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# EMP FOR THE PROPOSED 132KV POWER LINE ASSOCIATED WITH THE KORANA WIND ENERGY FACILITY ON A SITE NEAR POFADDER, NORTHERN CAPE PROVINCE

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## DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

Submitted as part of the Final Basic Assessment Report

February 2015

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## PROJECT DETAILS

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- DEA Reference No.** : 14/12/16/3/3/1/1348
- Title** : Environmental Management Plan of the proposed  
132kV Power Line associated with the Korana Wind  
Energy Facility on a site near Pofadder, Northern Cape  
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- Client** : South Africa Mainstream Renewable Power  
Developments (Pty) Ltd
- Report Status** : Draft EMPr submitted as part of the Final Basic  
Assessment Report

**When used as a reference this report should be cited as:** Savannah Environmental (2015) Proposed  
132kV Power line associated with the Korana Wind Energy Facility on a site near Pofadder, Northern  
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## **DEFINITIONS AND TERMINOLOGY**

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**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 of collecting, organising, analysing, interpreting and communicating information which is relevant.

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

**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.

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

**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.

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

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

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

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

**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.

**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 as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

**Interested and Affected Party:** Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

**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.

**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).

**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.

**Waste:** Any substance, whether or not that substance can be reduced re-used, recycled and recovered; that is surplus, unwanted, rejected, discarded, abandoned or disposed of which the generator has no further use for the purposes of production. Any product which must be treated and disposed of, that is identified as waste by the minister of Environmental affairs (by notice in the Gazette) and includes waste generated by the mining, medical or other sectors, but: A by-product is not considered waste, and portion of waste, once re-used, recycled and recovered, ceases to be waste (Van der Linde and Feris, 2010; pg. 186).

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## PROJECT DETAILS

## CHAPTER 1

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South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream) is proposing to establish the Korana Wind Energy Facility and associated infrastructure on a site located on Portion 1 and 2 of the farm Namies Suid 212 and Portion 1 of the Farm Poortje 209, approximately 25 km south-west of Pofadder in the Northern Cape Province. The site falls within the Khai-Ma Local Municipality in the Northern Cape Province. The purpose of the proposed wind energy facility will be to generate electricity to be fed into the National electricity grid. The entire facility would have a generating capacity of up to 140MW.

An Environmental Impact Assessment for the proposed Korana Wind Energy Facility is in the process of being conducted under the following DEA reference number: **(14/12/16/3/3/2/682)**. This facility forms part of a larger Renewable Energy Facility which also incorporates two other commercial wind energy facilities and one (1) solar energy facility and associated infrastructure. A broader area of approximately 175 km<sup>2</sup> is being considered within which the renewable energy facilities are to be constructed.

In order to evacuate the power from the Korana Wind Energy Facility (140MW) into the Eskom grid, the construction of a 132kV power line will be required. This Environmental Management Programme addresses the proposed grid connection options associated with this wind energy facility. Two options are being considered for the grid connection of this wind energy facility (Refer to Figure 1).

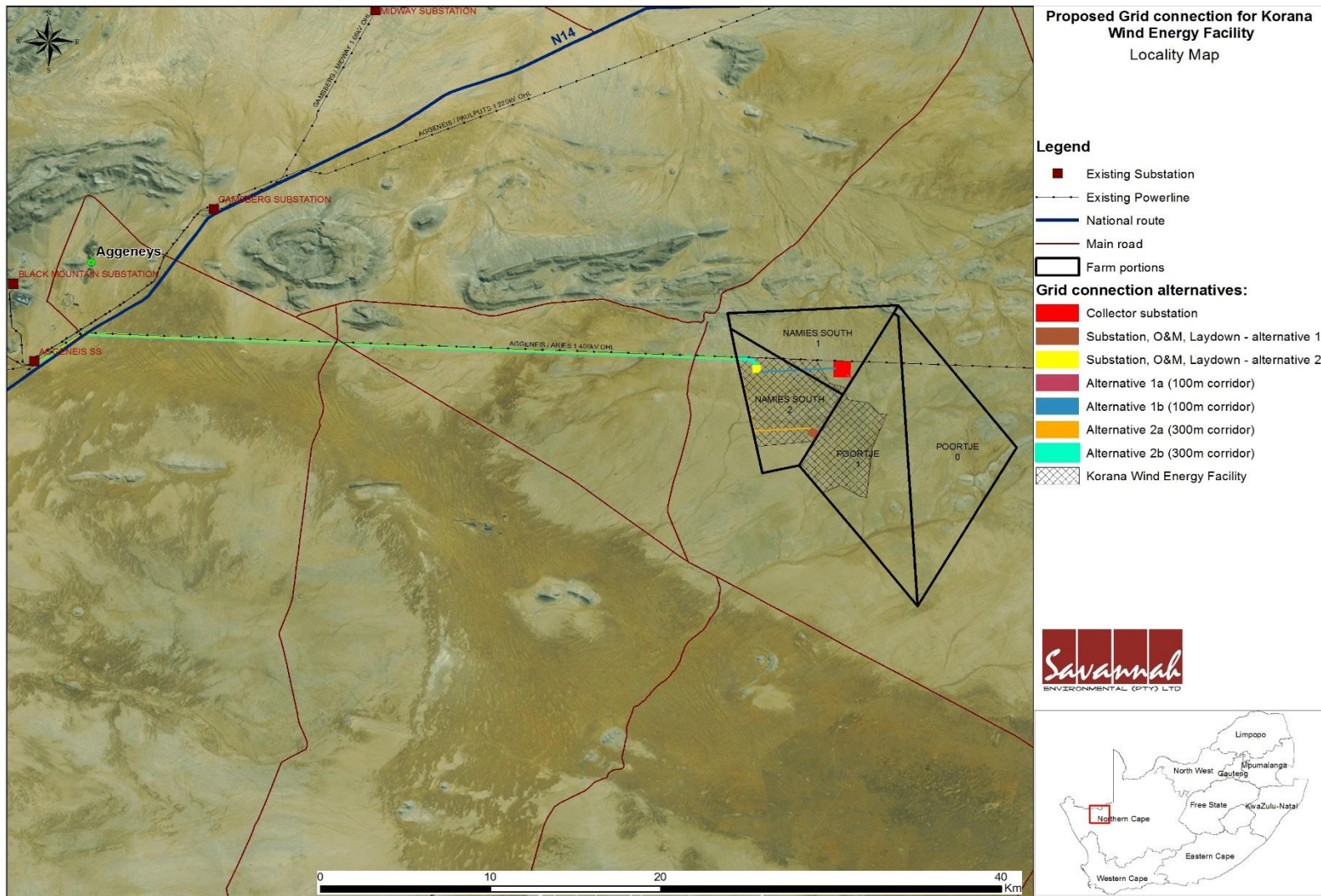
1. Connect the on-site substation to the proposed 400kV Khai-Ma Collector Substation (Alternative 1). The proposed 400kV Khai-Ma Collector Substation will connect to the existing Eskom Aggeneys–Aries 400kV power line, which traverses the proposed site, via a loop-in loop-out connection.
2. Connect the proposed on-site substation directly to the existing Eskom Aggeneys 400kV substation via a new 132kV power line (Alternative 2), a distance of approximately 45km. This power line will be constructed adjacent to the existing Eskom Aggeneys–Aries 400kV power line.

The following properties will be affected by the construction of Alternatives 1 and Alternative 2 by the proposed power line:

- » Remainder of the Farm Namies South 212 (Alternative 1 and Alternative 2)
- » Portion 2 of the Farm Namies South 212 (Alternative 1 and Alternative 2)
- » Remainder of the Farm Aggeneys 56 (Alternative2)
- » Portion 1 Aggeneys 56 (Alternative2)
- » Remainder Bloemhoek 61 (Alternative2)
- » Portion 1 of the Farm Kykgat 87 (Alternative2)
- » Portion 2 of the Farm Kykgat 87 (Alternative2)

- » Remainder of the Farm Kykgat 87 (Alternative2)
- » Portion 1 of the Farm Vogelstruis Hoek 88 (Alternative2)
- » Remainder of the Farm Vogelstruis Hoek 88 (Alternative2)
- » Portion 1 of the Farm Poortje 209 (Alternative2)

A 100m wide corridor for alternative 1 and 300m for Alternative 2 was assessed within which the 31m servitude will be negotiated.



**Figure 1.1:** Locality map showing the grid connection alternatives for the proposed 132kV power line associated with the Korana Wind Energy Facility on a site near Pofadder, Northern Cape Province

## 1.1. Potential impacts

Through the assessment of impacts associated with the proposed construction of a 132kV power line connecting the proposed Korana Wind Energy Facility to the electricity grid via either the proposed 400kV Khai-Ma Collector Substation (Alternative 1) or the existing Eskom Aggeneys 400kV substation (Alternative 2), both potentially positive and negative impacts have been identified. The most significant environmental impacts associated with the proposed project include:

### **Alternative 1:**

**Impacts on vegetation:** The overall impact on vegetation and ecological processes and functioning as a result of the construction and operation of the proposed power line is likely to be of low significance due to the close proximity of the two substation options to the proposed 400kV Khai-Ma Collector Substation.

**Impacts on terrestrial fauna:** Faunal disturbance during the construction phase of the project is inevitable, this impact will however be temporary and most fauna are likely to return to the area once construction has been completed. Areas of High sensitivity and their buffers must be avoided by laydown areas and other associated infrastructure. Provided that the mitigation measures as described in this report are implemented, the development of the site should not lead to a significant impact on terrestrial fauna.

**Impacts on avifauna:** The proposed power line will impact on avifauna as a result of displacement and disturbance during construction, and collisions and electrocution during operation. Impacts are expected to be of medium significance which, in most instances, could be reduced to a low impact through appropriate mitigation.

**Impacts on heritage sites:** The impacts to heritage resources are considered to be of low significance largely due to the limited presence of such sites within the study area. Impacts on the cultural landscape are expected as a result of the visual impact associated with the power line. These would however be restricted to the footprint of the wind energy facility with the implementation of power line Alternative 1.

**Visual impacts:** The proposed 132kV power line will impact on sensitive receptors of the study area during both the construction and operational phase.

Impacts are expected to be of moderate significance. Opportunity to mitigate visual impacts are limited due to the nature of the infrastructure proposed. Visual impacts would however be minimised to some extent with the implementation of power line Alternative 1 as the power line would be restricted to the footprint of the wind energy facility.

**Social impacts:** Social impacts are expected during all phases of the development and are expected to be both positive and negative. Impacts are expected to be of high moderate and low significance for the various issues. Impacts can be minimised or enhanced through the implementation of the recommended management measures.

**Preferred alternative:** The preferred alternative is dependent on the on-site substation position which is authorised. In terms of the EIA undertaken for the wind energy facility, Substation Alternative 1A is preferred for implementation.

#### **Alternative 2:**

**Impacts on vegetation:** The overall impact on vegetation and ecological processes and functioning as a result of the construction and operation of the proposed power line is likely to be of low significance but higher than that expected for Alternative 1 due to the longer length of this power line alternative and the associated potential for higher levels of disturbance.

**Impacts on terrestrial fauna:** Faunal disturbance during the construction phase of the project is inevitable, this impact will however be temporary and most fauna are likely to return to the area once construction has been completed. Areas of High sensitivity and their buffers must be avoided by laydown areas and other associated infrastructure. Provided that the mitigation measures as described in this report are implemented, the development of the site should not lead to a significant impact on terrestrial fauna.

**Impacts on avifauna:** The proposed power line will impact on avifauna as a result of displacement and disturbance during construction, and collisions and electrocution during operation. Impacts are expected to be of medium significance which and higher than that expected for Alternative 1 due to the longer length of this power line alternative and the associated potential for higher

levels of disturbance. In most instances impacts could be reduced to a low impact through appropriate mitigation.

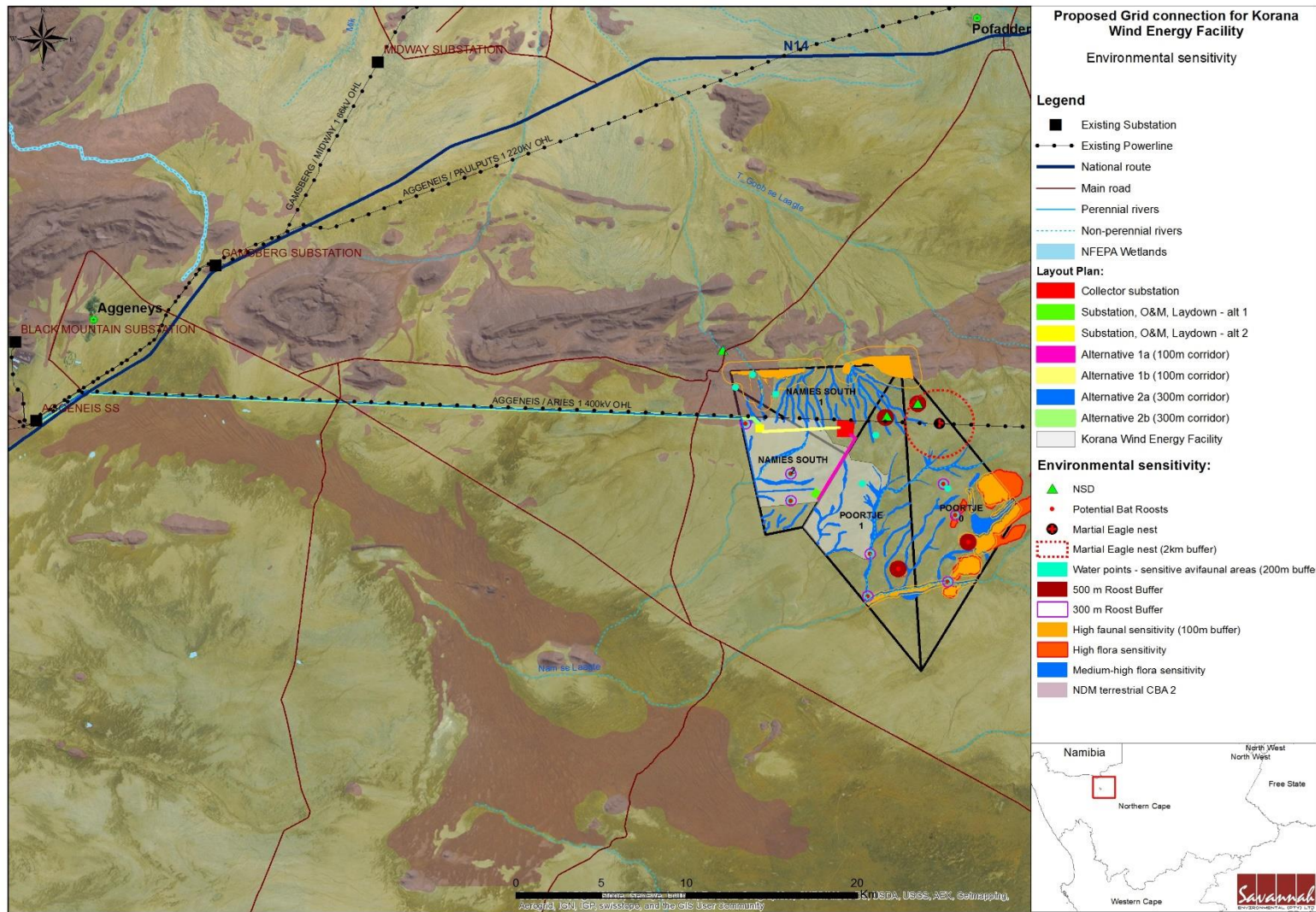
**Impacts on heritage sites:** The impacts to heritage resources are considered to be of low significance largely due to the limited presence of such sites within the study area. Impacts on the cultural landscape are expected as a result of the visual impact associated with the power line. These would however be minimised through the placement of the new power line adjacent to the existing 400kV power line to Aggeneys Substation.

**Visual impacts:** The proposed 132kV power line will impact on sensitive receptors of the study area during both the construction and operational phase. Impacts are expected to be of moderate significance. Opportunity to mitigate visual impacts are limited due to the nature of the infrastructure proposed. Visual impacts would however be minimised through the placement of the new power line adjacent to the existing 400kV power line to Aggeneys Substation.

**Social:** The social impacts during the construction, operational and decommission phase will have an impact on the areas in the vicinity. Neither alternative has preference in terms of social aspects over each other.

**Preferred alternative:** The preferred alternative is dependent on the on-site substation position which is authorised. In terms of the EIA undertaken for the wind energy facility, Substation Alternative 1A is preferred for implementation.

A sensitivity map has been prepared from the findings of the Basic Assessment studies undertaken (refer to **Figure 1.2**). The study area is considered to have a **low to moderate sensitivity** based on the extent of the area to be used for the power line. Some areas of high sensitivity have been identified due to the occurrence of sensitive vegetation. Placement of infrastructure within these areas should be avoided as far as possible.



**Figure 1.2:** Environmental Sensitivity map for the proposed 132kv power line associated with the Korana Wind Energy Facility on a site near Pofadder, Northern Cape Province



## **1.2. Activities and Components associated with the Construction of Power Lines**

### **1.2.1. Construction Phase**

The activities associated with the construction of the 132kV power line will include site clearance and construction of access roads to facilitate access the site (where required).

Power lines are constructed in the following simplified sequence:

- Step 1: Determination of technically feasible route/s;
- Step 2: EIA input into route selection;
- Step 3: Negotiation of final route with affected landowners;
- Step 4: Survey of the route;
- Step 5: Determination of the conductor type;
- Step 6: Selection of best-suited conductor, towers, insulators, foundations;
- Step 7: Final design of line and placement of towers;
- Step 8: Issuing of tenders, and award of contract to construction companies;
- Step 9: Vegetation clearance and construction of access roads (where required);
- Step 10: Tower pegging;
- Step 11: Construction of foundations;
- Step 12: Assembly and erection of towers;
- Step 13: Stringing of conductors;
- Step 14: Rehabilitation of disturbed area and protection of erosion sensitive areas;
- Step 15: Testing and commissioning.

Construction of the proposed power line will take approximately 12 months to complete.

### **1.2.2. Operation Phase**

The proposed power line and associated servitude and access roads will require routine maintenance work throughout the operation period. The site will be accessed using existing roads in the area as well as via access roads established during the construction phase.

### ***1.2.3. Decommissioning Phase***

The power line is expected to have a lifespan of more than 40 years (with maintenance) and the infrastructure would only be decommissioned once it has reached the end of its economic life, or if no longer required. Upon decommissioning, the power line would be disassembled and removed from site.

An Environmental Management Programme (EMPr) is defined as “an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts associated with the planning, construction, operation and decommissioning of a project are avoided or mitigated, and that the positive benefits of the projects are enhanced.”<sup>1</sup> 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 EMP is to ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation. An effective EMP is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMP provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (i.e. site clearing and site establishment), during the construction activities themselves (i.e. erosion, noise, dust, and visual impacts), during site rehabilitation (i.e. soil stabilisation, re-vegetation), during operation and during decommissioning (i.e. similar to construction phase activities).

This EMP 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 or permit issued for the proposed project. The EMPr has been developed as a set of environmental specifications (i.e. principles of environmental management), 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).

This EMPr has the following objectives:

- » Outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction and rehabilitation, operation, and decommissioning phases of the project in order to manage and minimise the extent of potential environmental impacts associated with the power line.

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<sup>1</sup> Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans*. 2005

- » Ensure that all the phases of the project do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- » Identify entities responsible for the implementation of the measures and outline functions and responsibilities.
- » Propose mechanisms and frequency for monitoring compliance, and preventing long-term or permanent environmental degradation.
- » Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the BA process.

The management and mitigation measures identified within the Basic Assessment (BA) process are systematically addressed in this EMPr, and ensure the minimisation of adverse environmental impacts to an acceptable level.

Mainstream must ensure that the implementation of the project complies with the requirements of all environmental authorisations, permits, and obligations emanating from relevant environmental legislation. This obligation is partly met through the development and the implementation of this EMPr and through its integration into the contract documentation. Since this EMP is part of the BA process, it is important that this document be read in conjunction with the Basic Assessment Report compiled for this project. This will contextualise the EMP and enable a thorough understanding of its role and purpose in the integrated environmental management process. Should there be a conflict of interpretation between this EMPr and the environmental authorisation, the stipulations in the environmental authorisation shall prevail over that of the EMPr, unless otherwise agreed by the authorities in writing. Similarly, any provisions in legislation overrule any provisions or interpretations within this EMPr.

This EMPr shall be binding on all the parties involved in the construction and operational phases of the project, and shall be enforceable at all levels of contract and operational management within the project.

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

- » Key legislation applicable to the development;
- » Planning and design activities;
- » Construction activities;
- » Operation activities; and
- » Decommissioning activities.

These chapters set out the procedures necessary for the construction of the proposed substation and power line to minimise environmental impacts and achieve environmental compliance. For each of the phases of implementation, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The EMP has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions, monitoring requirements and performance indicators. A specific EMPr table has been established for each environmental objective. The information provided within the EMPr table for each objective is outlined below.

**a). OBJECTIVE: Description of the objective, which is necessary to meet the overall goals; which take into account the findings of the BA specialist studies**

<b>Project Component/s</b>	» List of project components affecting the objective.
<b>Potential Impact</b>	» Description of potential environmental impact if objective is not met.
<b>Activity/Risk Source</b>	» Description of activities which could affect achieving objective.
<b>Mitigation: Target/Objective</b>	» Description of the target and/or desired outcomes of mitigation.

Mitigation: Action/Control	Responsibility	Timeframe
List specific action(s) required to meet the mitigation target/objective described above.	Who is responsible for the measures?	Periods for implementation.

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

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

- » Planned activities change;
- » Modification or addition to environmental objectives and targets;
- » Relevant legal or other requirements are changed or introduced; or
- » Significant progress has been made on achieving an objective or target such that it should be re-examined to determine if it is still relevant, should be modified, etc.

### 3.1. Project Team

This draft EMPr was compiled by and had input from:

	<b>Name</b>	<b>Company</b>
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<b>Specialist input:</b>	Dave McDonald	Bergwind Botanical Surveys & Tours
	Chris van Rooyen	Chris van Rooyen Consulting
	Werner Marias	Animalia
	Tony Barbour	Tony Barbour Environmental Consulting and Research
	Mandy van der Westhuizen	NuLeafe Planning & Environment
	Lourens du Plessis	MetroGIS
	Tim Hart	ACO Associates
	Johan van Tol	HydroPedological Solutions
	Brian Colloty	Scherman Colloty and Associates
	Jonathan Aronson and Jennifer Slack	Arcus Consultancy Services

Karen Jodas, the principle Environmental Assessment Practitioner (EAP) for the project, is a registered Professional Natural Scientists (in the practice of environmental science) with the South African Council for Natural Scientific Professions. She has extensive knowledge and experience in environmental impact assessment and environmental management, having being involved in EIA processes over the past eighteen (18) years. She has managed and drafted EMPs for other power line projects throughout South Africa.

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

- » National Environmental Management Act (Act No 107 of 1998).
- » EIA Regulations, published under Chapter 5 of the NEMA (GNR R544, GNR 546 in Government Gazette 33306 of 18 June 2010).
- » Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - \* Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010).
  - \* Public Participation in the EIA Process (DEA, 2010).
  - \* Integrated Environmental Management Information Series (published by DEA)

Several other Acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed in the BA Report. A review of legislative requirements applicable to the proposed project is provided in Table 4.1.



**Table 4.1:** Relevant legislative and permitting requirements applicable to the proposed power line

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
<b>National Legislation</b>			
National Environmental Management Act (Act No. 107 of 1998)	<ul style="list-style-type: none"> <li>» The Basic Assessment Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations.</li> <li>» In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation.</li> <li>» In terms of GN R543, R544 and R546 of 18 June 2010, a Basic Assessment Process is required to be undertaken for the proposed project.</li> </ul>	<ul style="list-style-type: none"> <li>» Department of Environmental Affairs (DEA)– competent authority</li> <li>» Department of Environmental and Nature Conservation (DENC)-- commenting authority</li> </ul>	<ul style="list-style-type: none"> <li>» The listed activities triggered by the proposed substation/s have been identified and assessed in the Basic Assessment Process being undertaken. This Basic Assessment Report will be submitted to the competent and commenting authority in support of the application for authorisation.</li> </ul>
National Environmental Management Act (Act No. 107 of 1998)	<ul style="list-style-type: none"> <li>» A project proponent is required to consider a project holistically and to consider the cumulative effect of potential impacts.</li> <li>» In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment</li> </ul>	<ul style="list-style-type: none"> <li>» DEA</li> </ul>	<ul style="list-style-type: none"> <li>» While no permitting or licensing requirements arise directly, the holistic consideration of the potential impacts of the proposed project has found application in the EIA Phase.</li> <li>» The implementation of mitigation measures are included as part of the Draft EMP and will continue to apply throughout the life cycle</li> </ul>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	associated with a project is avoided, stopped or minimised.		of the project.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	<ul style="list-style-type: none"> <li>» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53).</li> <li>» A list of threatened and protected species has been published in terms of S56 (1) - Government Gazette 29657.</li> <li>» Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations).</li> <li>» Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), and vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National</li> </ul>	<ul style="list-style-type: none"> <li>» DEA</li> <li>» NC DENC</li> </ul>	<ul style="list-style-type: none"> <li>» An Ecological Impact Assessment has been undertaken as part of the EIA process. A permit may be required should any listed plant species on site be disturbed or destroyed as a result of the proposed development.</li> </ul>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011).</p> <p>» This Act also regulates alien and invader species.</p>		
<p>National Forests Act (Act No. 84 of 1998)</p>	<p>» According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister'.</p> <p>» The list of protected tree species was published in GN 877 of 22 November 2013.</p>	<p>» National Department of Agriculture, Forestry and Fisheries (DAFF)</p>	<p>» A permit would need to be obtained for any protected trees that are affected by the proposed project.</p> <p>» No protected trees were found in the study area so permits would not be required for removal of such trees. However, a permit would be required from Northern Cape Province, Department of Environment &amp; Nature Conservation to clear natural vegetation mainly along the transmission line grid where poles would be planted.</p>
<p>Conservation of Agricultural Resources Act (CARA) (Act No 43 of 1983)</p>	<p>» Prohibition of the spreading of weeds (S5)</p> <p>» Classification of categories of weeds &amp; invader plants (Regulation 15 of GN R1048) &amp; restrictions in terms of where these species may occur.</p> <p>» Requirement &amp; methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).</p>	<p>» DAFF</p>	<p>» This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.</p> <p>» The permission of agricultural</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
			authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	<ul style="list-style-type: none"> <li>» The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.</li> <li>» In terms of the regulations published in terms of this Act (GN 921 of November 2013), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities.</li> <li>» Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that               <ul style="list-style-type: none"> <li>(a) The containers in which any waste is stored, are intact and not corroded or in any other way rendered unfit for the safe storage of waste;</li> <li>(b) Adequate measures are taken to prevent accidental spillage or leaking;</li> <li>(c) The waste cannot be blown away;</li> <li>(d) Nuisances such as odour, visual impacts and breeding of vectors do not arise; and</li> <li>(e) Pollution of the environment and harm to health are prevented.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>» DEA (hazardous waste)</li> <li>» NC DENC (general waste)</li> </ul>	<ul style="list-style-type: none"> <li>» As no waste disposal site is to be associated with the proposed project, no permit is required in this regard.</li> <li>» Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act. This is detailed in the EMP for the project.</li> <li>» The volumes of waste to be generated and stored on the site during construction of the power line will not require a waste license (provided these remain below the prescribed thresholds).</li> </ul>
National Environmental	» S18, S19 and S20 of the Act allow	» DEA	» While no permitting or licensing

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
<p>Management: Air Quality Act (Act No. 39 of 2004)</p>	<p>certain areas to be declared and managed as "priority areas".</p> <ul style="list-style-type: none"> <li>» Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards.</li> <li>» The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.</li> <li>» Dust control regulations promulgated in November 2013 may require the implementation of a dust management plan.</li> </ul>	<ul style="list-style-type: none"> <li>» NC DENC</li> </ul>	<p>requirements arise from this legislation, this Act will find application during the construction phase of the project.</p> <ul style="list-style-type: none"> <li>» The Air Emissions Authority (AEL) may require the compilation of a dust management plan.</li> </ul>
<p>National Water Act (Act No. 36 of 1998)</p>	<ul style="list-style-type: none"> <li>» Under S21 of the Act, water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation.</li> <li>» In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.</li> </ul>	<ul style="list-style-type: none"> <li>» National Department of Water Affairs</li> <li>» Northern Cape Department of Water Affairs</li> </ul>	<ul style="list-style-type: none"> <li>» A water use license is required to be applied for or obtained if infrastructure (such as access roads) impacts on a wetland or watercourse (Section 21c and i).</li> <li>» If ground or surface water is planned to be abstracted and/ or stored for use at the facility (either during construction or operation), this may also require a water use licence (Section 21a and b).</li> </ul>
<p>Environment Conservation Act (Act No. 73 of 1989)</p>	<ul style="list-style-type: none"> <li>» National Noise Control Regulations (GN R154 dated 10 January 1992).</li> </ul>	<ul style="list-style-type: none"> <li>» DEA</li> <li>» Local Authorities</li> </ul>	<ul style="list-style-type: none"> <li>» There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with</li> </ul>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
<p>National Heritage Resources Act (Act No. 25 of 1999)</p>	<ul style="list-style-type: none"> <li>» S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including                             <ul style="list-style-type: none"> <li>» The construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length;</li> <li>» Any development or other activity which will change the character of a site exceeding 5 000 m<sup>2</sup> in extent</li> </ul> </li> <li>» The relevant Heritage Authority must be notified of developments such as linear developments (i.e. roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m<sup>2</sup>; or the re-zoning of a site exceeding 10 000 m<sup>2</sup> in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided.</li> <li>» Stand-alone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should be covered by the heritage component.</li> </ul>	<ul style="list-style-type: none"> <li>» South African Heritage Resources Agency</li> </ul>	<p>SANS 10328.</p> <ul style="list-style-type: none"> <li>» A Phase 1 heritage impact assessment has been undertaken as part of the EIA process.</li> <li>» A permit may be required should identified cultural or heritage sites on site be required to be disturbed or destroyed as a result of the proposed development.</li> </ul>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Veld and Forest Fire Act (Act 101 of 1998)	<ul style="list-style-type: none"> <li>» Provides requirements for veld fire prevention through firebreaks and required measures for fire-fighting. Chapter 4 places a duty on landowners to prepare and maintain firebreaks, and Chapter 5 places a duty on all landowners to acquire equipment and have available personnel to fight fires.</li> <li>» In terms of S21 the applicant would be obliged to burn firebreaks to ensure that should a veld fire occur on the property, that it does not spread to adjoining land.</li> <li>» In terms of S12 the firebreak would need to be wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material.</li> <li>» In terms of Section 17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.</li> </ul>	» DAFF	» While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project in terms of fire prevention and management.
Hazardous Substances Act (Act No. 15 of 1973)	» This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising, or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation	» Department of Health	» It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.</p> <ul style="list-style-type: none"> <li>» Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance;</li> <li>» Group IV: any electronic product;</li> <li>» Group V: any radioactive material.</li> <li>» The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.</li> </ul>		
<p>National Road Traffic Act (Act No 93 of 1996)</p>	<p>The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed.</p>	<ul style="list-style-type: none"> <li>» Provincial Department of Transport (provincial roads)</li> <li>» South African National Roads Agency Limited (national roads)</li> </ul>	<ul style="list-style-type: none"> <li>» Abnormal load/vehicle permit will not be required to transport the various components to site for construction.</li> </ul>



Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts.</p> <p>» The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.</p>		
<b>Provincial Legislation</b>			
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	<p>Provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.</p> <p><b>Manipulation of boundary fences</b></p> <p>19. No Person may –</p> <p>(a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed,</p>	» NC DENC	» A permit is required for any activities which involve species listed under schedule 1 or 2. The DENC permit office provides an integrated permit which can be used for all provincial and Threatened or Protected Species (TOPS)-related permit requirements.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;</p> <p>» The Act also lists protected fauna and flora under 3 schedules ranging from Specially protected (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1.</p>		

**Overall Goal:** undertake the pre-construction (planning and design) activities in a way that:

- » Ensures that the design 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 and community concerns and that these are appropriately addressed through design and planning (where appropriate);
- » Ensures that the best environmental options are selected for the linear components, including the access roads and power line alignments;
- » Enables the construction activities to be undertaken without significant disruption to other land uses and activities in the area.

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

## 5.1 Objectives

***OBJECTIVE 1: Ensure the design responds to identified environmental constraints and opportunities***

The major impact associated with the construction of the power line is likely to result from vegetation clearing that may be required beneath the power line in order to comply with fire risk and safety requirements. Faunal disturbance during the construction phase of the project is inevitable, this impact will however be temporary and most fauna are likely to return to the area once construction has been completed.

A sensitivity map has been prepared from the findings of the Basic Assessment studies undertaken (refer to **Figure 1.2**). The study area is considered to have a low to moderate sensitivity based on the extent of the area to be used for the power line. Some areas of high sensitivity have been identified due to the occurrence of sensitive fauna and flora. Placement of infrastructure within these areas should be avoided as far as possible.

<b>Component/s</b>	<ul style="list-style-type: none"> <li>» Substation (Alternative 1)</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Soil erosion</li> <li>» Impacts on flora and fauna</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Positioning of all the facilities components</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» The design of the facility responds to the identified environmental constraints and opportunities.</li> <li>» Site sensitivities are taken into consideration and avoided as far as practical, thereby mitigating potential impacts.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Plan and conduct pre-construction activities in an environmentally acceptable manner	Developer	Design phase
Obtain any additional environmental permits required (such as a water use license, biodiversity permits, etc.).	Developer	Project planning
Undertake negotiations with affected landowners and agree on landowner-specific conditions for construction and maintenance	Developer	Project planning
Undertake specialist walk-overs of the final power line route – ecology, heritage and avifauna	Specialists	Pre-construction
A rehabilitation plan should be drawn up that specifies the rehabilitation process	Developer in consultation with specialist	Pre-construction
Undertake a detailed geotechnical survey of the proposed tower positions in order to fully understand the soils in terms of founding conditions and erosion potential.	Developer	Design phase
The proposed power line should be marked with Bird Flight Diverters on the earth wire of the line for their entire length, 5 metres apart, alternating black and white.	Developer	Design phase
Plan to install anti-collision devices such as bird flappers onto the power lines where these cross avifaunal sensitive areas.	Developer	Design phase
The terms of this EMP and the Environmental Authorisation must be included in all tender documentation and Contractors contracts.	Developer	Tender process
Areas of High sensitivity and their buffers must be avoided. Only access and connecting roads may intrude on High sensitivity buffers if no other alternative exists.	Developer	Design phase
Submit a final layout to DEA prior to the commencement of construction. This layout should	Developer	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
provide information on all components of the project.		

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» The design meets the objectives and does not degrade the environment.</li> <li>» Design and layouts respond to the mitigation measures and recommendations in the EIA Report.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Review of the design by the Project Manager prior to the commencement of construction.</li> </ul>

### **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 power lines. Any issues and concerns raised should be addressed as far as possible in as short a timeframe as possible.

<b>Project component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Impacts on affected and surrounding landowners and land uses</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Activities associated with power line construction</li> <li>» Activities associated with power line operation</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Effective communication with affected and surrounding landowners</li> <li>» Addressing of any issues and concerns raised as far as possible in as short a timeframe as possible</li> </ul>

Mitigation: Action/control	Responsibility	Timeframe
Compile and implement a grievance mechanism procedure for the public (following the guidelines of the grievance mechanism in Appendix A) 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 raised by interested and affected parties, and the process that will be followed to address issues.	Developer	Pre-construction (construction procedure) Pre-operation (operation procedure)
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	Developer	Pre-construction (construction procedure) Pre-operation (operation procedure)

Mitigation: Action/control	Responsibility	Timeframe
line with the South African Labour Law.		procedure)

<b>Performance Indicator</b>	» Effective communication procedures in place.
<b>Monitoring</b>	» An incident reporting system should be used to record non-conformances to the EMP.

***OBJECTIVE 3: Ensure the selection of the best environmental option for the alignment of development areas, laydown areas and access roads***

No protected plant species were identified within the proposed development area. Fauna listed in the IUCN red list is known to be present on site.

A preconstruction walk-through of the facility is recommended in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DAFF permitting requirements.

Opportunities to mitigate the negative impacts of large-scale developments largely arise during the Pre-Construction (Planning & Design) stage. The correct choice of footprint location and layout is paramount, thus ecosystem components such as biodiversity and ecosystem function should be given full consideration during the design phase, as determined by the Environmental Impact Assessment. The timing of pre-commencement, construction, maintenance and decommissioning activities also provides opportunities to reduce negative impacts on biodiversity.

<b>Project Component/s</b>	» Power line » Access roads, where required
<b>Potential Impact</b>	» Placement that damages and degrades the environment unnecessarily, particularly with respect to habitat destruction, loss of indigenous flora, establishment, and persistence of alien invasive plants, and erosion.
<b>Activities/Risk Sources</b>	» Activities associated with power line construction » Activities associated with power line operation
<b>Mitigation: Target/Objective</b>	» To ensure selection of best environmental option for positioning alignment of proposed infrastructure. » Environmental sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts.

Mitigation: Action/Control	Responsibility	Timeframe
<p>Undertake pre-construction walk-through survey for the final development footprint for protected flora.</p> <p>The final footprint investigation (walkthrough) is aimed to fully inform the developer, responsible conservation authority (that will issue the relevant destruction permits), contractors, EO and ECO regarding:</p> <ul style="list-style-type: none"> <li>» Location and nature of any nesting sites or active burrows of vertebrate species (birds, amphibians, reptiles and mammals), that will have to be inspected and cleared/relocated prior to construction by the contractor or duly appointed person(s).</li> <li>» Approximate location and nature of any alien invasive species that will have to be cleared by the contractor.</li> <li>» Location and nature of any other significant environmental concerns, e.g. extreme gully erosion that will need to be addressed by the contractor to prevent any unnecessary (further) degradation of the development footprint.</li> </ul>	<p>Developer, carried out by Specialist</p>	<p>Design review phase</p>
<p>Use design-level mitigation measures recommended in respect of habitat and ecosystem intactness and prevention of species loss as detailed within the EIA Report</p>	<p>Developer</p>	<p>Prior to submission of final construction layout plan</p>
<p>Utilise existing roads as far as possible. Where new access roads must be implemented, plan these and machinery turning points to minimise the impacted area, avoid the initiation of accelerated soil erosion and prevent unnecessary compaction and disturbance of topsoil, prevent obstruction or alteration of natural water flow</p>	<p>Developer</p>	<p>Design phase</p>
<p>Compile a comprehensive stormwater management and erosion control plan for the footprint area as part of the final design of the project</p>	<p>Developer and relevant specialist</p>	<p>Design phase</p>
<p>After the permissible biodiversity has been determined, compile a comprehensive vegetation and habitat rehabilitation management plan.</p>	<p>Developer and relevant specialist</p>	<p>Design phase</p>

<p><b>Performance Indicator</b></p>	<ul style="list-style-type: none"> <li>» All associated temporary and permanent infrastructure and access road alignments meet environmental objectives.</li> <li>» Grid connection and road alignments meet environmental objectives.</li> <li>» Ecosystem fragmentation is kept to a minimum.</li> <li>» Ecosystem functionality is retained and any degradation prevented.</li> </ul>
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**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 the ECO prior to the commencement of activity.



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

- » Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
- » Enables construction activities to be undertaken without significant disruption to other land uses and activities in the area, in particular concerning noise impacts, farming practices, traffic and road use, and effects on local residents.
- » Minimises the impact on the indigenous natural vegetation, and habitats of ecological value.
- » Minimises impacts on fauna (including birds) in the study area.
- » Minimises the impact on heritage sites should they be uncovered.
- » Establishes an environmental baseline during construction activities on the site, where possible.

### **6.1 Institutional Arrangements: Roles and Responsibilities for the Construction Phase**

As the proponent, Mainstream must ensure that the 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 EMP, and the implementation of the EMP through its integration into the contract documentation. Mainstream will retain various key roles and responsibilities during the construction phase.

***OBJECTIVE 1: Establish clear reporting, communication, and responsibilities in relation to overall implementation of the EMP***

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Site Manager; Safety, Health and Environment Representative; Environmental Control Officer (ECO) 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.

**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).

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.

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 EMP are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
- » Ensure that the compliance of the EMP is monitored through regular and comprehensive inspection of the site and surrounding areas.
- » Ensure that if the EMP conditions or specifications are not followed then appropriate measures are undertaken to address 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.

## 6.2 Objectives

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

### ***OBJECTIVE 1: Minimise impacts related to inappropriate site establishment***

The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Hazards to landowners and public.</li> <li>» Damage to indigenous natural vegetation, due largely to ignorance of where such areas are located.</li> <li>» Loss of threatened plant species</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Excavations.</li> <li>» Movement of construction vehicles in the area and on-site.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To secure the site against unauthorised entry.</li> <li>» To protect members of the public/landowners/residents.</li> <li>» No loss of or damage to sensitive vegetation in areas outside the immediate development footprint.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Secure site, working areas and excavations in an appropriate manner, as agreed with the Site Manager and EO.	Contractor	Site establishment, and duration of construction
Where necessary control access, fence, and secure area.	Contractor	Site establishment, and duration of construction
Fence and secure contractor's equipment camp.	Contractor	Site establishment

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Where the public could be exposed to danger by any of the works or site activities, the contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in English, Afrikaans and any other relevant local languages, all to the approval of the Site Manager.	Contractor	Site establishment and duration of construction
All unattended open excavations shall be adequately demarcated and/or fenced. Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.	Contractor	Site establishment and duration of construction
Establish appropriately bunded areas for storage of hazardous materials (i.e. fuel/chemicals to be required during construction).	Contractor	Site establishment
Establish the necessary ablution facilities with chemical toilets and provide adequate sanitation facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate walking distance. Provide sanitary bins for female workers.	Contractor	Site establishment, and duration of construction
Ablution facilities must be cleaned on a regular basis.	Contractor	Site establishment, and duration of construction
Ablution or sanitation facilities should not be located within 100 m from a 1:100 year flood line including drainage lines.	Contractor	Site establishment, and duration of construction
Supply adequate (closable, tamper proof) waste collection bins at site where construction is being undertaken.	Contractor	Site establishment, and duration of construction
Separate bins should be provided for general and hazardous waste.	Contractor	Site establishment, and duration of construction
As far as possible, provision should be made for separation of waste for recycling.	Contractor	Site establishment, and duration of construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Site is secure and there is no unauthorised entry.</li> <li>» No members of the public/ landowners injured.</li> <li>» Appropriate and adequate waste management and sanitation facilities provided at construction site.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» An incident reporting system will be used to record non-</li> </ul>

	<p>conformances to the EMP.</p> <ul style="list-style-type: none"> <li>» ECO to monitor all construction areas on a continuous basis until all construction is completed. Non-conformances will be immediately reported to the site manager.</li> </ul>
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**OBJECTIVE 2: Appropriate management of the construction site and construction workers**

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Damage to indigenous natural vegetation and sensitive areas.</li> <li>» Damage to and/or loss of topsoil (i.e. pollution, compaction etc.).</li> <li>» Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities.</li> <li>» Pollution/contamination of the environment.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Vegetation clearing and levelling of equipment storage area/s.</li> <li>» Access to and from the equipment storage area/s.</li> <li>» Ablution facilities.</li> <li>» Contractors not aware of the requirements of the EMP, leading to unnecessary impacts on the surrounding environment.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Limit equipment storage within demarcated designated areas.</li> <li>» Ensure adequate sanitation facilities and waste management practices.</li> <li>» Ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
The siting of the construction equipment camp/s must take cognisance of any sensitive areas identified by the EIA studies and reflected on the sensitivity map (Figure 1.2).	Contractor	Pre-construction
As far as possible, minimise vegetation clearing and levelling for equipment storage areas.	Contractor	Site establishment, and during construction
Rehabilitate all disturbed areas as soon as construction is complete within an area. No exotic plants may be used in rehabilitation. Only indigenous plants of the area may be used.	Contractor	Construction
Ensure waste containers are maintained and emptied on a regular basis.	Contractor	Duration of construction
Ensure that all personnel have the appropriate level of	Contractor	Duration of

Mitigation: Action/Control	Responsibility	Timeframe
environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm. This can be achieved through the provision of appropriate environmental awareness training to all personnel. Records of all training undertaken must be kept.		construction
Contractors must use chemical toilets/ablution facilities provided on site; no ablution activities will be permitted outside the designated areas. A minimum of one toilet shall be provided per 15 persons or less at each working area such as the Contractor's camp.	Contractor and sub-contractor/s	Duration of contract
Ensure ablution facilities are appropriately maintained. Ablutions must be cleaned regularly and associated waste disposed of at a registered/permitted waste disposal site. Ablutions must be removed from site when construction is completed.	Contractor	Duration of construction
Cooking and eating of meals must take place in a designated area.	Contractor and sub-contractor/s	Duration of contract
No firewood or kindling may be gathered from the site or surrounds.	Contractor and sub-contractor/s	Duration of contract
No open fires are permitted on site and construction personnel must be made aware of the consequences of starting a fire on site to avoid damage to neighbouring farms.	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 plants may be collected from site for medicinal or any other purpose.	Contractor	Duration of contract
No one may disturb flora or fauna in/outside of the demarcated construction area/s.	Contractor and sub-contractor/s	Duration of contract
Firefighting equipment and training must be provided before the construction phase commences.	Contractor and sub-contractor/s	Duration of contract
A code of conduct for construction workers should be implemented.	Contractor and sub-contractor/s	Construction
Contractors must ensure that all workers before commencing work are informed of the conditions contained in the EMPr, specifically consequences of stock theft and trespassing on adjacent farms.	Contractor and sub-contractor/s	Construction



Mitigation: Action/Control	Responsibility	Timeframe
On completion of the construction phase, all construction workers must leave the site.	Contractor and sub-contractor/s	Construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» The construction equipment camps have avoided sensitive areas.</li> <li>» Ablution and waste removal facilities are in a good working order and do not pollute the environment due to mismanagement.</li> <li>» All areas are rehabilitated promptly after construction in an area is complete.</li> <li>» Excess vegetation clearing and levelling is not undertaken.</li> <li>» No complaints regarding contractor behaviour or habits.</li> <li>» Appropriate training of all staff is undertaken prior to them commencing work on the construction site.</li> <li>» Code of Conduct drafted before commencement of construction phase.</li> </ul>
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<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Regular audits of the construction camps and areas of construction on site by the ECO.</li> <li>» Proof of disposal of sewage at an appropriate wastewater treatment works.</li> <li>» An incident reporting system should be used to record non-conformances to the EMP.</li> <li>» Observation and supervision of Contractor practices throughout construction phase by the ECO.</li> <li>» Complaints will be investigated and, if appropriate, acted upon.</li> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> </ul>
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***OBJECTIVE 3: Maximise local employment and business opportunities associated with the construction phase***

Although limited, employment opportunities could be created during the construction phase, specifically for semi-skilled and unskilled workers, use should be made of local labour as far as possible.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	» The opportunities and benefits associated with the creation of local employment and business.
<b>Activities/Risk Sources</b>	» Contractors who make use of their own labour for unskilled tasks, thereby reducing the employment and business

	<ul style="list-style-type: none"> <li>» opportunities for locals.</li> <li>» The inflow of various specialists from outside the study area and even abroad.</li> <li>» Sourcing of individuals with skills similar to the local labour pool outside the municipal area.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Employment of a maximum number of low-skilled to semi-skilled workers for the project from the local area where possible.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Construction workers should be recruited, as far as possible, from the local area.	Contractor	Duration of construction
Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses, and SMMEs from the local sector.	Developer	Pre-construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» The involvement of local labour and previously disadvantaged individuals is promoted.</li> <li>» Labour, entrepreneurs, businesses, and SMMEs from the local sector are awarded jobs, where possible, based on requirements in the tender documentation.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Developer and or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase.</li> </ul>

***OBJECTIVE 4: Management of the Contractors Camp / Accommodation Facility during construction to avoid negative environmental impacts***

Accommodation for construction workers will be required during the construction phase. The construction camp will also include workshop, ablutions and storage area. The location of the construction camp and accommodation facilities must be reflected in the layout plan.

<b>Project component/s</b>	<ul style="list-style-type: none"> <li>» Construction camp - Housing facilities (including kitchens, canteens, toilets, bedrooms and open spaces)</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Water contamination</li> <li>» Waste generation – potential soil pollution</li> <li>» Noise</li> <li>» Traffic</li> <li>» Safety risks</li> </ul>
<b>Activities/risk sources</b>	<ul style="list-style-type: none"> <li>» Construction workers</li> <li>» Living areas</li> <li>» Noise due to people residing on the site</li> </ul>

<b>Mitigation:</b>	» Appropriate management of housing facilities.
<b>Target/Objective</b>	» Zero complaints from surrounding landowners/ community/ stakeholders.
	» Zero pollution/ contamination due to construction camp and facilities.

Mitigation: Action/control	Responsibility	Timeframe
A Method Statement for the management of the contractors housing facility and camp considering the recommendations below is to be submitted to the ECO for approval.	Contractor and ECO	Prior to the start of construction
Ensure placement of accommodation/ construction camp / hostel away from the resident farmer's household.	Contractor and ECO	Prior to the start of construction
Ablution facilities shall be provided for use by construction staff residing on site.	Contractor	Construction
Waste bins shall strategically be located around the labour camp for ease of waste management	Contractor	Construction
No littering, burning or burying of waste shall be allowed. The waste should be removed regularly and appropriately disposed of.	Contractor	Construction
Develop a waste management plan for the construction camp.	Contractor	Construction
Excessive noise shall be prohibited at the accommodation facilities.	Contractor	Construction
No open fires shall be permitted out of the designated areas.	Contractor	Construction
Safe water for drinking shall be provided at the labour camp.	Contractor	Construction
Access to the labour camp shall be limited to labourers residing on site.	Contractor	Construction
Designated areas for smoking shall be provided at the labour camp.	Contractor	Construction
Due care must be employed in ensuring that water is not wasted at the labour camp.	Contractor	Construction
The construction camp used to house equipment and accommodate must be located in a disturbed or low sensitivity area and must be screened off as far as practical during the entire construction phase.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Avoid light pollution due to the construction camp and keep lighting to a minimum.	Contractor	Construction
The location of the construction equipment camp will take cognisance of any ecologically sensitive areas identified. The final location of this construction equipment camp shall be approved by the project ECO and agreed with the landowner.	Contractor	Pre-construction
No temporary site camps will be allowed outside the footprint of the development area.	Contractor	Contract duration

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Appropriate management of housing facilities.</li> <li>» No complaints from surrounding landowners/ community/ stakeholders.</li> <li>» No pollution/ contamination due to construction camp and facilities.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» ECO to monitor the construction camp for duration of construction period.</li> </ul>

**OBJECTIVE 5: Minimise impacts related to traffic management and transportation of equipment and materials to site**

The construction phase of the project will be the most significant in terms of generating traffic impacts; resulting from the transport of equipment and materials and construction crews to the site and the return of the vehicles after delivery of materials.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Impact of construction vehicles on road surfaces, and possible increased risk in accidents involving people and animals.</li> <li>» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted.</li> <li>» Deterioration of road pavement conditions (both surfaced and gravel road) due to increased traffic.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Construction vehicle movement.</li> <li>» Speeding on local roads.</li> <li>» Degradation of local road conditions.</li> <li>» Site preparation and earthworks.</li> <li>» Foundations or plant equipment installation.</li> </ul>

	<ul style="list-style-type: none"> <li>» Mobile construction equipment movement on-site.</li> <li>» Power line construction activities.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Minimise impact of traffic on local traffic volume, existing infrastructure, property owners, animals, and road users.</li> <li>» To ensure all vehicles are roadworthy and all materials/equipment are transported appropriately and within any imposed permit/licence conditions.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Appropriate dust suppression techniques must be implemented to minimise dust from gravel roads. These could include the use of water or other appropriate dust suppressants, as determined by the local site conditions.	Contractor	Construction
Construction vehicles and those transporting materials and goods should be inspected by the contractor or a sub-contractor to ensure that these are in good working order and not overloaded.	Contractor	Construction
Strict vehicle safety standards should be implemented and monitored.	Contractor	Construction
A designated access to the proposed site must be created to ensure safe entry and exit.	Contractor	Pre-construction
No deviation from approved transportation or construction routes must be allowed, unless roads are closed for whatever reason outside the control of the contractor.	Contractor	Duration of contract
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor (or appointed transportation contractor)	Pre-construction
Any traffic delays resulting from the presence of construction traffic must be co-ordinated with the appropriate authorities.	Contractor	Duration of contract
The movement of all vehicles within the site must be on designated roadways.	Contractor	Duration of contract
Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards).	Contractor	Duration of contract
Signs must be placed along construction roads to identify speed limits, travel restrictions, and other standard traffic control information. Signage must be appropriately maintained for the duration of the construction period.	Contractor	Duration of contract
Appropriate maintenance of all vehicles of the contractor must be ensured.	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
An appropriate speed limit as agreed with the ECO should be implemented for vehicles travelling on site in order to minimise dust generation and ensure safety of personnel and the environment and lessen environmental degradation	Contractor	Duration of contract
All construction vehicles and or machineries travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.	Contractor	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Vehicles keeping to the speed limits.</li> <li>» Vehicles are in good working order and safety standards are implemented.</li> <li>» Local residents and road users are aware of vehicle movements and schedules.</li> <li>» No construction traffic related accidents are experienced.</li> <li>» Local road conditions and road surfaces are up to standard.</li> <li>» Complaints of residents are not received (e.g. concerning the speeding of heavy vehicles).</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Developer and or appointed ECO must monitor indicators listed above to ensure that they have been implemented.</li> </ul>

***OBJECTIVE 6: To avoid and or minimise the potential impact of the activities during the construction on the safety of local communities and the potential loss of stock and damage to farm infrastructure***

An inflow of workers could, as a worst case scenario and irrespective of the size of the workforce, pose some security risks. Criminals could also use the opportunity due to "outsiders" being in the area to undertake their criminal activities.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Impact on safety of farmers and communities (increased crime etc.) and potential loss of livestock due to stock theft by construction workers and also damage to farm infrastructure, such as gates and fences.</li> <li>» Impact on irrigated fields</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» The presence of construction workers on the site can pose a potential safety risk to local farmers and communities and may result in stock thefts. The activities of construction workers may also result in damage to farm infrastructure.</li> </ul>
<b>Mitigation:</b>	<ul style="list-style-type: none"> <li>» To avoid and or minimise the potential impact on local</li> </ul>

**Target/Objective** communities and their livelihoods.

Mitigation: Action/Control	Responsibility	Timeframe
The housing of construction workers on the site should be limited to security personnel.	Contractor	Construction
Ensure that all farm gates are locked and secure at all times.	Contractor	Construction and Operation
Inform all landowners of activity on their land at least 2 days in advance of planned activities.	Contractor	All phases of the project
Procedures and measures to prevent, and in worst cases, attend to fires should be developed in consultation with the surrounding property owners.	Developer Contractor	Pre-construction and when required
Contact details of emergency services should be prominently displayed on site.	Contractor	Construction
Appropriate fire-fighting equipment must be present on site and members of the workforce should be appropriately trained in using this equipment in the fighting of veld fires.	Contractor	Construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No criminal activities and theft of livestock are reported.</li> <li>» No fires or on-site accidents occur.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Developer and appointed ECO must monitor indicators listed above to ensure that they have been implemented.</li> </ul>

### **OBJECTIVE 7: Management of dust and air emissions**

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

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Dust and particulates from vehicle movement to and on-site, foundation excavation, road construction activities, road maintenance activities, temporary stockpiles, and vegetation clearing affecting the surrounding residents and visibility.</li> <li>» Release of minor amounts of air pollutants (for example NO<sub>2</sub>, CO and SO<sub>2</sub>) from vehicles and construction equipment.</li> </ul>
<b>Activities/Risk</b>	<ul style="list-style-type: none"> <li>» Clearing of vegetation and topsoil.</li> </ul>

<b>Sources</b>	<ul style="list-style-type: none"> <li>» Excavation, grading, scraping, levelling, digging, drilling.</li> <li>» Transport of materials, equipment, and components on internal access roads.</li> <li>» Re-entrainment of deposited dust by vehicle movements.</li> <li>» Wind erosion from topsoil and spoil stockpiles and unsealed roads and surfaces.</li> <li>» Fuel burning vehicle and construction engines.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To ensure emissions from all vehicles and construction engines are minimised, where possible, for the duration of the construction phase.</li> <li>» To minimise nuisance to the community from dust emissions and to comply with workplace health and safety requirements for the duration of the construction phase.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Roads must be maintained in a manner that will ensure that nuisance from dust emissions from road or vehicle sources are not visibly excessive.	Contractor	Construction
Ensure that any damage to roads attributed to construction activities is repaired before completion of the construction phase.	Contractor	Construction
Appropriate dust suppressant must be applied on all exposed areas and stockpiles as required to minimise/control airborne dust. These could include the use of water or other appropriate dust suppressants, as determined by the local site conditions.	Contractor	Duration of contract
Haul vehicles moving outside the construction site carrying material that can be wind-blown must be covered with tarpaulins	Contractor	Duration of contract
An appropriate speed limit should be implemented for vehicles travelling on site in order to minimise dust generation and ensure safety of personnel and the environment.	Contractor	Duration of contract
Dust-generating activities or earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased during periods of high winds if excessive visible dust is blowing toward nearby residences outside the site.	Contractor	Duration of contract
Strictly control vibration pollution from compaction plant or excavation plant.	Contractor	Duration of contract
Disturbed areas must be re-vegetated as soon as practicable in line with the progression of construction activities.	Contractor	Completion of construction
Vehicles and equipment must be maintained in a road-worthy condition at all times.	Contractor	Duration of contract



<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No complaints from affected residents or community regarding dust or vehicle emissions.</li> <li>» Dust suppression measures implemented for all heavy vehicles that require such measures during the construction phase commences.</li> <li>» Drivers made aware of the potential safety issues and enforcement of strict speed limits when they are employed.</li> <li>» All heavy vehicles equipped with speed monitors before they are used in the construction phase in accordance with South African vehicle legislation.</li> <li>» Road worthy certificates in place for all heavy vehicles at outset of construction phase and up-dated on a monthly basis.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Monitoring must be undertaken to ensure emissions are not exceeding the prescribed levels via the following methods:</li> <li>» Immediate reporting by personnel of any potential or actual issues with nuisance dust or emissions to the Site Manager.</li> <li>» A complaints register must be maintained, in which any complaints from residents/the community will be logged, and thereafter complaints will be investigated and, where appropriate, acted upon.</li> <li>» An incident reporting system must be used to record non-conformances to the EMP.</li> </ul>

***OBJECTIVE 8: Minimisation of development footprint and disturbance to topsoil***

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

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Impacts on natural vegetation</li> <li>» Impacts on soil</li> <li>» Loss of topsoil</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Site preparation and earthworks</li> <li>» Excavation of foundations</li> <li>» Construction of site access road, where required</li> <li>» Site preparation (e.g. compaction)</li> <li>» Power line construction activities</li> <li>» Stockpiling of topsoil, subsoil and spoil material</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To retain natural vegetation, where possible.</li> <li>» To minimise footprints of disturbance of vegetation/habitats</li> <li>» Remove and store all topsoil on areas that are to be</li> </ul>

	<p>excavated; and use this topsoil in subsequent rehabilitation of disturbed areas.</p> <p>» Minimise spoil material.</p>
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Mitigation: Action/Control	Responsibility	Timeframe
Areas to be cleared must be clearly marked on-site to eliminate the potential for unnecessary clearing.	Contractor in consultation with Specialist	Pre-construction
The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on flora and fauna and their habitats is restricted.	Contractor	Site establishment & duration of contract
No activities must take place out of demarcated construction site	Contractor	Site establishment & duration of contract
Any fill material required must be sourced from a commercial off-site suitable/permitted source, quarry or borrow pit. Where possible, material from foundation excavations must be used as fill on-site.	Contractor	Duration of contract
Excavated topsoil must be stockpiled in designated areas separate from base material at a maximum height of 2m and covered (during windy conditions) until replaced during rehabilitation.	Contractor	Site establishment & duration of contract
Topsoil must not be stripped or stockpiled when it is raining or when the soil is wet as compaction will occur.	Contractor	Site establishment Maintenance: for duration of contract

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

***OBJECTIVE 9: Minimise the establishment and spread of alien invasive plants***

On-going alien plant monitoring and removal should be undertaken on all areas of natural vegetation on an annual basis.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Construction, environmental management.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» There is a target of no alien plants within project control area during the construction and operation phases.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Avoid creating conditions in which alien plants may become established: <ul style="list-style-type: none"> <li>» Keep disturbance of indigenous vegetation to a minimum.</li> <li>» Rehabilitate disturbed areas as quickly as possible.</li> <li>» Do not import soil from areas with alien plants.</li> </ul>	Contractor	Construction
Establish an on-going monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act and Biodiversity Act).	Contractor	Construction
Immediately control any alien plants that become established using registered control methods.	Contractor	Construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» For each alien species: number of plants and aerial cover of plants within project area and immediate surroundings.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» On-going monitoring of area by ECO during construction.</li> <li>» Annual audit of project area and immediate surroundings by qualified botanist.</li> <li>» If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants.</li> <li>» The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area.</li> <li>» The environmental manager should be responsible for driving this process.</li> <li>» Reporting frequency depends on legal compliance framework.</li> </ul>



**OBJECTIVE 10: Minimise soil degradation and erosion**

The soil on site may be impacted in terms of:

- » Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere (i.e. into the drainage lines).
- » Uncontrolled run-off relating to construction activity (excessive wetting, uncontrolled discharge, etc.) will also lead to accelerated erosion and possible sedimentation of the drainage lines.
- » Degradation of the natural soil profile due to excavation, stockpiling, compaction, pollution and other construction activities will affect soil forming processes and associated ecosystems. Degradation of parent rock is considered low as there are no deep excavations envisaged.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Soil and rock degradation.</li> <li>» Soil erosion.</li> <li>» Increased deposition of soil into drainage systems.</li> <li>» Increased run-off over the site.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Removal of vegetation, excavation, stockpiling, compaction, and pollution of soil.</li> <li>» Rainfall - water erosion of disturbed areas.</li> <li>» Wind erosion of disturbed areas.</li> <li>» Concentrated discharge of water from construction activity.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Minimise extent of disturbance areas.</li> <li>» Minimise activity within disturbance areas.</li> <li>» Minimise soil degradation (mixing, wetting, compaction, etc.).</li> <li>» Minimise soil erosion.</li> <li>» Minimise deposition of soil into drainage lines.</li> <li>» Minimise instability of embankments/excavations.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Identify disturbance areas and restrict construction activity to these areas.	Contractor	Before and during construction
Rehabilitate disturbance areas as soon as practicable when construction in an area is complete.	Contractor	During and after construction
Any new access roads required to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement, and compaction of soil.	Engineer Contractor	Design and construction
Where new access roads cross natural drainage lines,	Contractor	Design,

Mitigation: Action/Control	Responsibility	Timeframe
culverts must be designed to allow free flow and regular maintenance must be carried out. Permit to disturb the drainage lines must be obtained from the Department of Water & Sanitation.		before and during construction
Minimise removal of vegetation which adds stability to soil.	Contractor	Construction
Soil conservation: Stockpile topsoil for re-use in rehabilitation phase, protect stockpile from erosion.	Contractor	Before and during construction
Erosion control measures (i.e. run-off attenuation on slopes (sand bags, logs), silt fences, storm water catch-pits, shade nets, or temporary mulching over denuded area as required).	Contractor, and ECO	Erection: Before construction Maintenance: Duration of contract
Control depth of excavations and stability of cut faces/sidewalls.	Contractor	Duration of contract
Compile and implement an appropriate stormwater management plan.	Contractor	Duration of construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No activity outside demarcated disturbance areas.</li> <li>» Acceptable level of activity within disturbance areas, as determined by the ECO.</li> <li>» Acceptable level of soil erosion around site, as determined by the ECO.</li> <li>» Acceptable level of increased siltation in drainage lines, as determined by the ECO.</li> <li>» Acceptable state of excavations, as determined by the ECO.</li> <li>» No activity in restricted areas.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Monthly inspections of the site by the ECO.</li> <li>» Monthly inspections of sediment control devices.</li> <li>» Monthly inspections of surroundings, including drainage lines.</li> <li>» Immediate reporting of ineffective sediment control systems.</li> <li>» An incident reporting system will record non-conformances.</li> </ul>

**OBJECTIVE 11: Minimisation of visual impacts associated with construction**

During the construction phase heavy vehicles, components, equipment and construction crews will frequent the area and may cause, at the very least, a cumulative visual nuisance to landowners and residents in the area as well as road users. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future

perception of the project. Secondary visual impacts associated with the construction phase, such as the sight of construction vehicles, dust and construction litter must be managed to reduce visual impacts.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Laydown areas</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Visual impact of general construction activities.</li> <li>» Potential scarring of the landscape due to vegetation clearing.</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» The viewing of the above mentioned by observers on or near the site.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Minimal visual intrusion by construction activities and construction accommodation and intact vegetation cover outside of immediate works areas.</li> </ul>

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Ensure that vegetation is not unnecessarily removed during the construction period.	Developer or contractor	Planning
Reduce the construction period through careful logistical planning and productive implementation of resources.	Developer or contractor	Planning
Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Developer or contractor	Construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Contractor	Construction
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Contractor	Construction
Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Contractor	Construction
Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts.	Contractor	Construction
Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.	Contractor	Throughout and at the end of the construction phase
Monitor all rehabilitated areas for at least a year for rehabilitation failure and implement remedial action as		Throughout and at the

Mitigation: Action/Control	Responsibility	Timeframe
required. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.		end of the construction phase

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Vegetation cover on and near the site is intact with no evidence of degradation or erosion.</li> <li>» Construction site is kept in a neat and tidy state.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Monitoring of vegetation clearing during construction.</li> <li>» Monitoring of rehabilitated areas post construction.</li> </ul>

### OBJECTIVE 12: Minimise loss and disturbance to mammals, reptiles and amphibians

Prior to any earthworks (including road construction) in a demarcated area, The ECO needs to inspect the area and supervise the removal and relocation of any individual of mammal, reptile or amphibian that may be on the site, either in burrows or just traversing the area.

Roads must be constructed in such a way that they do not prevent the natural migration of small mammals, reptiles, or amphibians.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Laydown areas</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Loss of habitat and natural resources to small mammals, reptiles and amphibians.</li> <li>» Associated decline of populations of above fauna.</li> </ul>
<b>Activities/Risk Sources</b>	<ul style="list-style-type: none"> <li>» Permanent obstruction of natural migration routes.</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Creation of safe passage across roads or passages through fences.</li> </ul>

Mitigation: Action/Control	Responsibility	Timeframe
Fauna within the site which do not pose a danger to humans or the operation of the facility should be tolerated.	Contractor	Prior to and during construction
Ensure that off-road impact by heavy machinery is restricted to designated areas only and only previously disturbed sites or designated laydown areas are used for storing and handling materials and machinery.	Contractor	Prior to and during construction
After decommissioning, remove all foreign material and rip area to facilitate the establishment of vegetation	Contractor	Prior to and during

Mitigation: Action/Control	Responsibility	Timeframe
and implement a suitable rehabilitation plan of the area.		construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No animal death caused by construction activities.</li> <li>» No illegal snaring of fauna.</li> <li>» Continued safe movement of small fauna across the largest portions of the proposed development, except within areas where the type of infrastructure or use thereof may be dangerous to the animals.</li> </ul>	
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» ECO to monitor and keep record of animal deaths on site and report any incidences to management for immediate remedial action.</li> </ul>	

### **OBJECTIVE 13: Protection of avifauna**

During the operation, the threat of collision with the power line is the biggest potential threat to avifauna, particularly sensitive, collision prone species that may occur in the study area. The threat of electrocution while perching on the power line and associated infrastructure serves as a threat to certain sensitive species, depending on the power line structures implemented.

<b>Project Component/s</b>	» Power line	
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Mortality of avifauna caused by collision with the power line network.</li> <li>» Displacement of avifauna due to disturbance and habitat transformation.</li> </ul>	
<b>Activities/Risk Sources</b>	» The construction activities and operation of the power lines.	
<b>Mitigation: Target/Objective</b>	» The limitation of avifaunal mortality and displacement as far as is practically possible.	

Mitigation: Action/Control	Responsibility	Timeframe
Implementation of a comprehensive post-construction monitoring programme according to best practice guidelines and the implementation of mitigation measures e.g. selective curtailment if necessary on an ongoing basis.	Wind farm operator and avifaunal specialist consultant.	As an absolute minimum, post-construction monitoring should be undertaken for the first



Mitigation: Action/Control	Responsibility	Timeframe
		two (preferably three) years of operation, and then repeated again in year 5, and again every five years thereafter.

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Minimum disturbance outside of designated work areas.</li> <li>» Minimised clearing of existing/natural vegetation and habitats for fauna and avifauna.</li> </ul> <p>Limited impacts on faunal species (i.e. noted/recorded fatalities), especially those of conservation concern.</p>
<b>Monitoring</b>	» See above

#### ***OBJECTIVE 14: Appropriate handling and management of waste***

The main wastes expected will include spoil from excavation activities, general construction waste, hazardous waste (i.e. fuel), and liquid waste (including grey water and sewage).

In order to manage the wastes effectively, guidelines for the assessment, classification, and management of wastes, along with industry principles for minimising construction wastes must be implemented.

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Inefficient use of resources resulting in excessive waste generation.</li> <li>» Litter or contamination of the site or water through poor waste management practices.</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Packaging.</li> <li>» Other construction wastes.</li> <li>» Hydrocarbon use and storage.</li> <li>» Spoil material from excavation, earthworks, and site preparation.</li> </ul>
<b>Mitigation:</b>	» To comply with waste management legislation.

<b>Target/Objective</b>	<ul style="list-style-type: none"> <li>» To minimise production of waste.</li> <li>» To ensure appropriate waste storage and disposal.</li> <li>» To avoid environmental harm from waste disposal.</li> <li>» A waste manifests should be developed for the ablutions showing proof of disposal of sewage at appropriate water treatment works.</li> </ul>
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<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Construction method and materials should be carefully considered in view of waste reduction, re-use, and recycling opportunities.	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 as required. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.	Contractor	Duration of contract
Where practically possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc.).	Contractor	Duration of contract
Bins and skips must be labelled for ease of waste management	Contractor	Duration of contract
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract
Uncontaminated waste shall be removed at least weekly for disposal; other wastes can be removed for recycling/ disposal at an appropriate frequency or ECO's discretion.	Contractor	Duration of contract
Disposal of waste shall be in accordance with relevant legislative requirements, including the use of licensed contractors.	Contractor	Duration of contract
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract
Waste must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Duration of contract
Spilled cement will be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
site.		
Documentation (waste manifest) must be maintained detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor	Duration of contract
Regularly serviced chemical toilets facilities must be used to ensure appropriate control of sewage. Waste from these toilets should be disposed of at a licensed wastewater treatment works.	Contractor	Duration of contract
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction
Dispose of all solid waste collected at an appropriately registered waste disposal site. Waste disposal shall be in accordance with all relevant legislation and under no circumstances may waste be burnt on site.	Contractor	Duration of construction
Where a registered waste site is not available close to the construction site, provide a method statement with regard to waste management.	Contractor	Duration of construction
Proof of appropriate disposal of all waste must be obtained from the waste contractors and kept on file.	Contractor	Duration of construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No complaints received regarding waste on site or indiscriminate dumping.</li> <li>» Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately.</li> <li>» Provision of all appropriate waste manifests for all waste streams.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation and supervision of waste management practices throughout construction phase.</li> <li>» Waste collection will be monitored on a regular basis.</li> <li>» Waste documentation completed.</li> <li>» A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon.</li> <li>» An incident reporting system will be used to record non-conformances to the EMPr.</li> </ul>

**OBJECTIVE 15: Appropriate handling and storage of chemicals, hazardous substances**

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

<b>Project Component/s</b>	» Power line
<b>Potential Impact</b>	» Release of contaminated water from contact with spilled chemicals. » Generation of contaminated wastes from used chemical containers.
<b>Activity/Risk Source</b>	» Vehicles associated with site preparation and earthworks. » Construction activities of area and linear infrastructure. » Hydrocarbon use and storage.
<b>Mitigation: Target/Objective</b>	» 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.

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a potential/actual leak or spill of a polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures.	Contractor	Duration of contract
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.	Contractor	Duration of contract
Spilled cement must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Any contaminated/polluted soil can be stored onsite to a maximum of 90 days before removed from the site and must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles must not take place on-site but on designated bunded areas at the camp (except for emergencies). If repairs of vehicles must take place, an appropriate drip tray must be used to contain any fuel or oils leaks.	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

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Small construction machineries i.e. stumpers, generators etc. must be stored in an appropriately sealed area.	Contractor	Duration of contract
The storage of flammable and combustible liquids such as oils will be in designated areas which are appropriately bunded, and stored in compliance with Material Safety Data Sheets (MSDS) files.	Contractor	Duration of contract
Drip trays shall be placed under stationery machineries at appropriate areas i.e. areas that pose threat of leakage	Contractor	Duration of contract
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations	Contractor	Duration of contract
All small chemical substances used onsite must be accompanied by a portable drip tray to store them	Contractor	Duration of contract
Construction vehicles must be washed within designated area, agreed with the ECO and the site manager	Contractor	Duration of contract
The sediment control and water quality structures used on-site must be monitored and maintained in an operational state at all times.	Contractor	Duration of contract
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No chemical spills outside of designated storage areas.</li> <li>» No unattended water or soil contamination by spills.</li> <li>» No complaints received regarding waste on site or indiscriminate dumping.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase.</li> <li>» A complaints register must be maintained, in which any complaints from the community will be logged.</li> <li>» An incident reporting system will be used to record non-conformances to the EMP.</li> </ul>

**OBJECTIVE 16: Noise control**

Traffic movement to and from the site, particularly of heavy-duty vehicles during construction, could potentially result in a noise impact.

<b>Project component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Nuisance noise from construction affecting the surrounding community</li> </ul>
<b>Activity/risk source</b>	<ul style="list-style-type: none"> <li>» Site preparation and earthworks</li> <li>» Construction-related transport</li> <li>» Foundations or plant equipment installation</li> <li>» Power line construction activities</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» To minimise noise to any surrounding residences from the construction activities.</li> <li>» To comply with Noise Control Regulations and SANS Guidelines.</li> <li>» To ensure noise levels are acceptable at residences in close proximity to construction activities.</li> </ul>

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
On-site construction activities should be limited to daylight hours as far as possible. Affected and surrounding landowners should be notified if there is a need to deviate from standard working hours.	Contractor	Duration of contract
Construction noise shall be managed according to the Noise Control Regulations and SANS 10103.	Contractor	Duration of contract
All construction equipment, including vehicles, shall be properly and appropriately maintained in order to minimise noise generation.	Contractor	Duration of contract

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No complaints received concerning noise.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon.</li> <li>» An incident reporting system will be used to record non-conformances to the EMPr.</li> </ul>

### **OBJECTIVE 17: Limit impacts on heritage resources**

The current access road passes through the middle of the ruined village of Namies. This area is of concern because there are components of the village (buildings and graves) that are located very close to the roads and could be impacted by any road widening. Here depending on how the access road is designed, mitigation may be required.

<b>Project component/s</b>	<ul style="list-style-type: none"> <li>» Substation(s) construction</li> <li>» An overhead power line to connect the facility to the electricity grid</li> <li>» Internal access roads</li> <li>» Workshop area/office for maintenance</li> <li>» Construction of access road</li> </ul>
<b>Potential Impact</b>	» No impacts expected, avoid impacts to ruins and graves at Namies.
<b>Activity/risk source</b>	» Widening of existing access road.
<b>Mitigation: Target/Objective</b>	» Ensure that Namies is avoided by routing road to south of Namies village ruins. No mitigation is deemed necessary, other than to observe heritage law and report un-anticipated finds.

<b>Mitigation: Action/control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Check final selected access route with heritage consultant, design mitigation if necessary.	Proponent and project archaeologist	In planning stages before construction commences

<b>Performance Indicator</b>	Preservation of identified heritage sites managed in accordance with a heritage management plan.
<b>Monitoring</b>	Completed mitigation as recommended.

### **6.3 Detailing Method Statements**

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMP will be met. That is, the Contractor will be required to describe

how specified requirements will be achieved through the submission of written Method Statements to the Site Manager and ECO.

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

- » 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.

Specific method statements required may include:

- » Site establishment;
- » Preparation of the site;
- » Soil management/stockpiling and erosion control;
- » Excavations and backfilling procedure;
- » Stipulate norms and standards for water supply and usage (i.e.: comply strictly to licence and legislation requirements and restrictions);
- » Storm water management procedures;
- » Wash bay for the construction vehicles and or machineries;
- » Ablution facilities (placement, maintenance, management and servicing);
- » Solid Waste Management;
- » Liquid waste management;
- » Dust and noise pollution;
- » Hazardous substance storage (Ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, cement, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply);
- » Fire prevention and management measures on site;



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

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

Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved. The ECO should monitor the construction activities to ensure that these are undertaken in accordance with the approved Method Statement.

#### **6.4 Awareness and Competence: Construction Phase**

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

The Contractors obligations in this regard include the following:

- » Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- » Ensuring that a copy of the EMP is readily available on-site, and that all site employees are aware of the location and have access to the document.
- » Employees shall be familiar with the requirements of the EMP and the environmental specifications as they apply to the construction of the power line.
- » Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course.
- » The course should be sufficient to provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- » Awareness of any other relevant environmental matters, which are deemed necessary by the ECO.

- » Ensuring that employee information posters, outlining the environmental “do’s” and “don’ts” (as per the environmental awareness training course) are erected at prominent locations throughout the site.
- » Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances, minimisation of disturbance to sensitive areas, management of waste, and prevention of water pollution.
- » Records must be kept of those that have completed the relevant training.
- » Training should be done either in a written or verbal format but must be appropriate for the receiving audience.

#### **6.4.1 Environmental Awareness Training**

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

#### **6.4.2 Induction Training**

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

This induction training should include discussing the developer’s environmental policy and values, the function of the EMPr and Contract Specifications and the importance and reasons for compliance to these. The induction training must highlight overall do’s and don’ts on site and clarify the repercussions of not complying with these. The non-conformance reporting system must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the SHE Officer on site. Proof of induction training should be kept on record.

#### **6.4.3 Toolbox Talks**

Toolbox talks should be held on a scheduled and regular basis (at least twice a month) where foremen, environmental and safety representatives of different components of the Works and sub-consultants hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and ones

recommended by the onsite ECO and the prevention of reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

## **6.5 Monitoring Programme: Construction Phase**

A monitoring programme must be in place not only to ensure conformance with the EMP, but also to monitor any environmental issues and impacts which have not been accounted for in the EMP that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the Environmental Authorisation (once issued). The Project Manager will ensure that the monitoring is conducted and reported.

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

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

### **6.5.1. Non-Conformance Reports**

All supervisory staff including Foremen, Engineers, and the ECO must be provided the means to be able to submit non-conformance reports to the Site Manager. Non-conformance reports will describe, in detail, the cause, nature and effects of any environmental non-conformance by the Contractor. Records of penalties imposed may be required by the relevant authority within 48 (forty eight) hours.

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

### **6.5.2. Monitoring Reports**

A monitoring report will be compiled by the ECO on a monthly basis and must be submitted to DEA for their records. This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents

recorded if any, corrective action required, and details of those non-conformances or incidents which have been closed out.

### **6.5.3. Final Audit Report**

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

**Overall Goal:** 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.

### 7.1. Objectives

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

**OBJECTIVE 1: Ensure appropriate rehabilitation of disturbed areas such that residual environmental impacts are remediated or curtailed**

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

<b>Project Component/s</b>	<ul style="list-style-type: none"> <li>» Power line</li> <li>» Access roads, where required</li> </ul>
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion and increased runoff, and the requirement for on-going management intervention.</li> </ul>
<b>Activity/Risk Source</b>	<ul style="list-style-type: none"> <li>» Temporary construction areas</li> <li>» Temporary access roads/tracks</li> <li>» Power line servitudes</li> <li>» Other disturbed areas/footprints</li> </ul>
<b>Mitigation: Target/Objective</b>	<ul style="list-style-type: none"> <li>» Ensure and encourage site rehabilitation of disturbed areas.</li> <li>» Ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed.</li> </ul>

Mitigation: Action/Control	Responsibility	Timeframe
All temporary facilities, equipment, and waste materials must be removed from site.	Contractor	Following execution of the works
All temporary fencing and danger tape must be removed once the construction phase has been completed.	Contractor	Following completion of construction

Mitigation: Action/Control	Responsibility	Timeframe
		activities in an area
The area that previously housed the construction equipment camp is to be checked for spills of substances such as oil, paint, etc. and these should be cleaned up.	Contractor	Following completion of construction activities in an area
All hardened surfaces within the construction equipment camp area should be ripped, all imported materials removed, and the area shall be top soiled and re-vegetated.	Contractor	Following completion of construction activities in an area
Temporary roads must be closed and access across these blocked.	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
Erosion control measures should be used in sensitive areas such as areas with steep slopes.	Developer in consultation with rehabilitation specialist (if required)	Post-rehabilitation
Ongoing plant monitoring and removal must be undertaken on all areas of natural Vegetation on an annual basis.	Developer	Post-rehabilitation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» All portions of site, including construction equipment camp and working areas, cleared of equipment and temporary facilities.</li> <li>» Topsoil replaced on all areas and stabilised where practicable or required after construction and temporally utilised areas.</li> <li>» Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites.</li> <li>» Complete site free of erosion alien invasive plants.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented.</li> <li>» On-going alien plant monitoring and removal should be undertaken on an annual basis.</li> </ul>

**Overall Goal:** To ensure that the operation of the proposed 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 facility in a way that:

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

An environmental manager must ensure the implementation of the operational EMP.

### 8.1. Objectives

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

#### ***OBJECTIVE 1: Protection of Indigenous natural vegetation, fauna and maintenance of rehabilitation***

Indirect impacts on vegetation and fauna during operation could result from maintenance activities and the movement of people and vehicles on site and in the surrounding area. 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.

<b>Project component/s</b>	» Service road utilised during regular maintenance. » Areas disturbed during the construction phase and subsequently rehabilitated.
<b>Potential Impact</b>	» Disturbance to or loss of vegetation and/or habitat.
<b>Activity/Risk Source</b>	» Movement of employee vehicles within and around site.
<b>Mitigation: Target/Objective</b>	» Maintain minimised footprints of disturbance of vegetation/habitats on-site.

	» Ensure and encourage plant regrowth in non-operational areas of post-construction rehabilitation.
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Mitigation: Action/Control	Responsibility	Timeframe
Vehicle movements must be restricted to designated roadways.	Developer	Operation
No disturbance of vegetation outside of the project site must occur.	Developer	Operation
Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	Developer	Operation
An on-going alien plant monitoring and eradication programme must be implemented, where necessary.	Developer	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» No further disturbance to vegetation or terrestrial faunal habitats.</li> <li>» Continued improvement of rehabilitation efforts.</li> <li>» No disturbance of vegetation outside of project site.</li> </ul>
<b>Monitoring</b>	» Regular inspection to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas.

## **OBJECTIVE 2: Protection of avifauna**

During the operation, the threat of collision with the power line is the biggest potential threat to avifauna, particularly sensitive, collision prone species that may occur in the study area. The threat of electrocution while perching on the power line and associated infrastructure serves as a threat to certain sensitive species, depending on the power line structures implemented.

<b>Project Component/s</b>	» Power line
<b>Potential Impact</b>	» Collision and electrocution events with the overhead power line.
<b>Activities/Risk Sources</b>	» Operation of the power line without appropriate mitigation measures.
<b>Mitigation: Target/Objective</b>	» Maintain a low number of collision, and electrocution events.



Mitigation: Action/Control	Responsibility	Timeframe
Maintain bird flappers to new lines in identified sensitive Areas	Developer	Operation
Maintain insulation of live components at support structures.	Developer	Operation

<b>Performance Indicator</b>	» Minimal collision or electrocution events.
<b>Monitoring</b>	» Observation of electrocution or collision events with the power line. » Monitor power line servitude for mortalities.

### **OBJECTIVE 3: Minimise soil degradation and erosion**

The soil on site may be impacted in terms of:

- » Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern across the entire site which is 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, uncontrolled discharge, etc.) will also lead to accelerated erosion and possible sedimentation of drainage systems.
- » Degradation of the natural soil profile due to pollution.

<b>Project Component/s</b>	» Power line » Access roads, where required
<b>Potential Impact</b>	» Soil degradation. » Soil erosion. » Increased deposition of soil into drainage systems. » Increased run-off over the site.
<b>Activities/Risk Sources</b>	» Poor rehabilitation of cleared areas. » Rainfall - water erosion of disturbed areas. » Wind erosion of disturbed areas. » Concentrated discharge of water from construction activity.
<b>Mitigation: Target/Objective</b>	» Ensure rehabilitation of disturbed areas is maintained. » Minimise soil degradation (i.e. wetting). » Minimise soil erosion and deposition of soil into drainage lines. » Ensure continued stability of embankments/excavations.

<b>Mitigation: Action/Control</b>	<b>Responsibility</b>	<b>Timeframe</b>
Rehabilitate disturbance areas should the previous attempt be unsuccessful.	Developer	Operation
Maintain erosion control measures implemented during the construction phase (i.e. run-off attenuation on slopes (sand bags, logs), silt fences, storm water catch-pits, and shade nets).	Developer	Operation

<b>Performance Indicator</b>	<ul style="list-style-type: none"> <li>» Acceptable level of soil erosion around site, as determined by the site manager.</li> <li>» Acceptable level of increased siltation in drainage lines, as determined by the site manager.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>» Inspections of site on a bi-annual basis.</li> <li>» Water management plan.</li> </ul>

It is most likely that decommissioning activities of the infrastructure would comprise the disassembly and removal of the power line from the site.

The EMPr for Rehabilitation (chapter 7) is also relevant to the decommissioning of sections of the proposed distribution line and must be adhered to.

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 EMP to be revisited and amended.

### **9.1. Objectives**

The overall objective of the decommissioning phase is to leave the project area in a condition that minimises adverse impacts on the socio-economic and biophysical environment, with a legacy that contributes to sustainable development.

The objectives of the decommissioning phase of the proposed project are to:

- » Follow a process of decommissioning that is progressive and integrated into the short- and long-term project plans that will assess the closure impacts proactively at regular intervals throughout project life.
- » Implement progressive rehabilitation measures, beginning during the construction phase.
- » Leave a safe and stable environment for both humans and animals and make their condition sustainable.
- » Return rehabilitated land-use to a standard that can be useful to the post-project land user.
- » Where applicable, prevent any further soil and surface water contamination by maintaining suitable storm water management systems.
- » Maintain and monitor all rehabilitated areas following re-vegetation, and if monitoring shows that the objectives have been met, apply for closure.

### **9.2. Approach to the decommissioning phase**

It is recommended that planning of the decommissioning of the project and rehabilitation of the site should take place well in advance (at least two years) of

the planned decommissioning activities. Important factors that need to be taken into consideration are detailed below.

### **9.2.1. Identification of structures for post-closure use**

Access roads should be assessed in conjunction with the ultimate land users to determine if these could be used in future. Where not required, these access roads should be decommissioned and rehabilitated.

### **9.2.2. Removal of infrastructure**

All infrastructure must be dismantled and removed. Inert material must be removed from site and disposed of at a registered landfill site. All foundations must be removed to a depth of 1m. Hard surfaced must be ripped to a depth of 1m and vegetated.

### **9.2.3. Soil amelioration**

The steps that should be taken during the amelioration of soils are as follows:

- » The deposited soils must be ripped to ensure reduced compaction;
- » An acceptable seed bed should be produced by surface tillage;
- » Restore soil fertility;
- » Incorporate the immobile fertilisers in to the plant rooting zone before ripping; and
- » Apply maintenance dressing of fertilisers on an annual basis until the soil fertility cycle has been restored.

### **9.2.4. Establishment of vegetation**

The objective is to restore the project site to a self-sustaining cycle, i.e. to realise the re-establishment of the natural nutrient cycle with ecological succession initiated.

The objectives for the re-vegetation of reshaped and top-soiled land are to:

- » Prevent erosion;
- » Restore the land to the agreed land capability;
- » Re-establish eco-system processes to ensure that a sustainable land use can be established without requiring fertilizer additions; and
- » Restore the biodiversity of the area as far as possible.

### **9.2.5. Maintenance**

Established vegetation requires regular maintenance. If the growth medium consists of low-fertility soils, then regular maintenance will be required until the natural fertility cycle has been restored.

### **9.2.6. Monitoring**

The purpose of monitoring is to ensure that the objectives of rehabilitation are met and that the rehabilitation process is followed. The physical aspects of rehabilitation should be carefully monitored during the progress of establishment of desired final ecosystems.

The following items should be monitored continuously:

- » Erosion status;
- » Surface drainage systems and surface water quality;
- » Vegetation species diversity; and
- » Faunal re-colonisation.

**APPENDIX A:  
GRIEVANCE MECHANISM FOR PUBLIC  
COMPLAINTS AND ISSUE GRIEVANCE  
MECHANISM / PROCESS**

## **GRIEVANCE MECHANISM / PROCESS**

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### **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 be recorded and signed off by the relevant parties, including the mediator. The record should provide details on the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of the dispute not being resolved, the mediator will prepare a draft report that summarizes 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 B:**  
**PRINCIPLES FOR EROSION MANAGEMENT**

## **PRINCIPLES FOR EROSION MANAGEMENT**

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### **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. Internationally, standards have been set by the International Finance Corporation and the World Bank to address soil erosion in construction and decommissioning of areas. Therefore this document will ensure that the developer meets the South African legislative requirements and the IFC standards with regards to monitoring, managing and rehabilitating soil erosion on the Cookhouse wind energy facility site.

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 choked 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<sup>2</sup>/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 laid/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<sup>2</sup> (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 (to 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 specified 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.

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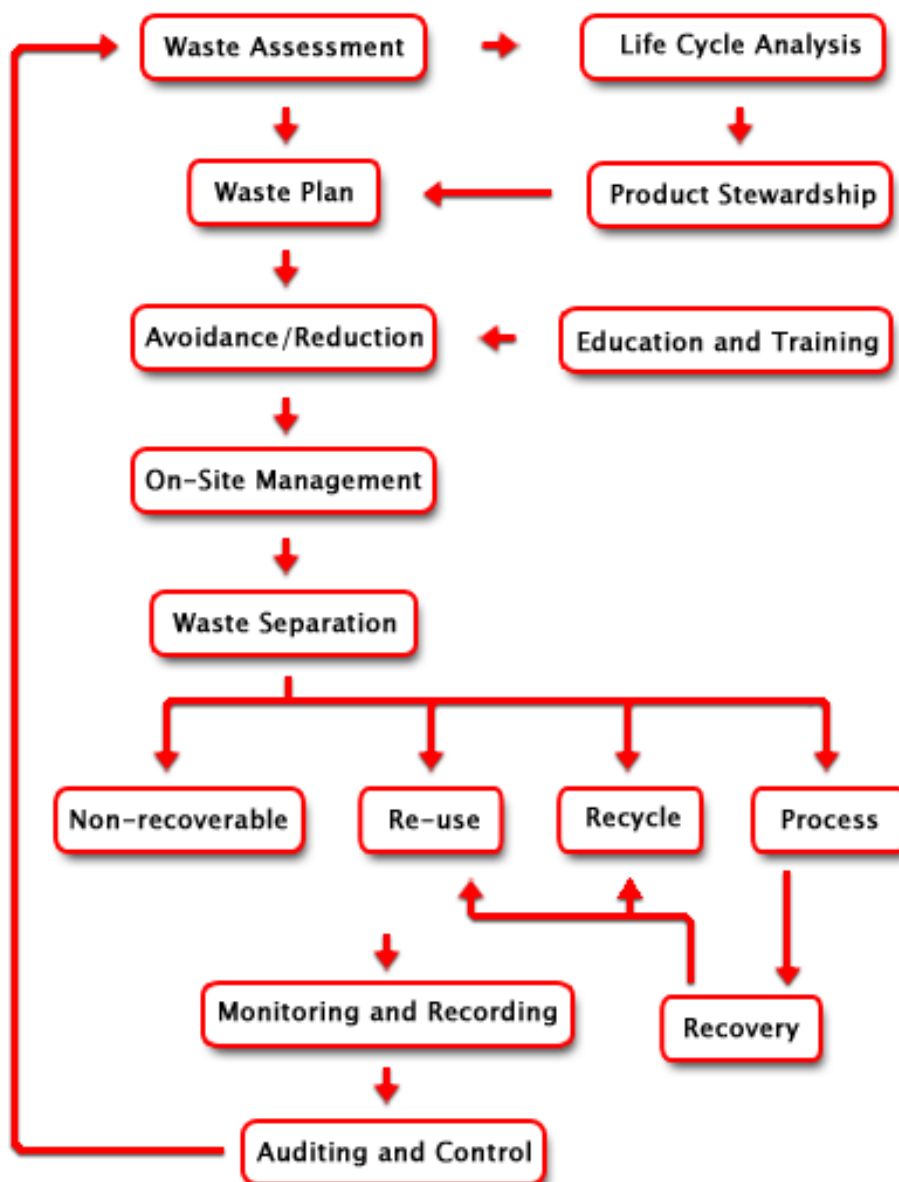
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**APPENDIX C:  
GUIDELINES FOR INTEGRATED MANAGEMENT OF  
CONSTRUCTION WASTE**

## **GUIDELINE FOR INTEGRATED MANAGEMENT OF CONSTRUCTION WASTE**

Waste is broadly defined by the Department of Water Affairs in 1994 as: 'an undesirable or superfluous by-product, emission, residue or remainder of any process or activity'. An integrated approach to waste management on site is needed. Such an approach is illustrated in the figure below.

### **The Integrated Waste Management Approach to Waste**



Source: <http://www.enviroserv.co.za/pages/content.asp?SectionId=496>

## 1. Waste Assessment

A detailed waste assessment is necessary to understand the waste types and volumes being produced. In order to achieve this, construction practices must be measured and analysed.

## 2. Waste Plan

A waste plan must be developed to provide appropriate solutions for managing the entire waste stream on site. The objective of the plan should be to reduce the volumes of waste to disposal and thereby to reduce the cost of management of the waste stream without compromising environmental standards. The plan should include recovery, re-use and recycle recommendations.

Construction Waste Management is the practice of reducing the actual waste that goes to the landfill site. Waste reduction is best met by recycling, and construction wastes offer several opportunities in this regard. In fact, 80% of the wastes found in construction waste piles are recyclable in some form or another. Wood, concrete, bricks, metals, glass and even paint offer several options for recycling.

There are three basic steps for construction waste management, i.e. Reduce, Reuse, and Recycle. **Reduce** is the prevention of the waste from arising and optimising material usage. Waste avoidance and waste reduction can be achieved through improved education and training - by improving efficiencies and by making staff environmentally aware.

**Reuse** is using existing materials instead of throwing these away. Reusing does not mean that it needs to be reused on the same construction site. Selling or donating waste materials to a third party is one option of construction waste management.

**Recycle** is somewhat limited since it only allows for those items that can be used on-site. The most important step for recycling of construction waste is on-site separation. Initially, this will take additional effort and training of construction personnel. Targets should be set for the levels of recycling. Once separation habits are established, on-site separation can be done at little or no additional cost.

## 3. What to Recycle

Before recycling construction waste, identify who will accept it. This is important in designating type of waste to separate, and in making arrangements for drop-off or delivery of materials. Materials that can be recycled include:



- » Cardboard and Paper
- » Wood
- » Metals
- » Plastics
- » Glass
- » Paints, Stains, Solvents and Sealants
- » Oil

#### **4. Materials Separation**

Successful recycling requires good clean uniform collections of single waste types. This is most effectively achieved by separating the waste streams close to source rather than at the landfill site. Containers for material recycling must be set up on site and clearly labelled. Construction personnel must be trained in material sorting policy, and bins must be monitored periodically to prevent waste mixing as a result of construction employees throwing rubbish into the bins.

Some materials will require bins or storage that protect these from rain. Other bins may be locked to prevent tampering.

#### **5. Recycling and Waste Minimisation Guidelines**

- » *Wood*
  - \* Optimise building dimensions to correspond to standard wood dimensions in order to reduce the need for cutting.
  - \* Store wood on level blocking under cover to minimize warping, twisting and waste.
- » *Metals*
  - \* During construction, separate metals for recycling, including copper piping, wire, aluminium, iron and steel, nails and fasteners, galvanized roofing. It is critical to keep lead out of landfills because it could leach into groundwater.
- » *Cardboard and Paper*
  - \* Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
  - \* As far as possible, use recyclable packaging.
  - \* Separate cardboard waste, bundle, and store in a dry place.
  - \* Minimise the number of blueprints and reproductions necessary during the design and construction process.
- » *Plastic*

- \* Avoid excessively packaged materials and supplies. However, be sure packaging is adequate to prevent damage and waste.
- \* As far as possible, use recyclable packaging.

Since more than 60 different types of plastic resins exist, the Plastics Federation of South Africa has adopted a voluntary number coding system for each category of plastics to aid in their sorting by material type for recycling (Bruyns et al, 2002). The most common resin types are itemised in Table 1.

**Table 1:** Identification System for Plastic

Id Number	Plastic Resin Type
1	PET (polyethylene terephthalate)
2	HDPE (high-density polyethylene)
3	PVC (polyvinyl chloride ) or V (vinyl)
4	LDPE (low-density polyethylene)
5	PP (polypropylene)
6	PS (polystyrene)
7	Other (laminates, etc.)

» *Paints, Stains, Solvents and Sealants*

- \* Unused materials should be taken to a hazardous waste collection facility.

## **6. On-site Management**

Good supervision of the waste management programme on site is critical to success. Management of the entire on-site program is critical to ensure smooth operations.

## **7. Auditing and Control**

The success of the waste plan is determined by measuring criteria such as waste volumes, cost recovery from recycling, cost of disposal. Recorded data can indicate the effect of training and education, or the need for education. It will provide trends and benchmarks for setting goals and standards. It will provide clear evidence of the success or otherwise of the plan. Finally, good record keeping and control, becomes a continuous waste assessment process, allowing the waste plan to be improved and adjusted as required.

## **8. Useful contacts:**

<http://www.transpaco.co.za/page5.htm>

Transpaco, a manufacturing and distribution company operating extensively in the plastics and packaging industries, conducts plastic reclamation and recycling.

<http://www.jclenterprises.co.za/>

JCL Enterprises for plastic sales of quality recycled plastic materials as well as the recycling of plastic.

<http://www.rosefoundation.org.za/>

The Rose Foundation specialises in the collection and recycling of used motor (engine) oil.

### **Information Sources:**

<http://www.greenbuilder.com/sourcebook/ConstructionWaste.html#Guidelines>

<http://www.enviroserv.co.za/pages/Content.asp?SectionID=587>

<http://www.enviroserv.co.za/pages/content.asp?SectionId=496>

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