
DWARSRUG ACCESS ROAD FOR THE DWARSRUG WIND ENERGY FACILITY, NORTHERN CAPE PROVINCE

ENVIRONMENTAL MANAGEMENT PROGRAMME

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PROJECT DETAILS

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DEFINITIONS AND TERMINOLOGY

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

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process, or technology alternatives, temporal alternatives or the 'do nothing' alternative.

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.

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

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

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

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

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

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

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

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

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

Environment: the surroundings within which humans exist and that are made up of:

- (i) The land, water and atmosphere of the earth;
- (ii) Micro-organisms, plant and animal life;
- (iii) Any part or combination of (i) and (ii) and the interrelationships among and between them; and
- (iv) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

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

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

Environmental impact assessment: Environmental Impact Assessment, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing and reporting environmental impacts associated with an activity.

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

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

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

Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

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

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

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

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

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

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

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

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

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

ABBREVIATIONS AND ACRONYMS

AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
BA	Basic Assessment
DAFF	Department of Forestry and Fishery
DME	Department of Minerals and Energy
DOT	Department of Transport
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EM	Environmental Manager
EO	Environmental Officer
EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
Ha	Hectare
HIA	Heritage Impact Assessment
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km ²	Square kilometres
km	Kilometres
m ²	Square meters
m ³	Cubic meters
MW	Mega Watt
NDM	Namakwa District Municipality
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
PM	Project Manager
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework

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LEGAL REQUIREMENTS IN TERMS OF THE EIA REGULATIONS

An overview of the contents of the Environmental Management Programme, as prescribed by Appendix 4 of the 2014 EIA Regulations (GNR 326) as amended, and where the corresponding information can be found within the reported is provided in **Table 1.1**

Table 1.1: Legal requirements in terms of the EIA regulations

EIA REGULATIONS 2014 (as amended) GNR 326: Appendix 1 CONTENT OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)	Cross-reference in this Environmental Management Programme
Content of environmental management programme (EMPr)	
(1) (a) An EMPr must comply with section 24N of the Act and include: <ul style="list-style-type: none"> i. Details of the EAP who prepared the EMPr; and ii. the expertise of that EAP to prepare an EMPr, including a curriculum vitae. 	Chapter 4, Section 4.1 Appendix A
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	Chapter 2, Section 2.1 Chapter 3
(c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers.	Chapter 2, Section 2.1 Appendix C
(d) a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through environmental impact assessment process for all phases of the development including- <ul style="list-style-type: none"> (i) planning and design (ii) pre-construction activities (iii) construction activities (iv) rehabilitation of the environment after construction and where applicable post closure; and where relevant, operation activities; 	Chapter 5, 6 and 7
(f) a description of proposed mitigation management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to- <ul style="list-style-type: none"> (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provision for rehabilitation 	Chapter 5, 6 and 7
(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f)	Chapter 5 Section 5.2.1-5.2.8 Chapter 6 Section 6.1 Chapter 7 Section 7.1
(i) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Chapter 5, 6 and 7
(j) an indication of the persons who will be responsible for the implementation of the impact management actions;	Chapter 5 Section 5.1
(k) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Chapter 2 Section 2.5.3

EIA REGULATIONS 2014 (as amended) GNR 326: Appendix 1 CONTENT OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)	Cross-reference in this Environmental Management Programme
(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 5.2.6, 5.2.7 and 5.2.8
(m) an environmental awareness plan describing the manner in which- <ul style="list-style-type: none"> i. the applicant intends to inform his or her employees of any environmental risk which may result from their work; and ii. risks must be dealt with in order to avoid pollution or the degradation of the environment; and. 	Chapter 6
(n) any specific information that may be required by the Competent Authority	
(2) where a government notice gazetted by the Minister provides for a generic EMPr, such generic EMPr as indicated in such notice will apply.	

CHAPTER 1: INTRODUCTION

This Environmental Management Programme has been compiled for the Dwarsrug Access Road Basic Assessment Project. The proposed access road is approximately 60km north of Loeriesfontein, in the Northern Cape Province, and falls within the jurisdiction of the Hantam Local Municipality and within the greater Namakwa District Municipality, in the Northern Cape Province.

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

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

CHAPTER 2: PROJECT DETAILS

South African Mainstream Renewable Power Developments (Pty) Ltd is proposing the construction of an Access Road for the Dwarsrug Wind Energy Facility near Loeriesfontein, Northern Cape Province. At present, untarred roads are planned for a maximum of 12m width, which will be rehabilitated to approximately 6 to 8m wide road following construction (and the agricultural use and zoning thereof restored following decommissioning). The planned power purchasing agreement and project life cycle (unless extended at a later point in time), will most likely be 20-25 years, for the entirety of which the proposed access road will be actively used (i.e. operational lifetime of approximately 20-25 years).

Two alternative access roads which will be assessed are proposed, including:

- » Alternative 1 - Gravel road from Granaatboskolk to the project site (approx. 11km); (PREFERRED ALTERNATIVE)
- » Alternative 2 - Gravel road from Granaatboskolk to the project site (approx. 8km).

The proposed Dwarsrug Access road will be located on the following properties:

- » Remainder of the Farm Brakpan No. 212;
- » Portion 1 of the Farm Aan de Karee Doorn Pan No. 213;
- » Remainder of the Farm Sous No. 226; and
- » Narosies No. 228

Laydown areas required for the project will be identical to those for the already approved Dwarsrug WEF, and as such no additional laydown, storage or site camp facilities will be employed or required for this component of the project – i.e. the only novel infrastructure proposed is the actual road itself. Alternative 1, the preferred alternative, is approximately 11km long, while alternative 2 is approximately 8km long.

The construction period for the proposed access road is approximately 3 months, which will need to be wholly completed to enable access provision for the construction of the associated Dwarsrug WEF. The WEF has a proposed, approved, 132kV steel monopole evacuation power line that would be connecting the onsite substation at the Dwarsrug WEF to the Helios Substation, for connection and further distribution into the national grid. The preferred road alternative occurs along that route, which coincides partially with the existing Eskom 400kV lines to and from Helios Substation. The proposed access road will thus be adjacent this Eskom service road for a moderate portion of the proposed road length.

The proposed access road will service the construction phase traffic for the associated Dwarsrug WEF. Thereafter it will be reduced to an approximately 6 to 8m wide road which will be utilised during the operation phase. Topsoil material will be removed and stockpiled in an appropriate manner adjacent the road, where it is sufficiently far away from the road to not prove an obstacle during operation of the road, or hampers the road safety. This topsoil will, as far as possible, be utilised for the rehabilitation of the road at both at the end of construction and decommissioning. Solid wastes produced during the construction phase of the road will be either utilised in the construction phase of the associated Dwarsrug WEF, or collected on site and disposed of at a licenced disposal facility. Should the amount of available construction fill material be insufficient, commercially sourced material may be utilised to make up the shortfall, or a separate, approved borrow pit will be utilised (to be authorised under a separate process).

The precise method statements for the development of the road will be determined prior to construction following the completion of engineering assessments and design, and contractor appointment, however the following general activities may be involved:

- i. Staking;
- ii. Clearing and grubbing;
- iii. Subgrade development;
- iv. Fill and cut operations (if necessary);
- v. Compaction;
- vi. Levelling and grading; and
- vii. Signage or markings (if necessary).

The following machinery may likely be employed during construction:

- i. Bulldozers;
 - ii. Front end Loader;
 - iii. Hydraulic excavators;
 - iv. Dump trucks or scrapers; and
 - v. Farm tractors.
- » The road will be suitably maintained, in line with municipal/provincial requirements or approvals, during both the construction and operation phase. Any waste material from the road construction will firstly be reused, where possible, in the larger construction of the Dwarsrug WEF, or alternatively disposed to the nearest licensed waste disposal site.

Based on the above set of factors taken into consideration, Mainstream identified two possible access roads (refer to **Figure 2 and 3**) as the most suitable from a technical and environmental perspective for the proposed Dwarsrug Access road.

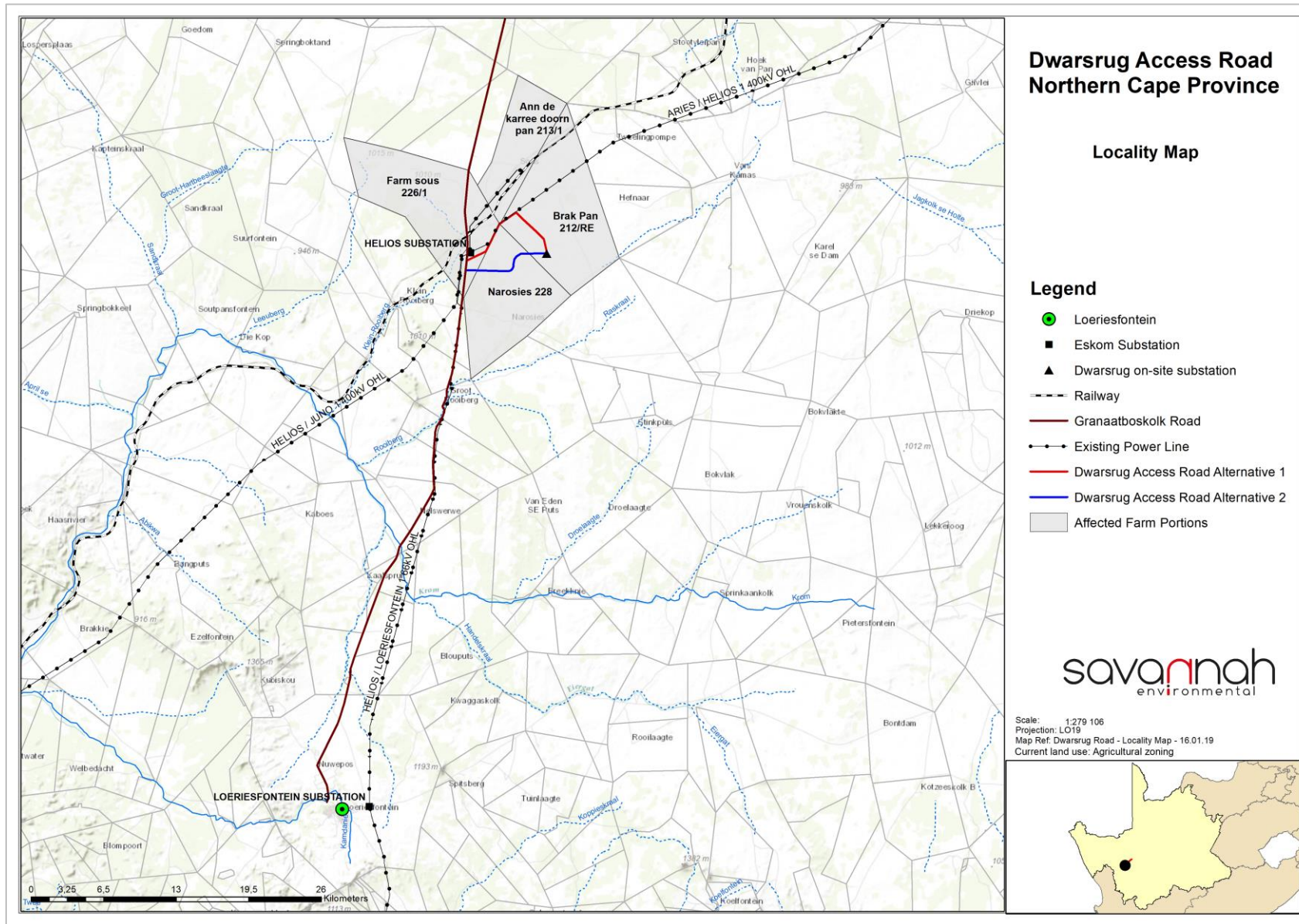


Figure 1: Locality map showing the location of the proposed Dwarsrug Access Road.

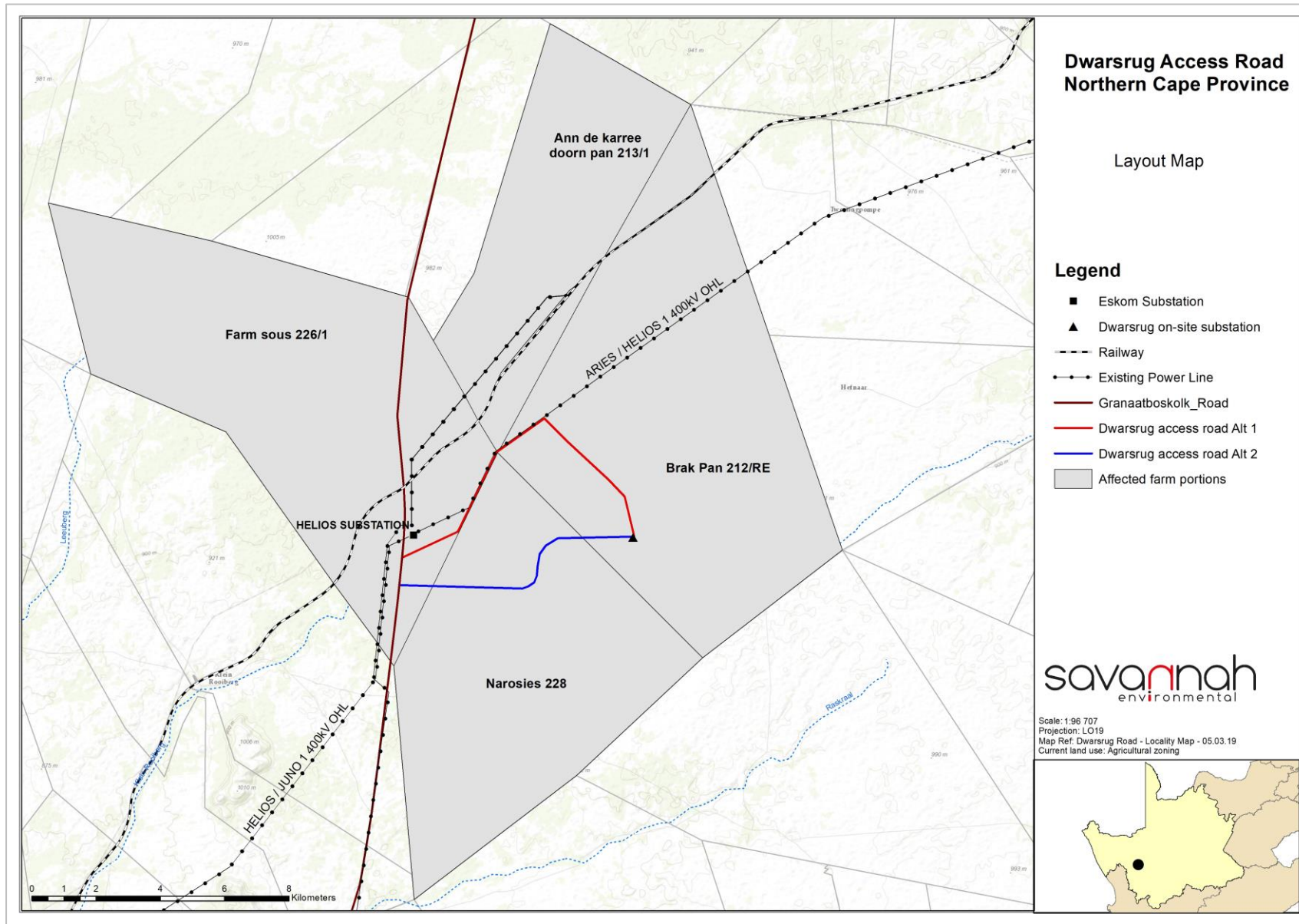


Figure 2 : Layout map showing the location of the project site.

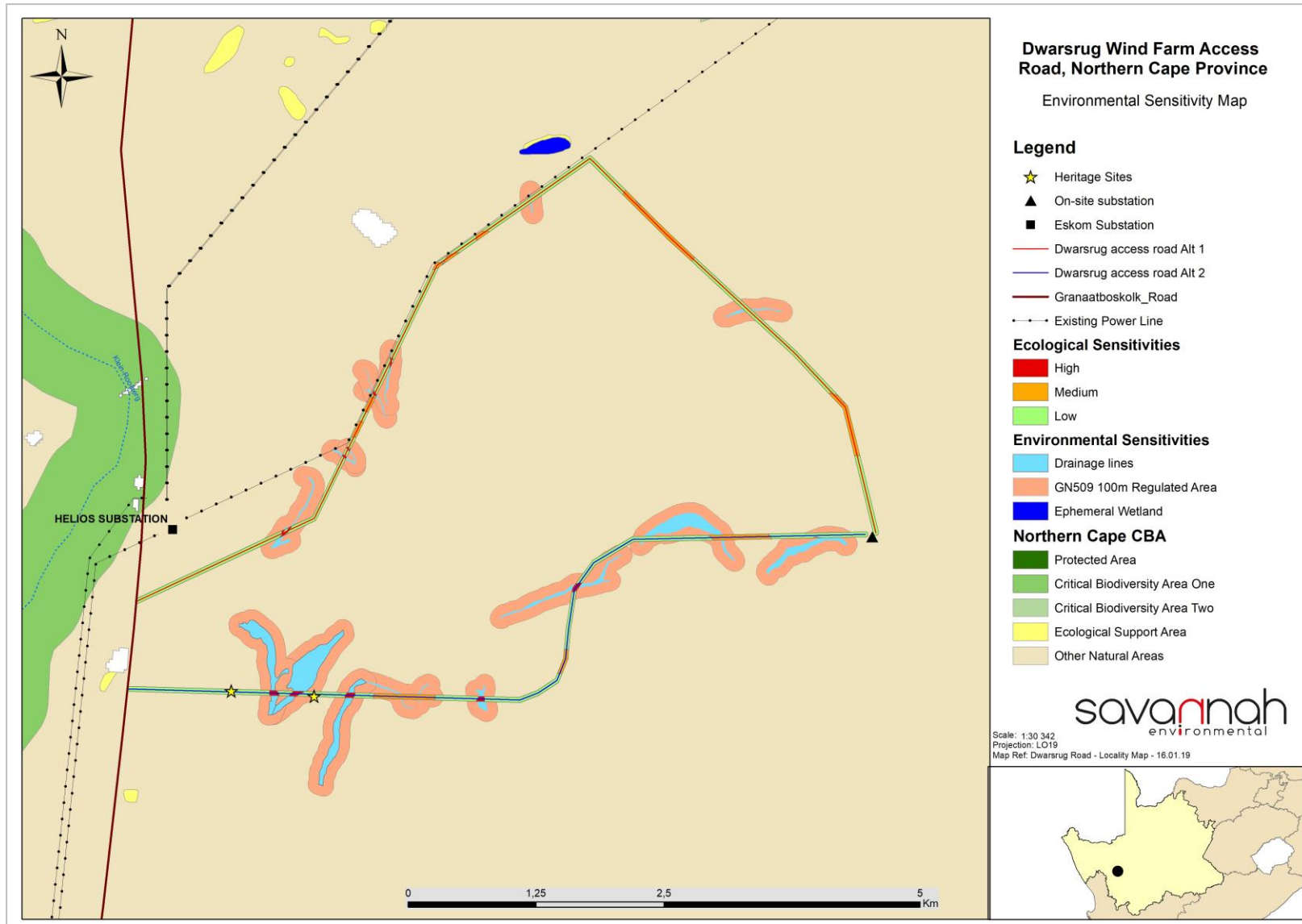


Figure 3: A map illustrating the sensitivity areas within the Dwarsrug Access Road as well as Critical Biodiversity Areas (CBAs).

Table 1.2: A detailed description of the Dwarsrug Access Road

Province	Northern Cape Province	
District Municipality	Namakwa District Municipality	
Local Municipality	Hantam Local Municipality	
Ward number(s)	5	
Nearest town(s)	Loeriesfontein	
Affected Properties: Farm name(s), number(s) and portion numbers	<ul style="list-style-type: none"> - Remainder of the Farm Brakpan No. 212; - Portion 1 of the Farm Sous No. 226; - Narosies No. 228 - Stink puts 229; and - Portion 1 of the Farm Aan de Karee Doorn Pan No. 213 	
SG 21 Digit Code (s)	<ul style="list-style-type: none"> - C01500000000021200000 - C01500000000022600001 - C01500000000022800000 - C01500000000022900000 - C01500000000021300001 	
Current zoning	Agriculture	
Site co-ordinates (centre of affected properties)	Latitude	Longitude
Alternative 1	30°29'59.15"S (start) 30°28'1.13"S (middle) 30°30'21.98"S (end)	19°37'55.57"E (start) 19°36'10.08"E (middle) 19°33'25.21"E (end)
Alternative 2	30°29'59.61"S (start) 30°30'39.70"S (middle) 30°30'49.88"S (end)	19°37'51.74"E (start) 19°36'2.15"E (middle) 19°33'22.18"E (end)

2.1. Findings of the Environmental Impact Assessment

The findings of the BA report provide a detailed assessment of the potential impacts that may result from the development of the Access road. This section provides a conclusion to the environmental assessment of the proposed development by providing a summary of the conclusions of the assessment of the project site and development footprint for the Dwarsrug Access Road. In so doing, it draws on the information gathered as part of the BA process and the knowledge gained by the environmental assessment practitioner (EAP), Specialists and presents an informed opinion of the environmental impacts associated with the proposed development.

From the conclusions of the detailed BA process undertaken no environmental fatal flaws were identified and associated with the Dwarsrug Access road provided that the recommended mitigation measures are implemented, specifically in terms of avoidance of sensitive features within the development footprint and the undertaking of the construction and operational monitoring as specified by the EAP and Specialists. The development footprint was designed by the Developer in order to respond to and avoid any sensitive environmental and social features located within the project site. This approach ensured the application of the mitigation hierarchy (i.e. avoid, minimise and offset) to the Dwarsrug Access road project which ultimately ensures that the development is appropriate from an environmental perspective and is suitable for development within the project site and its environmental challenges. The application of the mitigation hierarchy was undertaken by the developer prior to the commencement of the BA process for

Environmental Authorisation, as detailed in the BA report. Therefore, it is concluded that the development footprint is suitable and appropriate from an environmental perspective for the access road and will not have a detrimental impact on any sensitive features present.

The potential environmental impacts associated with the Dwarsrug Access Road identified and assessed through the BA process include:

- » Impacts on vegetation;
- » Impacts on the Ecology;
- » Soil compaction and erosion impacts;
- » Heritage and Palaeontological Impacts;
- » Drainage Systems Impacts; and
- » Traffic impacts.

2.1.1 Impacts on the Ecology

Short term impacts (vegetation clearing, dust and vibration and noise) are likely to have a short term increase in negative impacts. In terms of ecological features, the majority of the Dwarsrug Access Road routes traverse low or medium sensitivity and where the impact of the road on fauna and flora would be low or very low and of a local nature only. The overall diversity of the vegetation is low and the abundance of listed plant species is also very low. Apart from the low ridges, the only other significant feature of the site are the poorly developed drainage lines of the area. Overall the ecological impact is therefore likely to be of low significance and, from an ecological point of view, no fatal flaws are associated with the road realignment within the identified corridor. All impacts that may occur project can be mitigated to an acceptable level.

Please refer to the Appendix D of the associated Basic Assessment Report for a complete account of the Ecological impact and sensitivity of the project.

2.1.2 Soil compaction and erosion impacts

Site clearing activities such as earthworks on site will create soil compaction and erosion impacts during the construction and decommissioning phases of the project. In the view of the above, the anticipated impacts on soil due to the compaction of surfaces and erosion are considered negligible, provided the mitigation measures included in this EMP are implemented. Therefore, it is the view of the EAP that impacts of the Dwarsrug Access road can be mitigated to an acceptable level.

2.1.3 Heritage and Palaeontological Impacts

The destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. Taking into consideration the extremely localised nature of the proposed access road, the study has identified that the activities will have a low impact on heritage resources. There are therefore no fatal flaws associated with the access road and all impacts that may occur project can be mitigated to an acceptable level.

Please refer to the Appendix D of the associated Basic Assessment Report for a complete account of the Heritage impact and sensitivity of the project.

2.1.4 Drainage Systems Impacts

The impact on the hydrological nature of the area will be localised and there is already an existing impact for a section of the proposed access road which traverses the north western boundary of the farm Narosies 228, where an existing farm road is present. In addition, only minor drainage lines are affected. The present ecological state of the ephemeral depression wetland north of the access road assessed to be a Class C (moderately modified) ephemeral depression wetland system. Taking into consideration the mitigation measures included in this EMPr, the EAP is of the view that the Dwarsrug Access road be authorised provided the mitigation measures included in the report are implemented.

Please refer to the Appendix D of the associated Basic Assessment Report for a complete account of the freshwater impact and sensitivity of the project.

2.1.5 Impacts on Traffic

During the construction phase, Contractors will make use of the Granaatboskolk road to gain access to the project site. This will have localised impacts on the Granaatboskolk road and the surrounding areas, these impacts are considered to be low. The operational phase of the Dwarsrug access road will generate limited vehicle trips by the staff of the Dwarsrug WEF, therefore these impacts are considered to be low. Taking into consideration the location of the project site, the scale of the development and the road infrastructure already in place, the project presents low traffic impacts no fatal flaws from a traffic perspective.

2.1.6 Overall Impact

Overall, the impacts associated with the Dwarsrug Access road are considered to be of an acceptable significance and can be mitigated successfully in order to ensure that the development will not create any detrimental environmental impacts that will be long-term and unacceptable. Therefore, through the undertaking of the Basic Assessment process, the EAP and Specialists identified areas of high and low sensitivity to be associated with the development. In the view of the above, refer to **Figure 4** for a sensitivity map of the Dwarsrug Access Road.

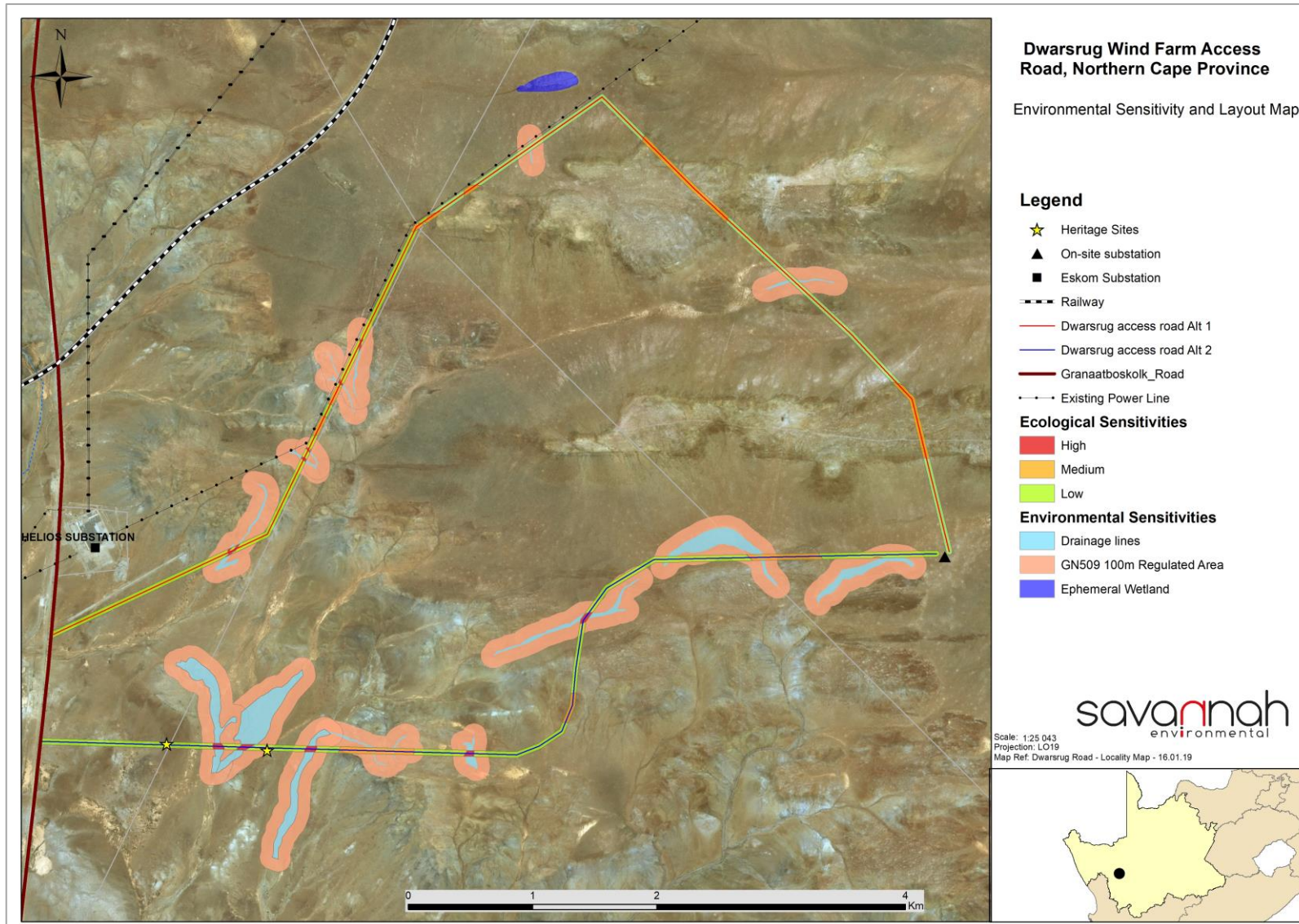


Figure 4: Map illustrating the ecological sensitivity of the proposed Dwarsrug Access road.

Table 1.4: Activities Associated with Planning, Construction, Operation and Decommissioning phase of the Access road

<u>Design and Planning Phase</u>	
Requirements	» Conduct technical surveys prior to initiating construction.
Activities to be undertaken	
Conduct surveys	<p>Prior to initiating construction, a number of detailed surveys will be required including, but not limited to:</p> <ul style="list-style-type: none"> » <i>Geotechnical survey</i> – The geotechnical study will look at the availability of natural construction materials. This study will serve to inform the extent of earthworks and compaction required. » <i>Site survey</i> - in order to finalise the design layout of the road. The finalisation will need to be confirmed in line with the Environmental Authorisation issued for the road realignment.
<u>Construction Phase</u>	
Requirements	<p>Site preparation activities will include:</p> <ul style="list-style-type: none"> * Clearance of vegetation within the footprint of the road realignment * Levelling of site (as necessary) * The development of stormwater control management systems which will divert water from construction areas and can be used during the operation phase of the road. <ul style="list-style-type: none"> » These activities will require the stripping of topsoil which will be needed for future rehabilitation. » Waste removal and sanitation will be undertaken in accordance with the Dwarsrug Wind Energy Facility Waste Management Procedure » Create direct construction employment opportunities for a 3 month period.
Establishment of the road	» Construction of a 11km long and 12 m wide access road (which will be reduced to 6 to 8m wide during the operation phase).
Undertake site rehabilitation and the establishment of the stormwater management plan	<ul style="list-style-type: none"> » Areas requiring rehabilitation will include those areas disturbed during the construction phase which are not required for operation. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area. » Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved. » All temporary facilities, temporary equipment, and waste materials must be removed from site. » Erosion control measures (i.e. drainage works and anti-erosion measures) should be used in sensitive areas (i.e. steep slopes, hills, and drainage lines) to minimise loss of topsoil and control erosion. » All temporary facilities, temporary equipment, and waste materials must be removed from site. » Any access points and/or access roads which are not required during the operational phase must be closed as part of the post-construction rehabilitation.
<u>Operation Phase</u>	
Requirements	<ul style="list-style-type: none"> » Duration will be 20-25 years. » Technical staff of the Dwarsrug WEF will undertake maintenance activities as and when required.

Activities to be undertaken	
Operation and Maintenance	» Areas which were disturbed during the construction phase to be rehabilitated during operation phase of the access road.
<u>Decommissioning Phase</u>	
Requirements	» Decommissioning of the Access road at the end of the economic life of the Dwarsrug WEF (after 20-25 years). » Decommissioning activities to comply with the legislation relevant at the time.
Activities to be undertaken	» Areas requiring rehabilitation will include those areas disturbed during the operation phase. Rehabilitation should be undertaken in an area as soon as possible after the completion of the operation phase. » Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.

CHAPTER 3: PURPOSE AND OBJECTIVES OF THE EMPR

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

The EMPr provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate activities so that unnecessary or preventable environmental impacts do not result. The impacts considered by the EMPr during construction and operation/maintenance of the road relate to loss of floral biodiversity, loss of heritage resources, stormwater management, soil erosion and siltation of water resources, waste management, and invasion by alien species.

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

This EMPr has been compiled in accordance with Appendix 4 of the EIA Regulations ,2014 (as amended). This is a dynamic document and will be further developed in terms of specific requirements listed in any authorisations issued for the Dwarsrug Access Road and/or as the project develops. 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).

The EMPr has the following objectives:

- » Outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation and operation phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the access road.
- » Ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- » Identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- » Propose mechanisms and frequency for monitoring compliance, and prevent long-term or permanent environmental degradation.
- » Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the BA process.

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

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 EMPr is part of the BA process for the Dwarsrug Access road, it is important that this document be read in conjunction with the BA report compiled for this project. This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. Should there be a conflict of interpretation between this EMPr and the Environmental Authorisation, the stipulations in the Environmental Authorisation shall prevail over that of the EMPr, unless otherwise agreed by the authorities in writing. Similarly, any provisions in legislation overrule any provisions or interpretations within this EMPr.

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

3.1 Project Team:

In accordance with the requirements of Appendix 4 of the EIA Regulations of 2014 (as amended in 2017), the details of the consulting team from Savannah Environmental (Pty) Ltd responsible for the BA process and compilation of this EMPr are as follows:

- » **Hermien Slabbert**, is responsible for the compilation of this EMPr. She holds a BSc degree with Honours in Environmental Management and has two years of experience in the renewable energy sector. She has worked on renewable energy projects and has provided assistance basic assessments (BAs), amendment applications and water use license (WUL) applications. She has also done GIS mapping (ArcGIS) for small and large-scale projects.
- » **Gideon Raath**, is the principal EAP for this project. He has 4.5 years of work experience in the environmental consulting industry. Furthermore, Gideon has an MSc in Environmental Management and Geography and is registered with SACNASP (11718), and his particular focus is on environmental impact assessments mainly within the renewable energy (wind and solar) sector, as well as for infrastructure (roads, pipelines and power line) related projects.
- » **Nicolene Venter**, a Board Member of IAPSA (International Association for Public Participation South Africa). She holds a Higher Secretarial Diploma and has over 21 years of experience in public participation, stakeholder engagement, awareness creation processes and facilitation of various meetings (focus group, public meetings, workshops, etc.). Her line of work pertains to managing the public participation process of Environmental Impact Assessments and Basic Assessments undertaken by Savannah Environmental (Pty) Ltd.
- » **Jo-Anne Thomas**, is a Director at Savannah Environmental (Pty) Ltd. Jo-Anne has a Master of Science Degree in Botany (M.Sc. Botany) from the University of the Witwatersrand and is registered as a Professional Natural Scientist (400024/2000) with the South African Council for Natural Scientific

Professions (SACNASP). She has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation and transmission projects through her involvement in related EIA processes over the past 20 years. She has successfully managed and undertaken EIA processes for infrastructure development projects throughout South Africa.

Curricula Vitae (CVs) detailing Savannah Environmental team's expertise and relevant experience are provided in **Appendix A**, and those of the Specialists in **Appendix B** of this EMPr,

The Savannah Environmental team has extensive knowledge and experience in environmental impact assessment and environmental management, having been involved in EIA processes for more than twelve (12) years. They have managed and drafted Environmental Management Programmes for various renewable energy and associated infrastructure development projects throughout South Africa

CHAPTER 4: STRUCTURE OF THIS EMPR

The first three chapters provide background to the EMPr and the Dwarsrug Access road, while the chapters which follow consider the following:

- » Construction activities;
- » Operation activities; and
- » Decommissioning activities.

Please note: As no impacts were determined for either alternative in the Basic Assessment or specialist studies, the following phases are not applicable for this EMPr:

- » Planning and design;
- » Pre-construction activities; and
- » Rehabilitation of the environment after construction and where applicable post closure.

These chapters set out the procedures necessary for Mainstream as the project owner, to minimise environmental impacts and achieve environmental compliance. For each of the phases of implementation, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The EMPr has been structured in a table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions, monitoring requirements and performance indicators. A specific EMPr table has been established for each environmental objective. The information provided within the EMPr table for each objective is illustrated below in **Table 1.3**. Furthermore, the objectives and EMPr tables are required to be reviewed and possibly modified throughout the life of the Dwarsrug Access road whenever changes, such as the following occur:

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

Table 1.3: An example of the detailed EMPr table for the proposed Dwarsrug Access Road.

PHASE									
Project Component/s									
No	Aspect	Potential Impact	Outcome	Mitigation measures/management actions	Responsible Persons	Time period for implementation	Implementation indicator (KPI)	Monitoring Mechanism & staff responsible	Monitoring Method & Frequency

This table is completed in the sections below to address each of the impacts identified through the Basic Assessment process, in accordance with the specifications of Appendix 4: Content of environmental management programme (EMPr), of GNR 326, EIA Regulations (as amended, 2017). Unless specified otherwise within the impact tables as shown in Table 1.3 above, all aspects, mitigation measures, impacts, roles & responsibility as well as performance indicators are identical for all alternatives proposed, and must be implemented as such.

4.1 Institutional Arrangements: Roles and Responsibilities for the implementation of the EMPr:

As the proponent, Mainstream must ensure that the implementation of the access road complies with the requirements of all environmental authorisations and permits, and obligations emanating from other relevant environmental legislation. This obligation is partly met through the development of the EMPr, and the implementation of the EMPr through its integration into the contract documentation.

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Engineer Representative; Environmental Manager; Environmental Officer; Environmental Control Officer; SHE Representative and the Contractor for the construction phase of this project are detailed below. Therefore, **Figure 5** provides an organogram indicating the organisational structure for the implementation of the EMPr.

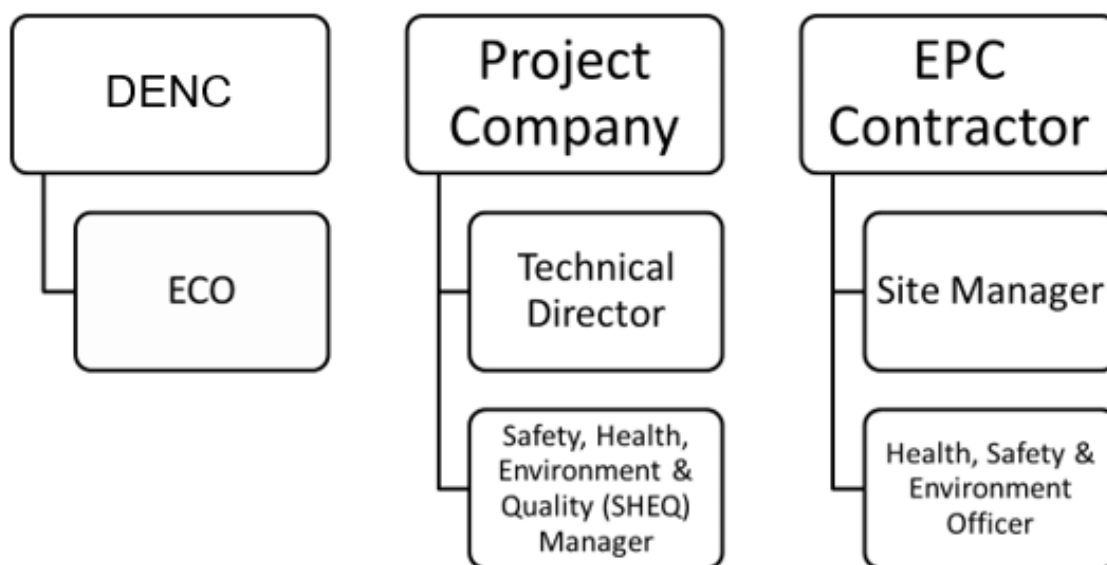


Figure 5: Organisational structure for the implementation of the EMPr.

The following roles and responsibilities are defined for the project, and may be applicable above and beyond the roles identified in Figure 5:

Project Manager (PM) will:

- » Be responsible for managing the proposed Dwarsrug Access Road, contractors and consultants, as well as ensuring that the environmental management requirements are met. All decisions pertaining to environmental procedures must be approved by the PM. Authority is bestowed on the PM to stop any

construction-related activity in contravention of the EMPr in accordance with an approved disciplinary procedure.

- » Ensure that all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these before commencing with any activity on site.
- » Ensure that all 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 contents of the BA report compiled for this project; the EMPr, the conditions stipulated in the EA (once issued), and all relevant environmental legislation; and

Engineer Representative (ER) will:

- » Be responsible for issuing instructions to the Contractor(s) including variation orders (VOs) as and when required subsequent to requests by the EM, EO or ECO.
- » Oversee site works, liaise with Contractor(s) and the ECO.
- » Ensure that adequate resources are made available and appropriately managed for the successful implementation of the EMPr.
- » Conduct annual basis reviews of the EMPr to evaluate its effectiveness.
- » Take appropriate action as a result of findings and recommendations in management reviews and audits.
- » Provide forums to communicate matters regarding environmental management.

Environmental Manager/Environmental Officer (EM/EO) will:

- » Be appointed by Mainstream as their representative at the Dwarsrug Access Road. He/she is not independent but must act on behalf of Mainstream with the mandate to enforce compliance under the proposed Dwarsrug Access Road contract which must include the EMPr.
- » Possess the relevant qualifications and preferably competent in construction related methods and practices.
- » Be part of the project team and be an active participant in all aspects of the proposed project planning that can potentially influence environmental conditions at the Dwarsrug Access Road.
- » Be present during relevant project meetings and provide feedback on potential environmental issues associated with the proposed Dwarsrug Access Road.
- » Ensure contents of the EMPr are clearly communicated to the Contractor(s) and ensure all site staff attend a site-specific induction programme and an environmental awareness training session prior to site handover to Contractor(s).
- » Conduct regular inspections to monitor compliance in terms of the EMPr
- » Issue non-compliances and hazard certificates.
- » Develop and Implement an Environmental Management System (EMS) for the Dwarsrug Access Road.
- » Maintain a register of all known environmental impacts and manage the monitoring thereof.
- » Conduct internal environmental audits and co-ordinate external environmental audits.
- » Compile environmental policies and procedures.
- » Liaise with statutory bodies such as the National and Provincial Department of Environmental Affairs (DEA and DENC) on environmental performance and other issues.
- » The Environmental Manager must provide fourteen (14) days written notification to the DENC that the activity operation phase will commence.

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

- » Be fully knowledgeable with the contents of the BA and risk management;
- » Be fully knowledgeable with the contents and conditions of the Environmental Authorisation (once issued);
- » Be fully knowledgeable with the contents of the EMPr;
- » Have overall responsibility of the EMPr and its implementation;
- » Ensure that no actions are commissioned which potentially harm or may indirectly cause harm to the environment, and take steps to prevent pollution on site;
- » Confine activities to the demarcated construction site;
- » Ensure that all employees and co-contractors are compliant with the requirements and provisions of this EMPr;
- » Prepare method statements;
- » Discuss implementation and compliance with this document with staff at routine site meetings;
- » Report progress regarding the implementation of non-conformances in terms of this document at site meetings with the EM, EO and ECO;
- » Ensure appropriate documentation and records are available to the EM/EO and ECO;
- » Notify the ECO of all incidents, accidents and transgressions on site pertaining to the requirements stipulated in this document as well as of any corrective actions/remedial actions taken;
- » Inform the EM/EO and ECO of any issues arising from the implementation of the EMPr; and
- » Inform the EM/EO and ECO of any complaints received.

An independent, suitably experienced **Environmental Control Officer (ECO)** must be appointed by Mainstream prior to the commencement of any authorised activities. The ECO will be based at the Dwarsrug Access Road and will be responsible for monitoring, reviewing and verifying compliance by the Contractor in terms of the requirements provided in the EMPr and the Environmental Authorisation. Therefore, the ECO will:

- » Be on site before the commencement of any construction-related activities. He/she must endeavour to form an integral part of the proposed project team.
- » Be fully knowledgeable with the contents of the conditions of the Environmental Authorisation (once issued), EMPr, and any environmental permits issued for the Dwarsrug Access road and the Dwarsrug WEF (i.e. WUL, AEL etc.)
- » Conduct compliance audits in terms of the EMPr, EA and any other applicable environmental legislation.
- » Liaise with relevant authorities (i.e. DENC, DWS and the project team).
- » Communicate contents of the EMPr to the Contractor(s) site staff and visitors.
- » Ensure that the Site Manager and co-contractors are continuously made aware of EMPr contents through discussion.
- » Ensure that the compliance of the EMPr, EA and the relevant environmental legislation is monitored through regular and comprehensive inspections of the site and surrounding areas.
- » Ensure that if the EMPr, EA and/or the legislation provisions, regulations or specifications are contravened, then appropriate corrective and remedial actions are undertaken to address non-compliances.
- » Ensure that the Site Manager has provided input into the review and acceptance of construction methods and method statements.
- » Ensure that activities on site adhere to and comply with all applicable environmental legislation.
- » Undertake periodic environmental monitoring and verification to ensure that environmental impacts are kept to a minimum, as far as possible.

- » Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMPr.
- » Keep record of all activities on site, issues identified, transgressions noted and a task schedule of tasks undertaken by the ECO.
- » Ensure that the compilation of progress reports for submission to the PM, ER and EM, 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 task schedule of tasks undertaken by the ECO.
- » Submit independent reports to the DEA/DENC and other regulating authorities regarding compliance with the requirements of the EMPr, EA and other environmental permits.

The ECO shall remain employed and undertake compliance audits until all rehabilitation measures, as may be required, are completed and the site handed over for operation.

Contractors and Service Providers: It is important that contractors are aware of their duties & responsibilities in terms of applicable environmental legislation and the contents of this EMPr. The contractor is hereby responsible for informing employees and sub-contractors of their environmental obligations in terms of the applicable environmental provisions, and for ensuring that employees are adequately experienced and properly trained in order to execute tasks in a manner that will minimise environmental impacts and risk. The contractor's obligations in this regard will include the following:

- » Ensure that all employees and sub-contractors have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- » Ensure a copy of the EMPr is easily accessible to all on-site staff members.
- » Ensure that all employee and sub-contractors are conversant with the requirements of this EMPr and the environmental specifications as they apply to the construction of the Dwarsrug Access Road.
- » Ensure prior to commencing of any site works, all employees and sub-contractors have attended an environmental awareness training course which must provide staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
- » Ensure staff is timeously informed of environmental issues as deemed necessary by the ECO.

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

- » Ensuring adherence to the environmental management specifications
- » Ensuring that Method Statements are submitted to the Site Manager for approval before any work is undertaken
- » Any lack of adherence to the above will be considered as non-compliance to the specifications of the EMPr
- » Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to
- » Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting
- » Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO
- » Ensuring that a register of all public complaints is maintained
- » Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful

implementation of the EMPr (i.e. ensure their staff are appropriately trained as to the environmental obligations)

Contractor's Safety, Health and Environment Representative: The Contractor's Safety, Health and Environment (SHE) Representative, employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the SHE Rep must act as liaison and advisor on all environmental and health related issues. He or she must ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor. In some instances, a separate EO may be appointed to support this function.

The Contractor's Safety, Health and Environment Representative and/or Environmental Officer should:

- » Be well versed in occupational health and 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.

CHAPTER 5: MANAGEMENT PROGRAMME: CONSTRUCTION PHASE

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, 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 in the study area.
- » Minimises the impact on heritage sites should they be uncovered.
- » Establish an environmental baseline during construction activities on the site, where possible.

5.1 Construction Phase Impacts

CONSTRUCTION PHASE									
Project Component/s		Dwarsrug Access road							
No	Aspect	Potential Impact	Outcome	Mitigation measures/ management actions	Responsible Persons	Timeframe	Implementation indicator (KPI)	Monitoring Mechanism & staff responsible	Monitoring Method & Frequency
1	Clearing of Vegetation	Impacts on Biodiversity	Effective rehabilitation of areas on-site affected by the construction phase.	<ul style="list-style-type: none"> » Contractors should rehabilitate areas that were affected by the proposed development. » The final route should be subject to a preconstruction walk-through before construction commences and adjusted where required to reduce impacts on Species of Conservation Concern (SCC) and habitats of concern. » Search and Rescue of SCCs should be conducted prior to clearing activities. » Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within the demarcated construction areas etc. » All construction vehicles should adhere to clearly defined and demarcated roads. » No off-road driving is to be allowed. 	<ul style="list-style-type: none"> » Contractor » Suitably qualified botanist (walk-through) 	» Prior to the construction phase.	» That the cleared areas affected by the construction of the access road are revegetated.	<ul style="list-style-type: none"> » Audits and Inspections by the Site Manager, Environmental Manager (EM) and Environmental Officer EO; » Audits by Independent Environmental Control Officer (ECO). 	<ul style="list-style-type: none"> » Inspections- every two weeks (Internal staff) » Audits-Monthly (Independent ECO)
2	Movement of machinery, trenching and excavation.	Soil Compaction and Erosion	Rehabilitation of areas on-site affected by the construction phase.	<ul style="list-style-type: none"> » Contractors should rehabilitate areas that were affected by the proposed development in accordance with the EMPr. » Bare areas should be suppressed for dust (using a water tank/bowser) in accordance with the EMPr. Therefore, this will reduce the likelihood of wind being an effective erosion agent for the duration of the 3-month construction phase. » All soils compacted as a result of construction activities should be profiled and monitored to ensure 	» Contractor	» After the completion of the construction phase and before the commencement of the operation phase.	» That rehabilitated areas affected by the construction of the access road are revegetated and reinstated in the same condition as prior to construction	<ul style="list-style-type: none"> » Audits and Inspections by the Site Manager, EM and EO; » Audits by Independent ECO. 	<ul style="list-style-type: none"> » Inspections-Weekly (Internal staff) » Audits-Monthly (Independent ECO)

				<p>establishment of natural vegetation.</p> <ul style="list-style-type: none"> » Removed soil should be used as infill material for any voids created during the construction phase. » Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads associated with the project during the construction phase. » A road/civil engineer must ensure that stormwater structures are included in the road design, in order to minimise erosion. » All stormwater structures must be designed to comply with engineering requirements as per the design team 					
3	Damage to the drainage lines	Damage to the drainage lines (such as erosion, siltation, dumping of waste) that will impact on ecosystem functioning.	Limit impacts on drainage features	<ul style="list-style-type: none"> » Disturbed areas should be rehabilitated and re-vegetated as soon as possible. » Vegetation clearance must be limited as far as possible and only within the servitude and course of the proposed access road. No unnecessary clearance is to be undertaken. » An alien invasive monitoring and control management programme must be compiled to manage encroachment of alien species within the watercourses and along the entire course of the road. » The alien invasive monitoring and control management programme is also to be implemented post-construction for approximately two (2) years to ensure alien invasive do not encroach following construction. » Movement of workers within the watercourse must be limited to the servitude of 	<ul style="list-style-type: none"> » Contractor » Suitably qualified ecologist (IAP plan) 	<ul style="list-style-type: none"> » After the completion of the construction phase and before the commencement of the operation phase. 	<ul style="list-style-type: none"> » No disturbance outside of designated work areas. » Minimal siltation in drainage lines as a result of construction activities. 	<ul style="list-style-type: none"> » On-going inspections of sediment control devices by SHE and ECO. » Immediate reporting of ineffective sediment control systems. » An incident reporting system must be implemented to record non-conformances. 	<ul style="list-style-type: none"> » Audits-Monthly (Independent ECO)

				<p>the road. Workers are not allowed to wonder freely in the watercourse. This will cause unnecessary degradation of the watercourse.</p> <ul style="list-style-type: none"> » Construction of the access road in the watercourse is to take place preferably in the summer and spring months (September to March) as these are the drier months in which rainfall is likely to be limited. Construction in the autumn and winter months (April to August) is to be avoided as far as possible, as this is when rainfall can be expected and the watercourses are likely to be in flow after rainfall events. » All vehicles and machinery to be used within the watercourses during construction must be checked for oil and fuel leaks before being allowed to cross or work in the watercourses. Should a leak be detected, the vehicle is to be prohibited from working within or crossing through the watercourses until repaired. » No soil stockpiles are to be placed within 50m of any watercourse. Soil stockpiles within 100m of a watercourse must be bunded with suitable materials (such as bricks or planks), to prevent sedimentation. » During construction, silt netting must be erected on the downstream side, along the length of the road crossing, through the watercourse and riparian habitat (as delineated) during the dry season to contain sediment as far as possible. 					
4	Soil erosion	Soil erosion and impacts on topsoil	Minimisation of development footprint, erosion and disturbance to topsoil	<ul style="list-style-type: none"> » Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads associated with the project during the construction phase. » Erosion management at the site should take place according to the Erosion 	» Contractor	» After the completion of the construction phase and before the commencement of the operation phase.	<ul style="list-style-type: none"> » No disturbance outside of designated work areas. » Retain natural vegetation, where possible 	<ul style="list-style-type: none"> » On-going inspections of sediment control devices by SHE and ECO. » Immediate reporting of ineffective sediment control systems. » An incident reporting system must be 	» Audits-Monthly (Independent ECO)

				<p>Management Plan and Rehabilitation Plan.</p> <ul style="list-style-type: none"> » All roads should have runoff control features which redirects water flow and dissipate any energy in the water that may pose an erosion risk. » Regular monitoring for erosion during construction to ensure that no erosion problems are developing as a result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. » All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. » All cleared areas should be revegetated with indigenous perennial species from the local area. » A road/civil engineer must ensure that stormwater structures are included in the road design, in order to minimise erosion. » All stormwater structures must be designed to comply with engineering requirements as per the design team. 				implemented to record non-conformances.	
5	Generation of dust emissions	Impacts on Air Quality	Reduction of dust emissions on-site	<ul style="list-style-type: none"> » Dust suppression methods should be undertaken during clearing, such as sprinkling and wind breaks. » Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads associated with the project during the construction phase. » Dust generation must comply with the National Dust Control Regulations (GN No. R. 827) of 1 November 2013, promulgated in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004). » Limit vegetation clearing as far as possible. 	» Contractor	<ul style="list-style-type: none"> » Pre-construction » Construction phase 	<ul style="list-style-type: none"> » Less than two complaints from construction workers, Dwarsrug Access Road staff and surrounding landowners per month concerning dust emissions. 	<ul style="list-style-type: none"> » Audits and Inspections by Site Manager. » Audits and Inspections Environmental manager (EM) and Environmental Officer (EO). » Audits by Independent Environmental Control Officer (ECO). 	<ul style="list-style-type: none"> » Audits-Monthly (independent ECO)

6	Presence of improperly disposed solid waste, i.e. litter, cement rubble and any surplus material generated during the clearance of the site	Generation of Solid Waste (General & Hazardous)	To minimise the production of general and hazardous waste.	<ul style="list-style-type: none"> » General waste should be disposed of an approved waste disposal facility. » Records of all waste being taken off site must be recorded and kept as evidence. » Management of solid waste should be handled according to the Dwarsrug Access Road Waste Management Procedure. » Where possible, waste should be recycled. » The waste management hierarchy must be adopted at the construction site where waste is prevented, if it cannot be prevented it should be minimised. If waste can't be minimised it must be reused or recycled. If this is not an option it should be used for energy recovery. This may involve selling waste to third part recovery organisations. Lastly if energy recovery is not possible waste should be disposal of. » Should waste be stored on site, it cannot be temporarily stored for longer than 80 days. 	» Contractor	<ul style="list-style-type: none"> » Pre-construction » Construction phase 	<ul style="list-style-type: none"> » Compliance with waste management legislation » To minimise production of waste » To ensure appropriate waste storage and disposal streams during auditing events. 	<ul style="list-style-type: none"> » Audits and Inspections by Site Manager » Audits and Inspections EM » Audits by Independent ECO 	<ul style="list-style-type: none"> » Observation and supervision of waste management practices throughout construction phase through daily inspections and monthly audits (internal staff) » Waste collection to be monitored on a weekly basis (internal staff) » Waste documentation completed by Site Manager in accordance with the Dwarsrug Access Road Waste Management Procedure. » An incident reporting system will be used and implemented by the EM and EO to record any non-conformances to the EMPr as and when an incident occurs.
7	Impacts on the health and safety of the Contractors and staff is anticipated during the construction phase.	Health & Safety Impacts	Zero occurrence of incidents and fatalities	<ul style="list-style-type: none"> » All construction staff must have the appropriate Personal Protective Equipment (PPE) and safety equipment before being allowed to carry construction activities. » The construction staff handling chemicals or hazardous materials must be trained in the use of the substances and the environmental, health and safety consequences of incidents. » Appoint Safety, Health and Environment (SHE) Officer to ensure monitoring of safety conditions during construction activities. » Classify all Hazardous waste and dispose of appropriately. » Adhere to the Occupational Health and 	» Contractor » Site SHE Rep	<ul style="list-style-type: none"> » Pre-construction » Construction 	<ul style="list-style-type: none"> » Any incidents or recorded on-site during the construction phase are limited to no more than 1 per month. 	<ul style="list-style-type: none"> » Audits and inspections by the Site SHE Representative. 	<ul style="list-style-type: none"> » Weekly or bi-weekly toolbox talks held by Site SHE Representative. » Weekly site inspections by the SHE Representative. » Monthly internal safety audits by the Site Manager and SHE Rep.

				Safety Act (OHSA) (Act 85 of 1993).					
8	Contractors are expected to give preference to unskilled and skilled labourers residing in the surrounding local communities for the duration of the construction phase.	Creation of employment opportunities	Ensuring that at least 15% unskilled labour is from the nearby communities.	<ul style="list-style-type: none"> » A local's first approach should be adopted for the procurement of sub-contractors and employees on the construction site. » Priority should be given to unskilled members of the local community. » Existing local community structures should be used as a communication or liaison tool between the applicant and members of the local community. 	<ul style="list-style-type: none"> » Project Manager » Site Manager 	<ul style="list-style-type: none"> » Duration of the Construction phase (3 months) 	<ul style="list-style-type: none"> » Employment opportunities be generated during the construction phase. 	<ul style="list-style-type: none"> » Project Manager will source and appoint accredited training service provider for the skills development programme. » Project Manager will liaise with local municipal and tribal authorities regarding the number of low-semi-skilled employees from local communities. 	<ul style="list-style-type: none"> » Bi-annual skills audit of workers on-site to be conducted by Site Manager and reported to Project Manager.
9	Noise generation due to civil works, and movement of heavy machinery.	Noise Impacts	Reduction of noise-related impacts on employees and surrounding landowners.	<ul style="list-style-type: none"> » Any drilling activity should take place during the approved working hours, these are to be known and agreed upon with all contractors. » Machinery and equipment are to be switched off when not used. » All operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993). » Retro-fit some equipment with dampening measures and ensure the use of noise protection ((i.e. earplugs/ear muffs) by all construction workers where excessive noise is to be generated. 	<ul style="list-style-type: none"> » Site Manager » SHE Rep 	<ul style="list-style-type: none"> » Duration of the Construction phase (3 months) 	<ul style="list-style-type: none"> » Zero complains from construction workers and neighbouring land owners regarding increased levels of noise due to the development. 	<ul style="list-style-type: none"> » Site Manager should ensure procure and supply workers with noise abatement devices (i.e. ear plugs or ear muffs). » SHE Representative in conjunction with supervisors/foremen should ensure that should ensure all workers have noise abatement devices and should report the lack thereof to the Site Manager. 	<ul style="list-style-type: none"> » Weekly Inspections by the SHE Representative. » Mass Meetings with the Site Manager.
10	Increase in vehicular movement on roads in the surrounding areas.	Impacts on traffic	Minimise the impact of traffic associated with the construction of the access road.	<ul style="list-style-type: none"> » Contractors should adhere to speed limits and roads signs on and off site at all times. » All construction vehicles must be road worthy and all designated drivers must be in possession of a valid South African drivers licence. » If any abnormal loads will be transported to site during the construction phase, all the prescribed permits and clearances should be obtained from the relevant authorities. Above all, abnormal load transportation should be 	<ul style="list-style-type: none"> » Project Manager » Engineering Representative » Site Manager 	<ul style="list-style-type: none"> » Duration of the Construction phase (3 months) 	<ul style="list-style-type: none"> » Any traffic-related incidents involving project personnel, or workers should be limited to no more than 1 per month. 	<ul style="list-style-type: none"> » Project Manager, Engineering Representative and Site Manager should ensure all traffic-related signage is made available. 	<ul style="list-style-type: none"> » Daily visual monitoring of traffic control measures to ensure they are effective by the Site Manager.

				<p>limited to during peak hours.</p> <ul style="list-style-type: none">» Where possible, heavy vehicle traffic should be discouraged from using roads during peak traffic hours.» Transport of material and waste should comply with the necessary road regulations					
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5.2 Detailing Method Statements

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

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

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

Method Statements must be compiled for all activities which affect any aspect of the environment and should be applied consistently to all activities. Specific areas to be addressed through method statements (pre, during and post construction) may include:

- » Site establishment (which explains all activities from induction training to offloading, construction sequence for site establishment and the different amenities to be established etc., including a site camp plan indicating all of these).
- » Excavations and backfilling procedure.
- » Stormwater management method statement.
- » Ablution facilities (placement, maintenance, management and servicing).
- » Solid Waste Management:
 - * Description of the waste storage facilities (on site and accumulative).
 - * Placement of waste stored (on site and accumulative).
 - * Management and collection of waste process.
 - * Recycle, re-use and removal process and procedure.
- » Dust and noise pollution:
 - * Describe necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels.
 - * Procedure to control dust at all times on the site.

- » 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, and any other harmful and hazardous substances and materials (South African National Standards apply).
 - * Lists of all potentially hazardous substances to be used.
 - * Appropriate handling, storage and disposal procedures.
 - * Prevention protocol of accidental contamination of soil at storage and handling areas.
 - * All storage areas, (i.e. for harmful substances appropriately bunded with a suitable collection point for accidental spills must be implemented and drip trays underneath dispensing mechanisms including leaking engines/machinery).
- » Fire prevention and management measures on site.
- » Incident and accident reporting protocol.
- » Designate access road and the protocol on roads in use.

The Contractor may not commence the activity covered by the Method Statement until it has been reviewed by the Site Manager and ECO, 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 required method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved.

5.3 Awareness and Competence: Construction Phase of the Dwarsrug Access Road

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

- » All Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment. This includes the discussion/explanation of site environmental matters during toolbox talks.
- » The content and requirements of Method Statements are to be clearly explained to all plant operators and general workers. All staff acting in a supervisory capacity is to have copies of the relevant Method Statements and be aware of the content thereof.
- » Ensuring that a copy of the EMPr is readily available on-site, and that all senior site staff is aware of the location and have access to the document. Senior site staff will be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the Water Treatment Plant.
- » Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training session. The training session must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.
 - * Records must be kept of those that have completed the relevant training.
 - * Training should be done either in a written or verbal format but must be appropriate for the receiving audience.

- * Refresher sessions must be held to ensure the contractor staff are aware of their environmental obligations as practically possible.
- » All sub-contractors must have a copy of the EMPr and sign a declaration/ acknowledgement that they are aware and familiar with the contents and requirements of the EMPr and that they will conduct work in such a manner as to ensure compliance with the requirements of the EMPr.

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

5.4 Monitoring Programme: Construction Phase of the Access Road

A monitoring programme must be in place not only to ensure conformance with the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the Environmental Authorisation. Where this is not clearly dictated, Mainstream will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The PM and EM will jointly ensure that monitoring is conducted and reported on. The intention of the monitoring and auditing process is to routinely monitor the implementation of the specified environmental specifications, in order to:

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

5.4.1 Environmental Awareness Training

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

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

5.4.3 Toolbox Talks

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

5.4.4 Non-Conformance Reports

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

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

5.4.5 Incident Reports

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

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

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

5.4.6 **Chance and Fossil Finds Procedure**

- » If a chance find is made the person responsible for the find must immediately **stop working** and all work must cease in the immediate vicinity of the find.
- » The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ECO or site manager. The ECO must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- » A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- » Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report the Heritage Agency will inform the ECO (site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- » The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advice on the most suitable method of protection of the find.
- » In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ECO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- » Once Heritage Agency have issued written authorization, the developer may continue with the development.

5.4.7 **Monitoring Reports**

A monitoring report will be compiled by the ECO on a monthly basis and must be submitted to the Director: Compliance Monitoring at the competent authority for their records. This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents recorded, corrective action required, and details of those non-conformances or incidents which have been closed out. The Contractor must ensure that all waste manifests are provided to the ECO on a monthly basis in order to inform and update the competent authority regarding waste related activities.

5.4.8 **Audit Report**

The Developer must ensure that project compliance with the conditions of the Environmental Authorisation is audited by an independent auditor, and that the audit reports are submitted to the Director: Compliance Monitoring at the competent authority. Such audits must be undertaken during both the construction and operation phases of the Dwarsrug Access Road. The effectiveness of the mitigation measures and recommendations for amongst others the following: grievance incidents; waste management, noise, dust emissions, traffic and transportation should be audited. The results form part of the project monitoring and audit reports.

5..9 Final Audit Report

A final environmental audit report must be compiled by an independent external auditor and be submitted to competent authority 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 EMPr.

CHAPTER 6: MANAGEMENT PROGRAMME: OPERATION

Overall Goal: To ensure that the operation of the Access Road 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 manage the access road in a way that:

- » Ensures that operation activities are properly managed in respect of environmental aspects and impacts
- » Minimises the impact on the indigenous natural vegetation, and habitats of ecological value.
- » Minimises impacts on fauna in the study area.
- » Minimises the impact on heritage sites should they be uncovered.

6.1 Operation Phase Impacts

OPERATION PHASE										
Project Component/s		Dwarsrug Access road								
No	Aspect	Potential Impact	Outcome	Mitigation measures/ management actions	Responsible Persons	Time period for implementation	Implementation indicator (KPI)	Monitoring Mechanism & staff responsible	Monitoring Method & Frequency	
1	Domestic Waste is anticipated to be generated during the operational phase of the access road	Generation of Solid Waste	To minimise the production general waste.	<p>General waste:</p> <ul style="list-style-type: none"> » Where possible, waste should be recycled. » The waste management hierarchy must be adopted at the construction site where waste is prevented, if it cannot be prevented it should be minimised. If waste can't be minimised it must be reused or recycled. If this is not an option it should be used for energy recovery, this may involve selling waste to third part recovery organisations. Lastly if energy recovery is not possible waste should be disposal of. » General waste should be disposed of an approved waste disposal facility. » No dumping of waste material must be permitted in the surrounding open areas. » Records of all waste being taken off site must be recorded and kept as evidence. » All solid waste should be handled and disposed of in accordance with the Dwarsrug Access Road Waste Management Procedure. » Records of all waste being taken off site must be recorded and kept as evidence. » Should waste be stored on site, it cannot be temporarily stored for longer than 80 days. 	» EM »	Duration of the Operation Phase	<ul style="list-style-type: none"> » Compliance with waste management legislation » To minimise production of waste » To ensure appropriate waste storage and disposal 	<ul style="list-style-type: none"> » Internal audits by the EO and EM. » Quarterly inspections by the EO. » Quarterly audits - for the first 2 years by an independent ECO. » Annual audits for the years thereafter by an independent ECO. 	<ul style="list-style-type: none"> » Observation and supervision of waste management practices throughout operation phase through daily inspections and monthly audits. » Waste collection to be monitored on a weekly basis by the EO. » An incident reporting system will be used to record non-conformances to the EMPr as and when an incident occurs. This to be implemented by the EO and EM. 	
2	Damage to the drainage lines	Damage to the drainage lines (such as erosion, siltation, dumping of waste) that will impact on ecosystem functioning.	Limit impacts on drainage features	<ul style="list-style-type: none"> » Disturbed areas should be rehabilitated and re-vegetated as soon as possible. » An alien invasive monitoring and control management programme must be compiled to manage encroachment of alien species within the watercourses and along the entire course of the road. Control along the entire route of the access road is required is to 	» Contractor	Duration of the Operation Phase	<ul style="list-style-type: none"> » No disturbance outside of designated work areas. » Minimal siltation in drainage lines as a result of construction activities. 	<ul style="list-style-type: none"> » On-going inspections of sediment control devices by SHE and ECO. » Immediate reporting of ineffective sediment control systems. » An incident reporting system must be implemented to record non-conformances. 	» Monthly Audits by the Site Manager	

				<p>ensure that vegetation disturbance is managed and alien vegetation establishment does not take place high or lower along the road route which could result in encroachment on the watercourses at a later stage.</p> <ul style="list-style-type: none"> » The alien invasive monitoring and control management programme is also to be implemented post-construction for approximately two (2) years to ensure alien invasive do not encroach following construction. » No fuels, oils or any other hazardous materials are to be brought into the watercourse or stored within 100m from the edge of the watercourses. 					
3	Generation of dust emissions	Impacts on Air Quality	Reduction of dust emissions on-site	<ul style="list-style-type: none"> » Driving must take place on existing roads and must adhere to speed limits associated with the project during the operational phase. » Dust generation must comply with the National Dust Control Regulations (GN No. R. 827) of 1 November 2013, promulgated in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004). » Limit vegetation clearing as far as possible. 	» Contractor	Duration of the Operation Phase	<ul style="list-style-type: none"> » Less than two complaints from construction workers, Dwarsrug Access Road staff and surrounding landowners per month concerning dust emissions 	<ul style="list-style-type: none"> » Audits and Inspections by Site Manager. » Audits and Inspections Environmental manager (EM) and Environmental Officer (EO). » Audits by the Site Manager. 	» Monthly Audits by the Site Manager
4	Los of vegetation and faunal and fauna habitat	Impacts on Biodiversity	Minimise the impacts on and loss of indigenous vegetation and faunal habitat and fauna	<ul style="list-style-type: none"> » Contractors should rehabilitate areas that were affected by the proposed development. » Species of concern to be relocated and conserved in situ should be marked. Identification of suitable relocation sites for each species should be identified » Areas containing protected plant species must be noted and every effort made to reduce the impacts of construction on these areas. Protected plant species in any area to be cleared should be identified and rescued. Permits will be required from NC DENC to remove or translocate protected plant or animal species, if they are to be affected 	» Contractor	Duration of the Operation Phase	<ul style="list-style-type: none"> » To minimise footprints of disturbance of vegetation/habitats on-site » To protect fauna 	<ul style="list-style-type: none"> » Audits and Inspections by Site Manager. » Annual Audits and Inspections Environmental manager (EM) and Environmental Officer (EO). » Annual Audits by Independent Environmental Control Officer (ECO). 	» Annual Audits by the Site Manager

				<ul style="list-style-type: none"> » Should any species be relocated, suitable relocation sites should be identified. » All construction vehicles should adhere to clearly defined and demarcated roads. » No off-road driving is to be allowed 					
5	Soil erosion	Soil erosion and impacts on topsoil	Minimisation of, erosion and disturbance to topsoil	<ul style="list-style-type: none"> » Driving must take place on existing roads and a speed limit of 30km/h must be implemented on all roads associated with the project during the operation phase. » Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » A road/civil engineer must ensure that stormwater structures are included in the road design, in order to minimise erosion. » All stormwater structures must be designed to comply with engineering requirements as per the design team. 	» Contractor	Duration of the Operation Phase	<ul style="list-style-type: none"> » No disturbance outside of designated work areas. » Retain natural vegetation, where possible 	<ul style="list-style-type: none"> » On-going inspections of sediment control devices by SHE and ECO. » Immediate reporting of ineffective sediment control systems. » An incident reporting system must be implemented to record non-conformances. 	Monthly Audits by the Site Manager
6	Increase in vehicular movement on roads in the surrounding areas.	Impacts on traffic	Minimise the impact of traffic associated with the construction of the access road.	<ul style="list-style-type: none"> » Staff should adhere to speed limits and roads signs on and off site at all times. » All vehicles using the access road must be road worthy and all designated drivers must be in possession of a valid South African drivers licence. » Where possible, heavy vehicle traffic should be discouraged from using roads during peak traffic hours. » Transport of material and waste should comply with the necessary road regulations 	» Project Manager » Site Manager	Duration of the Operation Phase	<ul style="list-style-type: none"> » Any traffic-related incidents involving project personnel, or workers should be limited to no more than 1 per month. 	<ul style="list-style-type: none"> » Project Manager and Site Manager should ensure all traffic-related signage is made available. 	» Daily visual monitoring of traffic control measures to ensure they are effective by the Site Manager.
7	Stormwater impacts during periods of rainfall	Storm Water Impacts	Minimal soil erosion occurrence on the access road	<ul style="list-style-type: none"> » Monitor and control hydrocarbon leakages from operations equipment and machinery (i.e. placement of drip trays underneath components during mechanical breakdowns). » Ensure ongoing and sufficient maintenance of the stormwater drains of the access road to ensure effective stormwater control on site. » All stormwater structures must comply with DWS and SANRAL requirements. » The road engineer must ensure that suitable stormwater structures are included in the road design in 	» EM » EO	Operation Phase	<ul style="list-style-type: none"> » Minimal soil erosion within the road reserve. » Minimal siltation in drainage lines due to operation of the road. 	<ul style="list-style-type: none"> » EO should conduct inspections monthly and report any erosion incidents to the ER. » ER should implement feasible, environmentally friendly measures to prevent erosion. 	» Monthly internal audits by the EO or EM.

				order to minimise erosion and sedimentation of watercourses.					
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CHAPTER 7: MANAGEMENT PROGRAMME: DECOMMISSIONING

Overall Goal: To ensure that the decommissioning of the Access road and associated infrastructure does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action is taken at all costs.

The decommissioning activities of the access road would involve the rehabilitation of disturbed areas and establishment of vegetation. It must be noted that decommissioning activities need to be undertaken in accordance with the legislation applicable at that time.

» **Soil Amelioration**

The steps that should be undertaken 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.

» **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.

7.1 Decommissioning Phase Impacts

DECOMMISSIONING PHASE									
Project Component/s	Dwarsrug Access Road								
No	Aspect	Potential Impact	Outcome	Mitigation measures/ management actions	Responsible Persons	Time period for implementation	Implementation indicator (KPI)	Monitoring Mechanism & staff responsible	Monitoring Method & Frequency
1	Disturbance created during decommissioning will leave the site vulnerable to alien plant invasion for several years after site clearing and decommissioning.	Invasion of alien plant species	Minimise the establishment and spread of alien invasive plants during the decommissioning phase	<ul style="list-style-type: none"> » Rehabilitate disturbed areas as quickly as possible. » Alien management at the site should take place according to the Alien Invasive Management Plan. » Regular monitoring for alien plant invasion following decommissioning to ensure that no erosion problems have developed as result of the disturbance, as per the Alien Management Plan for the project. 	<ul style="list-style-type: none"> » EM » EO » ER » Site Manager 	Decommissioning phase	<ul style="list-style-type: none"> » Minimal erosion and invasion of alien invasive plants. » Minimal establishment of additional alien invasive species. 	<ul style="list-style-type: none"> » Monthly internal audits by the EM and EO. » Site Manager should ensure all disturbed areas are rehabilitated 	<ul style="list-style-type: none"> » Annual audits by the EO and EM for 5 years.
2	Decommissioning of the site will leave the site vulnerable to soil erosion from earthwork.	Soil erosion impacts	Minimise soil erosion during the decommissioning phase	<ul style="list-style-type: none"> » Regular monitoring for erosion after decommissioning for at least 5 years to ensure that no erosion problems have developed as a result of the disturbance. » All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. » All cleared areas resulting from decommissioning should be revegetated with indigenous perennial species from the local area. 	<ul style="list-style-type: none"> » EM » EO » Site Manager 	Decommissioning phase	<ul style="list-style-type: none"> » Minimal soil erosion during the decommissioning phase 	<ul style="list-style-type: none"> » EO should conduct inspections monthly and report any erosion incidents to the ER. » ER should implement feasible, environmentally friendly measures to prevent erosion. 	<ul style="list-style-type: none"> » Annual audits by the EO and EM for 5 years.
3	Generation of Dust	Air Quality Impact	To minimise the generation of dust during this phase	<ul style="list-style-type: none"> » Regular suppression of bare areas with a water tank or bowser. 	<ul style="list-style-type: none"> » EM » EO » Site Manager 	Decommissioning phase	<ul style="list-style-type: none"> » Any complaints received from workers of the Dwarsrug Access Road staff and surrounding landowners should be limited to no more than 1 per month. 	<ul style="list-style-type: none"> » EM » EO » Site Manager 	<ul style="list-style-type: none"> » Visual inspections to ensure bare areas on site are suppressed by a water bowser.
4	Increase in vehicular movement	Traffic Impact	» Control traffic at the access road	<ul style="list-style-type: none"> » Contractors tasked with the decommissioning of the access road should 	<ul style="list-style-type: none"> » PM » Site Manager » Security 	Decommissioning phase	<ul style="list-style-type: none"> » Any traffic-related incidents involving project personnel, 	<ul style="list-style-type: none"> » PM should ensure the appointed Contractor 	<ul style="list-style-type: none"> » Visual monitoring of traffic control measures to ensure

				adhere to the speed limit and road signs at all times.			or workers should be limited to no more than 1 per month.	(represented by the Site Manager) adheres to all Dwarsrug Access Road traffic management procedures. » Site Manager should ensure drivers adhere to the prescribed speed limits. » Site Manager should ensure all drivers are in possession of valid South African Drivers Licences.	they are effective by the Site Manager
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CHAPTER 8: REPORTING

Record keeping

The Engineers representative and the ECO must continuously monitor the contractor's adherence to the approved impact prevention procedures, and the RE must issue to the contractor a notice of non-compliance whenever transgressions are observed. The ECO should document the nature and magnitude of the non-compliances in a designated register , to include the following aspects:

- » The action taken to discontinue the non-compliance;
- » The action taken to mitigate its effects; and
- » The results of the mitigatory actions and whether an issue may be closed or not.

The non-compliance shall be documented and reported to the engineer in the monthly report. These reports must be made available to competent authority when requested. The Contractor must further ensure that an electronic filing system identifying all documentation related to the EMP is established and kept diligently, for scrutiny should disputes arise, or historical documents need to be reviewed. Documents filed may include the following, per example:

A list of reports likely to be generated during all phases of the project is provided below, and all applicable documentation must be included in the environmental filing system catalogue or document retrieval index.

- » Final Environmental Impact Assessment Report (BAR).
- » Environmental Management Plan (this document).
- » Final design documents and diagrams issued to and by the Contractor.
- » Daily, weekly and monthly site monitoring reports.
- » Complaints register.
- » Training manual.
- » Training attendance registers.
- » Incident and accident reports.
- » Emergency preparedness and response plans.
- » Permits and legal documents.
- » Disciplinary procedures.
- » Monthly site meeting minutes during construction.
- » Environmental Authorisation copies.
- » All method statements from the Contractor for all phases of the project.

Document control:

The Contractor must ensure that documents are periodically reviewed and revised, where necessary, and that current versions are available at all locations where operations essential to the functioning of the EMP are performed. All documents must be made available to the independent external auditor when requested.

CHAPTER 9: CONCLUSION

This EMPr should be seen as a day-to-day management document, containing foreseeable actions and potential mitigation or management actions as pertaining to the project. The EMPr thus sets out the environmental and social standards, which would be required to minimise the negative impacts and maximise the positive benefits of development, as detailed in the BAR and specialist reports. The EMPr could thus change frequently, and if managed correctly lead to a successful construction and operational phases. Further guidance should also be taken for any conditions contained in the Environmental Authorisation, if the project is granted approval, and that these conditions from the competent authority must be incorporated into the final EMPr.






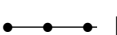



APPENDIX A:

A3 LAYOUT AND SENSITIVITY MAPS

Dwarsrug Access Road Northern Cape Province

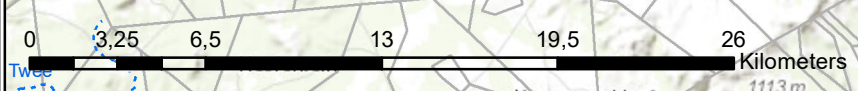
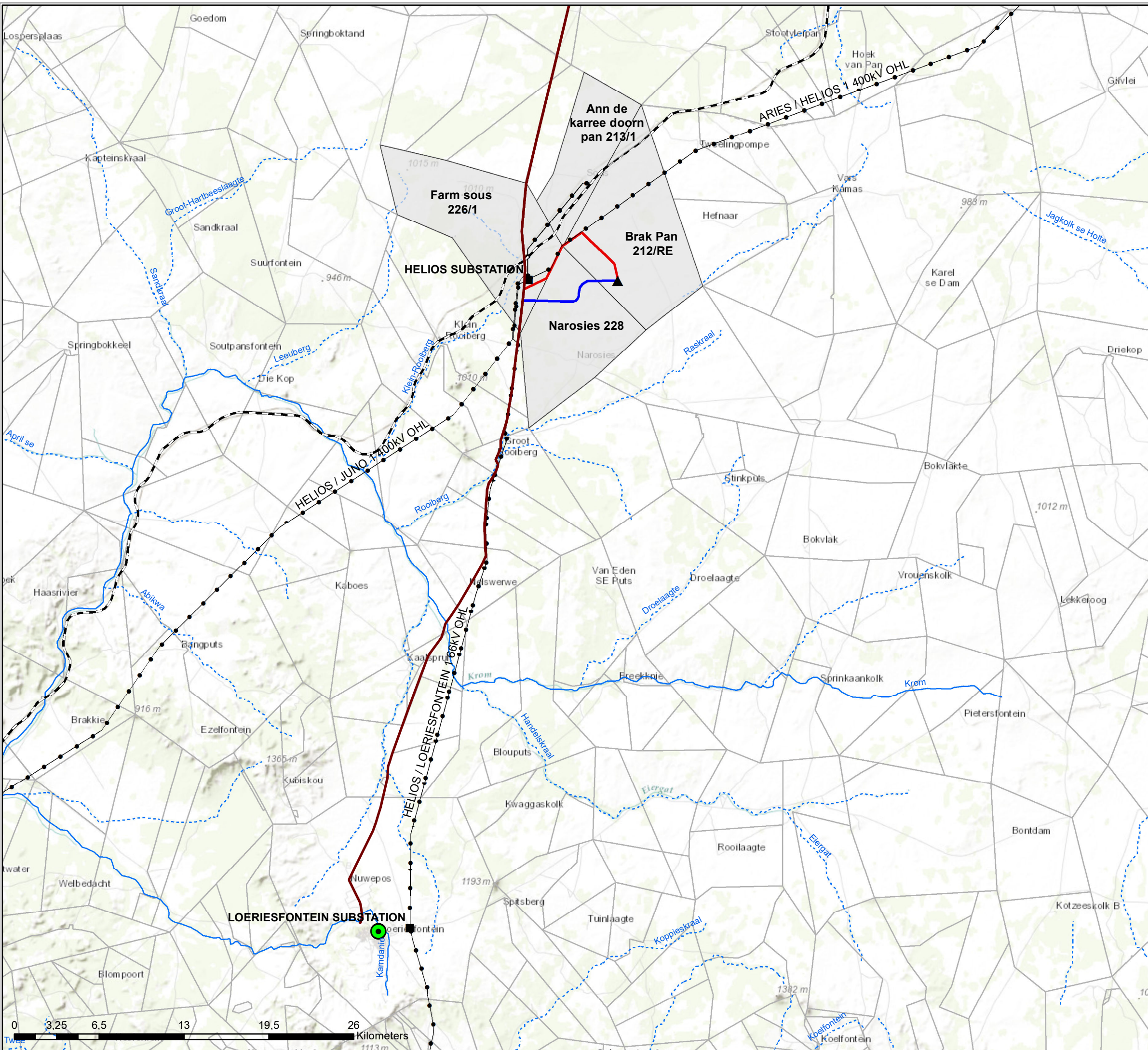
Locality Map

Legend

-  Loeriesfontein
-  Eskom Substation
-  Dwarsrug on-site substation
-  Railway
-  Granaatboskolk Road
-  Existing Power Line
-  Dwarsrug Access Road Alternative 1
-  Dwarsrug Access Road Alternative 2
-  Affected Farm Portions



Scale: 1:279 106
 Projection: LO19
 Map Ref: Dwarsrug Road - Locality Map - 16.01.19
 Current land use: Agricultural zoning

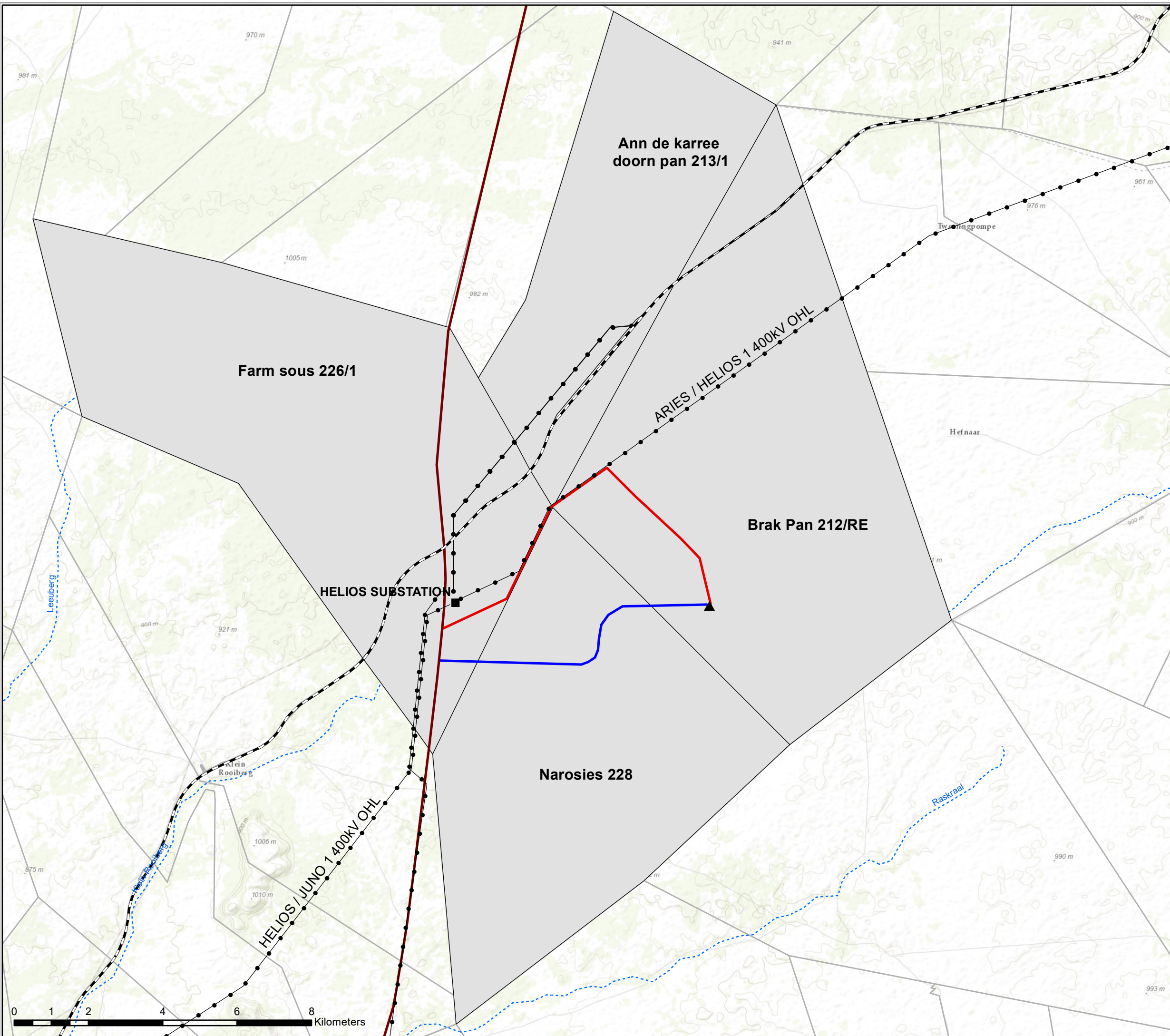


Dwarsrug Access Road Northern Cape Province

Layout Map

Legend

- Eskom Substation
- ▲ Dwarsrug on-site substation
- Railway
- Existing Power Line
- Granaatboskolk_Road
- Dwarsrug access road Alt 1
- Dwarsrug access road Alt 2
- Affected farm portions



Scale: 1:96 707
Projection: LO19
Map Ref: Dwarsrug Road - Locality Map - 05.03.19
Current land use: Agricultural zoning



APPENDIX B:
GRIEVANCE MECHANISM

GRIEVANCE MECHANISM / PROCESS

1. PURPOSE

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

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

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

2. PROCEDURE FOR RECEIVING AND RESOLVING GRIEVANCES

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

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

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

- » Resolved. Complaints where a resolution has been agreed and implemented and the Complainant has signed the Confirmation Form.

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

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

APPENDIX C:
WASTE MANAGEMENT PLAN

WASTE MANAGEMENT PLAN

1. PURPOSE

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

This WMP has been compiled as part of the project Environmental Management Programme (EMPr) and includes waste stream information available at the time of compilation. Construction practices must be measured and analysed on an ongoing basis in order to determine the efficacy of the plan and whether further revision of the plan is required. This plan should be further updated should further detail regarding waste quantities and categorisation become available, during the construction phase.

2. WASTE GENERATED

It is expected that the development of the access road will generate construction solid waste, general waste, contaminated water and soil.

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

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

3. LEGISLATIVE REQUIREMENTS

Waste in South Africa is currently governed by several pieces of legislation, including:

- » National Environmental Management: Waste Act (NEM:WA), 2008 (Act 59 of 2008)
- » National Environmental Management: Waste Amendment Act, 2014 (Act 26 of 2014)
- » The South African Constitution (Act 108 of 1996)
- » Hazardous Substances Act (Act 5 of 1973)
- » Health Act (Act 63 of 1977)
- » Environment Conservation Act (Act 73 of 1989)
- » Occupational Health and Safety Act (Act 85 of 1993)
- » National Water Act (Act 36 of 1998)
- » National Environmental Management Act (Act 107 of 1998) (as amended)
- » Mineral and Petroleum Resources Development Act (Act 28 of 2002)
- » Air Quality Act (Act 39 of 2004)

Storage of waste must be undertaken in accordance with the National Norms and Standards for the Storage of Waste published in GN926.

4. WASTE MANAGEMENT PRINCIPLES

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

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

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

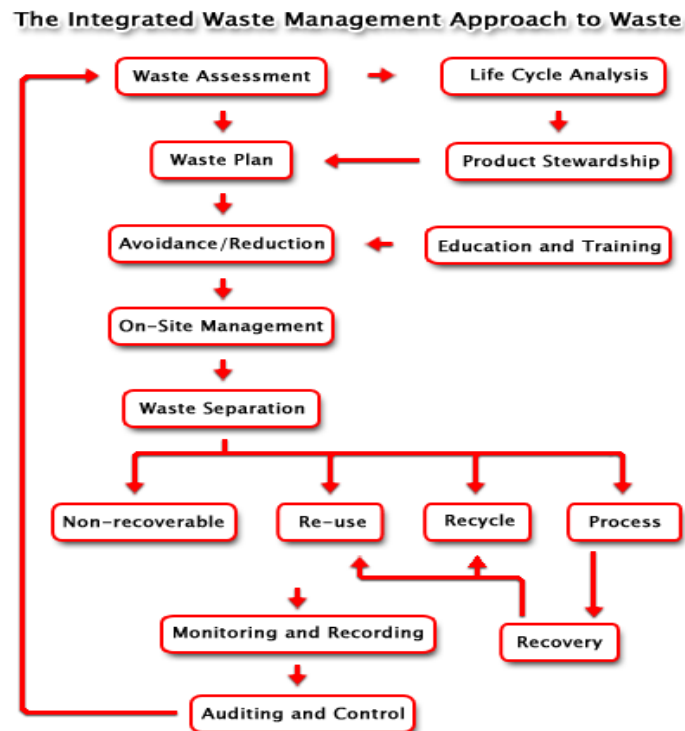


Figure 1: Integrated Waste Management Flow Diagram

4.1. Construction phase

A plan for the management of construction waste is detailed below. Construction practices must be measured and analysed in order to determine the efficacy of the plan and whether further revision of the plan is required. A Method Statement detailing specific waste management practices during construction should be prepared by the Contractor prior to the commencement of construction.

4.1.1. Waste Assessment / Inventory

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

4.1.2. Waste collection, handling and storage

- » It is the responsibility of the EO to ensure that each subcontractor implements their own waste recycling system, i.e. separate bins for food waste, plastics, paper, wood, glass cardboard, metals, etc.
- » Waste manifests and waste acceptance approvals from designated waste facilities must be kept on hand in order to prove compliance.
- » Septic tanks and portable toilets must be monitored and maintained daily. Below ground storage of septic tanks must withstand the external forces of the surrounding environment. The area above the tank must be demarcated to prevent any vehicles or heavy machinery from driving around the area.
- » Waste collection bins and hazardous waste containers must be provided by the principal contractor and subcontractors and placed at various areas around site for the storage of organic, recyclable and hazardous waste.
- » A dedicated waste area must be established on site for the storage of all waste streams, before removal from site. The storage period must not trigger listed waste activities as per the NEMWA, GN 921 of November 2013.
- » Signage/ colour coding must be used to differentiate disposal areas for the various waste streams (i.e. paper, cardboard, metals, food waste, glass etc.).
- » Hazardous waste must be stored within a bunded area constructed according to SABS requirements. The volume of waste stored in the bunds must not exceed 110% of the bund capacity.
- » The location of all temporary waste storage areas must aim to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.
- » Waste storage shall be in accordance with all Regulations and best-practice guidelines and under no circumstances may waste be burnt on site.
- » If possible a dedicated waste management team must be appointed by the principal contractors' EO, whom will be responsible for ensuring
- » The continuous sorting of waste and maintenance of the area should be ensured. The principal contractors' EO will be responsible, and must be trained.
- » All waste removed from site must be done so by a registered/ licensed subcontractor, whom must supply information regarding how waste recycling/ disposal will be achieved. The registered subcontractor must provide waste manifests for all removals at least once a month or for every disposal made.

4.1.3. Management of waste storage areas

- » The position of all waste storage areas must be located at least 32m away from water features and ensure minimal degradation to the environment. The main waste storage area must have a suitable stormwater system separating clean and dirty stormwater.
- » Collection bins placed around site and must be maintained and emptied on a regular basis by the principal contractor.
- » Inspections and maintenance of the main waste storage area must be undertaken daily. Skips and storage containers must be clearly marked or colour coded and well-maintained, not allowing access to vermin or other rodents. A tarp or shade cloth should ideally be used to ensure avifauna does not have access to waste.
- » Waste must be stored in designated containers and not on the ground.
- » Inspections and maintenance of bunds must be undertaken daily. Bunds must be inspected for leaks or cracks in the foundation and walls.

- » It is assumed that any rainwater collected inside the bund is contaminated and must be removed and stored as hazardous waste, and not released into the environment. If any leaks occur in the bund, these must be removed immediately.

4.1.4. Disposal

- » Waste generated on site must be removed on a regular basis, as determined by the EO and ECO. This frequency may change during construction depending on waste volumes generated at different stages of the construction process.
- » Waste must be removed by a suitably qualified contractor and disposed at an appropriately licensed landfill site. Proof of appropriate disposal must be provided by the contractor to the EO and ECO.

4.1.5. Record keeping

The success of the Waste Management Plan is determined by measuring criteria such as waste volumes, cost recovery from recycling, cost of disposal.

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

4.1.6. Training

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

2. Operation phase

The Northern Cape Department of Roads and Public Works (NC DR&PW) will be responsible for maintenance activities.

3. Monitoring of Waste Management Activities

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

- » Monthly volumes/ mass of the different waste streams collected;
- » Monthly volumes/ mass of the waste that is disposed of at a landfill site, including proof of disposal (disposal slips or similar);
- » Monthly volumes/ mass of the waste that is recycled;

» Data illustrating progress compared to previous months.

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

APPENDIX D:
ALIEN MANAGEMENT PLAN

ALIEN PLANT AND OPEN SPACE MANAGEMENT PLAN

1. PURPOSE

Invasive alien plant species pose the second largest threat to biodiversity after direct habitat destruction. The purpose of this Alien Management Plan is to provide a framework for the management of alien and invasive plant species during the construction of the access road. The broad objectives of the plan includes the following:

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

2. RELEVANT ASPECTS OF THE SITE

The disturbance created during the construction phase of the project would leave the site highly vulnerable to invasion by alien plant species, which would impact diversity and ecological processes within the area. Alien plant species currently present in the study area include the *Atriplex lindleyi* subsp *inflata*, *Atriplex semibaccata*, *Sasola kali* and *Prosopis glandulosa*.

3. LEGISLATIVE CONTEXT

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

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

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

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

The National Environmental Management: Biodiversity Act (NEM:BA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Regulations have been published in

Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEMBA. According to this Act and the regulations, any species designated under Section 70 cannot be propagated, grown, bought or sold without a permit. Below is an explanation of the three categories:

- » **Category 1a:** Invasive species requiring compulsory control. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- » **Category 1b:** Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- » **Category 2:** Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Cat 2 plants to exist in riparian zones.
- » **Category 3:** Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Cat 3 plants to exist in riparian zones.

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

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

4. ALIEN PLANT MANAGEMENT PRINCIPLES

4.1. Prevention and early eradication

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

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

4.2. Containment and control

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

4.3. General Clearing and Guiding Principles

Alien species control programs are long-term management projects and should include a clearing plan which includes follow up actions for rehabilitation of the cleared area. The lighter infested areas should be cleared first to prevent the build-up of seed banks. All clearing actions should be monitored and documented to keep records of which areas are due for follow-up clearing.

i. Clearing Methods

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

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

» Mechanical control

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

» Chemical Control

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

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

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

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

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

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

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

» **Biological control**

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

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

4.4. General management practices

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

- » Establish an on-going monitoring programme for construction phase to detect and quantify any alien species that may become established and identify the problem species.

- » Alien vegetation regrowth on areas disturbed by construction must be immediately controlled once recorded throughout the entire site and the road reserve during construction, operation and maintenance.
- » Care must be taken to avoid the introduction of alien invasive plant species to the site and the road reserve. Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment. Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.
- » Cleared areas that have become invaded by alien species can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides should not be used.
- » The effectiveness of vegetation control varies seasonally and this is also likely to impact alien species. Control early in the wet season will allow species to re-grow and follow-up control is likely to be required. It is tempting to leave control until late in the wet season to avoid follow-up control. However, this may allow alien species to set seed before control and hence will not contribute towards reducing alien species abundance. Therefore, vegetation control should be aimed at the middle of the wet season, with a follow-up event towards the end of the wet season. There are no exact dates that can be specified here as each season is unique and management must therefore respond according to the state and progression of the vegetation.
- » Alien plant management is an iterative process and it may require repeated control efforts to significantly reduce the abundance of a species. This is often due to the presence of large and persistent seed banks. However, repeated control usually results in rapid decline once seed banks become depleted.
- » Some alien species are best individually pulled by hand. Regular vegetation control to reduce plant biomass within the site and road reserve should be conducted. This should be timed so as to coincide with the critical growth phases of the most important alien species on site. This will significantly reduce the cost of alien plant management as this should contribute towards the control of the dominant alien species and additional targeted control will be required only for a limited number of species.
- » No alien species should be cultivated on-site. If vegetation is required for aesthetic purposes, then non-invasive, water-wise locally-occurring species should be used.
- » During operation, surveys for alien species should be conducted regularly. It is recommended that this be undertaken every 6 months for the first two years after construction and annually thereafter. All alien plants identified should be cleared using appropriate means.

4.5. Monitoring

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

In general, the following principles apply for monitoring:

- » Photographic records must be kept of areas to be cleared prior to work starting and at regular intervals during initial clearing activities. Similarly, photographic records should be kept of the area

from immediately before and after follow-up clearing activities. Rehabilitation processes must also be recorded.

- » Simple records must be kept of daily operations, e.g. area/location cleared, labour units and, if ever used, the amount of herbicide used.
- » It is important that, if monitoring results in detection of invasive alien plants, that this leads to immediate action.

The following monitoring should be implemented to ensure management of alien invasive plant species.

Construction Phase

Monitoring Action	Indicator	Timeframe
Document alien species present at the site of construction activities	List of alien plant species	Preconstruction & monthly thereafter
Document & record alien plant control measures implemented	Record of clearing activities	Monthly

Operation and Maintenance

Monitoring Action	Indicator	Timeframe
Document alien plant species distribution and abundance within road reserve	Alien plant distribution map	Biannually
Document alien plant control measures implemented during maintenance activities & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Biannually

APPENDIX E:
REHABILITATION PLAN

REHABILITATION PLAN

1. PURPOSE

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

- » Achieve long-term stabilisation of all disturbed areas to minimise erosion potential.
- » Re-vegetate all disturbed areas with suitable local plant species.
- » Minimise visual impact of disturbed areas.

This Rehabilitation Plan should be closely aligned with other site-specific plans, including inter alia an Erosion Management Plan and the Alien Management Plan. Prior to commencement of construction, a detailed Rehabilitation Plan and Method Statement for the construction site and road reserve should be compiled with the aid of a Rehabilitation Specialist, as required.

2. RELEVANT ASPECTS OF THE SITE

A site visit took place in October 2014 with a follow-up site visit on 26 October 2018. Based on species composition, physiognomy, moisture regime, rockiness, slope and soil properties, the main vegetation communities that were recognised is illustrated in Figure 1. The entire site falls within the Bushmanland Basin Shrubland vegetation type. With an extent of 34 690 km² this is one of the most extensive vegetation types in South Africa. Bushmanland Basin Shrubland occurs on the extensive basin centred on Brandvlei and Van Wyksvlei, spanning Granaatboskolk in the west to Copperton in the east, and Kenhardt in the north to around Williston in the south. The area is characterised by slightly irregular plains dominated by a dwarf shrubland, with succulent shrubs or perennial grasses in places. The geology consists largely of mudstones and shales of the Ecca group and Dwyka tillites with occasional dolerite intrusions. Soils are largely shallow to non-existent, with calcrete present in most areas. Rainfall ranges from 100-200 mm and falls mostly during the summer months as thunder storms.

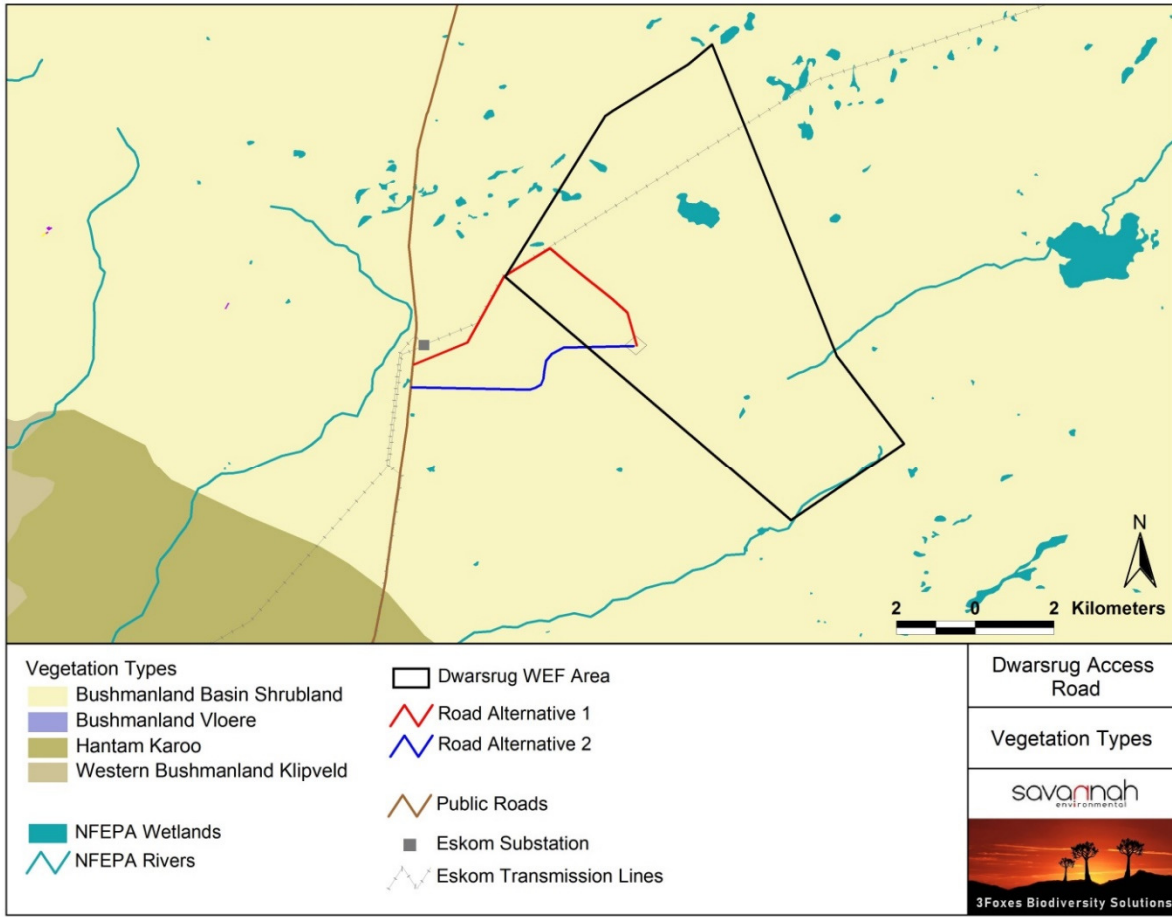


Figure 1: The national vegetation map for the Dwarsrug access road alternatives.

The site consists of flat to gently undulating open plains dominated by low shrubs or arid tussock grasses. It is typical of southwestern Bushmanland and does not contain any remarkable ecological features. The only notable features present are some low gravelly hills and some poorly developed drainage lines. There are also some small pans in the area, but these are not in proximity to the road routes. The vegetation of the site is very homogenous and shifts from shrub-dominated vegetation on gravelly soils to tussock-grass-dominated areas on sandy soils, with large areas also transitional between these extremes. The current road footprint areas are restricted to the Bushmanland Basin Shrubland habitat type with occasional drainage lines. These two habitats are described below.

Bushmanland Basin Shrubland

The majority of the site consists of low open shrubland on shallow, stony soils, typical of the Bushmanland Basin Shrubland vegetation type. Typical species include the shrubs *Pentzia incana*, *Zygophyllum lichtensteinianum*, *Asparagus capensis*, *Zygophyllum retrofractum*, *Eriocephalus spinescens*, *Aptosimum spinescens*, *Tripteris sinuata*, *Hermannia spinosa*, *Thesium lineatum*, *Felicia clavopilosa*, *Osteospermum armatum*, *Pegolettia retrofracta*, *Pteronia mucronata*, *Pteronia sordida*, *Rosenia humilis*, *Galenia fruticosa*, *Lycium pumilum* and *Salsola tuberculata*; succulent shrubs such as *Aridaria noctiflora*, *Ruschia intricata*, *Brownanthus ciliatus*, *Drosanthemum lique*, *Psilocaulon coriarium* and *Sarcocaulon patersonii* forbs such as *Aptosimum indivisum*, *Hypertelis salsoloides*, *Gazania lichtensteinii*, *Galenia sarcophylla* and *Fockea*

sinuata; geophytes including *Drimia intricata* and *Moraea miniata*. Overall diversity within this vegetation type at the site is low, which can be ascribed to the aridity of the area and the poorly developed soils. Areas of higher diversity include exposed calcrete soils which contain specialist species such as *Titanopsis calcarea*, while there are also some low shale-derived hills present which have species such as *Aloinopsis luckhoffii*, *Cephalophyllum fulleri* which is listed as Rare and protected species such as *Aloe falcata*, *Aloe claviflora* and *Hoodia gordonii*.

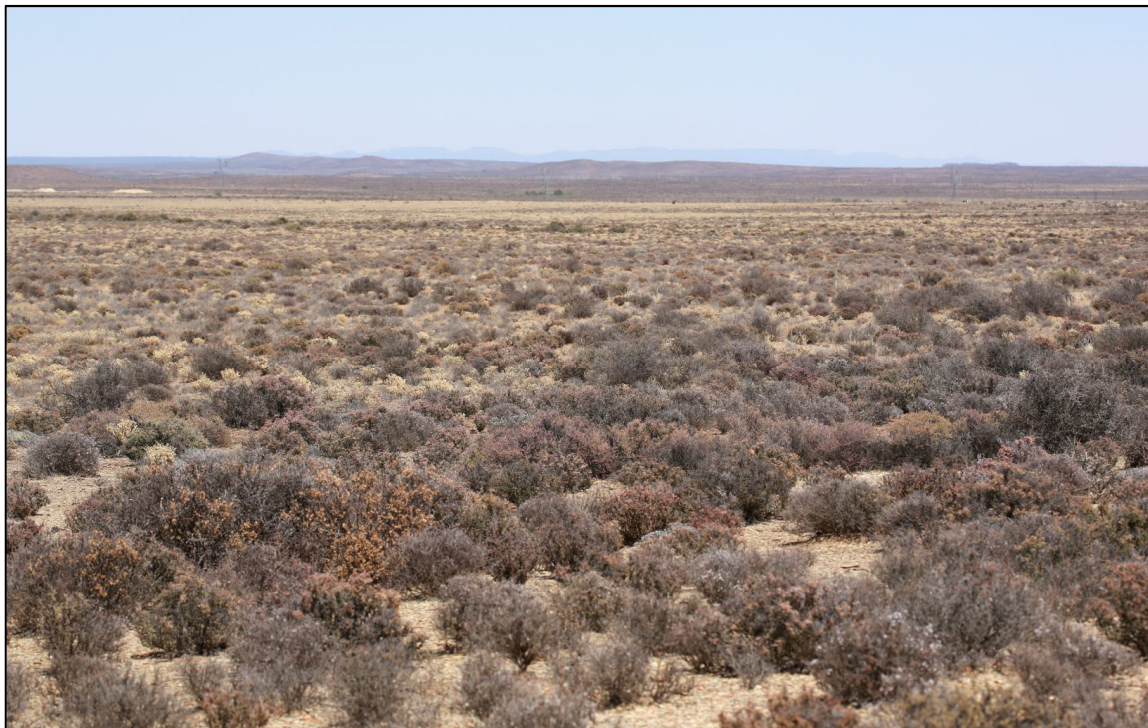


Figure 2. Typical low shrubland along Alternative 1, with woody vegetation in the foreground and the paler vegetation in the distance is dominated by *Brownanthus ciliatus*.



Figure 3. Looking over the plains near the substation and control buildings, where the access road would terminate within the Dwarsrug site.



Figure 4. Looking along the alignment of the central section of access road Alternative 2, showing the typical open shrubland of the area, with occasional Prosopis trees along a small drainage system in the distance.

Washes & Drainage Lines

The drainage lines of the site (**Error! Reference source not found.**) are not very well developed and do not have a tall woody component. Typical and dominant species include *Stipagrostis namaquensis*, *Stipagrostis obtusa*, *Osteospermum armatum*, *Arctotis fastuosa*, *Deverra denudata*, *Melianthus comosus*, *Salvia disermas*, *Lycium pumilum*, *Lycium oxycarpum*, *Galenia sarcophylla*, *Salsola aphylla* and *Sesamum capense*. Although the drainage lines are not well developed, which can be ascribed to aridity of the area, they are ecologically important because the higher cover and productivity of these areas is important for fauna forage and habitat availability and they also play an important hydrological role and regulate flow following occasional strong rainfall events. As such disturbance to these areas should be minimised as far as possible.



Figure 5. Typical small drainage line along road Alternative 1, about 1.5km from the Granaatboskolk road.

Listed Plant Species

The study area has been very poorly sampled in the past and many of the quarter degree squares in the area have no data available. According to the SIBIS database, a total of 135 indigenous species are known from the area, of which 89 have been observed by the consultant on the site and an additional 28 species were observed that have not been recorded from the area before. Although some additional species would undoubtedly be discovered with additional sampling, the area is not species-rich and even with intensive sampling the area is not likely to demonstrate exceptional richness. Listed and protected species observed in the area include *Cephalophyllum fullerii* which is classified as Rare and a number of provincially protected species including *Aloe falcata*, *Hoodia gordonii* and *Aloinopsis luckhoffii* and *Euphorbia multiceps*.

3. REHABILITATION METHODS

Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and, where deemed necessary by the ECO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).

- » Immediately after replacing topsoils in disturbed areas, the soil surface must be revegetated with a suitable plant cover.
- » It is expected that soil seed banks of indigenous vegetation will be present to initiate initial vegetation cover. However, simply applying this topsoil to a well-prepared rehabilitation site does not result in the same species richness and diversity as the surrounding areas. In some areas the natural regeneration of the vegetation may be poor and the application relevant of seed to enhance vegetation recovery may be required.
- » Where possible, seed should be collected from plants present at the site during plant rescue operations. Indigenous seeds may also be harvested for purposes of re-vegetation in areas that are free of alien or invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites.
- » Seed collection should be undertaken by a suitably qualified specialist who is familiar with the various seed types associated with the plant species and rehabilitation in the area.
- » Seed collection may be done throughout the year as seed ripens, but can also be restricted to summer, when a large amount of the perennial seed should have ripened. The collection of unripe seeds will reduce the percentage germination thereby reducing the effectiveness of the rehabilitation efforts. Seeds should be stored in paper or canvas bags dusted with insecticide, and sown at the onset of the rainy season.
- » Seed can be sown onto the soil, but should preferably be applied in conjunction with measures to improve seedling survival such as scarification of the soil surface or simultaneous application of mulch. Additional organic material may be added to the soil mix, if required, to assist with water retention during the early stages of seedling establishment.
- » It should be ensured that the seed mix is as diverse as possible in the first season. After the first season, when pioneer plant communities have successfully established, attempts should be made to re-sow and replant the area with more perennial and woody species. It is a process that will require several follow-ups.
- » Planting is dependent on species involved. Planting of species recommended for rehabilitation should be carried out as far as is practicable to coincide with the onset of the first significant rains. In general however, planting should commence as soon as possible after construction is completed in order to minimise the potential for erosion.
- » The final vegetation cover should resemble the original (non-encroached and indigenous) vegetation composition and structure as far as practicably possible.
- » Progressive rehabilitation is an important element of the rehabilitation strategy and should be implemented where feasible. Re-vegetation of disturbed surfaces must occur immediately after construction activities are completed.
- » Once revegetated, areas should be protected to prevent trampling and erosion.

- » No construction equipment, vehicles or unauthorised personnel should be allowed onto areas that have been vegetated.
- » Any erosion channels or wash aways developing after revegetation should be restored to a stable condition.

4. MONITORING AND FOLLOW-UP ACTION

The following are the minimum criteria that should be monitored within the road reserve during road maintenance activities:

- » Composition, density and stability of replanted vegetation.
- » Associated nature and stability of surface soils.
- » Emergence of alien and invasive plant species. If noted, remedial action must be taken immediately.

The initial revegetation period post-construction is estimated to be over a period of 6 months (minimum) to 12 months. The rehabilitation phase (including post seeding maintenance) should be at least 12 months (depending on time of seeding and rainfall) to ensure establishment of an acceptable plant cover is achieved (excluding invasive plant species or weeds).

Monitoring and follow-up action is important in order to achieve the desired cover and soil protection. The following monitoring protocol is recommended:

- » Re-vegetated areas should be monitored every 4 months for the first 12 months following construction.
- » Re-vegetated areas showing inadequate surface coverage (less than 20% within 12 months after re-vegetation) should be prepared and re-vegetated.
- » Any areas showing erosion should be re-contoured and seeded with indigenous grasses or other locally occurring species which grow quickly.

If the plants have not established and the acceptable plant cover is not achieved within the specified maintenance period, maintenance of these areas shall continue until an acceptable plant cover is achieved (excluding alien plant species or weeds). Additional seeding or planting may be necessary to achieve acceptable plant cover. Hand seeding may have to be considered as an option in this case.

Monitoring of rehabilitation success and follow-up adaptive management, together with clearing of emerging alien plant species should continue for as long as considered necessary, depending on regrowth rates.

APPENDIX F:

EROSION AND STORMWATER MANAGEMENT PLAN

PRINCIPLES FOR EROSION AND STORMWATER MANAGEMENT PLAN

1. PURPOSE

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

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

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

2. EROSION AND SEDIMENT CONTROL PRINCIPLES

The goals of erosion control during and after construction for the length of the access road should be to:

- » Protect the land surface within the road reserve and beyond from erosion;
- » Intercept and safely direct and dissipate run-off water from the road surface without allowing it to cause erosion.
- » Contain soil erosion, whether induced by wind or water forces, by constructing protective works to trap sediment at appropriate locations. This applies particularly during construction.
- » Plan and construct stormwater management systems to remove contaminants before they pollute surface waters or groundwater resources.
- » Reduce stormwater flows as far as possible by the effective use of attenuating devices (such as swales, berms, silt fences). As construction progresses, the stormwater control measures are to be monitored and adjusted to ensure complete erosion and pollution control at all times.
- » Design culvert inlet structures to ensure that the capacity of the culvert does not exceed the pre-development stormwater flow at that point. Provide detention storage on the road and/or upstream of the stormwater culvert; and
- » Progressively revegetate or stabilise disturbed areas.

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

2.1. On-Site Erosion Management

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

- » Due to the sandy nature of soils in the study area, soil loss will be greater during dry periods as it is more prone to wind erosion.
- » Soil loss will be greater on steeper slopes. Ensure that steep slopes are not de-vegetated unnecessarily and subsequently become hydrophobic (i.e. have increased runoff and a decreased infiltration rate) increasing the erosion potential.
- » Soil loss is related to the length of time that soils are exposed prior to rehabilitation or stabilisation. Therefore, the gap between construction activities and rehabilitation should be minimised. Phased construction and progressive rehabilitation, where practically possible, are therefore important elements of the erosion control strategy.
- » The extent of disturbance will influence the risk and consequences of erosion. Therefore site clearing should be restricted to areas required for construction purposes only.
- » The road should be planned and constructed in a manner which minimises the erosion potential. The road should therefore follow the natural contour as far as possible.
- » Ensure that development does not increase the rate of stormwater flow above that which the natural ground can safely accommodate at any point in the sub-catchments.
- » Where necessary, the new road constructed should include water diversion structures present with energy dissipation features present to slow and disperse the water into the receiving area.
- » The road and other disturbed areas should be regularly monitored for erosion. Any erosion problems recorded should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
- » Compacted areas should have adequate drainage systems to avoid pooling and surface flow. Where compaction does occur during construction outside of the pavement area, the areas should be ripped.
- » All bare areas should be revegetated with appropriate locally occurring species, to bind the soil and limit erosion potential.
- » Gabions and other stabilisation features should be used on steep slopes and other areas vulnerable to erosion to minimise erosion risk as far as possible.
- » Topsoil should be removed and stored in a designated area separately from subsoil and away from construction activities (as per the recommendations in the EMPr). Topsoil should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation in cleared areas.
- » Regular monitoring of the site for erosion problems during construction (ongoing) and operation (at least twice annually) is recommended, particularly after large summer thunderstorms have been experienced.

2.2. Engineering Specifications

A detailed engineering specification Stormwater Management Plan describing and illustrating the proposed stormwater control measures must be prepared by the Civil Engineers during the detailed design phase and should include erosion control measures. Requirements for project design include:

- » Erosion control measures to be implemented before and during the construction period, including the final stormwater control measures (post construction).

- » All temporary and permanent water management structures or stabilisation methods must be indicated within the Stormwater Management Plan.
- » The drainage system for the site should be designed to specifications that can adequately deal with a 1:50 year intensity rainfall event or more to ensure sufficient capacity for carrying stormwater away.
- » Procedures for stormwater flow through a project site need to take into consideration both normal operating practice and special circumstances. Special circumstances in this case typically include severe rainfall events.
- » An on-site Engineer or Environmental Officer (EO)/ SHE Representative to be responsible for ensuring implementation of the erosion control measures on site during the construction period. The ECO to monitor the effectiveness of these measures on the interval agreed upon with the Site Manager and EO.

2.3. Monitoring

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

- » Assess the significance of the situation.
- » Photograph the areas of soil degradation as a record.
- » Determine the cause of the soil erosion.
- » Inform the contractor/operator that rehabilitation must take place and that the contractor/operator is to implement a rehabilitation method statement and management plan to be approved by the Site/Environmental Manager in conjunction with the ECO.
- » Monitor that the contractor/operator is taking action to stop the erosion and assist them where needed.
- » Report and monitor the progress of the rehabilitation weekly and record all the findings in a site register (during construction).
- » All actions with regards to the incidents must be reported on a monthly compliance report which should be kept on file for if/when the Competent Authority requests to see it (during construction) and kept on file for consideration during the annual audits (during construction and operation).

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

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

3. CONCLUSION

The implementation of management measures is not only good practice to ensure minimisation of degradation, but also necessary to ensure compliance with legislative requirements. This document forms part of the EMPr, and is required to be considered and adhered to during the design, construction, and maintenance phases of the project (if and where applicable).