	Summer	VP6	0.0	0.50	0.0	0.54
99	2014-02-28	Summer	VP4	1.0	0.52	1.0	0.56
100	2014-02-28	Summer	VP5	0.0	0.50	0.0	0.54
101	2014-02-28	Summer	VP5	1.0	0.52	1.0	0.55
102	2014-02-28	Summer	VP4	0.0	0.50	0.0	0.53
103	2014-03-02	Summer	VP5	0.0	0.48	0.0	0.52
104	2014-03-02	Summer	VP6	0.0	0.47	0.0	0.50
105	2014-03-02	Summer	VP3	1.0	0.48	1.0	0.52
106	2014-03-03	Summer	VP4	1.0	0.50	1.0	0.53
107	2014-03-04	Summer	VP4	1.0	0.51	1.0	0.54
108	2014-03-04	Summer	VP5	2.0	0.56	2.0	0.58
109	2014-04-20	Autumn	VP3	0.0	0.00	0.0	0.00
110	2014-04-20	Autumn	VP6	0.0	0.00	0.0	0.00
111	2014-04-20	Autumn	VP3	0.0	0.00	0.0	0.00

112	2014-04-20	Autumn	VP6	0.0	0.00	0.0	0.00
113	2014-04-21	Autumn	VP5	1.0	0.20	1.0	0.20
114	2014-04-21	Autumn	VP6	0.0	0.17	0.0	0.17
115	2014-04-21	Autumn	VP2	0.0	0.14	0.0	0.14
116	2014-04-21	Autumn	VP4	0.0	0.13	0.0	0.13
117	2014-04-21	Autumn	VP5	0.0	0.11	0.0	0.11
118	2014-04-21	Autumn	VP6	2.0	0.30	2.0	0.30
119	2014-04-21	Autumn	VP2	0.0	0.27	0.0	0.27
120	2014-04-21	Autumn	VP4	0.0	0.25	0.0	0.25
121	2014-04-22	Autumn	VP1	0.0	0.23	0.0	0.23
122	2014-04-22	Autumn	VP1	0.0	0.21	0.0	0.21
123	2014-04-22	Autumn	VP2	0.0	0.20	0.0	0.20
124	2014-04-22	Autumn	VP4	0.0	0.19	0.0	0.19
125	2014-04-22	Autumn	VP2	0.0	0.18	0.0	0.18
126	2014-04-22	Autumn	VP4	0.0	0.17	0.0	0.17
127	2014-04-23	Autumn	VP4	1.0	0.21	1.0	0.21
128	2014-04-23	Autumn	VP2	0.0	0.20	0.0	0.20
129	2014-04-23	Autumn	VP1	0.0	0.19	0.0	0.19
130	2014-04-23	Autumn	VP5	4.0	0.36	5.0	0.41
131	2014-04-23	Autumn	VP5	0.0	0.35	0.0	0.39
132	2014-04-23	Autumn	VP1	0.0	0.33	0.0	0.38
133	2014-04-24	Autumn	VP4	2.0	0.40	2.0	0.44
134	2014-04-24	Autumn	VP1	0.0	0.38	0.0	0.42
135	2014-04-24	Autumn	VP2	0.0	0.37	0.0	0.41
136	2014-04-25	Autumn	VP1	0.0	0.36	0.0	0.39
137	2014-04-26	Autumn	VP6	1.0	0.38	2.0	0.45
138	2014-04-26	Autumn	VP5	0.0	0.37	0.0	0.43
139	2014-04-26	Autumn	VP3	0.0	0.35	0.0	0.42
140	2014-04-26	Autumn	VP3	0.0	0.34	0.0	0.41
141	2014-04-27	Autumn	VP6	2.0	0.39	2.0	0.45
142	2014-04-27	Autumn	VP3	0.0	0.38	0.0	0.44
143	2014-04-27	Autumn	VP3	0.0	0.37	0.0	0.43
144	2014-04-28	Autumn	VP5	0.0	0.36	0.0	0.42

Table I: ***Terrestrial Birds*: Flights and Individuals for priority species per watch period and by vantage point over time with updated averages per consecutive watch period.**

Watch Number	Date	Season	VP	Flights count	Flights Updated Avge	Individuals count	Individuals Updated Avge
1	2013-07-02	Winter	VP1	0.0	0.00	0.0	0.00
2	2013-07-02	Winter	VP2	0.0	0.00	0.0	0.00
3	2013-07-02	Winter	VP4	0.0	0.00	0.0	0.00
4	2013-07-02	Winter	VP4	1.0	0.25	1.0	0.25
5	2013-07-02	Winter	VP1	0.0	0.20	0.0	0.20
6	2013-07-02	Winter	VP2	0.0	0.17	0.0	0.17
7	2013-07-03	Winter	VP6	6.0	1.00	24.0	3.57
8	2013-07-03	Winter	VP5	1.0	1.00	2.0	3.38
9	2013-07-03	Winter	VP3	0.0	0.89	0.0	3.00
10	2013-07-03	Winter	VP5	0.0	0.80	0.0	2.70
11	2013-07-03	Winter	VP6	2.0	0.91	8.0	3.18
12	2013-07-03	Winter	VP3	0.0	0.83	0.0	2.92
13	2013-07-03	Winter	VP1	1.0	0.85	4.0	3.00
14	2013-07-03	Winter	VP2	0.0	0.79	0.0	2.79
15	2013-07-03	Winter	VP4	0.0	0.73	0.0	2.60
16	2013-07-04	Winter	VP4	0.0	0.69	0.0	2.44
17	2013-07-04	Winter	VP1	0.0	0.65	0.0	2.29
18	2013-07-04	Winter	VP2	1.0	0.67	1.0	2.22
19	2013-07-04	Winter	VP4	0.0	0.63	0.0	2.11
20	2013-07-04	Winter	VP1	0.0	0.60	0.0	2.00
21	2013-07-04	Winter	VP2	0.0	0.57	0.0	1.90
22	2013-07-04	Winter	VP5	0.0	0.55	0.0	1.82
23	2013-07-04	Winter	VP3	0.0	0.52	0.0	1.74
24	2013-07-04	Winter	VP6	0.0	0.50	0.0	1.67
25	2013-07-05	Winter	VP6	8.0	0.80	28.0	2.72
26	2013-07-05	Winter	VP5	2.0	0.85	3.0	2.73
27	2013-07-05	Winter	VP3	1.0	0.85	1.0	2.67
28	2013-07-05	Winter	VP3	0.0	0.82	0.0	2.57
29	2013-07-05	Winter	VP5	1.0	0.83	1.0	2.52
30	2013-07-05	Winter	VP6	3.0	0.90	14.0	2.90
31	2013-07-06	Winter	VP4	0.0	0.87	0.0	2.81
32	2013-07-06	Winter	VP1	1.0	0.88	2.0	2.78
33	2013-07-06	Winter	VP2	0.0	0.85	0.0	2.70
34	2013-07-07	Winter	VP3	0.0	0.82	0.0	2.62

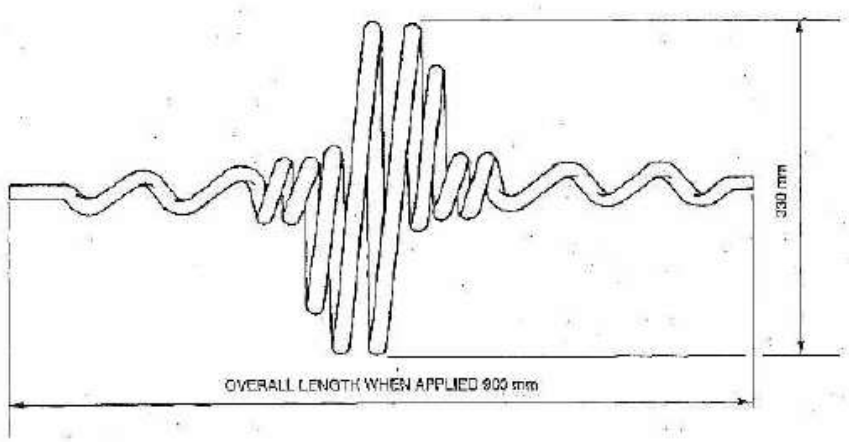
35	2013-07-07	Winter	VP5	0.0	0.80	0.0	2.54
36	2013-07-07	Winter	VP6	0.0	0.78	0.0	2.47
37	2013-10-29	Spring	VP3	1.0	1.00	2.0	2.00
38	2013-10-29	Spring	VP1	0.0	0.50	0.0	1.00
39	2013-10-29	Spring	VP1	1.0	0.67	1.0	1.00
40	2013-10-30	Spring	VP1	0.0	0.50	0.0	0.75
41	2013-10-30	Spring	VP2	0.0	0.40	0.0	0.60
42	2013-10-30	Spring	VP3	1.0	0.50	1.0	0.67
43	2013-10-30	Spring	VP1	1.0	0.57	1.0	0.71
44	2013-10-30	Spring	VP6	0.0	0.50	0.0	0.63
45	2013-10-30	Spring	VP2	0.0	0.44	0.0	0.56
46	2013-10-30	Spring	VP3	0.0	0.40	0.0	0.50
47	2013-10-30	Spring	VP4	0.0	0.36	0.0	0.45
48	2013-10-31	Spring	VP6	7.0	0.92	34.0	3.25
49	2013-10-31	Spring	VP5	0.0	0.85	0.0	3.00
50	2013-10-31	Spring	VP2	0.0	0.79	0.0	2.79
51	2013-10-31	Spring	VP6	0.0	0.73	0.0	2.60
52	2013-10-31	Spring	VP5	0.0	0.69	0.0	2.44
53	2013-10-31	Spring	VP4	0.0	0.65	0.0	2.29
54	2013-10-31	Spring	VP2	0.0	0.61	0.0	2.17
55	2013-10-31	Spring	VP1	0.0	0.58	0.0	2.05
56	2013-10-31	Spring	VP3	0.0	0.55	0.0	1.95
57	2013-11-01	Spring	VP6	8.0	0.90	19.0	2.76
58	2013-11-01	Spring	VP5	2.0	0.95	3.0	2.77
59	2013-11-01	Spring	VP1	0.0	0.91	0.0	2.65
60	2013-11-01	Spring	VP3	0.0	0.88	0.0	2.54
61	2013-11-01	Spring	VP4	0.0	0.84	0.0	2.44
62	2013-11-01	Spring	VP4	0.0	0.81	0.0	2.35
63	2013-11-01	Spring	VP5	0.0	0.78	0.0	2.26
64	2013-11-01	Spring	VP6	0.0	0.75	0.0	2.18
65	2013-11-02	Spring	VP4	0.0	0.72	0.0	2.10
66	2013-11-02	Spring	VP5	0.0	0.70	0.0	2.03
67	2013-11-02	Spring	VP3	0.0	0.68	0.0	1.97
68	2013-11-02	Spring	VP2	0.0	0.66	0.0	1.91
69	2013-11-03	Spring	VP4	0.0	0.64	0.0	1.85
70	2013-11-03	Spring	VP2	0.0	0.62	0.0	1.79
71	2013-11-03	Spring	VP5	0.0	0.60	0.0	1.74
72	2013-11-03	Spring	VP6	1.0	0.61	2.0	1.75

73	2014-02-23	Summer	VP1	0.0	0.00	0.0	0.00
74	2014-02-23	Summer	VP2	0.0	0.00	0.0	0.00
75	2014-02-23	Summer	VP2	0.0	0.00	0.0	0.00
76	2014-02-23	Summer	VP1	0.0	0.00	0.0	0.00
77	2014-02-24	Summer	VP1	0.0	0.00	0.0	0.00
78	2014-02-24	Summer	VP2	0.0	0.00	0.0	0.00
79	2014-02-24	Summer	VP1	0.0	0.00	0.0	0.00
80	2014-02-24	Summer	VP2	0.0	0.00	0.0	0.00
81	2014-02-26	Summer	VP3	0.0	0.00	0.0	0.00
82	2014-02-26	Summer	VP6	0.0	0.00	0.0	0.00
83	2014-02-26	Summer	VP3	1.0	0.09	1.0	0.09
84	2014-02-26	Summer	VP6	0.0	0.08	0.0	0.08
85	2014-02-27	Summer	VP1	0.0	0.08	0.0	0.08
86	2014-02-27	Summer	VP2	0.0	0.07	0.0	0.07
87	2014-02-27	Summer	VP4	0.0	0.07	0.0	0.07
88	2014-02-27	Summer	VP5	0.0	0.06	0.0	0.06
89	2014-02-27	Summer	VP3	1.0	0.12	1.0	0.12
90	2014-02-27	Summer	VP4	0.0	0.11	0.0	0.11
91	2014-02-27	Summer	VP5	0.0	0.11	0.0	0.11
92	2014-02-27	Summer	VP6	1.0	0.15	2.0	0.20
93	2014-02-28	Summer	VP6	0.0	0.14	0.0	0.19
94	2014-02-28	Summer	VP2	0.0	0.14	0.0	0.18
95	2014-02-28	Summer	VP1	1.0	0.17	2.0	0.26
96	2014-02-28	Summer	VP3	0.0	0.17	0.0	0.25
97	2014-02-28	Summer	VP3	0.0	0.16	0.0	0.24
98	2014-02-28	Summer	VP6	0.0	0.15	0.0	0.23
99	2014-02-28	Summer	VP4	1.0	0.19	1.0	0.26
100	2014-02-28	Summer	VP5	0.0	0.18	0.0	0.25
101	2014-02-28	Summer	VP5	0.0	0.17	0.0	0.24
102	2014-02-28	Summer	VP4	1.0	0.20	1.0	0.27
103	2014-03-02	Summer	VP5	6.0	0.39	7.0	0.48
104	2014-03-02	Summer	VP6	2.0	0.44	6.0	0.66
105	2014-03-02	Summer	VP3	0.0	0.42	0.0	0.64
106	2014-03-03	Summer	VP4	2.0	0.47	2.0	0.68
107	2014-03-04	Summer	VP4	2.0	0.51	2.0	0.71
108	2014-03-04	Summer	VP5	2.0	0.56	2.0	0.75
109	2014-04-20	Autumn	VP3	0.0	0.00	0.0	0.00
110	2014-04-20	Autumn	VP6	0.0	0.00	0.0	0.00
111	2014-04-20	Autumn	VP3	0.0	0.00	0.0	0.00

112	2014-04-20	Autumn	VP6	8.0	2.00	16.0	4.00
113	2014-04-21	Autumn	VP5	0.0	1.60	0.0	3.20
114	2014-04-21	Autumn	VP6	0.0	1.33	0.0	2.67
115	2014-04-21	Autumn	VP2	0.0	1.14	0.0	2.29
116	2014-04-21	Autumn	VP4	0.0	1.00	0.0	2.00
117	2014-04-21	Autumn	VP5	1.0	1.00	1.0	1.89
118	2014-04-21	Autumn	VP6	1.0	1.00	2.0	1.90
119	2014-04-21	Autumn	VP2	0.0	0.91	0.0	1.73
120	2014-04-21	Autumn	VP4	0.0	0.83	0.0	1.58
121	2014-04-22	Autumn	VP1	0.0	0.77	0.0	1.46
122	2014-04-22	Autumn	VP1	0.0	0.71	0.0	1.36
123	2014-04-22	Autumn	VP2	0.0	0.67	0.0	1.27
124	2014-04-22	Autumn	VP4	1.0	0.69	2.0	1.31
125	2014-04-22	Autumn	VP2	0.0	0.65	0.0	1.24
126	2014-04-22	Autumn	VP4	1.0	0.67	2.0	1.28
127	2014-04-23	Autumn	VP4	0.0	0.63	0.0	1.21
128	2014-04-23	Autumn	VP2	1.0	0.65	1.0	1.20
129	2014-04-23	Autumn	VP1	0.0	0.62	0.0	1.14
130	2014-04-23	Autumn	VP5	0.0	0.59	0.0	1.09
131	2014-04-23	Autumn	VP5	2.0	0.65	4.0	1.22
132	2014-04-23	Autumn	VP1	0.0	0.63	0.0	1.17
133	2014-04-24	Autumn	VP4	1.0	0.64	7.0	1.40
134	2014-04-24	Autumn	VP1	1.0	0.65	3.0	1.46
135	2014-04-24	Autumn	VP2	1.0	0.67	2.0	1.48
136	2014-04-25	Autumn	VP1	0.0	0.64	0.0	1.43
137	2014-04-26	Autumn	VP6	3.0	0.72	8.0	1.66
138	2014-04-26	Autumn	VP5	2.0	0.77	7.0	1.83
139	2014-04-26	Autumn	VP3	3.0	0.84	3.0	1.87
140	2014-04-26	Autumn	VP3	1.0	0.84	3.0	1.91
141	2014-04-27	Autumn	VP6	2.0	0.88	14.0	2.27
142	2014-04-27	Autumn	VP3	1.0	0.88	1.0	2.24
143	2014-04-27	Autumn	VP3	0.0	0.86	0.0	2.17
144	2014-04-28	Autumn	VP5	2.0	0.89	2.0	2.17

APPENDIX D: BIRD FLIGHT DIVERTER

Double Loop Bird Flight Diverter



Material Used: Manufactured from rigid solid high impact polyvinyl chloride, possessing excellent chemical and strength properties and which will retain good physical characteristics within the range of extreme temperatures. Outdoor aging tests indicate that the material does not deteriorate in function or appearance from the effects of severe weather conditions. Industrial fumes and salt water cannot seriously degrade the properties of rigid PVC.

Colour: White or Black

Lay Direction: Bird Flight Diverters are supplied right hand lay for both right hand and left hand lay bare conductors and insulated cables.

CATALOGUE NO.	CONDUCTOR/ E/WIRE DIA. RANGE
BFD 0914/LD2*	9 mm – 14 mm

*Add B or W to denote colour

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APPENDIX I:

OPEN SPACE MANAGEMENT PLAN

Open Space Management Plan

POORTJIES WIND ENERGY FACILITY

December 2014

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Table of Contents

1. Purpose

The Open Space Management Plan addresses the need to prevent and mitigate significant impacts due to staff presence and activities that could lead to disturbed fauna and flora, disturbed soil surfaces, and generally bare soils prone to erosion and further degradation on the Tsitsikamma Community Wind Energy Facility to be developed on a site near Humansdorp, Eastern Cape Province.

The plan must be used in conjunction with the Erosion Management, Vegetation Rehabilitation, and Alien Invasive Management Plans.

The objective of the plan is therefore to provide protocols for the access, use and general conduct of all construction, maintenance and operational staff of the facility

2. Scope

This document is the Open Space Management Plan that acts as a guideline to be applied by all contractors, subcontractors and other staff employed by and active on the Tsitsikamma Community Wind Energy Facility site as per the environmental authorisation Condition 18 issued by the Department of Environmental Affairs. The authorisation clearly states:

> (18.5): An open space management plan to be implemented during the construction and operation of the facility

This plan, as a requirement of the authorisation, is a legally authorised document that must be implimented to fullfil the requirements of the authorisation. However, the management plan is an evolving guideline that needs to be updated or adapted as progress is made with the revegetation and rehabilitation of the project area, and successes and failures of procedures identified.

3. Legislation and Standards

Relevant legislation:

- Conservation of Agricultural Resources Act 43 of 1983
- Environment Conservation Act 73 of 1989
- National Forestry Act 84 of 1998
- National Environmental Management Act 107 of 1998

4. Open Space Management

The objective of open space management within the project area is to ensure that construction activities and the operation of the facility is in harmony with the biodiversity, general land use practices and local residents and will not interfere with

or degrade the functionality of the ecosystems affected on and beyond the infrastructure developed. Several steps must be taken toward this objective:

4.1. Access Control

» Access to the facility during construction and operation should be restricted to permanent staff or authorised persons only.

» Non-permanent on-site staff and all other contractors or visitors should be required to register when entering.

4.2. Prohibited activities

» Clear, visible signs must be displayed to show:

- Disturbance to fauna and flora or the physical environment within the project area, other than regular authorised operational activities (e.g. annual mowing), is strictly prohibited.
- No open fires are permitted in the project area
- Strictly no off-road driving
- No random collection of firewood; only if allowed and controlled by the developer and from designated windrows of cleared alien invasive woody vegetation
- Strictly no littering, especially no discarded cigarette butts that could ignite a fire in flammable alien vegetation present on site

4.3. Fire Risk Management

» Fires are a regular part of Fynbos dynamics and the potential for such occurrences in remaining Fynbos areas must be incorporated into the maintenance plan of the facility. In addition, most of the alien invasive vegetation present on and beyond the site has highly flammable foliage and wood, and if this vegetation cannot be cleared adequately, the risk of fire from this vegetation must be clearly understood

» Ignition risk sources in the area include the following:

- Lightning strikes
- Personnel within the facility
- Infrastructure such as transmission lines
- Discarding of burning cigarette stumps

» A fire-risk management strategy must be compiled and implemented:

- This should also be in collaboration with the land users within and on surrounding properties
- Within that strategy it must be clear who will be responsible for what actions in the event of a fire

- If firebreaks need to be created and maintained and by whom
- What kind of equipment should be available on site, and who is trained to use and authorised to have access to that equipment
- Vegetation management (e.g. annual mowing of grasses, clearing of alien vegetation) that may be necessary to limit risks of fires

» Fire-fighting training must be provided to on site staff and/or local community members

» Fire-fighting equipment must be regularly inspected and maintained

4.4. Waste Management

» Pollution and littering of any form or amount will not be tolerated on the site during construction, operation and decommissioning

» Adequate measures must be in place for managing and disposing of any form of waste on site

4.5. Specific protection of Flora

Apart from above measures to prohibit disturbance to any flora and prevent fires, the following will be required:

» It shall be made clear to all staff that no indigenous flora may be picked, cut, dug out, damaged or disturbed in any way unless a relevant permit is issued for protected plants affected by the construction of the energy facility

» Large machinery and other vehicles moving into the project area shall first be inspected for the presence of seeds of invasive species carried by tyres, undercarriage or other structures, especially if such machinery or vehicles went past or through areas with alien plant infestations en route to the project area

4.6. Protection of Fauna

Apart from above measures to prohibit disturbance to any fauna and prevent fires, the following will be required:

» Any means of deliberately killing any kind of animal shall be strictly prohibited, unless it is an invasive declared pest that needs to be controlled

» Where fauna pests need to be controlled, this shall be done by a suitably qualified person/company in a manner that will not affect any other species of the resident biodiversity

» Fence lines and similar structures shall be inspected on a regular basis to detect and remove any snares that may have been put to ensnare animals

» Should snares be detected on a regular basis, the necessary investigative steps shall be taken to determine who is responsible for these activities and the matter shall be referred to the local conservation and policing authorities for follow-up procedures

» Driving speeds shall be limited to 40 km/h or less during construction and operation of the facility on all internal access routes of the project to limit the incidence of road kills of mammals, reptiles and amphibians and the deterioration of roads

» Driving speeds on public roads through the area shall be strictly kept within the speeds indicated on those roads

» After heavy rains when amphibian activity can be high, especially near watercourses, no driving shall be undertaken on internal access roads between dawn and dusk (when these species are most active and move around), except in the case of an emergency