ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED BRANDVALLEY WIND ENERGY FACILITY, NORTHERN AND WESTERN CAPE PROVINCES, SOUTH AFRICA

ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

VERSION 4

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Prepared for:	**Prepared by:**
Brandvalley Wind Farm (Pty) Ltd	EOH Coastal and Environmental Services
Brandvalley Wind Farm (Pty) Ltd	**Coastal & Environmental Services**
5th Floor, 125 Buitengracht Street, 8001, Cape Town	The Point, Suite 408, 4th Floor, 76 Regent Road, Sea Point, 8005, Cape Town
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EOH Coastal and Environmental Services

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Authors	
Name	**Responsibility**
Gideon Raath	Author
Dr Cherie-lynn Mack	Reviewer
Mr Marc Hardy	Reviewer

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LIST OF ACRONYMS/ABBREVIATIONS

BA	Basic Assessment
CAA	Civil Aviation Authorities
CITES	Convention of International Trade in Endangered Species
CLO	Community Liaison Officer
CSF	Co-ordinating Social Facilitator
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DENC	Department of Environment and Nature Conservation (Northern Cape)
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Assessment Report
EMPr	Environmental Management Programme report (this report)
ESO	Environmental Site Officer
GWH	Giga-Watt Hours
HWC	Heritage Western Cape
I&AP	Interested and Affected Party
IEC	Independent Environmental Consultant
IEM	Integrated Environmental Management
IPP	Integrated Power Producers
KPI	Key Performance Indicator
MW	Mega-Watt
NEM:BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act
OHSA	Occupational Health and Safety Act
PC	Principal Contractor
PSC	Project Steering Committee
S&EIR	Scoping and Environmental impact assessment process
SAHRA	South African Heritage Resource Agency
SWMP	Storm Water Management Plan
WEF	Wind Energy Facility

DEFINITIONS

The definitions contained within this document are for explanatory purposes only. In the event that any conflict occurs between the definitions herein and those contained within the final Contract, those within the Contract shall prevail.

Alien Vegetation: Alien vegetation is defined as undesirable plant growth which shall include, but not be limited to all declared category 1 and 2 listed invader species as set out in the Conservation of Agricultural Resources Act (CARA) and the National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations, 2014 (GNR 598). Other vegetation deemed to be alien shall be those plant species that show the potential to occupy in number, any area within the defined construction area and which are declared to be undesirable.

Bat: A small animal like a mouse with wings that flies at night. Bats are mammals of the order *Chiroptera*, whose forelimbs form webbed wings, making them the only mammals naturally capable of true and sustained flight.

Brandvalley Wind Energy Facility: Refers to the 140 megawatt wind energy facility and all associated infrastructure developed by Brandvalley Wind Farm (Pty) Ltd including all farm parcels specified in Table 2-1 of this report.

Contractor: Any party appointed by the Brandvalley Wind Farm Pty Ltd, and made responsible for any activities from design, procurement, construction, to commissioning and handover of the specified tasks to the end user or proponent.
Construction Camp: Construction camp (site camps) refers to all storage and stockpile sites, site offices, container sites, workshops and testing facilities, and other areas required for undertaking or supporting construction activities.

Curtailment: Curtailment is defined as the act of limiting the supply of electricity to the grid during conditions when it would normally be supplied. This is usually accomplished by locking or feathering the turbine blades.

Cut-in speed: The cut-in speed is the wind speed at which the generator is connected to the grid and producing electricity. For some turbines, their blades will spin at full or partial RPMs below cut-in speed when no electricity is being produced.

Environmental Site Officer (ESO): An ESO is the site-based designated person responsible for implementing the environmental provisions of the construction contract and is appointed by the service provider that carries-out construction activities. The ESO shall be the designated responsible person, for implementing any remedial measures as required from time to time and for any authorisations/licences that are required in terms of the service contract. The ESO shall record and communicate environmental issues (as they occur) to the contractor and maintain records thereof. The ESO shall report concurrently to the contractor and the Environmental Control Officer (ECO).

Environmental Control Officer (ECO): A suitably qualified and experienced independent person to monitor the obligations specified in the Environmental Authorisation.

Environment: Environment means the surroundings within which humans exist and that could be made up of:-

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

Environmental Aspect: An environmental aspect is any component of a contractor's construction activity that is likely to interact with the environment.

Environmental Assessment Practitioner: Individual responsible for the planning, management, coordination or review of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instruments introduced through Regulations.

Environmental Authorisation (EA): A written statement from the relevant competent environmental authority, with or without conditions, that records its approval of listed activities associated with the construction and operation of the proposed development, and the mitigating measures required to prevent or reduce the effects of environmental impacts resulting from the activity.

Environmental Impact: An impact or environmental impact is the change to the environment, whether desirable or undesirable, that will result from the effect of the project activity. An impact may be the direct or indirect consequence of the project activity.

Environmental Impact Assessment*:* The legislated process with the objective to consider, investigate, assess and report on potential consequences for or impacts on the environment of listed activities or specified activities as required n in terms of the National Environmental Management Act (Act 107 of 1998) (as amended).

Environmental Management Programme: 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; and that the positive benefits of the projects are enhanced.

Environmental Policy: A statement by the organisation of its intentions and principles in relation to its overall environmental performance which provides a framework for action and for the setting of its environmental objectives and targets.

External Auditor: A suitably qualified and experienced independent expert as per the required auditor qualifications.

Feathering or Feathered: Adjusting the angle of the rotor blade parallel to the wind, or turning the whole unit out of the wind, to slow or stop blade rotation. Normally operating turbine blades are angled almost perpendicular to the wind at all times.

Free-wheeling: Free-wheeling occurs when the blades are allowed to rotate below the cut-in speed or even when fully feathered and parallel to the wind. In contrast, blades can be "locked" and cannot rotate, which is a mandatory situation when turbines are being accessed by operations personnel.

Increasing cut-in speed: The turbine's computer system (referred to as the Supervisory Control and Data Acquisitions or SCADA system) is programmed to a cut-in speed higher than the manufacturer's set speed, and turbines are programmed to stay locked or feathered at 90° until the increased cut-in speed is reached over some average number of minutes (usually 5 – 10 min), thus triggering the turbine blades to pitch back "into the wind" and begin to spin normally and produce power.

Interested and Affected Party (I&AP): Refers to an I&AP contemplated in section 24(4)(d) of the NEMA (1998, Act No. 107) and which, in terms of that section, includes –

a) *Any person, groups of persons, organisation interested in or affected by an activity, and;*

b) Any organ of state that may have jurisdiction over any aspect of the activity.

Liaison Committee: A committee comprising representatives of the Proponent, the Resident Engineer, the Primary contractor and the ESO. This committee will be mandated with decision-making authority based on the different reporting mechanisms discussed in this document.

Method Statement: A written submission by the contractor in response to the specification, setting-out the plant, materials, labour and method the contractor proposes using to carry-out an activity, identified by the relevant specification or the ECO when requesting the method statement, in such detail that the ECO is enabled to assess whether the contractor's proposal is in accordance with the EMPr and associated specifications.

Mitigate: The implementation of practical measures to reduce the adverse impacts, or to enhance beneficial impacts of a particular action.

Nacelle: A housing cover that contains all of the generating components of the wind turbine, including the generator, gearbox, drive train, and brake assembly.

No-Go Area: Areas where project activities, including construction, are prohibited without sufficient mitigation.

Project Manager: The person in overall charge of the planning and execution of a particular project, and ultimately responsible for the execution of a project.

Pollution: According to the NEMA (Act No. 107 of 1998), pollution can be defined as, "*Any change in the environment caused by (i) substances; (ii) radioactive or other waves; or (iii) noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future*".

Rehabilitation: To re-establish or restore to a healthy, sustainable capacity or state.

Site: The area approved for the project development.

Species of Special/Conservation Concern (SSC or SCC): Those species listed in the rare, indeterminate, or monitoring categories of the South African Red Data Books, and/or species listed in globally near threatened, nationally threatened or nationally near threatened categories (Barnes, 1998).

Threatened species: Threatened species are defined as: a) species listed in the endangered or vulnerable categories in the revised South African Red Data Books or listed in the globally threatened category; b) species of special conservation concern (i.e. taxa described since the relevant South African Red Data Books, or whose conservation status has been highlighted subsequent to 1984); c) species which are included in other international lists; or d) species included in Annexure 1 or 2 of the Convention of International Trade in Endangered Species (CITES).

Topsoil: The top layer of soil and may include top material e.g. vegetation and leaf litter.

1. INTRODUCTION

1.1 Background

Brandvalley Wind Farm (Pty) Ltd proposes to development the 140 megawatt (MW) Brandvalley Wind Energy Facility (hereafter simply referred to as the "wind farm" or WEF) between Matjiesfontein and Sutherland within the Northern and Western Cape Provinces. This Environmental Management Programme (EMPr) is a set of requirements to manage environmental impacts anticipated during the planning, construction, operation and decommissioning phases. This EMPr was compiled as part of an Environmental Impact Assessment (EIA) process undertaken in terms of the 2014 EIA Regulations of the National Environmental Management Act (Act 107 of 1998) (as amended) (NEMA) for the Brandvalley WEF.

The structure of the EMPr is as follows:

- Chapter 1: Provides an introduction to the EMPr, the project description, an overview of the EIA process followed, the scope and content of the EMPr and details of the Environmental Assessment Practitioner (EAP) who compiled this report;
- Chapter 2: Provides a breakdown of the relevant environmental legislation, the applicability thereof and an overview of the permits required by Brandvalley WEF;
- Chapter 3: This Chapter describes the typical management structure for the implementation of this WEF, the roles and responsibilities and the reporting structure;
- Chapter 4: Detailed management measures split between the planning, construction, operation and decommissioning phases;
- Chapter 5: Details the specific plans required for this document;
- Chapter 6: Details the invasive species management plan;
- Chapter 7: Details the storm water management plan;
- Chapter 8: Details the hazardous substances management plant;
- Chapter 9: Provides and outline of the grievance procedures; and
- Chapter 10: Concludes this document.

It is important to note that the EMPr is a dynamic document and will be amended throughout the life-cycle of the project.

1.2 Project description

1.2.1 Location

Brandvalley Wind Farm (Pty) Ltd proposes to develop a WEF on the border of the Northern Cape and Western Cape Provinces of South Africa (Figure 2-1). In the Northern Cape, the proposed project falls within the Karoo Hoogland Local Municipality and within the Namakwa District Municipality. In the Western Cape, the WEF falls within the Witzenburg Local Municipality and the Laingsburg Local Municipality and within the Cape Winelands and the Central Karoo District Municipalities, respectively. Sutherland is the closest town within the Northern Cape Province and is situated approximately 60km north of the project area. The closest town within the Western Cape Province is Matjiesfontein, situated 30km south of the project area. Laingsburg is a further 30km east of Matjiesfontein, along the N1 national road in the Western Cape Province.

The project area can be accessed via the R354 that connects to the N1 between Matjiesfontein and Laingsburg. The R354 is the main arterial road providing access to the project area, where there are a number of existing local, untarred roads providing access within the project area. The proposed Brandvalley WEF falls across eleven (11) farm portions, provided in Table 1-1 below. These land portions, collectively referred to as the project area for the Brandvalley WEF, are currently used for animal husbandry, game farming and agriculture, including grazing of sheep.

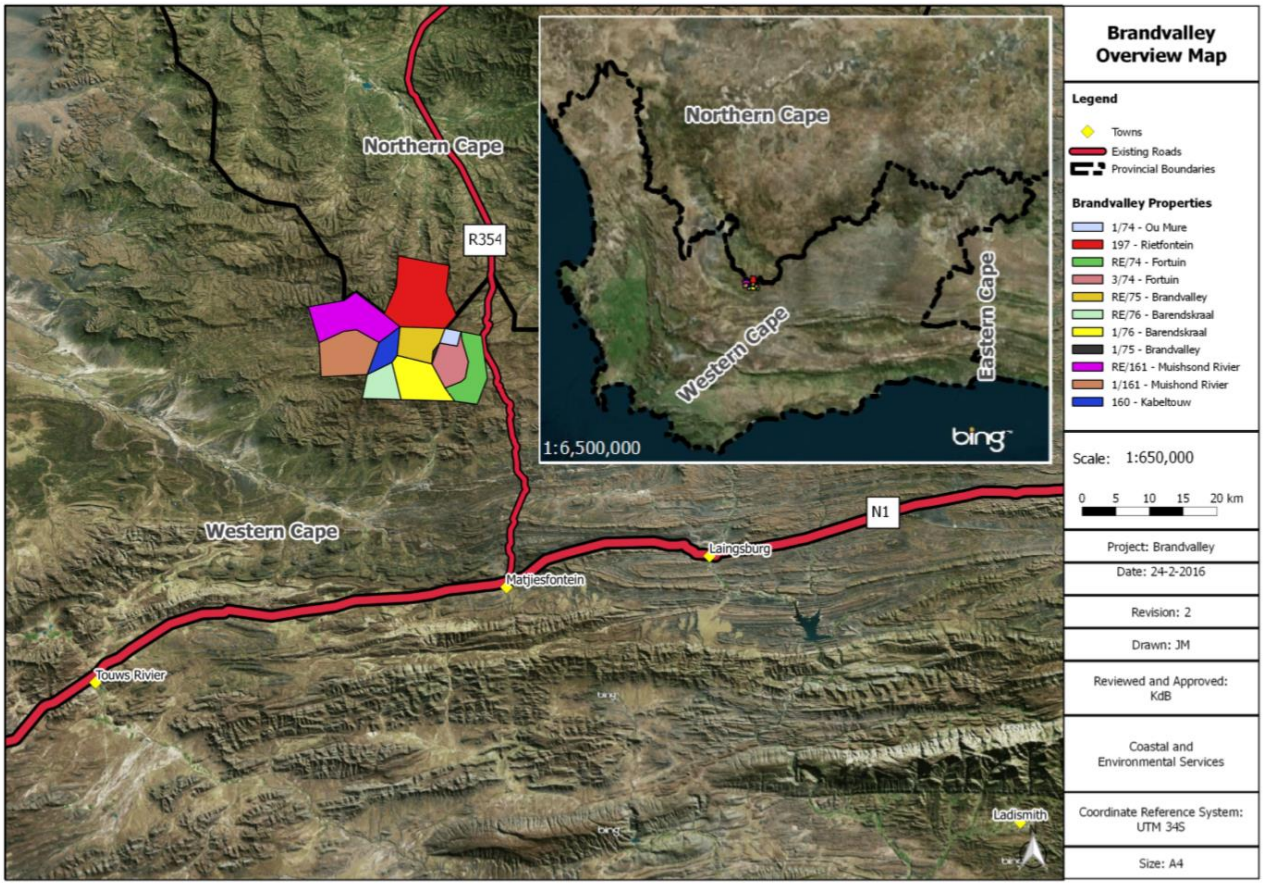

Figure 2-1: Final locality map, indicating the different property portions relevant to this project.

Table 1-1. Property portions of the proposed Brandvalley WEF.

Description of affected farm portions			
Farm Name and Number	21 digit SG Code	Municipality/ Province	Farm size (ha)
The Remainder of Barendskraal 76	C04300000000007600000	Laingsburg LM / Central Karoo DM / Western Cape	1,523.7
Portion 1 of Barendskraal 76	C04300000000007600001	Laingsburg LM / Central Karoo DM / Western Cape	2,828.6
The Remainder of Brandvalley 75	C04300000000007500000	Laingsburg LM / Central Karoo DM / Western Cape	1,981.9
Portion 1 of Brandvalley 75	C04300000000007500001	Laingsburg LM / Central Karoo DM / Western Cape	56.3
The Remainder of Fortuin 74	C04300000000007400000	Laingsburg LM / Central Karoo DM / Western Cape	2,454.98
Portion 3 Fortuin 74	C04300000000007400003	Laingsburg LM / Central Karoo DM / Western Cape	1,868.4
The Remainder of Kabeltouw 160	C01900000000016000000	Laingsburg LM / Central Karoo DM / Western Cape	1,082.8
The Remainder of Muishond Rivier 161	C01900000000016100000	Witzenberg (Ceres) LM/ Cape Winelands DM/ Western Cape	4,051.8
Portion 1 of Muishond Rivier 161	C01900000000016100001	Witzenberg (Ceres) LM/ Cape Winelands DM/ Western Cape	3391

Portion 1 of Fortuin 74 (Ou Mure)	C04300000000007400001	Laingsburg LM / Central Karoo DM / Western Cape	408.9
The Farm Rietfontein 197	C07200000000019700000	Karoo Hoogland LM/ Namakwa DM/ Northern Cape	5,873.6
Total hectares			**25,521.98**

1.2.2 Project infrastructure

Brandvalley WEF will have an energy generation capacity (at point of grid feed-in) of up to 140 megawatt (MW), and will include the following:

- Up to 70 potential wind turbine positions (between 1.5MW and 4MW in capacity each), each with a foundation of 25m in diameter and 4m in depth.
- The hub height of each turbine will be up to 120m, and the rotor diameter up to 140m.
- Permanent compacted hard-standing laydown areas for each wind turbine (70mx50m, total 24.5ha) will be required during construction and for on-going maintenance purposes.
- Electrical turbine transformers (690V/33kV) adjacent to each turbine (typical footprint of 2m x 2m, but can be up to 10m x 10m at certain locations) would be required to increase the voltage to 33kV.
- Internal access roads up to 12m wide, including structures for storm-water control would be required to access each turbine location and turning circles. Where possible, existing roads will be upgraded.
- 33kV overhead power lines linking groups of wind turbines to onsite 33/132kV substation(s).
- Underground 33kV cabling between turbines buried along access roads, where feasible.
- A 33/132kV onsite substation location including all low voltage components (including isolators, control room, cabling, transformers etc.). Low voltage components are managed by this EMPr, whereas the high voltage components of this onsite 33/132kV substation will likely be ceded to Eskom and covered by a separate EMPr. The total footprint of this onsite substation will be approximately 200m x 200m.
- Up to 4 x 120m tall wind measuring lattice masts strategically placed within the wind farm development footprint to collect data on wind conditions during the operational phase.
- Temporary infrastructure including a construction camp (~10ha) and an on-site concrete batching plant (~1ha) for use during the construction phase.
- Fencing will be limited around the construction camp and the entire facility would not necessarily need to be fenced off. The height of fences around the construction camp is anticipated to be up to 4m.

1.2.3 Activities associated with the WEF life-cycle

The following activities (Table 1-2) are expected during the life-cycle of the WEF and are likely to have positive or negative impacts on the environment.

Table 1-2. Summary of anticipated activities

Phase	Duration	Activities
Planning phase	Approximately two years	1. Detailed geotechnical investigations to inform designs 2. Final site walkthroughs by specialists to inform micro-sitting
Construction phase	18 to 24 months	**Site Establishment** 1. Setting out of construction area 2. Site camp establishment a. Clearing of vegetation where necessary. b. Levelling of camp area c. Import and placement of aggregates to form a free draining platform d. Delivery of office and welfare containers

		e. Electricity, sanitation and internet connections 3. Erection of temporary stock-proof fencing, where needed on the site, to separate stock from the construction area.
		Civil and Electrical Works 1. Topsoil stripping and bulk earthworks (excavations and backfill) for roads, hardstanding and turbine foundations. 2. Concrete works 3. Fixing reinforcement 4. Cable ducting, trenching and laying 5. Road and hardstanding construction (placement of aggregate layers) 6. Blasting (if hard rock present) 7. Pylon erection and electrical cable stringing 8. A combination of all the above activities, as they relate to the substation. This includes building construction works e.g. bricklaying, roofing, installation and testing of electrical equipment such as transformers and switchgear
		Wind Turbine Assembly and Testing 1. Delivery of turbine components 2. Assembly/ disassembly of the main crane 3. Assembly and erection of turbine 4. Internal fit-out of turbines 5. Testing and commissioning
		Overall Wind Farm Testing 1. Testing
		Site Rehabilitation 3. Remove all construction equipment. 4. Rehabilitation of temporarily disturbed areas as far as practical. **5.** Removal of all construction related rubble, stockpiles and waste.
Operational phase	20 years	**6.** Operation of turbines within the WEF and low voltage grid connection infrastructure. **7.** Maintenance
Decommissioning phase	Two years	Depending on the future use of the site

The following impact ratings were determined in the EIR:

Terrestrial ecology

Impact	Overall Significance	
	Without Mitigation	With Mitigation
Construction		
Impact on vegetation and listed plant species due to transformation within the development footprint.	Moderate -	Low -
Soil erosion risk as a result of clearing and disturbance within the development footprint and adjacent affected areas.	Moderate -	Low -
Operation		
Following construction, the site will be highly vulnerable to soil erosion	Moderate -	Low -
Following construction, the site will be highly vulnerable to alien plant invasion	Moderate -	Low -
Decommisioning		
Soil Erosion Risk Following Decommissioning will be high	Moderate -	Low -
Alien plant invasion will be highly likely within disturbed areas following decommissioning	Moderate -	Low -
Cumulative		
Impact on CBAs and Broad-Scale Ecological Processes due habitat loss and the presence and operation of the facility	High -	Moderate -

Terrestrial fauna

Impact	Overall Significance	
	Without Mitigation	With Mitigation

Construction		
Direct faunal impacts due to the construction phase noise and physical disturbance	High -	Moderate -
Operation		
Faunal impacts due to operational activities of the wind farm such as noise, and human presence during maintenance activities.	High -	Moderate -
Decommissioning		
Faunal Impacts due to Decommissioning Phase activities such as noise and disturbance due to the presence of construction staff and the operation of heavy machinery	Moderate -	Low -

Agricultural potential and soils

Impact	Overall Significance	
	Without Mitigation	With Mitigation
Planning and Design		
Increase in erosion potential	Moderate -	Low -
Increase in renewable energy development in the local area	Low -	Low -
Construction		
Management of hazardous chemicals	Moderate -	Low -
Increased risk of fires from construction activities	Moderate -	Low -
Loss of agricultural potential due to poor management of the soil stockpile	Moderate -	Low -
Soil profile disturbance and resultant decrease in soil agricultural capability	Moderate -	Low -
Establishment of renewable energy infrastructure on agricultural land	Moderate -	Low -
Increase in erosion potential	Moderate -	Low -
Operation		
Increase in erosion potential	Moderate -	Low -
Establishment of renewable energy infrastructure on agricultural land	Moderate -	Low -
Establishment of new access roads	High +	High +
Decommissioning		
Decommissioning and removal of renewable energy infrastructure on agricultural land	Moderate +	Moderate +
No-Go option		
Not constructing the WEF will result in no change in the current agricultural landscape.	Moderate +	Moderate +

Birds

Impact	Overall Significance	
	Without Mitigation	With Mitigation
Construction		
Destruction of vegetation will reduce habitat available to birds	Low -	Low -
Human activity and noise that causes birds to leave area of preferred habitat	Low -	Low -
Operation		
Activities and/or presence of intrusive structures cause birds to permanently move away from infrastructure	Moderate -	Moderate -
Birds collide with turbine blades and are killed	Low -	Low -
Powerline collision mortality associated with the placement of 33kV Powerlines throughout the project site	Moderate -	Moderate -
Cumulative		
The combined impacts from other renewable energy developments within close proximity to the Brandvalley wind farm	Moderate -	Moderate -

Bats

Impact	Overall Significance	
	Without Mitigation	With Mitigation
Construction		

Destruction of bat roosts due to earthworks and blasting	Moderate -	Low -
Loss of foraging habitat	Moderate -	Low -
Operation		
Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration)	High -	Moderate -
Artificial lighting	High -	Low -
Decommissioning		
Loss of foraging habitat	Low -	Low -
Cumulative		
Cumulative bat mortalities due to direct blade impact or barotrauma during foraging (resident and migrating bats affected).	High -	Moderate -

Rivers and wetlands

Impact	Overall Significance	
	Without Mitigation	With Mitigation
Construction		
Loss of riparian systems and disturbance to alluvial water courses	Moderate -	Low -
Loss of wetlands and wetland function in the construction phase	Moderate -	Low -
Increase in sedimentation and erosion in the construction, operational and decommissioning phases	Moderate -	Low -
Impact on localised surface water quality	Moderate -	Low -
Impact on localised aquatic systems due to the storage of hazardous substances	Moderate -	Low -
Operation		
Impact on riparian systems through the possible increase in surface water runoff on riparian form and function during the operational and decommissioning phases	Moderate -	Moderate -
Decommissioning		
Loss of riparian systems and disturbance to alluvial water courses	Moderate -	Low -
Increase in sedimentation and erosion in the construction, operational and decommissioning phases	Moderate -	Low -
Impact on localised surface water quality	Moderate -	Low -
Impact on riparian systems through the possible increase in surface water runoff on riparian form and function during the operational and decommissioning phases	Moderate -	Moderate -
Cumulative		
Loss of riparian systems and disturbance to alluvial water courses	Insignificant if all mitigation measures for phases are implemented	
Loss of wetlands and wetland function in the construction phase		
Increase in sedimentation and erosion in the construction, operational and decommissioning phases		
No-Development Option		
No-Development	Moderate -	Low -

Visual

Impact	Overall Significance	
	Without Mitigation	With Mitigation
Construction		
Visual impact of construction activity	Moderate -	Moderate -
Construction camp alternatives 1, 2 and 3	Low -	Low -
Operation		
Impact of the layout on sensitive visual receptors	High -	High -
The access road, including alternatives 1 and 2	Moderate -	Moderate -
Visual impact of the on-site substation	Moderate -	Moderate -
Shadow flicker	No impact	
Decommissioning		
Visual impact of decommissioning activity	Moderate -	Moderate -
Cumulative		
Cumulative Visual impact	High -	High -

Noise

Impact	Overall Significance	
	Without Mitigation	With Mitigation
Construction		
Disturbance, damage or destruction of fossil heritage within development footprint during the construction phase	Low -	Low -
Potential improved palaeontological database	Low +	High +
Operation		
None		
Decommissioning		
None		
Cumulative		
Disturbance, damage or destruction of fossil heritage within development footprint during the construction phase of the WEF	Low -	Low -
Potential improved palaeontological database	Low +	High +

Archaeology and palaeontology

Impact	Overall Significance	
	Without Mitigation	With Mitigation
Construction		
Destruction of precolonial / stone age material	Very High -	Moderate -
Destruction of Stone Walling Features (BV_SW1 - BV_SW17) and associated Historical Artefact Scatters (BV_Hist1 – BV_Hist3)	Very High -	Moderate -
Destruction of Graves (formal and informal burials) (HV_G1 – BV_G2)	Very High -	Moderate -
The Destruction of Homesteads / Farmhouse Complexes (BV_HS1 – BV_HS6)	Very High -	Moderate -
Operation		
None		
Decommissioning		
None		

Social

Impact	Overall Significance	
	Without Mitigation	With Mitigation
Construction		
Creation of employment and business opportunities during the construction phase	Low +	Moderate +
Technical advice for local farmers and municipalities	N/A	Moderate +
Impact of construction workers on local communities	Moderate -	Low -
Influx of job seekers	Low -	Low -
Risk to safety, livestock and farm infrastructure	Moderate -	Low -
Increased risk of grass fires	Moderate -	Low -
Impacts associated with construction vehicles	Moderate -	Low -
Impacts associated with loss of farmland	Moderate -	Low -
Potential impact on tourism	Low -	Low -
Operation		
Creation of employment and business opportunities associated with the operational phase	Low +	Moderate +
Creation of an alternative income source for farmers, which in turn can assist to reduce and or prevent job losses in the farming sector	Low +	Low +
Benefits associated with the establishment of a Community Trust	Moderate +	High +
Promotion of clean, renewable energy	Moderate -	Moderate -
Visual impact associated with the proposed WEF and the potential impact on the areas rural sense of place	Moderate -	Moderate -
Potential impact of the WEF on local tourism	Low -	Low -
Potential visual impacts associated with access roads and	Low -	Low -

construction camps (all alternative locations)		
Decommissioning		
Social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income	Low -	Low -
Cumulative		
Cumulative visual impacts associated with the establishment of a number of WEFs on the on the areas rural sense of place and character of the landscape	Moderate -	Moderate -
The establishment of a number of renewable energy facilities in the KHLM and LLM will place pressure on local services, specifically medical, education and accommodation	Moderate -	Low -
The establishment of a number of renewable energy facilities in the KHLM and LLM will create employment, skills development and training opportunities, creation of downstream business opportunities	Moderate +	High +
No-Go		
The no-development option would result in the lost opportunity in terms of job and business creation and also the opportunity for South Africa to supplement is current energy needs with clean, renewable energy	Moderate -	Moderate -

1.2.4 Specialist studies and environmental impacts

Various environmental impacts were identified and assessed by specialists during the EIA process as tabled in Table1-3.

Table 1-3. Specialists and specialist studies conducted to form part of this EMPR.

Specialist field	Specialist		Impacts Assessed
Archaeological Impact Assessment	Ms Celeste Booth	Booth Heritage Consulting (Pty) Ltd	Archaeological Impact
Agricultural Impact Assessment	Mr Roy de Kock	EOH CES	Agricultural Impact
Aquatic Impact Assessment	Dr Brian Colloty	Scherman Colloty & Associates (SC&A)	Aquatic Impact
Avifaunal Impact Assessment	Dr Tony Williams	African Insights	Avifaunal Impact
Bat Impact Assessment	Mr Werner Marais	Animalia Zoological & Ecological Consultation CC	Bat Impact
c Assessment	Mr Simon Todd	Independent Ecological Consultant	Bat Impact
Heritage Screeners	Mr Nicholas Wiltshire	Cedar Tower Services	Heritage sensitivities
Heritage Impact Assessment	Ms Celeste Booth	Booth Heritage Consulting (Pty) Ltd	Heritage Impact
Noise Impact Assessment	Dr Brett Williams	Safetech	Noise Impact
Socio-Economic Impact Assessment	Mr Tony Barbour	Independent Consultant	Socio-Economic Impact
Visual Assessment Specialist	Mr Thomas King	EOH CES	Visual Impact
Traffic Impact Assessment	Mr Hermanus	Aurecon South Africa (Pty) Ltd	Traffic Impact

	Steyn		

1.2.5 Environmental sensitivities

Please see Figures 2-2 to 2-9 below for a summary of the environmental and social sensitivities found during the EIR phase including:

1. Palaeontology sensitive area (off site)
2. Heritage features
3. Bat sensitive areas
4. Avifauna sensitive flightpath
5. Agricultural sensitive areas
6. Aquatic features
7. Ecology features

All of these sensitive features will be taken into account when optimising and finalising the site development plan.

The following sections summarise the key specialist issues established during the specialist phase. These are also discussed as is in the Environmental Impact Assessment Report.

TERRESTRIAL ECOLOGY

Fragmentation and transformation of habitats can lead to the loss of viable plant populations and/or species of conservation concern, especially for species with restricted ranges. In the case of the Brandvalley Wind Farm, apart from the direct loss of vegetation within the development footprint, listed and protected species are highly likely to be impacted. In addition, the disturbance created during construction would leave the site vulnerable to soil erosion, especially as many parts of the site are steep, and the infestation of alien plants. The Brandvalley site consists of a series of ridges and valleys mostly orientated in a north south direction. The majority of the site is considered medium-low sensitivity and consists of open veld with few species of conservation concern present.

The majority of turbines are located on the higher-lying ridges of the site which are considered to be somewhat higher sensitivity than the adjacent lowlands and most of the affected areas are considered to be of Medium-High sensitivity. There are some ridges which are considered higher sensitivity on account of the likely presence of species or habitats of concern. While development within some of these areas is considered acceptable, there are some areas where it is recommended that the turbines are relocated to a lower sensitivity area. There are only two turbines that are located within areas that are considered very high sensitivity and which should be relocated to less sensitive areas. In response to these findings, the applicant has produced a mitigated layout in which turbine 56 and 57 have been dropped and there are two changes to the road layout which are also seen as positive. These changes to the layout are sufficient to meet the recommended avoidance measures to reduce the impact of the development to an acceptable level.

Although there are a number of other turbines within areas considered High Sensitivity, these are not considered no go areas and provided that specific mitigation and avoidance startegies are implemented in these areas, then the impact would be reduced to an acceptable level.

It is also important to note that while the direct extent of habitat loss resulting from the turbines would be about 25ha, the access roads would create up to 120ha of habitat transformation, indicating that the access roads are ultimately more of concern for the development than the turbines themselves.

However, provided that the development footprint and associated impact within the higher

elevation northern ridges can be managed, then the major impact of the Brandvalley development would be on ecological processes (fragmentation) rather than on biodiversity pattern. Direct impacts on species and habitats can be mitigated to a moderate to low level through design and preconstruction walk-throughs to inform the final approved layout. The recommendations for impact mitigation and avoidance for the various turbines is detailed below.

Construction

- There are confirmed listed and protected species present at the site and it is highly likely that some of these species would be impacted during construction activities and site clearing. Although a preconstruction walk-through can reduce this impact, there is still likely to be some unavoidable impact on vegetation and listed plant species. Overall, after mitigation, which includes relocating the two turbines out of the Very High sensitivity areas, the impact is likely to be of Moderate to Low significance.
- During and immediately after construction, the disturbed areas within the site will be highly vulnerable to erosion. It is a common misconception that erosion in semi-arid environments is a low risk factor, however, this is false as these areas are often exposed to high intensity rainfall events and the vegetation cover is low, leaving the soils exposed and vulnerable to erosion. Erosion results in soil loss and a decline in biodiversity and productive potential from the affected areas and may also result in the siltation and degradation of aquatic systems which receive the eroded soils. With the implementation of erosion control and avoidance measures, this impact can however be effectively reduced to a Low level of significance.

Operation

- All Areas disturbed during construction will remain vulnerable to disturbance for some time into the operational phase and will require regular maintenance to ensure that erosion is minimised. With mitigation, this impact can however be reduced to a Low level of significance.
- Disturbed areas are vulnerable to alien plant invasion and it is likely that road verges, crane pads and other cleared or disturbed areas will be foci for the infestation of alien plants. Uncontrolled infestation can result in invasion into the intact rangeland and where woody species are involved, this can result in loss of biodiversity and a decline in ecosystem services. With regular clearing and management, this impact can be reduced to a Low significance level.

Decommissioning

- Decommissioning will result in a lot of disturbance which will leave the site vulnerable to erosion. As a result, the site should be monitored for erosion problems for at least 2 years after decommissioning or until perennial cover is 60% of the undisturbed levels. With mitigation, this impact can be reduced to a Low significance
- Decommissioning will cause disturbance to the vegetation in the project area leaving the site vulnerable to the infestation of alien plant species. The site should be monitored and managed for alien plant species for at least two years following decommissioning or until an adequate cover of perennial plants has been established in disturbed areas. With mitigation, this impact can be reduced to a Low significance.

Cumulative

Cumulative impacts are a significant concern at the site due to the large amount of wind energy development proposed in the area. Furthermore, the development is within a CBA and the loss of habitat within the CBA may impact the ecological functioning of the CBA and result in increased habitat fragmentation and reduced landscape connectivity.

In order to reduce the cumulative impact of the development, the two turbines within the Very High sensitivity areas should be relocated and the footprint of the development should be kept as low as possible. Overall, the cumulative impact significance of the development is considered to be Medium after mitigation and cannot be reduced to a Low level as the impact results from the presence of the facility.

TERRESTRIAL FAUNA

Mammals are likely to be most impacted on during the construction phase when a lot of noise and disturbance would be generated. There is little that can be done to avoid this impact as disturbance cannot be avoided at this time. In the longer term, the noise generated by the turbines would have a potential impact on species which use sound to find their prey or avoid their predators. This might include such species as the Bat-eared Fox which uses hearing to detect prey underground, golden moles which use minute vibrations in the soil to detect prey as well as rodents such as gerbils which have expanded auditory bullae and large ears to help them avoid predators such as owls at night.

Furthermore, studies have shown that in the face of increased background noise, fauna spend more time being vigilant and less time on foraging and other activities which ultimately represents habitat degradation for such species. This effect occurs over a much larger area than the direct footprint of the development and the affected area in the current context is likely to amount to several thousand hectares. Although the extent of this impact depends on wind conditions and type of turbine, as an indicative evaluation of this impact, there would be 3220ha of the site within 500m of a wind turbine and there would be a significant increase in background noise within this area when the turbines were operating. Although some fauna can adapt to this in various ways such as by changing the pitch of their calls, some aspects such as using sound to find prey or avoid predators will persist for the lifetime of the facility.

For reptiles, the major impact associated with the development would be habitat loss and fragmentation, with the potential for increased levels of predation being a secondary impact which may occur as a result of vegetation clearing for roads and turbine pads. There do not appear to be any reptiles which are specifically restricted to the higher-lying ridges of the site and which would be particularly vulnerable to impact as a result.

In general, the most important areas for amphibians at the site are the riparian areas, seeps and wetlands and the man-made earth dams which occur in the area. As these are widely recognized as sensitive habitats, impacts to these areas are avoided largely at the design phase of the development and a minimum amount of infrastructure has been located in the vicinity of these features. Consequently, direct impacts on amphibians at the site are likely to be fairly low. Amphibians are however highly sensitive to pollutants and the large amount of construction machinery and materials present at the site during the construction phase would pose a risk to amphibians should any spills occur.

Construction

- The construction phase will involve a lot of disturbance at the site due to the operation of heavy machinery, human presence and noise from blasting. This will deter larger fauna from the area and smaller fauna may suffer direct habitat loss or be killed if they are unable or too slow to move away from construction activities. As the construction activities cannot be avoided, it is not possible to mitigate some of these impacts. They are however transient and disturbance levels will subside significantly in the operational phase. Construction phase faunal disturbance is considered to have a Moderate significance after mitigation.

Operation

- Although disturbance during the operational phase will be significantly lower than during the construction phase, it is also higher than the background pre-development levels of noise and this will impact some species, especially those that use sound to find their prey or avoid their predators. This includes species such as Bat-eared Fox, gerbils and golden moles and potentially other species such as owls and frogs. Although the severity of this impact is moderate, it cannot be well mitigated as the primary source of noise in the area would be from the turbines themselves. It is difficult to quantify the extent of this impact, but it is likely to extend 500m or more from turbines depending on wind conditions. The overall significance of this impact is likely to be Medium.

Decommissioning

- Decommissioning will require the use of heavy machinery on-site and will generate a lot of noise and disturbance which would have a negative impact on fauna. This impact would however be relatively short-lived and would ultimately result in the removal of the development and rehabilitation of the site and as such the ultimate impact of decommissioning on fauna would be Low after mitigation.

AGRICULTURAL POTENTIAL AND SOILS

Based on the agricultural potential onsite, DAFF (Agriculture) has determined the grazing capacity to be between 18-25 hectare per large stock unit (ha/LSU) on low undulating landscapes and 26-30 ha/LSU on steep mountainous areas. Grazing capacity potential was determined in 1995 by DAFF (Agriculture) to be between 41-80 ha/LSU increasing to 26-30 ha/LSU towards the eastern sections. Grazing onsite is not utilised to its fullest potential capacity, but this is as a result of water availability. Soils within the Brandvalley Wind Farm may be considered as optimum for a wide variety of crops under minimal soil management. However, due to the limiting factor being water availability and soil depth, such crops can only be grown under irrigation in deeper alluviums next to river systems. The Brandvalley wind farm only receives about 61mm of rainfall per year, and therefore dryland cropping is not viable. Irrigation is intensively practiced in small areas along dry riverbeds where irrigation dams can be erected and soils are suitable. Various cash crops and winterfeed are produced under irrigation, but are restricted to small areas along dry riverbeds. The area supports some hunting practices and livestock farming.

The development of the Brandvalley Wind Farm will result in the loss of approximately 5ha of agricultural rangeland as these areas are transformed and replaced with turbine hardstands, access roads and other associated infrastructure.

The following sensitive areas were identified:

Area type	Sensitivity allocation
Crop areas under irrigation	High
Water bodies	High
Drainage systems	High
Shallow soils on sloped areas	Moderate

All the identified impacts on agriculture are considered to have high reversibility because the land will be able to be returned to agriculture after closure, with very little change in agricultural potential. Impacts on agriculture are also considered to have low irreplaceability of resource loss because:

1. of the small area of land involved,
2. low suitability for crops outside small areas along dry riverbeds that are under irrigation,
3. it is highly unlikely to be irreplaceably lost to agriculture,
4. of a low agricultural potential for livestock, and
5. the proportion of surface area likely to be affected is minimal and therefore the overall impact on the carrying capacity/agricultural potential of the site will be minimal.

Planning and Design Phase Impacts

- During the planning and design phase inappropriate storm water design may lead to an increase in surface soil erosion
- During the planning and design phase the increase in renewable energy development in the local area will result in a gradual reduction of available agricultural land over time.

Construction

- During the construction phase hazardous chemical spills and leakages could lead to soil contamination and a loss of fertile soils if not managed appropriately.
- During construction phase fires originating from the construction site could lead to the loss of grazing and game.
- During the construction phase incorrect stockpiling of soil could result in a decrease of agricultural viability/potential.
- During the construction phase excavations for the construction of the turbines and associated infrastructure will disturb the soil profile. If topsoil becomes buried, or subsoil rock, that is less suitable for root growth, remains at the surface, the agricultural suitability of the soil, that will become available for agriculture again after decommissioning of the WEF, will be reduced.
- During the construction phase the WEF infrastructure (permanent and temporary) will result in the loss of up to 5 ha of low agricultural land.
- During the construction phase the increase in impacted areas and hard surfaces will increase run-off and potentially lead to soil erosion.

Operation

- During the operational phase an increase in hard surfaces (hardstands and roads) will increase run-off and potentially lead to soil erosion.
- During the operational phase the WEF infrastructure will result in the loss of up to 5 ha of low agricultural land
- During the operational phase the new access roads will allow for an easier access to farm areas previously inaccessible or difficult to access.

Decommissioning

During the decommissioning phase the decrease in renewable energy development in the local area will result in an increase of available agricultural land.

BIRDS

Bird occurrence was monitored across 12-months in the Brandvalley project area, the monitoring was conducted for a total of 20 days across four seasons in the period April 2015 to January 2016 (representative of the full annual or seasonal cycle).
In the Brandvalley area three groups of birds are considered to be potentially at risk of collision with turbine blades and powerlines. These groups are: 1) large ground foraging species; 2) birds of prey; and 3) corvids. The only large ground foraging species of collision risk concern that were recorded during the four season survey were a single Ludwig's Bustard (Endangered) and Namaqua Sandgrouse (not red listed). Neither species was common. Fourteen species of birds of prey have been reported either in the Brandvalley area or on closely adjacent WEFs. Most occur in the valleys where prey is more abundant. In the Brandvalley surveys only four species were recorded at turbine location heights. These were: Verreaux's Eagle, Rock Kestrel, Pale Chanting Goshawk, and Jackal Buzzards.

Four species of established (red-listed) conservation concern were recorded across the four field surveys: a Ludwig's Bustard (Endangered) seen once; Verreaux's Eagles (Vulnerable) were seen on numerous occasions; a single, immature, Martial Eagle (Endangered) was seen on Eskom pylons; and Black Harriers (Endangered) were seen twice. The species potentially at greatest risk of mortality through collision with turbine blades is the Namaqua Sandgrouse (not red-listed).

Construction

Development of the infrastructure footprints inevitably causes the loss of foraging and nesting habitat for most locally resident species of birds. Birds displaced by this loss of habitat must find alternative suitable habitat, which may be less favourable. The displaced birds must compete for resources with the established population of birds of the same or other species potentially to the detriment of both. The result is a reduction in the local population of most small-bodied bird species.

Habitat destruction is scarcely an issue for the proposed Brandvalley windfarm as a high proportion of the ground along the ridges is bare and or rock covered and so of limited attraction to birds. Nor is population displacement a major issue for most resident bird species since the population of birds using the ridges is very small (negligible in drought conditions) and all their needs can be reasonably fulfilled on adjacent slopes where most already breed. Development of access roads and powerlines on hill sides and in valleys will have a greater impact than turbines in terms of habitat destruction and bird displacement.

Construction period disturbance and subsequent maintenance and operation are also unlikely to have substantial negative effects on resident bird populations since the species will temporarily avoid the area largely by moving down the hillsides which are already their preferred habitat. Two years earlier than the present survey a new Eskom 400 kV powerline was constructed during bird monitoring for a proposed wind farm north of the Brandvalley WEF. Despite considerable vehicle and human activity, birds of prey were still often seen in the area.

Operation

A potentially negative issue is the effect turbine noise may have on birds accustomed to generally quiet habitats. Turbines create noise that can be heard by humans up to 1 km distant. Studies of birds along roads have shown that due to traffic noise some bird species are less common, or even absent, within 2-5 km of major roads (Forman & Deblinger 2000, Rheindt 2003). To date, there has been no assessment anywhere in the world on the effect that turbine noise may have on local bird populations. Where, as in the Roggeveld, turbines are erected on ridges noise is considered to have little effect on the hillsides and may be beneficial in deterring bird use of the ridges and so keeping them away from the turbines.

The crucial issue of concern is mortality of birds through collision with either the turbine rotor blades or the powerlines associated with the development and the degree to which such mortality is acceptable for particular groups or species of birds. The risk of collision mortality varies in several general ways and these affect the manner in which collision mortality can be mitigated. Birds flying in daylight have a better chance of seeing and avoiding turbines and powerlines than those flying at night - hence the concern raised over the night moving transients by the bird specialist. Daylight fliers may have an increased risk of collision in periods of fog or mist when visibility is severely reduced. In the Roggeveld low clouds often cover the ridges in fog. It is unclear to what extent birds fly over the ridges in such conditions. The other factors that affect bird collision with turbines are: 1) the degree to which birds fly at heights equivalent to the turbine rotor blades – planned to be up to 20-190 m above ground level; 2) their ability to manoeuvre in flight – which is lower for larger and heavier bird species, and for most birds in headwinds; 3) the degree to which birds may be pre-occupied - i.e. through chasing prey or in courtship display – and so pay less attention to moving rotor blades; 4) familiarity with the location of turbines; 5) the frequency with which they place themselves at risk of collision; and 6) the angle of approach, since rotor blades are more conspicuous seen head on than from the side.

From an avifaunal perspective there are two key high risk areas in the Brandvalley area. These areas are:

1. The saddle between the two Snydersberg plateaux each with its turbine string. This saddle is regularly used by Verreaux's Eagles and White-necked Ravens.
2. The col on the ridge between the Ou Mure and Fortuin farms. This is a preferred flight path for waterbirds moving between the Fortuin dam and dams to the north. Waterbirds, which often fly low during localized movements and also fly in flocks, are likely to use this route at night when any obstructions, such as powerlines are detectable.

Cumulative

For several reasons cumulative effects on birds are not considered a serious impediment to authorisation of the proposed Brandvalley WEF. These reasons are:

- Most of the bird species recorded are local residents with extensive ranges in similar habitats across a wide swathe of South Africa.
- Other than the limited footprints of WEFs and solar power there are unlikely to be any other new major changes in regional land that will overlap with the construction phases of the WEFs have any serious effect on local bird distribution and numbers.
- The forecast for the Karoo in the medium term – equivalent to the predicted operational life, 20-30 years, of wind turbines - is of progressive drying. If this equates to the summer conditions in 2016 it will considerably reduce bird populations and so decrease the potential impacts on birds of wind farms in the Roggeveld.

Provided appropriate mitigation measures are applied in all the proposed regional wind and solar projects which is the case, the cumulative impact must be considered acceptable. This is especially relative to the situation in coastal lowland areas of the Western Cape where the number and diversity of birds at risk, especially those of conservation concern, is far greater than in the Roggeveld region. From an avifaunal perspective this semi-arid, low resourced region, is probably one of the areas in South Africa the development of WEFs will have the least negative impact on the avifauna.

BATS

Construction

During construction, the earthworks and especially blasting can damage bat roosts in rock crevices. Intense blasting close to a rock crevice roost, if applicable, can cause mortality to the inhabitants of the roost. Some minimal foraging habitat will be permanently lost by construction of turbines and access roads. Temporary foraging habitat loss will occur during construction due to storage areas and movement of heavy vehicles.

Operation

The concerns for foraging bats in relation to wind turbines are discussed in Section 2.4. If the impact is too severe (e.g. in the case of no mitigation) local bat populations may not recover from mortalities.

During operation strong artificial lights that may be used at the turbine base or immediate surrounding infrastructure will attract insects and thereby also bats. This will significantly increase the likelihood of impact to bats foraging around such lights. Additionally, only certain species of bats will readily forage around strong lights, whereas others avoid such lights even if there is insect prey available, which can draw insect prey away from other natural areas and thereby artificially favour only certain species.

Decommissioning

Some minimal foraging habitat will be temporarily lost during decommissioning of turbines and access roads. Temporary foraging habitat loss will occur due to storage areas and movement of heavy vehicles.

Cumulative

Mortalities of bats due to wind turbines during foraging and migration can have significant ecological consequences as the bat species at risk are insectivorous and thereby contribute significantly to the control of flying insects at night. On a project specific level insect numbers in a certain habitat can increase if significant numbers of bats are killed off. But if such an impact is present on multiple projects in close vicinity of each other, insect numbers can increase regionally and possibly cause outbreaks of colonies of certain insect species.
Additionally, if migrating bats are killed off it can have detrimental effects on the cave ecology of the caves that a specific colony utilises. This is due to the fact that bat guano is the primary form of energy input into a cave ecology system, given that no sunshine that allows photosynthesis exists

in cave ecosystems.

RIVERS AND WETLANDS

The proposed development occurs within the following catchments within the Nama Karoo ecoregion:

1. E23A – Wilgebos / Kleinpoorts tributaries of the Tankwa River
2. E22B – Muishond River
3. E22A – Groot River
4. J11D – Roggeveld River

These catchments are characterised by several perennial water courses associated with these mainstem systems listed above. While the larger systems towards the south of the study area are alluvial systems, characterised as natural sediment transport mechanisms within the regional environment. Overall with the exception of impacts such as erosion and present road crossings, conversion of floodplain areas to agriculture, while some areas still have small remaining *Juncus* wetlands (valley bottom wetland types – with and without channels).

The Present Ecological State scores (PES) for the respective subquaternary catchments within the study area were rated as follows (*DWS, 2014 – where A = Natural or Close to Natural & C = Moderately Modified*):

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
8162	C	High	High
8171	A	High	Very High
8258	A	High	Very High
8233	A	High	Very High
8134	A	High	Very High
7876	A	High	High
7875	A	High	High

It is thus evident that the study area systems are largely functional and or have limited impacts as a result of current land use practices. This was confirmed for each of the affected reaches located within the development footprint and in particular the areas that would be crossed by the proposed road layout. In other words, the systems observed are largely natural, with small or narrow riparian zones, dominated by *Searsia lancea* and *Vachellia karroo.* The only obligate species observed include small areas of *Juncus rigidus* and *Phragmites australis* associated with small pools created by road culverts found throughout the study area. Thus the DWS 2014 assessment for each of the study area systems is supported and the current ratings can be upheld. No aquatic protected or species of special concern (flora) were observed during the site visit

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, several large natural wetlands could occur within the study area. While the remaining waterbodies are artificial or man-made systems such as dams. However, the natural wetlands observed within the study area are *Juncus* (Sedge) dominated valley bottom wetlands, some containing channels, while others i.e., those associated with broader floodplains have no channels.

These natural wetland areas, were dominated by impacts such as dams, and the conversion to agricultural lands, thus most were Moderately Modified (PES = C), Largely Modified (PES = D) or somewhere between (PES = C/D). These systems do still contain value in terms of acting as sponge areas within an arid environment, providing additional aquatic habitat (mostly for birds) and filtering any runoff due peak flow periods. For this reason, all the wetlands were rated as having a Moderate Ecological Importance and Sensitivity (EIS) Score.

The construction and operation of the Brandvalley Wind Farm is likely to have direct and indirect

impacts on the riparian areas and water courses located within the development area. The physical removal of the riparian zones and disturbance of any alluvial watercourses and wetlands by new road crossings or upgrades of existing roads are likely within the watercourses at the site. These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in lost or damaged vegetation. In addition, increased surface water run-off could cause changes in downstream riparian form and function due to impacts to the hydrological regime such as alteration of surface run-off patterns.

Pollution of the sensitive riparian zones and wetlands from accidental spills of hazardous waste is a risk associated with the construction activities and to a limited degree the operation activities. Strict use and management of all hazardous materials used on site will be required to ensure that these systems are not inadvertently polluted.

Construction

- The physical removal of the riparian zones and disturbance of any alluvial watercourses by new road crossings or upgrades of existing roads are likely within the watercourses within the site. These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in lost or damaged vegetation.
- Impact on the possible loss of wetlands due to the potential need to upgrade the existing crossing through the most northern wetland. The southern-most structures are outside of the wetland boundary and the proposed 50m buffer, but located within 500m of the wetland boundaries. The potential impacts could occur during the construction and again in the decommissioning phase.
- Impacts to the hydrological regime such as alteration of surface run-off patterns could cause an increase in sedimentation and erosion within the development footprint during the construction, operational and decommissioning phases.
- During both preconstruction, construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could be washed downslope via the ephemeral systems.
- During the construction and to a limited degree the operational activities, hazardous substances mostly associated with the substations could be washed downslope via the ephemeral systems. This impact would be similar for all substation options.

Operation

Impacts on the hydrological regime such as a change of surface water run-off patterns due to the hard surfaces associated with hardstands and roads, could impact downstream riparian form and function during the operational and decommissioning phases.

Mitigation Measures
Refer to mitigation measures listed under the construction phase.

Decommissioning

In this instance, impacts associated with the decommissioning phase are similar to those for the construction phase and as such have not been repeated here.

Cumulative

The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur considering that the site is near the main drainage channels, however the annual rainfall figures are low and this impact is not anticipated if the mitigation measures listed under the construction phase are properly implemented. These are not anticipated due to the state of the current wetlands, lack of connectivity within the impact area and the nature of the development together with the proposed layout. Erosion and sedimentation of the downstream systems and farming operations could result in cumulative impacts. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together

with the proposed layout.

The proposed layout for the facility would seem to have limited impact on the aquatic environment as the proposed structures for the most part have either avoided the delineated watercourses and wetlands with the exception of a number of water course crossings. Use of any existing roads will further support this conclusion, particularly with regard the two wetland crossings, although the wetlands concerned are already impacted by the surrounding roads, dams and farming activities. Where any road upgrades are required it is understood that these current crossings may be upgraded by increasing the current size of the culverts and provide additional erosion protection, thus a possible net benefit to the local aquatic systems. The actual requirements and designs will be finalized in the detail design phase. The following conditions need be adhered to:

- No transmission line towers, substations and construction camps will be placed within the delineated water courses as well as their respective buffers without obtaining the required approvals.
- It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within these areas (inclusion of buffers) to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMP preparation

VISUAL

Wind turbines, with a hub height of up to 120m, and the rotor diameter up to 140m can be considered visually intrusive by neighbouring properties and key stakeholders. The overall aim of a Visual Impact Assessment (VIA) is to determine the current landscape quality (scenic views, visual sensitivity) and the visual impact of the proposed development. The site and its surroundings are not highly developed. The site is remote and the sense of place is typically Karoo. A large 765kV Eskom transmission line, and a 400kV Eskom transmission line are the only features which currently detract from the otherwise high scenic quality of the area.

Within twenty kilometres of the Brandvalley WEF boundary, eighty (80) buildings were identified. These were identified using aerial imagery and were ground-truthed during the site visit. Thirty (30) of these were found to be the homesteads of surrounding farmers. The visual impact of the WEF on these homesteads is dependent on the number of turbines visible and their proximity to the turbines (i.e. their visual exposure to the development). Not all of these homesteads are necessarily sensitive to the proposed wind energy facility, as this depends on their perception of wind turbines: they may have a neutral or positive opinion towards them. Therefore, we consider tourist facilities and interested and affected parties that have stated that they are opposed to the wind energy facility to be particularly sensitive. In terms of tourist facilities, the Gatsrivier and Saaiplaas guest farms have been identified as sensitive. The following protected areas were identified within 50km of the WEF boundary:

- Anysberg Nature Reserve, Provincial Nature Reserve, 32km south of the WEF boundary;
- Touw Local Authority Nature Reserve, Local Nature Reserve, 46km south-west of the WEF boundary.

The visual impact assessment found the following homesteads and guest houses to be visually senstivie the the Brandvalley WEF, the sensitivity is based on their visual exposure (Table 9-1). The homesteads/guest houses which are closer to the turbines are likely to see fewer turbines but more of the turbine itself (if not the entire turbine), i.e. they will be closer and larger, whereas the guesthouses/homesteads further away (>10km) will see a greater number of turbines but only a portion of each turbine i.e. since they are viewed at a distance they will appear further away and small.

Sensitive Visual Receptors	# Turbines Visible (distance in km to nearest turbine)	Visual Exposure

Within 5 km		
Gatsrivier Guest House	11-15 (8.6)	Wind turbines will dominate views from these distances and visual receptors will be highly exposed to the development.
Aurora farm homestead (Gielie Hanekom)	11-15 (5.9)	
Bona Esperance farm homestead (P.J. Conradie)	6-10 (4.9)	
Swartland Homestead (T.J. Calldo)	1-5 (5.3)	
Within 5 to 10 km		
Brandenburg farm Homestead (Mr A.J. Du Plessis)	21-25 (11.8)	At these distances the wind turbines will not be dominant in views but they will be clearly recognisable by visual receptors (their visual exposure to the wind turbines will be moderate).
Saaiplaas Guest House/ homestead	Farms are planned to host wind turbines associated with different projects, they are not considered to be sensitive receptors.	
Ekkraal farm homestead (Mr Kosie Steenkamp)		
Within 10 to 15 km		
Kareerivier farm homestead	21-25 (18)	The wind turbines will be recognisable to these visual receptors and their visual exposure to the development will be moderate.
Bantamsfontein farm homestead (Mr Jan du Toit)	16-20 (20.3)	
Smitskraal farm homestead	6-10 (14.5)	
Patatsrivier farm homestead	1-5 (15)	
Within 15 to 20 km		
Zeekoegat farm homestead (Mr Warren Petterson)	6-10 (17)	At a distance of 17km and 17.5km respectively from the nearest turbine (Wind Turbine 3), the wind turbines will not be easily noticeable during the day. , at night, the red light on the turbine hub that blinks approximately every two seconds will be noticeable.
Keurkloof farm guesthouse (Mr Steve Swanepoel)	6-10 (17.8)	

Objections to the wind energy facility have been received from two nearby land owners during the scoping public participation process. The first objector is Mr Warren Petterson whose farm “Zeekoegat” is located to the south of the proposed WEF site. The homestead on the farm is 17km from the nearest turbine (Wind Turbine 3). The mountain hut that he is refurbishing is 21km from the nearest turbine (Wind Turbine 3).

The second objector is Mr Steve Swanepoel whose cottage on the farm “Keurkloof” is located 17.5km from the nearest wind turbine (Wind Turbine 3). Photomontages were done at visual vantage points to depict what Mr Petterson and Mr Swanepoel views of Brandvalley WEF could be should the proposed project be approved.

Construction

There are various construction activities which will have impacts on sensitive visual receptors:

- Large areas of vegetation will need to be cleared to make way for digging of the turbine foundations, hardstand areas, substation footprints, access roads, laydown areas, workshops and storage yards.
- Construction of wind turbines will potentially draw attention if they are exposed above the skyline.
- There will be a large increase in the movement of vehicles in the area: large trucks delivering supplies and construction material; graders, excavators and bulldozers; light vehicle movement around site; large trucks hauling rubble and construction waste, etc.
- Soil stockpiles and heaps of vegetation debris.
- Dust emissions from construction activity
- The footprint of the construction camp alternatives are largely similar, but the viewsheds differ quite significantly based on their location in the landscape. The Brandvalley construction camp alternative 1 has the smallest viewshed, and is visually the preferred option.

Operation

Turbines
There are no structures similar in size and type to the proposed wind turbines in existing views and the turbines are likely to change these views to a considerable extent. The sense of place of the region is remote rural in many parts of the study area and wind turbines will, for some visual receptors, alter the remoteness of the region. Visual intrusion of the proposed development is therefore rated as high (although it should be noted that this will not be the case for all visual receptors in the region since the aesthetic appeal of wind turbines differ significantly among viewers). It should also be noted that wind turbines have to be fitted with red lights that flash intermittently. These will be highly visible at night, especially at this particular site due to the almost total absence of other non-natural light emitters.

Access roads
The access roads (excluding the alternatives considered above) will have a total length of 88,280.2m. Based on a width of 12m, these will have a footprint of 106ha. This road network will be visible from an area of 23,595ha, limited to within 5km of the road network. A part of this road network will be visible to Gielie Hanekom at his homestead on the farm “Aurora”. The viewshed of access road alternative 1 is approximately 2470ha less than viewshed 2.

Substation
The visual impact of four substation options were assessed and substation alternative 1 was found to have the smallest viewshed (418ha) half that of alternative 2 and a third of alternative 3 and 4. There are no visual receptors.

Shadow flicker
Shadow flicker results from the shade cast by a wind turbine and its rotating blades. The shade cast by the blades “flicker” from the point of view of a stationary observer as the blades rotate. Shadow flicker is potentially a problem if a turbine is located within 800 metres of an occupied building. No buildings are located within 800m of a wind turbine.

Decommissioning

Wind farms are typically designed for a 25 year life. After 25 years, the proposed Brandvalley Wind Farm may either be refurbished (re-powered) or decommissioned. If it is decommissioned, the impacts during the decommissioning phase will be very similar to those identified in the construction phase, specifically the visual impact of construction activities. The mitigation measures applicable to the construction phase are applicable to decommissioning as well.

Cumulative

The wind energy facilities listed below are within 30km of the Brandvalley WEF and are seeking environmental authorisation or have received environmental authorisation.

- Konstabel Solar Project
- Roggeveld Wind Project
- Perdekraal Wind Project
- Witberg Wind Project
- Sutherland Wind and Solar Project
- Hidden Valley Wind Project
- PV Solar Project, south of Sutherland
- Suurplaat Wind Project
- Gunstfontein Wind Project
- Komsberg Substation
- Rietkloof Wind Project

Although it makes sense from a business and engineering perspective to concentrate facilities in this way, there is no escaping the fact that the development of multiple wind energy facilities, at this scale, will change the character of this remote area significantly. However, it should also be noted that the area is located within a Renewable Energy Development Zone - “Komsberg Wind” - as identified in the Strategic Environmental Assessment undertaken by the Council for Scientific and Industrial Research (CSIR) and the Department of Environmental Affairs. The planning instruments therefore support the concentration of renewable energy development within this area.

The impact of the wind farm on its own, and when considered cumulatively with other wind farms in the region, will have a high negative visual impact for the following reasons:

- The screening effect of vegetation in this arid environment is non-existent;
- The construction of infrastructure of this type in this region will contract strongly with the sense of place of the region.

NOISE

Noise pollution will be generated during the construction phase as well as the operational phase. The decommissioning noise impacts will be the same as for the construction phase. For more information as to how sound is generated please refer to the noise specialist report. **The South African guideline limit for noise is** 45 dB(A) **(**day/night limit**) and** 35 dB(A) **(**night limit**) for rural districts.**

Construction

During construction if the ambient noise level is at 45dB(A) during the day, the construction noise will be similar to the ambient level at approximately 1280m from the noise source, if the noise characteristics are similar. Beyond this distance, the noise level will be below the ambient noise and will therefore have little impact. The above only applies to the construction noise and light wind conditions. High wind conditions will have a masking effect on the construction noise. In all likelihood, the construction noise will have little impact on the surrounding community as it will most likely occur during the day when the ambient noise is louder and there are unstable atmospheric conditions.

Furthermore, none of the turbines are located closer than 1200m from the receptors. The construction of the access roads is a linear activity and will be of a short duration at each receptor. The construction of the roads is thus not significant as it is conducted mostly with mobile plant and equipment.

Operation

The sources of sounds emitted from operating wind turbines can be divided into two categories, firstly mechanical sounds, from the interaction of turbine components, and secondly aerodynamic sounds, produced by the flow of air over the blades. The ability to hear a wind turbine in a given installation depends on the ambient sound level. When the background sounds and wind turbine sounds are of the same magnitude, the wind turbine sound gets lost in the background. Both the wind turbine sound power level and the ambient sound pressure level will be functions of wind speed. Thus whether a wind turbine exceeds the background sound level will depend on how each of these varies with wind speed.

Sound levels from large modern wind turbines during constant speed operation tend to increase more slowly with increasing wind speed than ambient wind generated sound. As a result, wind turbine noise is more commonly a concern at lower wind speeds and it is often difficult to measure sound from modern wind turbines above wind speeds of 8 m/s because the background wind-generated sound generally masks the wind turbine sound above 8 m/s.

The potential effects of low frequency noise generated by turbines on humans include sleep disturbance, nausea, vertigo etc. However, these effects are unlikely to impact upon residents at the Brandvalley site due to the distance between the turbines and the nearest communities. In addition, other sources of low frequency noise in the area include wind noise and vehicular traffic, which are all sources that currently also impact on the receptors.

The turbines proposed for use will be between 1.5MW and 3.5MW. The noise impact assessment was done at a conservative measure of a 3.6MW turbine. Each turbine type (Vestas, Acciona and Siemens) each have their own predicted noise level during operation.

Twenty-nine Noise Sensitive Areas (NSA) were identified in the vicinity where the 70 Brandvalley WEF turbines (excl. turbine 56 & 57) have been proposed to be erected. Noise modelling was done to assess the noise impact of turbines on each NSA.

The results above indicate that the 24 hour 45 dB(A) limit for **day/night** operations will not be exceeded at any of the noise sensitive areas.

The 35 dB(A) limit for **night** operations will be exceeded at Noise Sensitive Area 1 for all turbines at wind speeds as indicated in the table below:

Predicted noise levels during the operational phase				
Turbine type	**Wind speed**	**Noise sensitive Receptor exceeding 35 dB(A)**	**Predicted noise level dB(A)**	**Turbine 52 & 53 Removed**
Vestas V117	6m/s >	NSA 1	35.5-36.8	
Vestas V126	6m/s >		35.0-35.8	33.6-34.4
Acciona	3m/s >		37.2-36.8	
Siemens	6m/s >		35.0-35.8	

- It is highly likely that the wind noise will provide a masking effect and thus the impact is likely to be very low.
- If two turbines are removed (WTG 52 & 53), the SANS 10103:2008 night limit will not be exceeded (based on the Vestas V126 turbine).

Cumulative

The cumulative effect of developing both the Brandvalley and Rietkloof Wind Energy Projects was modelled using the Vestas V117 turbine. The 35 dB(A) **night** guideline limit will be exceeded at NSA 18 and NSA 28 if both the Brandvalley and Rietkloof Wind Energy Farms are developed.

Cumulative Effect Brandvalley and Rietkloof			
Turbine type	**Wind speed**	**Noise sensitive Receptor exceeding 35dB(A)**	**Predicted noise level**
Vestas V117	8m/s >	NSA 18	35.0
	7m/s >	NSA 28	35.1-35.5

- It is highly likely that the wind noise will provide a masking effect at:
  - NSA 18 as the rating limit is only exceeded at 8m/s and
  - NSA 28 as the rating limit is only exceeded at 7m/s
  - The WTG noise emissions are thus unlikely to impact the receptors at NSA 18 and 28.

PALEONTOLOGICAL

The Brandvalley WEF study area lies in the mountainous Klein-Roggeveldberge region and is underlain by several formations of potentially fossil-baring sedimentary rocks. The majority of the bedrocks are of Late Palaeozoic age (Middle Permian) and belong to the Karoo Supergroup which is internationally famous for its rich fossil record. Palaeontological assessment shows that the Brandvalley WEF study area is underlain by two mappable units of Late Palaeozoic sedimentary rocks of the Karoo Supergroup plus unmapped Late Caenozoic superficial sediments such as alluvium and colluvium (scree, surface gravels), all of which contain fossils of some sort. The areas shows that:

- Waterford Formation (Upper Ecca Group) deltaic bedrocks have small outcrop areas crossing the central part of the study area. These small areas lie largely outside the main development footprint and are generally fossil-poor, apart from low-diversity trace fossil assemblages. Isolated blocks and rare logs of well-preserved petrified wood are of high scientific and conservation value and similar material might also be present in the Brandvalley WEF study area.
- Abrahamskraal Formation (Lower Beaufort Group) fluvial bedrocks underlying the great majority of the study area are generally considered to be of high palaeontological sensitivity. However, in this area of the SW Karoo they are generally fossil-poor, apart from occasional horizons with plant debris or low-diversity trace fossils. A few examples of large tetrapod (i.e. terrestrial vertebrate) burrows as well as disarticulated skeletal remains (dispersed bones, teeth) recorded from these beds during the present field assessment are of considerable scientific interest but are very rare indeed.
- Late Caenozoic superficial sediments (alluvium, colluvium, calcretes, soils, surface gravels etc) overlying the Palaeozoic bedrocks are of low palaeontological sensitivity. Pediment and surface gravels along the foot of the Klein-Roggeveld Escarpment and elsewhere locally contain numerous clasts of petrified wood reworked from the Karoo Supergroup (probably Waterford Formation).

Construction

The Brandvalley WEF study area is underlain by Palaeozoic to Late Caenozoic sedimentary rocks that contain legally-protected fossil heritage. The construction phase of the proposed wind energy facility will entail substantial surface clearance (e.g. for access roads, wind turbine placements) as well as excavations into the superficial sediment cover (soils, surface gravels etc) and the underlying bedrock. The latter include excavations for the wind turbine foundations and transmission line pylon footings, underground cables, new internal access roads, construction camps and foundations for associated infrastructure such as the on-site substation and any control / storage buildings. In addition, sizeable areas of potentially fossiliferous bedrock may be sealed-in or sterilized by infrastructure such as hard standing areas for each wind turbine, lay down areas and access roads. All these developments may adversely affect fossils exposed at the surface or preserved underground within the development footprint. Fossil material here may be damaged, destroyed, disturbed from its original geological context or permanently sealed- in and is then no longer available for scientific research or other public good. Significant impacts are likely to be limited to very small portions of the development footprint since scientifically-important fossils are very scarce within the project area.

Residual negative impacts from inevitable loss of fossil heritage would be partially offset by an improved palaeontological database as a direct result of appropriate mitigation. This is a positive outcome because any new, well-recorded and suitably curated fossil material from this paleontologically under-recorded region of the Great Karoo would constitute a useful addition to our scientific understanding of the fossil heritage here.

Operation

Significant impacts on fossil heritage are not anticipated during the operational phases of the development.

Decommissioning

Significant impacts on fossil heritage are not anticipated during the decommissioning phases of the development.

Cumulative

A considerable number of alternative energy developments have been proposed or authorised in the broader south-western Karoo region within which the Brandvalley WEF study area is situated. Several of these projects entail impacts on fossil heritage resources preserved within the same rock units of the Karoo Supergroup and overlying superficial sediments that are represented within the present study area. It is noted that this region also falls within the shale gas prospecting area of Falcon Oil and Gas Ltd as well as the broader study area for the on-going Strategic Environmental Assessment for shale gas exploitation in the Karoo (fracking) that is being co-ordinated by the CSIR. Desktop- and field-based assessments for a major proportion of these projects have been carried out by the author and colleagues (e.g. Miller 2011). For example, field assessments of the Rietkloof WEF and Kareebosch WEF (Roggeveld Phase 2) project areas situated immediately south and north of, as well as overlapping with, the Brandvalley WEF study area have recently been completed (Almond 2014, Almond, 2016b).

In all cases it was concluded by the author that, despite the undoubted occurrence of scientifically-important fossil remains (notably fossil vertebrates, vertebrate trackways and burrows, petrified wood), the overall impact significance of the proposed developments was low because the probability of significant impacts on unique or rare fossils was slight. Provided that the proposed monitoring and mitigation recommendations made for these various projects are followed through, their cumulative impact on palaeontological heritage resources - including impacts envisaged for the Brandvalley WEF project – is predicted to be low (negative). On the other hand, unavoidable residual negative impacts may be partially counterbalanced by an improved understanding of Karoo palaeontology resulting from appropriate professional mitigation for these projects. This is regarded as a significant positive impact for Karoo palaeontological heritage.

There are no fatal flaws in the Brandvalley WEF development proposal as far as fossil heritage is concerned. Providing that the recommendations for palaeontological monitoring and mitigation outlined below are followed through, there are no objections on palaeontological heritage grounds to authorisation of the Brandvalley WEF project.

ARCHAEOLOGY AND HERITAGE

The area held several of historical features (stone walling kraals and cottages) some with associated historical artefacts situated along the access roads in the valleys and associated with the homestead settlements. The area, however, also held evidence of both Middle and Later Stone Age stone artefacts alongside water courses and on the flat floodplains. The heritage resources encountered are explained in detail in the specialist report and includes:

- Precolonial / Stone Age material
- Stone Walling Features
- Historical Artefact Scatters
- Built Environment Structures
- Burial Grounds and Graves (formal and informal burials)
- Homesteads / Farmhouse Complexes

Only one Later Stone Age stone artefacts was documented within areas proposed for the turbines this likely due to the inaccessibility of area comprising of steep hills and high elevations ranging between 1 100 m and 1 400 m above sea level. Surface scatters of Middle Stone Age and Later Stone Age stone artefacts were recorded in some low lying areas within exposed surface and disturbed donga areas. It is unlikely that the stone artefact surface scatters that occur on the exposed surface areas are positioned in situ; however, stone artefacts may occur between 50 – 80 cm below the surface.

Several stone walling features were identified. These features include historical stone packed dwellings / cottages as well as kraals and pens. Historical artefacts were also located within the vicinity of some of the stone packed dwellings and kraals. The historical artefacts scatters include fragments of glass, ceramics and metal material probably dating to the late 19th century. These scatters are mainly identified to be associated with within the vicinity of stone packed dwellings / cottages and/or stone packed kraals.

Construction

- Precolonial / archaeological heritage remains occur on the flat floodplains and along water courses within the proposed Brandvalley WEF area. The existing internal roads run through these areas and close to water courses. On such areas, artefacts have been found to become exposed within the internal gravel farm roads. Therefore it is likely that more stone artefacts and possibly other material and organic material may be uncovered during the construction of infrastructure and upgrade of the roads situated with these areas. The stone artefacts are considered as being irreplaceable heritage resources, once the artefact or the sire has been destroyed so has the information for interpretation.
- Several stone walling features and associated historical artefacts scatters occur on the flat floodplains and along water courses within the proposed Brandvalley WEF area. The existing internal roads run through these areas and close to water courses and artefacts have found to become exposed within the internal gravel farm roads. These features may be damaged by the construction of infrastructure and roads if not mitigated appropriately. Some of these features occur very close to existing roads proposed for upgrading resulting in a serious loss of the cultural landscape.
- One of the two areas with graves / burials encountered are within close proximity to the development activities. These family graves are mostly older than 60 years protected and should be respected.
- Six homesteads / farm complexes were identified within the proposed Brandvalley WEF area. The homesteads are situated either adjacent to the proposed access roads or in some cases the proposed internal access roads are expected to go through the homesteads. These homesteads include the farm house and associated staff accommodation, outbuildings and stone walling features and built environment structures.
- It has been stipulated by Heritage Western Cape (HWC) that the impact on the cultural landscape is necessary. The construction of these immense wind turbines and associated infrastructure required completely changes the character of the landscape and hence impacts on the sense of place and aesthetic value negatively as well as impedes and threatens untouched heritage resources.

Operation

Significant impacts are not anticipated during the operational phases of the development.

Decommissioning

Significant impacts are not anticipated during the decommissioning phases of the development.

SOCIAL

Planning and design phase

The legislative and policy context plays an important role in identifying and assessing the potential social impacts associated with a proposed development. In this regard a key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents. The findings of the review of policy and planning tools indicate that renewable energy is strongly supported at a national, provincial and local level. The proposed project site is located within the Komsberg Renewable Energy Zone as identified in the Strategic Environmental Assessment (SEA) for Wind and Solar PV energy in South Africa (CSIR, 2015) and therefore the

area has been identified as suitable for the establishment of a WEF.

Construction

Based on the information from other WEF projects the construction phase for a 140 MW WEF is expected to extend over a period of 20-24 months and create approximately 250 (full-time equivalent) employment opportunities during peak construction. The work associated with the construction phase will be undertaken by contractors and will include the establishment of the WEF and the associated components, including, access roads, substation, services and power line. It is anticipated that approximately 55% (136) of the employment opportunities will be available to low skilled workers (construction labourers, security staff etc.), 30% (76) to semi-skilled workers (drivers, equipment operators etc.) and 15% (38) for skilled personnel (engineers, land surveyors, project managers etc.).

Members from the local community in the area are likely to be in a position to qualify for the majority of the low skilled and a proportion of the semi-skilled employment opportunities. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local KHLM and LLM community. A small number of employment opportunities may also be created in the WLM. As indicated above, the levels of unemployment in the KHLM, LLM and WLM are relatively high. The creation of potential employment opportunities, even temporary employment, will represent a significant, if localised, social benefit. However, in the absence of specific commitments from the applicant to maximise local employment targets the potential opportunities for local employment will be limited. In this regard the KHLM Municipal Manager, Mr. Allistar Gibbons, indicated that based on the experience from the last major construction project in the Sutherland area (SALT, 2001-2004) there was no meaningful skills transfer for locals. Locals were employed as unskilled labour, and remained such after SALT was constructed. The majority of the skilled employment opportunities are likely to be associated with the contactors appointed to construct the WEF and associated infrastructure.

While the current pool of suitably qualified local community members in Laingsburg, Sutherland and the LLM may be limited the construction of three of renewable energy projects in the area which are planned to commence in 2016 will create opportunities to develop the required skills prior to the commencement of the construction phase for the proposed Brandvalley WEF. It is estimated that these projects will be employing 50-70% of their workers locally and where training is required it will be carried out in order to comply with commitments for local employment made to the Department of Energy. In addition, the implementation of a training and skills development programme prior to the commencement of construction would also increase the potential to employ local community members. The number of low skilled and semi-skilled positions taken up by members from the local community will depend on the effective implementation of these enhancement measures by the applicant in consultation with the KHLM, LLM and potentially the Department of Labour.

The capital expenditure associated with the construction of a 140 MW WEF will be in the region of R 2.5 billion (2016 Rand value). A percentage of the capital expenditure associated with the construction phase has the potential to benefit local companies and communities. However, the opportunities for companies in Sutherland and Laingsburg are likely to be limited. In this regard the benefits are likely to accrue to companies based in towns based further afield, such as Worcester and Cape Town. Implementing the enhancement measures listed below can enhance these opportunities.

The total wage bill for the 20-24 month construction phase of a 140 MW WEF will be in the region of R 69 million (2016 Rand value). This is based on an average monthly wage of R 8 000 for low-skilled workers, R 12 000 for semi-skilled workers and R 30 000 for skilled workers over a period of 22 months. A percentage of the wage bill will be spent in the local economy and will create opportunities for local businesses in Sutherland and Laingsburg. The sector of the local economy that is most likely to benefit from the proposed development is the local service industry. This is confirmed by the experience with the other renewable projects. The potential opportunities for the

local service sector are linked to accommodation, catering, cleaning, transport and security, etc. associated with the construction workers on the site. The benefits to the local economy will be confined to the construction period (20-24 months).

However, based on the findings of the site visit there is not sufficient accommodation in Laingsburg and Sutherland and surrounds to accommodate the ~ 250 workers associated with the construction phase, unless these workers are sourced locally. The local farmers in the area have also indicated that they do not support the establishment of a construction camp on the site to house workers. The issue of accommodation therefore represents a key challenge and will need to addressed in consultation with the KHLM, LLM, community representatives and local farmers from the area should the project proceed.

The implementation of the proposed enhancement measures listed below would also enable the establishment of the proposed WEF to support co-operation between the public and private sectors which would support local economic development in the KHLM, LLM and WLM.

The hospitality industry in the area is also likely to benefit from the provision of accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other (non-construction) personnel involved on the project. Experience from other renewable energy projects indicates that the potential opportunities are not limited to on-site construction workers but also to consultants and product representatives associated with the project.

Technical advice for local farmers and municipalities
The establishment of a WEF in the area creates an opportunity for the technical staff involved in the project to provide local farmers and the KHLM and LLM with advice regarding the installation of wind energy technology to supplement their current and future energy needs. Experience from other renewable energy projects indicate that farmers would appreciate assistance in this regard in the form of expert opinion as to what type of small scale wind technologies could be installed to meet their needs and how best to install small-scale wind energy installations on their farms. This could be achieved via a workshop / discussion with the local farmers in the area. Local municipalities would also benefit from the knowledge of technical staff involved in the establishment of the project.

Influx of construction workers
The presence of construction workers not sourced locally poses a potential risk to local family structures and social networks in the town of Sutherland and Laingsburg. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour, mainly of male construction workers, including:

- An increase in alcohol and drug use;
- An increase in crime levels;
- The loss of girlfriends and/or wives to construction workers;
- An increase in teenage and unwanted pregnancies;
- An increase in prostitution; and
- An increase in sexually transmitted diseases (STDs), including HIV.

As indicated above, the majority of the low skilled (136) and semi-skilled (76) work opportunities associated with the construction of a 140 MW WEF can potentially benefit members from the local community. If these opportunities are taken up by local residents the potential impact on the local community will be low as these workers will form part of the local family and social network. Employing members from the local community to fill the low-skilled job categories will therefore reduce the risk and mitigate the potential impact on the local communities. The use of local

residents to fill the low skilled job categories will also reduce the need to provide accommodation for construction workers in Sutherland and Laingsburg. This would also reduce the potential pressure on local services, such as clinics. The skilled workers (38) are likely to be accommodated in local guest houses in Sutherland, Laingsburg and surrounds.

While the risks associated with construction workers at a community level will be low, at an individual and family level they may be significant, especially in the case of contracting a sexually transmitted disease or an unplanned pregnancy. The experience with solar projects in the Northern Cape Province has demonstrated that this risk is real. The presence of construction workers associated with some of these projects has resulted in an increase in the spread of STD, increase in un-planned pregnancies, increase in drugs, alcohol abuse and anti-social behaviour. Mr. Allistar Gibbons (KHLM, Manager (Sutherland)) also indicated that the construction of SALT had left a tangible legacy of HIV, TB and single mothers.

In terms of potential threat to the families of local farm workers in the vicinity of the site, the risk is likely to be low. This is due to the low number of permanent workers residing on local farms in the area. The potential risk is therefore likely to be limited. The risk can also be effectively mitigated by ensuring that the movement of construction workers on and off the site is carefully controlled and managed. However, given the nature of construction projects it is not possible to totally avoid these potential impacts at an individual or family level.

Influx of job seekers

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become “economically stranded” in the area or decide to stay on irrespective of finding a job or not. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social impact. However, the manner in which they conduct themselves can impact on the local community.

Experience from other projects has also shown that the families of job seekers may also accompany individual job seekers or follow them at a later date. In many cases the families of the job seekers that become “economically stranded” and the construction workers that decided to stay in the area, subsequently moved to the area. The influx of job seekers to the area and their families can also place pressure on the existing services in the area, specifically low income housing. In addition to the pressure on local services the influx of construction workers and job seekers can also result in competition for scarce employment opportunities. Further secondary impacts included increase in crime levels, especially property crime, as a result of the increased number of unemployed people. These impacts can result in increased tensions and conflicts between local residents and job seekers from outside the area.

These issues are similar to the concerns associated with the presence of construction workers and are discussed in Section 4.3.3. However, in some instances the potential impact on the community may be greater given that they are unlikely to have accommodation and may decide to stay on in the area. In addition, they will not have a reliable source of income. The risk of crime associated with the influx of job seekers it therefore likely to be greater. However, the findings of the SIA indicate that potential for economically motivated in-migration and subsequent labour stranding in Sutherland and Laingsburg is likely to be low. This is due to their small size, location and the limited economic opportunities that these small towns offer. The risks associated with job seekers staying on in Sutherland and Laingsburg are therefore likely to be low and are likely to be limited to the construction phase.

Risk to safety, livestock and farm infrastructure

The presence on and movement of construction workers on and off the site poses a potential safety threat to local famer’s and farm workers in the vicinity of the site threat. In addition, farm infrastructure, such as fences and gates, may be damaged and stock losses may also result from gates being left open and/or fences being damaged or stock theft linked either directly or indirectly to the presence of farm workers on the site. Irrigation infrastructure (or stock watering

infrastructure), including buried pipelines, is located on most study area properties. The relevant owners should be consulted closer to the time, i.e. at the start of the construction phase to identify the location of the relevant infrastructure and ensure that it is not damaged during the construction phase.

The local farmers in the area interviewed indicated that the presence of construction workers on the site increased the exposure of their farming operations and livestock to the outside world, which, in turn, increased the potential risk of stock theft and crime. The local farmers did, however, indicate that the potential risks (safety, livestock and farm infrastructure) can be effectively mitigated by careful planning and managing the movement of construction on the site workers during the construction phase.

Interviewees have indicated that the area is currently regarded as safe and stock theft is not currently considered to be a problem in the immediate area. In terms of access the farms Kruispad, Ou Mure and Barendskraal are accessed off a semi-circular gravel road which intersects with the R354 at Kruispad in the north, just to the south of Dwars-in-die Weg ("Ou Mure road"). Rietfontein is accessed via a north-south aligned gravel road witch intersects with the Ou Mure Road at Ou Mure farmstead in the south, and runs all the way north to the Tuinplaas gravel road (linking the R354 and the R356). The properties comprising the western portion of the WEF site are accessed off terminal farm roads from the R356 (Ceres road). Only camps located near the R354 are considered vulnerable. The local farmers in the area avoid keeping sheep in these camps at night.

The potential impact of construction related activities on vegetable seed cropping operations should also be taken into account. Of the two major operations, only Fortuin would potentially be affected by dust generated by construction traffic. In this regard, a portion of the site would be accessed along the existing farm road flanked by cropping areas. The seed crops rely on bees for pollination and only flower for a few weeks of the year. Bees are susceptible to dust, and any excessive dust generated by construction vehicles may impact on the pollination process. Fortuin is owned by Mr Andries le Roux, and is the only permanently inhabited property in the study area. Mr le Roux should be contacted to discuss timing of construction related activities in the vicinity for his cropping areas. In terms of safety, as indicated above, the majority of the farms are not inhabited. The issue of safety was therefore not raised as a concern. With regard to the potential risks to farm animals, the farmers interviewed indicated that these risks could be effectively mitigated. The mitigation measures are listed below.

Increased risk of grass fires

The presence of construction workers and construction-related activities on the site poses an increased risk of grass fires that could in turn pose a threat to livestock, crops, and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened. The issue of fire risks was raised by a number the local farmers in the area. In this regard they pointed out that grazing is the main productive resource in the study area. For some operations it provides crucial seasonal grazing. As is the case in arid areas, the study area veld is vulnerable to disturbances and can take decades to recover. The local farmers also indicated that grass fires resulted in change in the composition of the veld, favouring the establishment of less palatable grazing. Given the very slow rate of succession, grass fires may therefore significantly diminish the grazing resource for a period of decades.

However, the local farmers did indicate that measures should be implemented to reduce the potential risk of fires developing. This included the provision of fire-fighting equipment on the site during the construction phase. They also indicated that the potential risk of grass fires was heightened by the windy conditions in the area, specifically during the dry, summer months from October to April.

Construction vehicles

The movement of heavy construction vehicles during the construction phase has the potential to damage local farm roads and create dust and safety impacts for other road users in the area and also impact on farming activities. As indicated above, the vegetable seed operations on Fortuin

may also be impacted by dust generated by construction vehicles.

The project components will be transported to the site via the N1. The N1 provides the key link between the Western Cape and Gauteng and is an important commercial and tourist route. The transport of components of the WEF to the site therefore has the potential to impact on other road users travelling along the N1. Measures will need to be taken to ensure that the potential impact on motorist using the N1 is minimised. The recommended mitigation measures are listed below.

In terms of access the site from the N1, construction traffic would make use of the R354 (Matjiesfontein-Sutherland tar road) and the internal farm roads, including the semi-circular gravel road which intersects with the R354 at Kruispad in the north, just to the south of Dwars-in-die Weg ("Ou Mure road") and the north-south aligned gravel road witch intersects with the Ou Mure Road at Ou Mure farmstead in the south, and runs all the way north to the Tuinplaas gravel road (linking the R354 and the R356). The western sections of the site may be accessed via the R356 (Ceres road).

In terms of impacts along the R354, the winter months are of key importance to Sutherland tourism (snow and star-gazing). This should be taken into account when planning the construction phase. The R354 is the only access road from the south leading into Sutherland. The road is a relatively narrow 2-lane road and passes over the Verlatenkloof Pass. Construction related traffic on the R345 over winter weekends or school holidays has the potential to impact on visitors travelling to and from Sutherland.

Experience from other projects also indicates that the transportation of construction workers to and from the site can result in the generation of waste along the route (packaging and bottles etc. thrown out of windows etc.). These wastes, specifically plastic wastes, pose a threat to livestock and wildlife if they are ingested.

Farm Land
Grazing is the main productive resource in the study area. For some operations it provides crucial seasonal grazing. As generally the case in arid areas, the study area veld is very vulnerable to disturbance, and takes decades to recover. The high clay content of the shale-derived soils makes them vulnerable to compaction and erosion.

The key construction phase related issues are linked to the movement of heavy construction vehicles on the site, establishment of laydown areas, construction roads and trenching etc. All of these activities would impact on productive soils and grazing. Overview of properties comprising the WEF site, the main land use in the area is winter grazing. The key concern is therefore to avoid or minimize the potential loss of grazing areas. Areas used for vegetable seed cropping should also be avoided.

Tourism
The potential impact on tourism during the construction phase is likely to be largely linked to the movement of construction related vehicles along the R354. As indicated above, the winter months are of key importance to Sutherland tourism (snow and star-gazing). This should be taken into account when planning the construction phase. Construction related traffic on the R345 over winter weekends or school holidays has the potential to impact on visitors travelling to and from Sutherland. The construction phase will also create opportunities for tourist facilities in the area linked to the accommodation of staff as discussed and assessed in Section 4.3.1. This would represent a positive impact.

Operation

Creation of employment and business opportunities and support for local economic development
Based on information from other wind projects the establishment of a 140 MW WEF would create ~ 20 employment opportunities for over a 20 year period. Of this total approximately 4 will be low skilled, 10 semi-skilled and 6 high skilled positions. The annual wage bill for the operational phase

would be ~ R 2 million. The majority of employment opportunities associated with the operational phase is likely to benefit HD members of the community.

It will also be possible to increase the number of local employment opportunities through the implementation of a skills development and training programme linked to the operational phase. Such a programme would support the strategic goals of promoting employment and skills development contained in the HKLM and LLM. However, as indicated above, the experience with the SALT project was that there the commitment to the implementation of a skills development was limited (Allistar Gibbons pers. comm.).

Given the location of the proposed facility the majority of permanent staff is likely to reside in Sutherland and or Laingsburg. In terms of accommodation options, a percentage of the non-local permanent employees may purchase houses in one of these towns, while others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which will benefit local businesses in these towns. The benefits to the local economy will extend over the 20 year operational lifespan of the project. The local hospitality industry in Sutherland and Laingsburg is also likely to benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc.) who are involved in the company and the project but who are not linked to the day-to-day operations.

Income generation of farmers

The bona fide farmers in the study area, which make up the bulk of the relevant landowners, currently face a number of significant challenges, which all impact on the economic viability of their farming operations. These include increasing wage bills, progressive price hikes by Eskom (affecting irrigated cropping operations), and the weakening of the Rand (more expensive agri-inputs). These cost increases in combination with low stocking levels has resulted in the size of commercially viable farms in the study area increasing to around 10 000 ha and more. Land owners with smaller properties are finding it increasing difficult to farm productively. Added to this the area is affected by periodic droughts and is anticipated to become progressively more drought-prone as a result of long-term climate change. Stock losses to black backed jackal, baboons, caracal and African wild cats are described as epidemic in scale, with cumulative losses described as crippling. This is largely linked to the sparse and intermittent human presence, the broken nature of the terrain, and the fact that nightly kraaling has largely disappeared on commercial farms.

Against this background, most of farm owners interviewed indicated that the steady income from wind turbines on their properties would make a significant contribution towards keeping their farming operations viable and productive. This would also assist to reduce and or prevent job losses in the farming sector area.

Establishment of a Community Trust

In terms of the Request for Proposal document prepared by the Department of Energy all bidders for operating licences for renewable energy projects must demonstrate how the proposed development will benefit the local community. This can be achieved by establishing a Community Trust which is funded by revenue generated from the sale for energy. Community Trusts and other socio-economic investments provide an opportunity to generate a steady revenue stream that is guaranteed for a 20 year period. This revenue can be used to fund development initiatives in the area and support the local community. The long term duration of the revenue stream also allows local municipalities and communities to undertake long term planning for the area. In terms of the requirement the minimum ownership percentage for local community is 2.5 %. However, projects could exceed this figure in order to increase the competitiveness of the project. The revenue for the Community Trusts could be via dividend pay-outs once the wind farm is fully operational and revenue generating. The revenue from the proposed community trust can be used to support a number of social and economic initiatives in the area, including but not limited to:

- Creation of jobs;
- Education;
- Support for and provision of basic services;
- School feeding schemes;
- Training and skills development; and
- Support for SMME's.

Based on the findings of the site visit there are limited economic and associated employment opportunities in Laingsburg and Sutherland. There is a high dependency on social grants, including child support grants. Given these conditions the benefits associated with the establishment of a Community Trust funded by revenue from the proposed WEFs represents a significant positive socio-economic opportunity for Laingsburg and Sutherland. Mr Wilhelm Theron, the major of Laingsburg, also anticipated that the project would generate development capital for a cash-strapped Laingsburg LM via the Community Trust (Theron, pers. Comm.).

In addition, the establishment of the WEF is not likely to have a significant impact on the current agricultural land uses that underpin the local economic activities in the area. The loss of this relatively small area will not impact on the current and future farming activities. Experience has however also shown that Community Trusts can be mismanaged. This issue will need to be addressed in order to maximise the potential benefits associated with the establishment of a Community Trust.

Development of infrastructure for the generation of clean, renewable energy

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is the nineteenth largest per capita producer of carbon emissions in the world, and Eskom, as an energy utility, has been identified as the world's second largest single producer of carbon emissions. The overall contribution associated with the proposed WEF to South Africa's total energy requirements is relatively small. However, the development of a single 140 MW produced will help to offset the total carbon emissions associated with energy generation in South Africa. Given South Africa's reliance on Eskom as a power utility the benefits associated with an IPP based on renewable energy are regarded as an important contribution.

Sense of place and rural character of the landscape

The components associated with the proposed facility will have a visual impact and, in so doing, impact on the landscape and rural sense of the place of the area. A Visual Impact Assessment (VIA) has been undertaken as part of the EIA. Based on the findings of the VIA the significance of the visual impact was rated as High Negative. While the SIA does not dispute the findings of the VIA, the potential visual impacts associated with the proposed WEF were not raised as a key concern during the interviews with the affected landowners in the area and local municipal officials. It should however be borne in mind that the local landowners stand to benefit from the proposed WEF. However, this also applies to other landowners in the vicinity of the site on whose properties other proposed WEFs are located. As indicated below, visual impact and the significance thereof will vary from individual to individual and is not simply linked to visibility.

Based on the findings of the SIA the site is relatively isolated. While some wind turbines will be visible from the R 354 and properties in the vicinity of the site, the issue of visual impact is a complex issue and is not simply linked to visibility, but also to individual perceptions. It is unlikely that any turbines will be visible from the N1 to the south. While some may view the turbines as a negative impact on the existing landscape, others may perceive them as a positive addition to the landscape. The authors experience in this regard is that a number of people have commented positively on a number of wind energy facilities that have been established in the last 12-24 months, such as the facilities located near Vredenburg, Caledon and Humansdorp in the Western and Eastern Cape respectively. These facilities are clearly visible from the N2 and local roads in the area. A number of people that the authors have spoken to indicated that they did not feel that the turbines had a negative impact on the visual quality of the landscape. The visual impact and the significance thereof associated with the proposed Brandvalley WEF on the areas sense of place is therefore likely to vary from individual to individual. The potential visual impact on the

areas sense of place should also be viewed within the context of the area being identified as a Renewable Energy Development Zone by the Strategic Environmental Assessment (SEA) for Wind and Solar PV energy in South Africa undertaken by the CSIR (2015). The area has therefore been identified as an area where renewable energy should be concentrated. In this regard in the region of 12-14 renewable energy projects, including ~ 12 WEFs, area located in the study area.

The findings of the SIA also indicate that all of the affected landowners have been consulted by the applicant with regard to the location of wind turbines on their properties and are satisfied that is reflected in the proposed layout. The turbines are largely proposed on higher-lying terrain in more inaccessible portions of the relevant properties. No turbines or substations are proposed in close proximity to any permanently inhabited farmsteads. As such, none of the landowners raised any concerns regarding the location of turbines or substations. The owner of Fortuin, Mr Andries le Roux, has however indicated that he would prefer the construction camp proposed on his property (Alternative 3, on Kruispad, near the intersection of the R354 and the Ou Mure road) to also be used to accommodate construction activities proposed for the adjacent Rietkloof WEF project.

A number of interviewees also indicated that they would only allow supporting for the establishment of infrastructure on their properties, such as access roads and borrow pits, if turbines are in fact developed on their properties. This is motivated by the perception that the impact on the areas sense of place would be off-set by the revenue generated from wind turbines on their farms.

Tourism

The N1 is an important tourism route linking Cape Town with Gauteng. However the area is not a tourism destination in itself and none of the turbine structures will be visible from the N1 due to the distance of the site from the N1 (~ 40km). Based on the findings of the SIA there appear to be no major tourism activities and or destinations in the immediate vicinity of the site that would potentially be impacted by the proposed WEF, such as holiday cottages or game lodges etc. The impact on tourism in the area is therefore likely to be limited.

Careful placing would reduce the overall visual impact of the proposed WEF on the areas sense of place. However, this is unlikely to change the significance rating in terms of impact on tourism. The proposed WEF may also attract visitors to the area. However, the significance of this positive impact is also likely to be minor.

Assessment of Access Roads and Construction Camps

Two access road alternatives have been identified, namely access road Alternative 1 and 2, and three construction camp alternatives, namely construction camp 1, 2 and 3. While the social impacts associated with the proposed access roads and construction camp is limited the preferred alternatives are Alternative 1 for the access road and Alternative 1 for the construction camp. Access Road Alternative 1 supports the establishment of Substation Alternative 1. Construction Camp Alterative 1 is located on Fortuin owned by Mr Andries le Roux, who indicated that Alternative 1 (on Kruispad, near the intersection of the R354 and the Ou Mure road) should also be used to accommodate the construction activities associated with the proposed Rietkloof WEF project. The disturbance associated with the establishment of a construction camp for the proposed Brandvalley and Rietkloof WEFs projects would therefore be confined to a single area. In addition, the location of Alternative 1 close to the R354 reduces the movement of traffic and construction workers into relatively remote areas.

Decommissioning

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. After 20-25 years of operations, the WEF would either be decommissioned and the area rehabilitated or the structures would be replaced with more modern technology (referred to as refurbishment or re-powering). Both options would create temporary employment opportunities. In the case of refurbishment the permanent jobs would be retained. There would therefore be no job losses. In

the case of decommissioning the 20 permanent jobs associated with the operational phase would be lost. The potential impacts associated with the decommissioning phase can however be effectively managed with the implementation of a retrenchment and downscaling programme.

Cumulative

Sense of Place

The Australian Wind Farm Development Guidelines (Draft, July 2010) indicate that the cumulative impact of multiple wind farm facilities is likely to become an increasingly important issue for wind farm developments in Australia. The key concerns in terms of cumulative impacts are linked to visual impacts and the impact on rural, undeveloped landscapes. The Scottish Natural Heritage (2005) describes a range of potential cumulative landscape impacts associated with wind farms on landscapes. The relevant issues raised by the Scottish Natural Heritage Report include:

- Combined visibility (whether two or more wind farms will be visible from one location).
- Sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail).
- The visual compatibility of different wind farms in the same vicinity.
- Perceived or actual change in land use across a character type or region.
- Loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

The guidelines also note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one wind farm at a time, but if each successive stretch of the road is dominated by views of a wind farm, then that can be argued to be a cumulative visual impact (National Wind Farm Development Guidelines, DRAFT - July 2010).

Research on wind farms undertaken by Warren and Birnie (2009) also highlights the visual and cumulative impacts on landscape character. The paper notes that given that aesthetic perceptions are a key determinant of people's attitudes, and that these perceptions are subjective, deeply felt and diametrically contrasting, it is not hard to understand why the arguments become so heated. Because landscapes are often an important part of people's sense of place, identity and heritage, perceived threats to familiar vistas have been fiercely resisted for centuries. The paper also identifies two factors that are important in shaping people's perceptions of wind farms' landscape impacts. The first of these is the cumulative impact of increasing numbers of wind farms (Campbell, 2008). The research found that if people regard a region as having 'enough' wind farms already, then they may oppose new proposals. The second factor is the cultural context. This relates to people's perception and relationship with the landscape. In the South African context, many South Africans have a strong connection with and affinity for the large, undisturbed open spaces that are characteristic of the South African landscape.

There are 18 renewable energy projects, including 14 WEFs and associated power lines, located in the Komsberg REDZ area. These include the proposed Komsberg East and West WEF with a combined capacity of 280 MW that are located immediately to the east of the proposed Brandvalley WEF. The potential for cumulative impacts associated with combined visibility (whether two or more wind facilities will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more renewable energy facilities along a single journey, e.g. road or walking trail) is therefore high. However, this should be viewed within the context of the identification of the area as a Renewable Energy Development Zone by the CSIR as part of the DEAs SEA process. The area has therefore been identified as an area where renewable energy should be concentrated.

In addition, due to the proximity of the different sites the various WEFs and associated power lines could potentially be viewed as a single large WEF as opposed to a number of separate WEFs.

While viewing these WEFs as a single large facility, as opposed to separate facilities, does not reduce the overall visual impact on the scenic character of the area, it does reduce the potential cumulative impact on the landscape. Viewing each of the proposed WEFs as a single, large WEF may, to some extent, reduce the cumulative impacts associated with combined visibility (whether two or more wind farms will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail). The proximity of the WEFs also has the benefit of concentrating the visual impacts on the areas sense of place in to one area as opposed to impacting on a number of more spread out areas.

However, the potential impact of wind energy facilities on the landscape is an issue that does need to be considered, specifically given South African's strong attachment to the land and the growing number of wind facility applications. With regard to the area, a number of WEFs have been proposed in the Western Cape Province. The Environmental Authorities should therefore be aware of the potential cumulative impacts when evaluating applications. However, as indicated above, the proposed site falls within a Renewable Energy Development Zone (CSIR, 2015) and has therefore been identified as suitable for the establishment of WEFs.

Local Services and Accommodation

The establishment of the proposed 140 MW Brandvalley WEF and the other renewable energy facilities in the Komsberg REDZ will place pressure on local services, specifically medical, education and accommodation. This pressure will be associated with the influx of workers to the area associated with the construction and operational phases of renewable energy projects proposed in the area, including the proposed Brandvalley WEF. The potential impact on local services can be mitigated by employing local community members. However, due to the low education and skills levels in the area there is likely to be a need to implement a training and skills development programme to ensure that local employment opportunities are maximised. The presence of non-local workers during both the construction and operation phase will also place pressure on property prices and rentals. As a result, local residents, such as government officials, such as municipal workers, school teachers, and the police, may no longer be able to buy or afford to rent accommodation in towns such as Sutherland and Laingsburg. However, as indicated below, this impact should also be viewed within the context of the potential positive cumulative impacts for the local economy associated with the establishment of a renewable energy hub in the area. These benefits will create opportunities for investment in Laingsburg and Sutherland, including the opportunity to up-grade and expand existing services and the construction of new houses. In this regard the establishment of a renewable energy hub will create a unique opportunity for these towns to develop.

The Community Trusts associated with each project will generate revenue that can be used by the KHLM and LLM in consultation with the Northern and Western Cape Provincial Government, to invest in up-grading local services where required (see below). In should also be noted that it is the function of national, provincial and local government to address the needs created by development and provide the required services. The additional demand for services and accommodation created by the establishment of development renewable energy projects in the Komsberg REDZ should therefore be addressed in the Integrated Development Planning process undertaken by the KHLM and LLM.

Impacts on Local Economy

In addition to the potential negative impacts, the establishment of the proposed 140 MW Brandvalley WEF and the other renewable energy facilities in the area has the potential to result in significant positive cumulative socio-economic opportunities for the region, which, in turn, will result in a positive social benefit. As indicated above, there are 18 renewable energy projects proposed in the study area. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The Community Trusts associated with each project will also create significant socio-economic benefits. These benefits should also be viewed within the context of the limited socio-economic opportunities in the area.

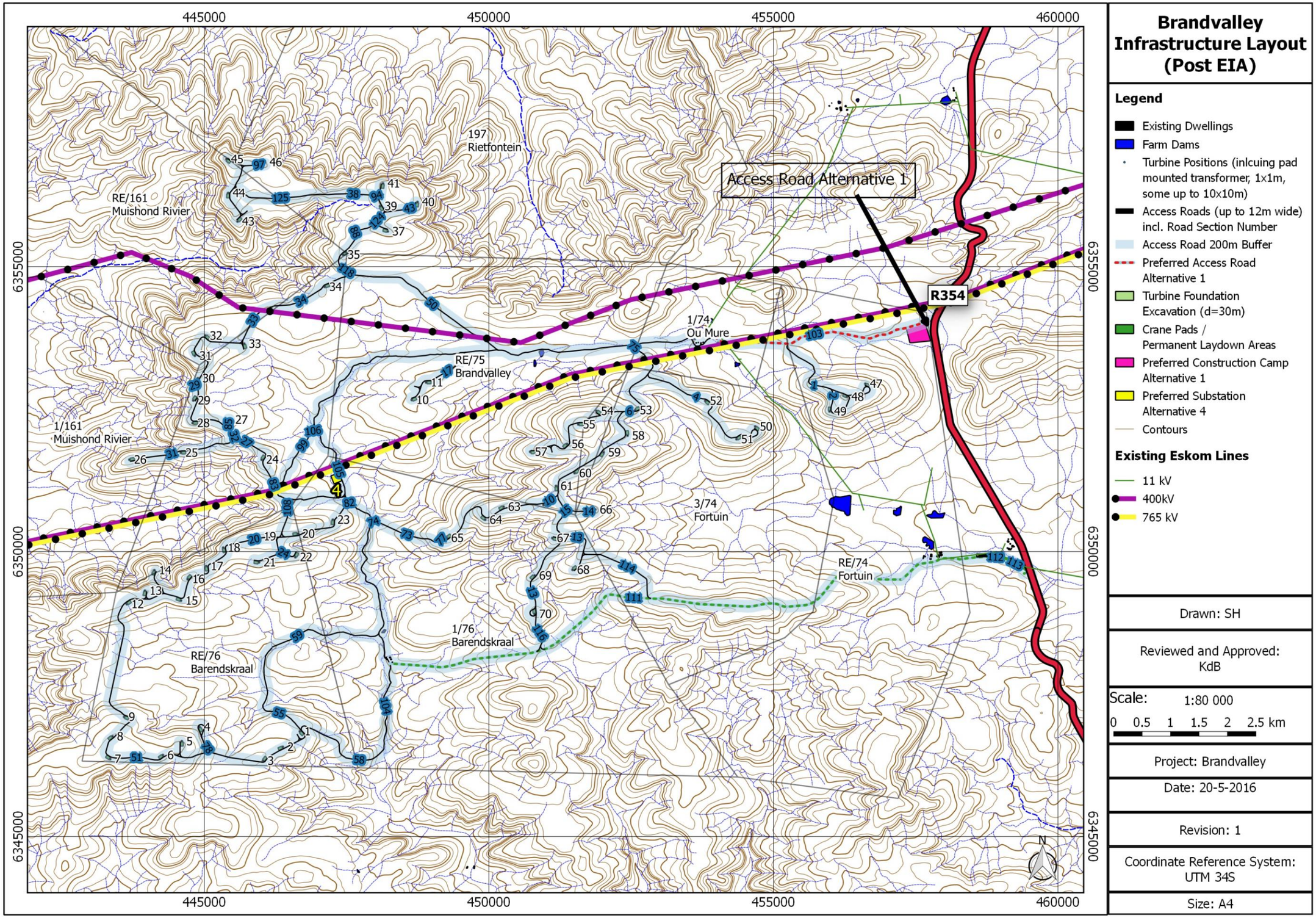

Figure 2-2. The proposed project layout.

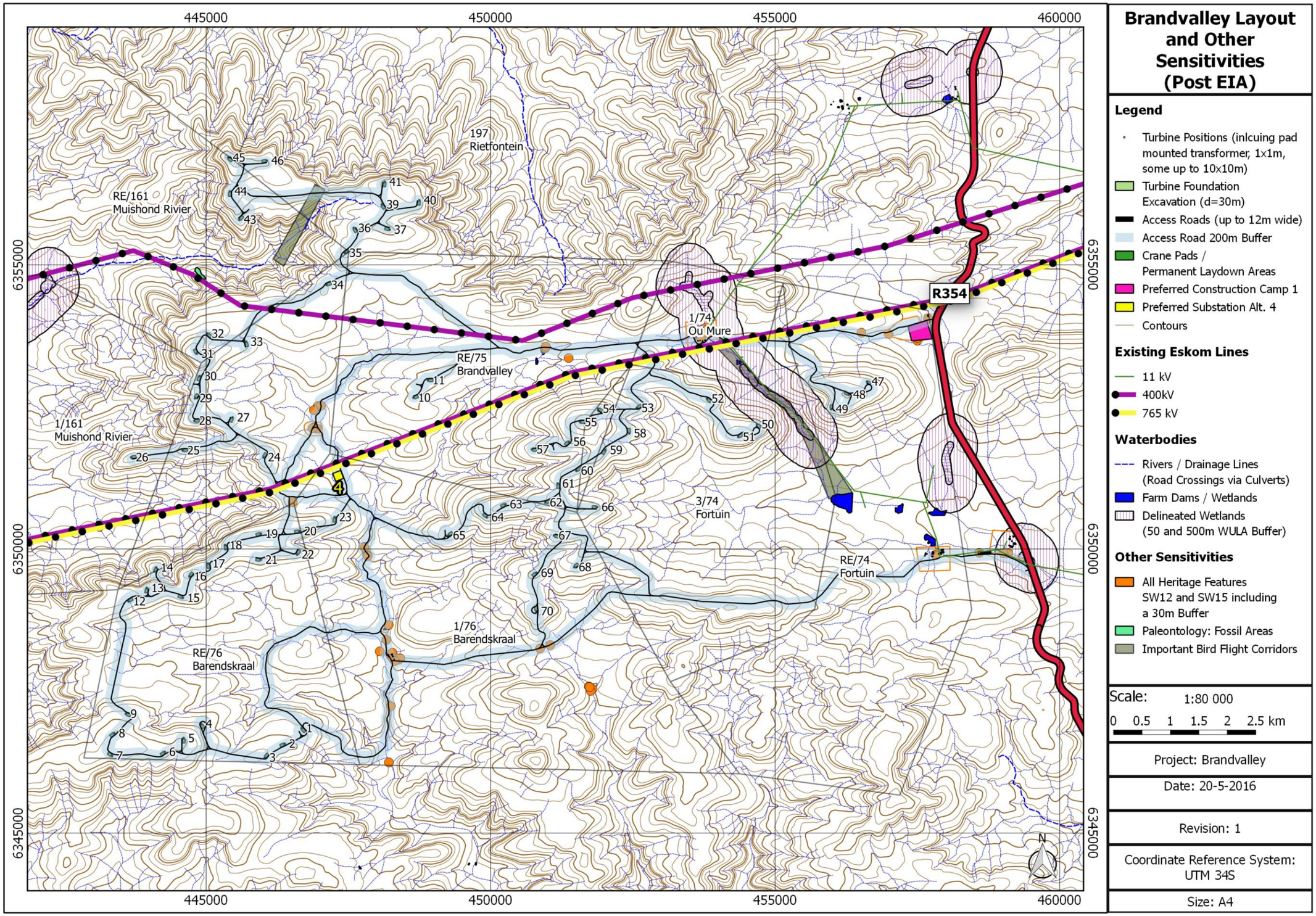

Figure 2-3. Paleontological, heritage and hydrological sensitivities of the proposed project region.

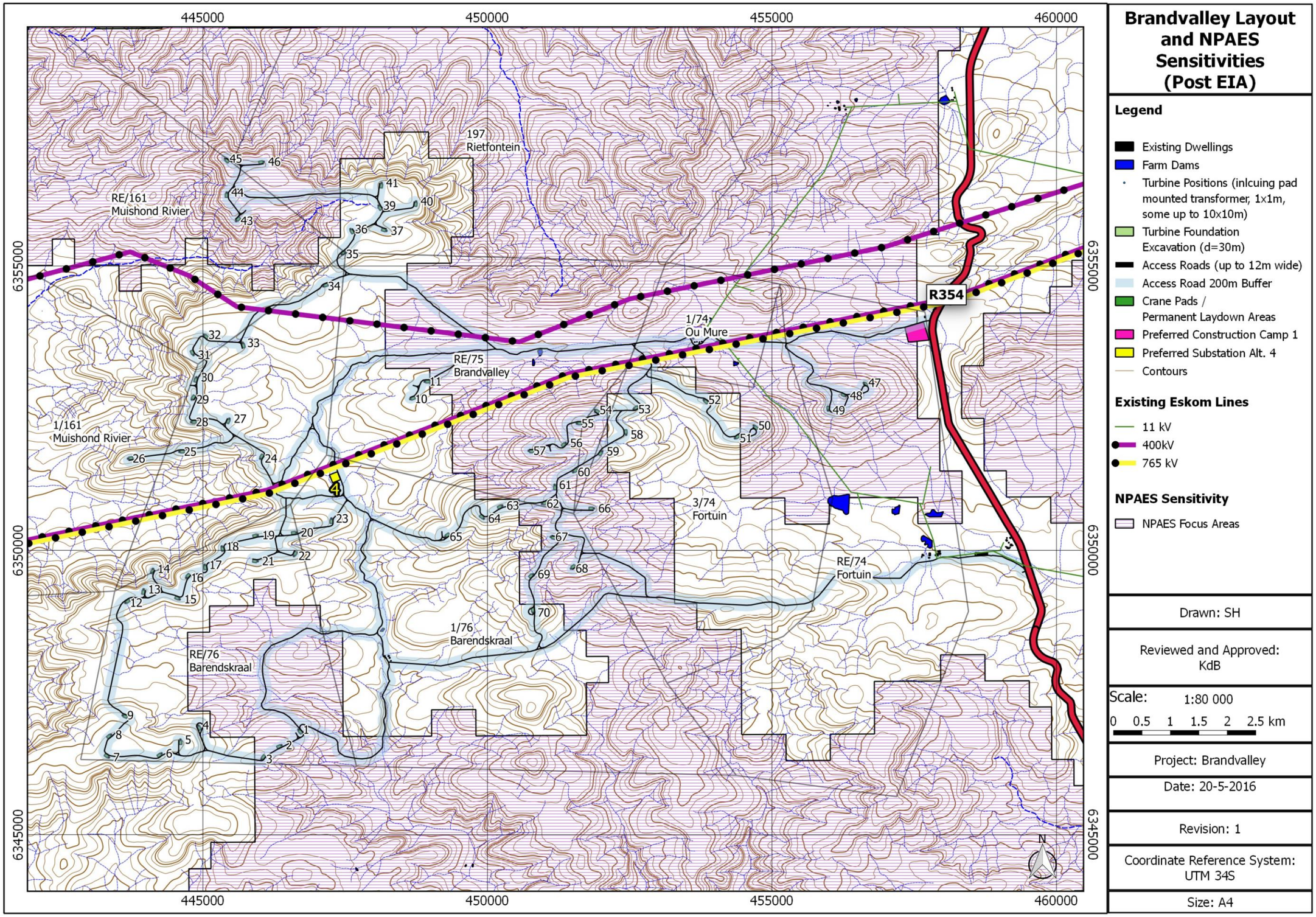

Figure 2-4. National Protected Areas Expansion Strategy (NPAES) sensitivities of the proposed project region.

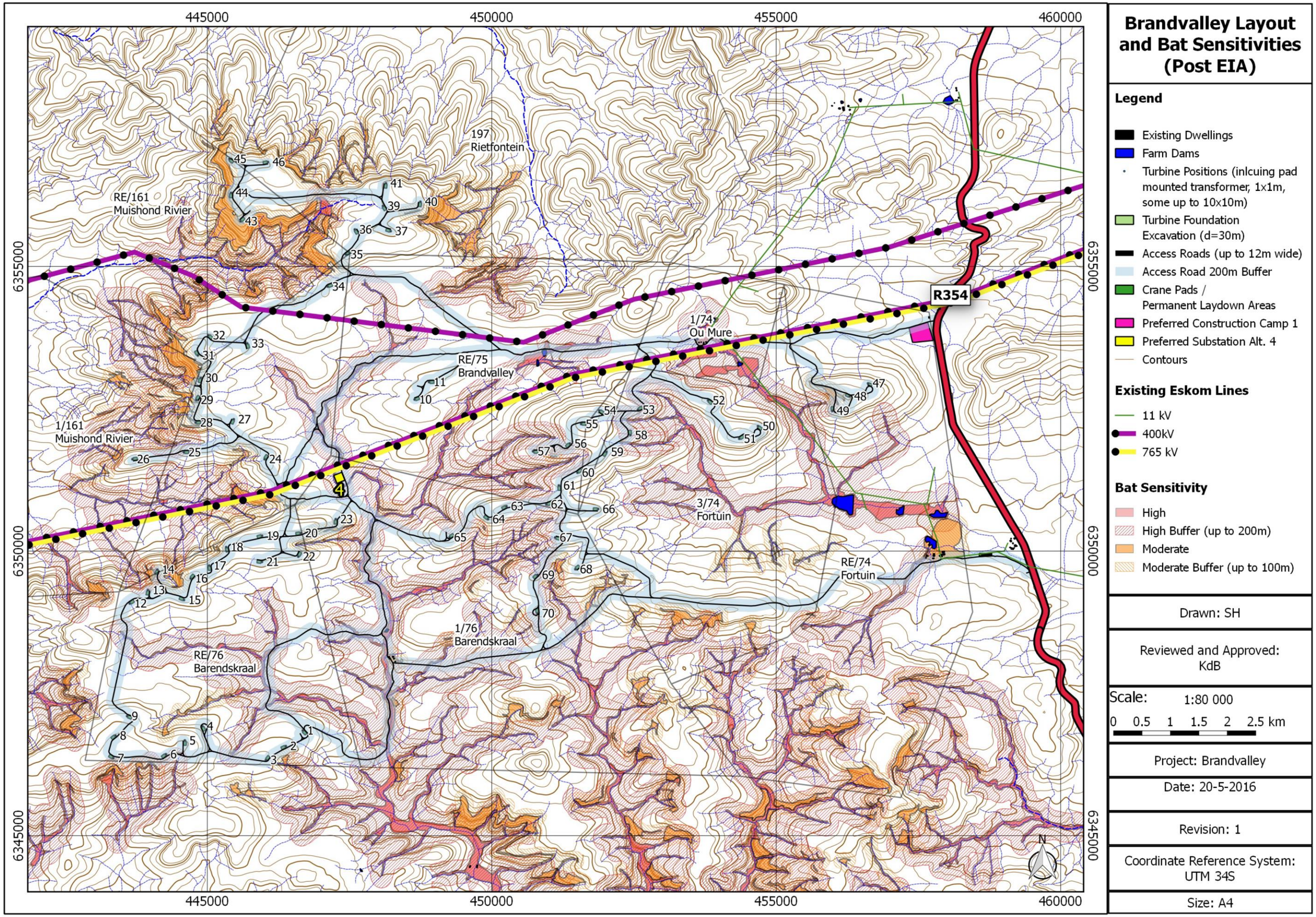

Figure 2-5. Layout and bat sensitivities of the proposed project region.

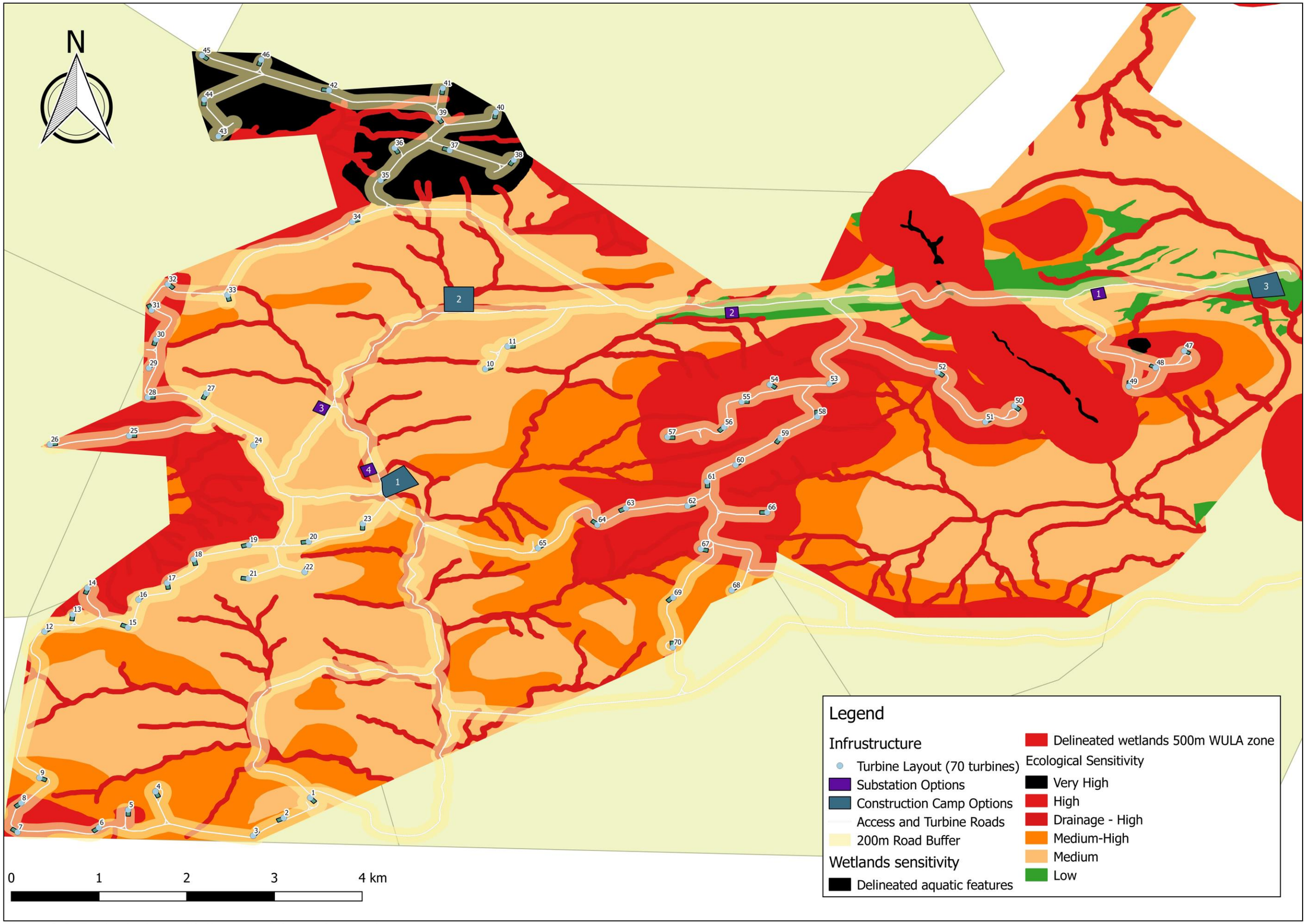

Figure 2-6. Ecological sensitivity map of the project region.

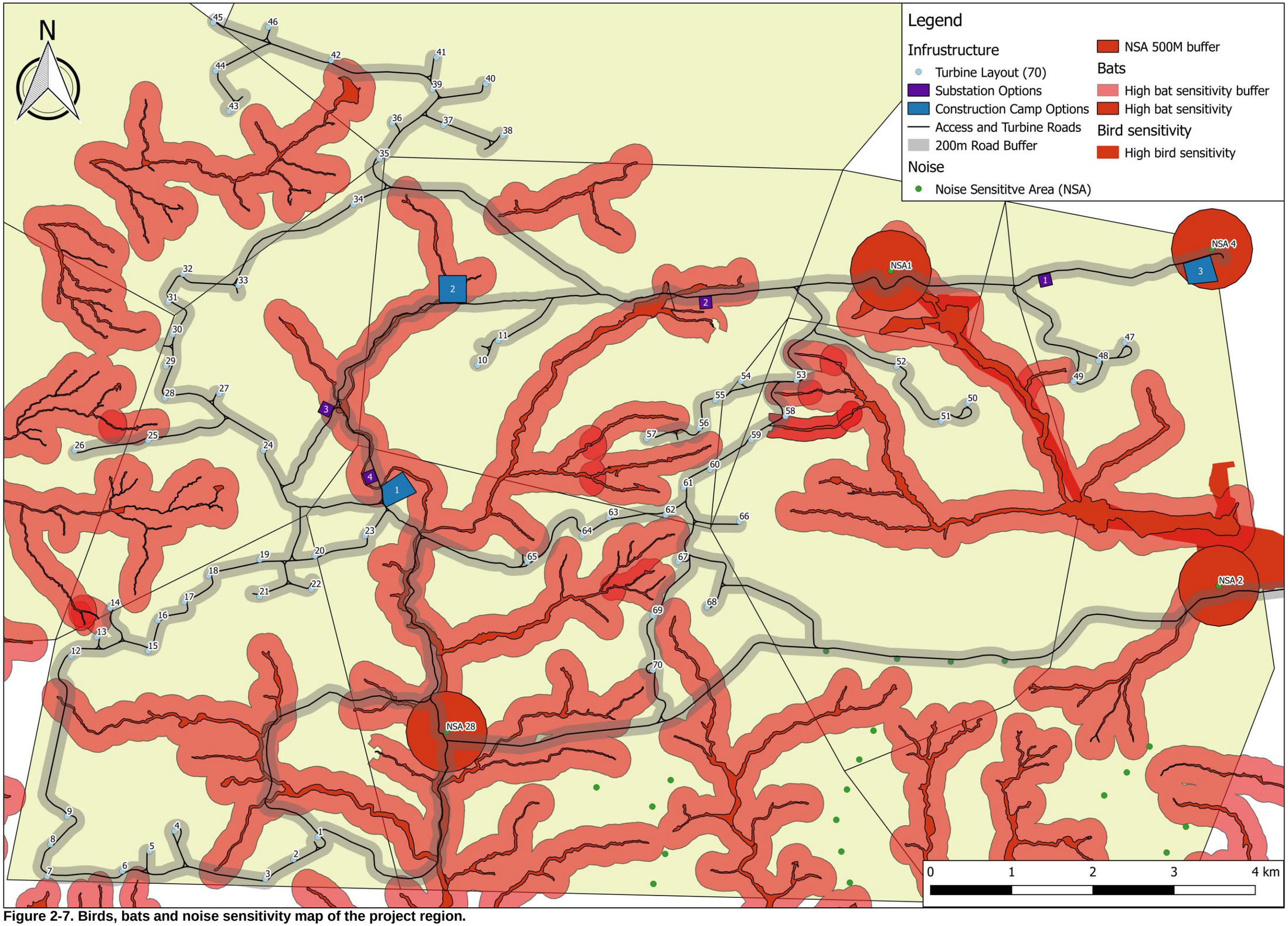

Figure 2-7. Birds, bats and noise sensitivity map of the project region.

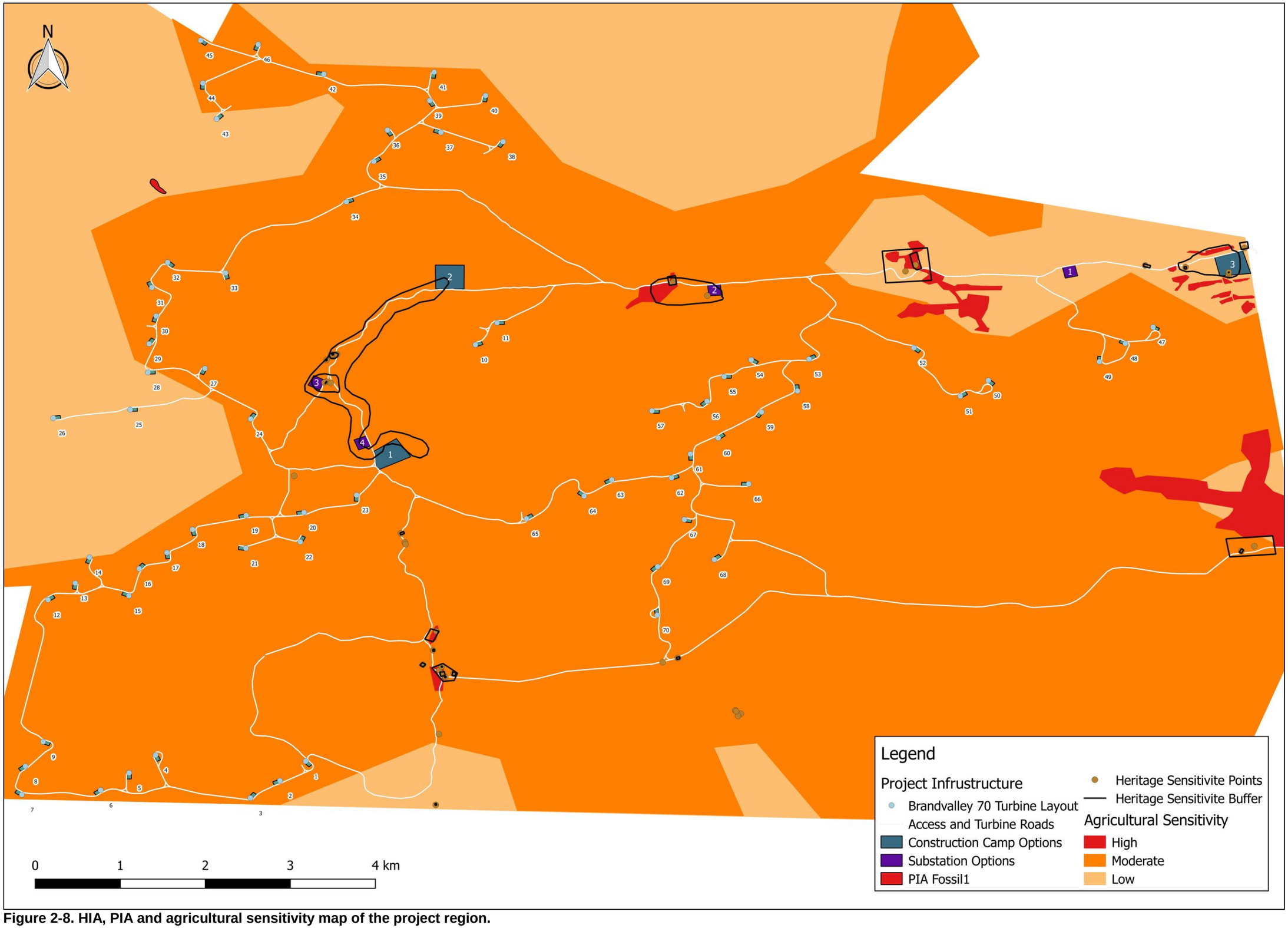

Figure 2-8. HIA, PIA and agricultural sensitivity map of the project region.

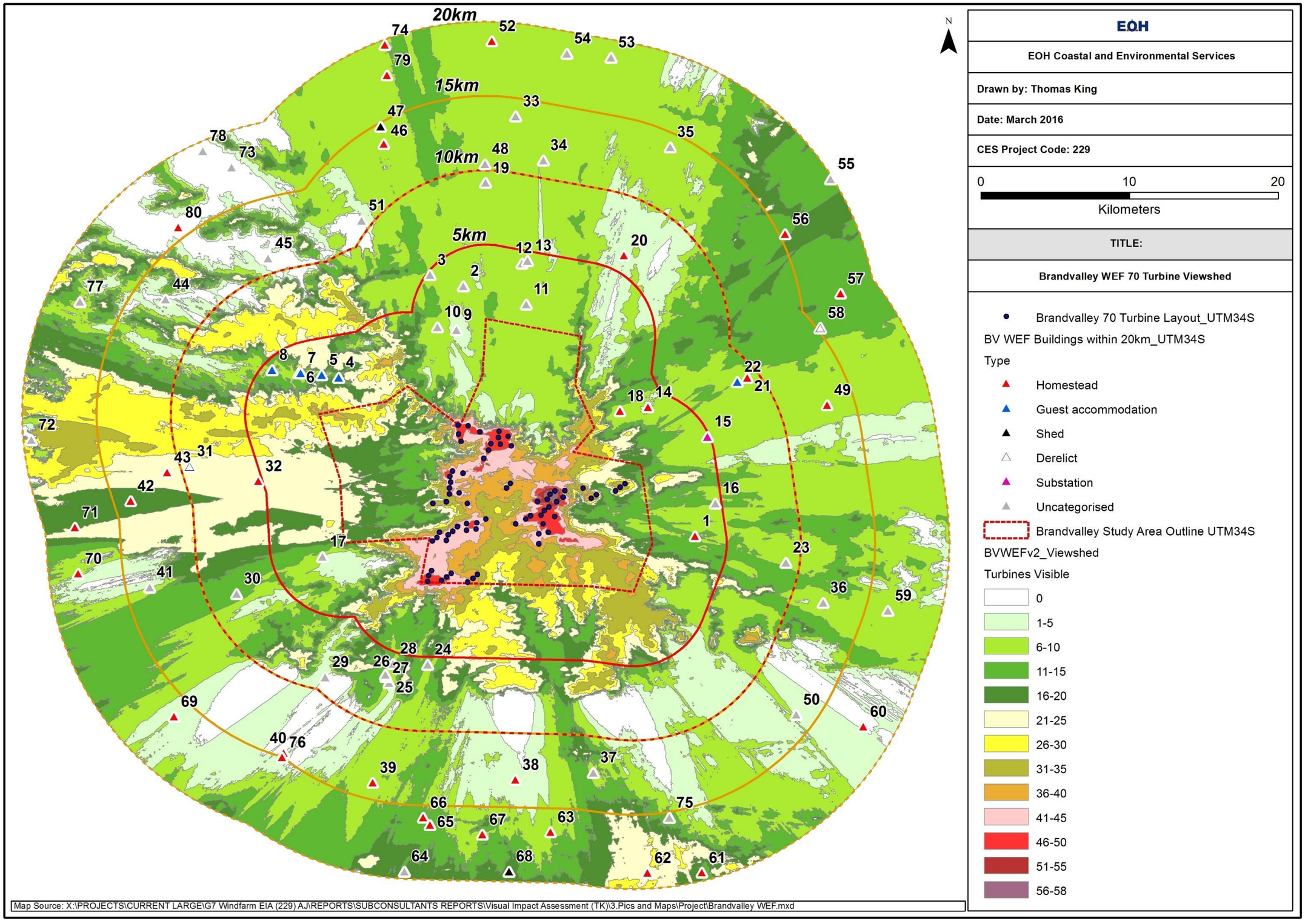

Figure 2-9. VIA sensitivity map of the project region.

Ref	Type	Name	Owner	Y[1]	X[1]	Turbines Visible (distance in km to nearest turbine)
1	Homestead	Aurora	Gielie Hanekom	6349410	461339	11-15 (5.9)[3]
16	Uncategorised[2]	Aanstoot		6351610	462707	11-15 (6.3)
4	Guest accommodation	Gatsrivier		6360070	437350	11-15 (8.6)
15	Substation	Komsberg		6356090	462164	6-10 (6.3)
18	Homestead	Bona Esperance	P.J. Conradie	6357820	456285	6-10 (4.9)
5	Guest accommodation	Gatsrivier		6360250	436216	6-10 (9.8)
7	Guest accommodation	Gatsrivier		6360370	434779	6-10 (11.2)
6	Guest accommodation	Gatsrivier		6360390	434684	6-10 (11.3)
8	Guest accommodation	Gatsrivier		6360590	432869	6-10 (13.1)
10	Uncategorised			6363470	444005	6-10 (6.6)
11	Uncategorised			6365000	449975	6-10 (8.6)
2	Uncategorised			6366240	445744	6-10 (9.3)
3	Uncategorised			6366990	443506	6-10 (10.2)
12	Uncategorised			6367770	449680	6-10 (11.3)
13	Uncategorised			6367940	450066	6-10 (11.7)
17	Uncategorised	Haasvlei		6348010	436268	1-5 (7.2)
14	Homestead	Swartland	T.J. Calldo	6358090	458174	1-5 (5.3)
9	Uncategorised			6363280	445269	1-5 (6.3)
32	Homestead	Brandenburg	A.J. Du Plessis	6353100	431946	21-25 (11.8)
31	Derelict	Brandenburg	A.J. Du Plessis	6354080	427312	21-25 (16.6)
30	Uncategorised	Haasvlei		6345530	430488	11-15 (12.9)
25	Uncategorised	Luipaardskloof		6339540	440740	6-10 (7.4)
26	Uncategorised	Luipaardskloof		6339940	440526	6-10 (7)
27	Uncategorised	Luipaardskloof		6340090	440492	6-10 (6.9)
24	Uncategorised	Luipaardskloof		6340750	443335	6-10 (5.7)
28	Uncategorised	Luipaardskloof		6340810	441002	6-10 (6.1)
23	Uncategorised			6347620	467446	6-10 (12.1)
22	Guest accommodation	Saaiplaas Guest House		6359790	464181	6-10 (10.1)
21	Homestead	Saaiplaas	F.D. Conradie	6360060	464865	6-10 (10.1)
19	Uncategorised			6373200	447229	6-10 (16.4)
29	Uncategorised			6339910	436431	1-5 (9.6)
20	Homestead	Ekkraal	K. Steenkamp	6368290	456549	1-5 (14.3)
43	Homestead	Kareerivier		6353700	425810	21-25 (18)
42	Homestead	Bantamsfontein	Jan du Toit	6351780	423342	16-20 (20.3)
39	Homestead			6332810	439634	6-10 (14.1)
37	Uncategorised			6333490	454484	6-10 (15.2)
36	Uncategorised			6344930	469961	6-10 (15.6)
41	Uncategorised			6345960	424626	6-10 (18.7)
49	Homestead	Smitskraal		6358230	470231	6-10 (14.5)
48	Uncategorised			6374450	447197	6-10 (17.6)
34	Uncategorised			6374690	451129	6-10 (18.1)
35	Uncategorised			6375580	459658	6-10 (22.2)
46	Homestead			6375790	440387	6-10 (19.4)
47	Shed			6376980	440171	6-10 (20.7)
33	Uncategorised			6377650	449265	6-10 (20.9)
38	Homestead			6333010	449244	1-5 (13.7)
40	Homestead	Patatsrivier		6334800	433644	1-5 (15)

50	Uncategorised			6337390	468141	1-5 (19.4)
51	Uncategorised			6370650	438889	1-5 (15.1)
44	Uncategorised			6365340	425705	0 (N/A)
45	Uncategorised			6368100	432606	0 (N/A)
43	Homestead	Kareerivier		6353700	425810	21-25 (18)
42	Homestead	Bantamsfontein	Jan du Toit	6351780	423342	16-20 (20.3)
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40	Homestead	Patatsrivier		6334800	433644	1-5 (15)
50	Uncategorised			6337390	468141	1-5 (19.4)
51	Uncategorised			6370650	438889	1-5 (15.1)
44	Uncategorised			6365340	425705	0 (N/A)
45	Uncategorised			6368100	432606	0 (N/A)

1.3 Scope and Content of this EMPR

The purpose of this EMPr is to ensure 'good environmental practice' by taking a holistic approach to the management of environmental impacts during the construction and operation of the Proposed Brandvalley Wind Farm. This EMPr therefore sets out the methods by which proper environmental controls are to be implemented by the Holder of the EA and nominated contractor based largely on the mitigation measures recommended during the EIA process. However, where necessary, these methods have been expanded upon and additional issues addressed in order to ensure that all environmental aspects are appropriately considered and monitored. It is important to note that this EMPr will be focused primarily on the construction and operational phases of the project, but are relevant to the planning and decommissioning phases as well.

- This EMPr incorporates both general construction mitigation measures and specific project mitigation measures to address the impacts discussed in Chapter 4.

The EMPr therefore includes the following:

- Construction activities that will impact on the environment; and
- Operation activities that will impact on the environment;
- Specifications with which the contractor shall comply in order to protect the environment from the identified impacts; and
- Actions that shall be taken in the event of non-compliance.

The contents of the Environmental Management Programme report (EMPr) are consistent with the requirements as set out in Annexure 4 of the EIA Regulations published as Government Notice No R. 982 in Government Gazette No 38282 of 4 December 2014 in terms of Chapter 5 of the National Environmental Management Act No 107 of 1998 (NEMA), in addition to the DEA requirements in the Acceptance of Scoping letter dated 15 April 2016. Table 1-4 provides a list of this information and where in the report it can be found.

Table 1-4. Legislative requirements and location in document.

Requirement	EMPr Reference
EMP REQUIREMENTS IN TERMS OF APPENDIX 4 OF EIA REGULATIONS	
(a) details of— (i) the EAP who prepared the EMPr; and (ii) the expertise of the EAP to prepare an EMPr	Section 1.4
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 1.2
(c) a description of the impact management objectives, including management statements, identifying the impacts that need to be avoided, managed and/or mitigated as identified through the environmental impact assessment process for all phases of the development including— (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iii) where relevant operation activities; and (iv) rehabilitation of the environment after construction and where applicable post closure;	Chapter 4
(d) a description of impact management outcomes, identifying the standard of impact management required for the aspects contemplated in paragraph (c);	Chapter 4
(e) a description of impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (c) and (d) will be achieved, and may include actions to —	Chapter 4

Requirement	EMPr Reference
(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) remedy the cause of pollution or degradation and migration of pollutants; (iii) comply with any prescribed environmental management standards or practices; (iv) comply with any applicable provisions of the Act regarding closure, where applicable; (v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable	
(f) the method of monitoring the implementation of the impact management actions contemplated in paragraph (e);	Chapter 4
(g) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (e);	Chapter 4
(h) an indication of the persons who will be responsible for the implementation of the impact management actions;	Chapter 4
(i) the time periods within which the impact management actions contemplated in paragraph (e) must be implemented;	Chapter 4
(j) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (e);	Chapter 4
(k) a program for reporting on compliance, taking into account the requirements as prescribed by these Regulations; and	Section 3.3
(l) an environmental awareness plan describing the manner in which— (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.	Section 3.3.5
EMPR REQUIREMENTS IN TERMS OF ACCEPTANCE OF SCOPING LETTER	
i. Recommendations and mitigation measures recorded in the EIAr and specialist studies;	Contained in Chapter 4
ii. A final site layout map;	Figures in Chapter 1
iii. Measures as dictated by the final site layout map and micro-siting;	Chapter 4
iv. An environmental sensitivity map;	Chapter 1
v. A environmental sensitivity map overlaid with the final layout;	Figures in Chapter 1
vi. An invasive alien species management plan;	Chapter 6
vii. A plant rescue and protection plan;	Contained in Chapter 4
viii. A re-vegetation and habitat rehabilitation plan;	Contained in Chapter 4
ix. An open space management plan;	Contained in Chapter 4
x. A traffic management plan;	Annexure E
xi. A transportation plan;	Annexure E
xii. A storm water management plan;	Chapter 7
xiii. A fire management plan;	Contained in Chapter 4
xiv. An erosion management plan;	Contained in Chapter 4
xv. A hazardous substance monitoring and management plan;	Chapter 8
xvi. Measures to protect hydrological features	Contained in Chapter 4

1.4 Details and expertise of the EAP that prepared this EMPR

According to Appendix 4 Section 1 (1)(a) of the EIA Regulations (2014), an Environmental Management Program (EMPr) must include:

a) details of –

i. The EAP who prepared the EMPr; and

ii. The expertise of that EAP to prepare an EMPr, including a curriculum vitae"

(b) In fulfilment of the above-mentioned legislative requirement, as well as Section 13 of the EIA Regulations (2014), which states that, "an EAP must have expertise in conducting environmental impact assessments or undertaking specialist work as required, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity", provided below are the details of the Environmental Assessment Practitioner (EAP) who prepared this EIA, as well as the expertise of the individual specialists who completed this EMPr.

Coastal & Environmental Services (EOH CES) was commissioned by the applicant, Brandvalley Wind Farm (Pty) Ltd., to prepare an EMPr that seeks to comply with the EIA Regulations. In fulfilment of this requirement, provided below (Table 1-5) are the details of EAP:

Table 1-5. Details of the EAP.

EAP	Mr Marc Hardy
Company	Coastal and Environmental Services, trading as EOH Coastal & Environmental Services (EOH CES), Cape Town branch.
Physical Address	The Point, Suite 408, 4th Floor, 76 Regent Road Sea Point, Cape Town, 8001
Postal Address	Same as above
Telephone	+27 21 045 0900
Fax	046 622 6564
	www.cesnet.co.za
Email	m.hardy@cesnet.co.za

See CVs in Annexure A.

2. ENVIRONMENTAL LEGISLATION

2.1 Legislative framework

The contractor must comply with all South African national and provincial environmental legislation, including associated regulations and all local by-laws relevant to the project. Key legislation currently applicable to the design, construction and implementation phases of the project must be complied with. The list of applicable legislation provided below is intended to serve as a guideline only and is not exhaustive:-

- The Constitution of the Republic of South Africa Act 108 of 1996;
- National Environmental Management Act 107 of 1998;
- National Environmental Management: Protected Areas Act 57 of 2003;
- National Environmental Management: Biodiversity Act 10 of 2004;
- National Forests Act 43 of 1983;
- National Water Act 36 of 1998;
- Conservation of Agricultural Resources Act 43 of 1983;
- National Veld and Forest Fire Act 101 of 1998;
- Hazardous Substances Act 15 of 1973;
- National Heritage Resources Act 25 of 1999;
- National Environmental Management: Air Quality Act 39 of 2004;
- National Environmental Management: Waste Management Act 59 of 2008;
- Mineral and Petroleum Resources Development Act 28 of 2002;
- Occupational Health and Safety Act 85 of 1993;
- Astronomy Geographic Advantage Act 21 of 2007;
- National Road Traffic Act 93 of 1996;
- Spatial Planning and Land Use Management Act 16 of 2013;
- Civil Aviation Act No. 13 of 2009: 13th Amendment of the Civil Aviation Regulations;
- Subdivision of Agricultural Land Act 70 of 1970; and
- All relevant provincial legislation, Municipal by-laws and ordinances.

The contractor shall establish and maintain procedures to keep track of, document and ensure compliance with environmental legislative changes. The permitting currently applicable to this project are described in Section 2.2 of this report.

2.2 Permits required

The following permits (Table 2-1) have been identified as being required prior to construction commencing. It is the Holder of the Environmental Authorisation's (EA) responsibility to obtain the appropriate permits.

Table2-1. Permitting required for this Wind Energy Facility.

Relevant legislation	Compliance requirement	Relevant authority
National Environmental Management Act (No. 107 of 19989) (NEMA) AND Environmental Impact Assessment (EIA) Regulations, 2014	Environmental Authorisation.	An EA must be obtained prior to commencing with listed activities. The final EIA documentation, including this EMPr to be submitted by the EAP to the DEA.
The National Environment Management: Biodiversity Act (No. 10 of 2004)	A final site walkthrough of the optimised site development plan are required post-EIA to inform the micro-sitting of infrastructure. This should be undertaken by a qualified ecologist.	Permit applications must be submitted to Cape Nature (in the Western Cape) or the Department of Environment and Nature Conservation

Relevant legislation	Compliance requirement	Relevant authority
	Should any listed/protected species in terms of this Act be identified, there will be a requirement to apply for the necessary permit(s) in terms of this act and any applicable provincial Acts.	(DENC) (in the Northern Cape) during the pre-construction phase.
	Alien invasive species management must be compliant with the Alien and Invasive Species regulations (GN 598 of 2014) in terms of this Act.	Alien invasive species must be managed throughout the construction, operation and decommissioning phases.
National Water Act (No. 36 of 1998)	The WEF and its associated infrastructures could potentially trigger Section 21 c and i of the NWA by for instance, road crossings. Once the layout is fully optimised and exact locations of the watercourse crossings confirmed, the Holder of the EA will apply for the relevant water use authorisations or General Authorisation from the Catchment Management Agency.	Must be completed prior to construction commencing.
National Forests Act (No. 84 of 1998)	The ecologist confirmed that there are no protected trees present onsite that will be affected by the development. However, if any protected trees in terms of this Act are identified during the final ecology site walkthrough and would need to be removed, the Holder of the EA will apply for a permit from the Department of Agriculture, Forestry and Fisheries.	Permit applications must be submitted to DAFF during the pre-construction phase if applicable.
Subdivision of Agricultural Land Act (No. 70 of 1970)	Long-term lease agreements (over 10 years) on portion/s of agricultural land require the consent from the Minister of Agriculture, Forestry and Fisheries before they can be registered. Some of the leases for the project may be over portions on agricultural land and will require consent from DAFF.	Application for consent to be submitted by the Holder of the EA to DAFF.
National Heritage Resources Act (No. 25 of 1999)	Section 38 of the Act is triggered by the EIA. As part of the EIA process, the project was registered with South African Heritage Resource Agency (SAHRA) and Heritage Western Cape. A phase I heritage assessment has been undertaken to identify heritage features within the site, undertake an impact assessment and recommend mitigation measures. The layout of the infrastructure will avoid all heritage features. In the event that archaeological or historically significant sites would be destroyed, damaged, excavated, altered or defaced by the proposed project activity	If applicable, applications for areas within the Northern Cape should be submitted to SAHRA and applications for areas within the Western Cape should be submitted to the Heritage Western Cape.

Relevant legislation	Compliance requirement	Relevant authority
	during the construction phase the relevant permit will need to be granted before the works on the disturbed heritage site can continue.	
National Road Traffic Act (No. 93 of 1996)	All the requirements stipulated in the Act will need to be complied with during the construction and operational phases of the proposed WEF.	Approvals should be obtained from the District Roads Authority prior to commencing with construction, offsite road upgrades or the transportation of abnormal loads.
Civil Aviation Act (Act No. 13 of 2009): 13th Amendment of the Civil Aviation Regulations (2011)	Due to requirements of the Act to ensure the safety of aircrafts, the WEF applicant must engage directly with the Civil Aviation Authority (CAA) regarding the structural details of the facility.	Approval to be obtained from CAA prior to commencement of construction.
Electronic Communication Act (No. 36 of 2005)	All service providers were notified of the WEF.	Approvals from all service providers obtained in terms of Section 29 (1) (b) of the Act.

3. IMPLEMENTATION OF THE EMPR

3.1 Management structure

Brandvalley Wind Farm will be responsible for the implementation of the proposed WEF to ensure compliance with the requirements of all environmental authorisations and permits, and obligations. This EMPr plays a role in meeting this requirement and should therefore be included in all contract documentation. In line with this EMPr, all parties involved in the implementation of the WEF must be made aware of their environmental responsibilities, accountability and liability.

There are various key roles and responsibilities as described in Section 3.2. All official communication and reporting lines including instructions, directives and information need to be developed for the organisation structure shown in Figure 3-1.

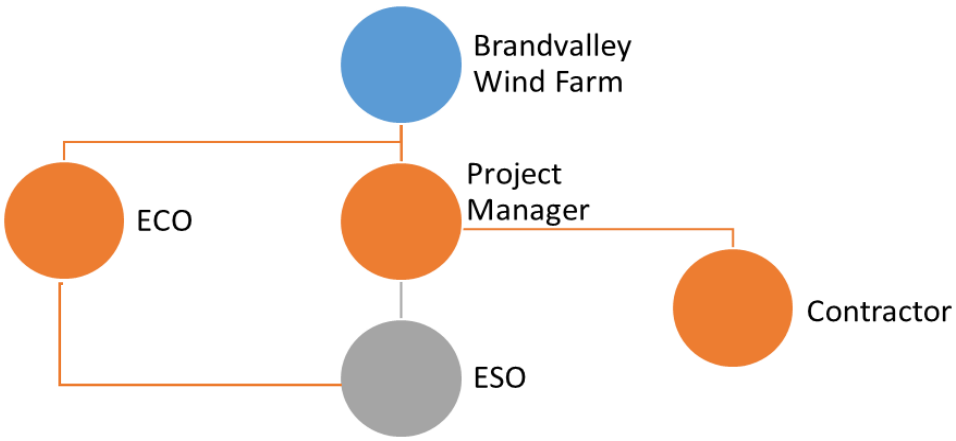

Figure 3-1: Draft organisation structure.

3.2 Roles and responsibilities

3.2.1 Holder of the EA / Brandvalley Wind Farm (Pty) Ltd

Brandvalley Wind Farm (Pty) Ltd is the applicant and the Holder of the EA should DEA decide to issue a positive EA. Brandvalley Wind Farm shall therefore be the entity responsible for the monitoring and implementation of the EMPr and compliance with the authorisation. part thereof.

Responsibilities include:

- Assume overall responsibility for the implementation of the EMPr and adherence to all relevant legislation;
- Ensure that the WEF is designed to meet all the specified environmental parameters and legal requirements as specified in the EMPr and EA; and
- Liaise with authorities.

3.2.2 Project Manager

The overall Project Manager will be appointed by Brandvalley Wind Farm (Pty) Ltd and will be required to oversee the construction programme and construction activities performed by all Contractors. The Project Manager is expected to liaise with the Contractor and ECO on environmental matters, as well as any pertinent engineering matters where these may have environmental consequences. The Project Manager, with support from the Environmental Site Officer (see section 3.2.4) will oversee the general compliance of the Contractor with the EMPr and other pertinent site specifications. The Project Manager will also be required to be familiar with the EMPr and further monitor the Contractor's compliance with the EMPr on a daily basis, through the site diary, and enforce compliance.

The Project Manager shall have the following responsibilities:

- Oversee the construction programme and construction activities performed by all Contractors.
- Appointing an Environmental Site Officer (see section 3.2.4) and Independent Environmental Control Officer (see section 3.2.5) for the duration of the construction phase.
- Regular liaison with the ECO and ESO during the construction phase to ensure compliance with the EMPr.
- Ensuring that all contractors received the required environmental training and adhere to the requirements of the EMPr.
- Review Method Statements.
- Stop work in emergency situations.
- Liaison with Interested and Affected Parties.

The Project Manager should also consider establishing a liaison committee consisting of a representative from Brandvalley Wind Farm (Pty) Ltd, the contractor (s), the relevant engineers, and any other role-player deemed necessary by the members of the committee (the 'Liaison Committee') that will meet monthly to review the progress of the contract in implementing and complying with its obligations in terms of this EMPr.

3.2.3 Contractor

Any contractor involved shall:

- Be responsible for adherence to the EMPr and all relevant legislation;
- Be responsible for preparing method statements for approval;
- Respond to instructions from both the Project Manager, ESO and ECO.
- Be committed to health and safety requirements;
- Ensure that all staff attend environmental awareness training;
- Prepare monitoring reports demonstrating compliance with the EMPr; and
- Ensure that all third parties who carry out all or part of the contractor's obligations under the contract comply with the requirements of this EMPr.

3.2.4 Environmental Site Officer

The Project Manager shall appoint a nominated representative as the ESO for the contract. The ESO can be an internal or external party that will be site-based and shall be the responsible person for day to day implementation of the EMPr. There shall be an approved ESO on the site at all times. It may be necessary to have more than one ESO. The ESO's duties will include, *inter alia*, the following:

- Ensuring that all the EAs and permits required in terms of the applicable legislation have been obtained prior to construction commencing;
- Reviewing construction method statements in order to ensure that the environmental specifications contained within the construction contract are adhered to;

- Assisting the contractor in finding environmentally responsible solutions to problems;
- Keeping accurate and detailed records of all activities on site;
- Keeping a register of complaints on site and recording community comments and issues, and the actions taken in response to these complaints;
- Presenting environmental awareness training (see Annexure B for an example) to all contractors;
- Ensuring that the required actions are undertaken to mitigate the impacts resulting from non-compliance (see Chapter 4 of this EMPr);
- Undertaking continual internal reviews of the EMPr and submitting any changes to the Project Manager and ESO for review and approval or to DEA if any objectives or outcomes are amended; and
- Reporting all incidences of non-compliance to the ECO and Project Manager.

The ESO shall submit regular written reports to the ECO, but not less frequently than once a month. The ESO must have:

- The ability to manage public communication and complaints;
- The ability to think holistically about the structure, functioning and performance of environmental systems;
- The ESO must be fully conversant with the EIR[1] and EMPr for the Wind Farm and all relevant environmental legislation; and
- The ESO must have received sufficient training.

The Environmental Control Officer (see Section 3.2.5 below) shall be in the position to determine whether or not the ESO has adequately demonstrated his/her capabilities to carry-out the tasks at hand. The ECO shall therefore have the authority to instruct the Project Manager to replace the ESO if, in the ECO's opinion, the appointed officer is not fulfilling his/her duties in terms of the requirements of the EMPr. Such instruction will be in writing and shall clearly set out the reasons why a replacement is required and within what timeframe.

3.2.5 Environmental Control Officer

For the purposes of implementing the conditions contained herein, Brandvalley Wind Farm (Pty) Ltd shall appoint an independent ECO for the contract. The ECO shall be the responsible person for monitoring compliance with the provisions of the EMPr as well as the EA during the construction period. The ECO will be responsible for issuing instructions to the Project Manager, ESO and or contractor where environmental considerations call for action to be taken. The ECO shall submit regular written reports to Brandvalley Wind Farm (Pty) Ltd, but not less frequently than once a month.

The ECO will be responsible for the monitoring, reviewing and verifying of compliance with the EMPr and conditions of the EA by the contractor. The ECO's duties in this regard will include, *inter alia*, the following:

- Verifying that all the EAs and permits required in terms of the applicable legislation have been obtained prior to construction commencing;
- Monitoring and verifying that the EMPr, EA and legislative requirements are adhered to at all times and taking action if there are transgressions;
- Monitoring and verifying that environmental impacts are kept to a minimum as far as possible;
- Reviewing and approving construction method statements with input from the ESO and Project Manager, where necessary, in order to ensure that the environmental specifications contained within this EMPr and EA are adhered to;
- Inspecting the site and surrounding areas on a regular basis, but not less than monthly,

[1] EOH Coastal & Environmental Services, May 2016: Proposed Brandvalley Wind Energy Facility, Northern and Western Cape Provinces, South Africa, Draft Environmental Impact Assessment Report. EOH CES, Cape Town

throughout the construction phase;
- Monitoring the undertaking by the contractor of environmental awareness training for all new personnel on site;
- Ordering corrections of any transgressions, or issuing spot fines for person/s and/or equipment not complying with the specifications of the EMPr and/or EA;
- Confirming that the required actions are/were undertaken to mitigate the impacts resulting from non-compliance;
- Checking the register of complaints kept on site and maintained by the ESO and ensuring that the correct actions are/were taken in response to these complaints;
- Reporting all incidences of non-compliance to Brandvalley Wind Farm (Pty) Ltd;
- Conducting environmental performance audits in respect of the activities undertaken relating to the project in terms of Regulation 34 of GN R. 982 EIA Regulations. The ECO shall also submit compliance audit reports that are compliant to Appendix 7 of the 2014 EIA Regulations to DEA, in accordance with the requirements of the EA. Such reports shall be reviewed by Brandvalley Wind Farm (Pty) Ltd, prior to submission;
- Keeping a photographic record of progress on site from an environmental perspective. This can be conducted in conjunction with the ESO as the ESO will be the person that will be onsite at all times and can therefore take photographic records weekly. The ECO would need to check and ensure that the ESO understands the task at hand;
- Recommending additional environmental protection measures, should this be necessary; and
- Providing report back on any environmental issues at site meetings.

The ECO must have:

- A good working knowledge of all relevant environmental policies, legislation, guidelines and standards;
- Thorough understanding of the EIA and EMPr;
- The ability to conduct inspections and audits and to produce thorough, readable and informative reports;
- The ability to manage public communication and complaints; and
- The ability to think holistically about the structure, functioning and performance of environmental systems.

Brandvalley Wind Farm (Pty) Ltd shall have the authority to replace the ECO if, in their opinion, the appointed officer is not fulfilling his/her duties in terms of the requirements of the EMPr. Such instruction will be in writing and shall clearly set out the reasons why a replacement is required and within what timeframe, and will be subject to contractual agreements set in place. Regardless, the project may at no time proceed without an actively engaged, independent ECO, bound to the conditions contained in this EMPr.

3.3 Reporting

3.3.1 Method Statements

Before the contractor begins each construction activity, the contractor shall give to the ECO and Project Manager a written Method Statement setting out the following:

- The type of construction activity;
- Locality where the activity will take place;
- Identification of impacts that might result from the activity;
- Identification of activities or aspects that may cause an impact;
- Methodology and/or specifications for impact prevention for each activity or aspect;
- Methodology and/or specifications for impact containment for each activity or aspect;
- Emergency/disaster incident and reaction procedures; and
- Treatment and continued maintenance of impacted environment.

The contractor must provide such information at least two weeks in advance of any or all construction activities for review and approval. Any changes made to the Method Statement after approval shall be given to the Project Manager for review and the ECO for approval.

The ECO and/or Project Manager may provide comment on the methodology and procedures proposed by the contractor, but shall not be responsible for the contractor's chosen measures of impact mitigation and emergency/disaster management systems.

3.3.2 Good housekeeping

The contractor shall undertake 'good housekeeping' practices during construction. This will help avoid disputes on responsibility and allow for the smooth-running of the contract as a whole. Good housekeeping extends beyond the wise practice of construction methods that leaves production in a safe state from the ravages of weather to include the care for and preservation of the environment within which the site is situated.

3.3.3 Record keeping

The ESO and the ECO will continuously monitor the contractor's adherence to the approved impact prevention procedures and the ESO or ECO shall issue to the contractor a notice of non-compliance whenever transgressions are observed. This should be documented to record the nature and magnitude of the non-compliance in a designated register, the action taken to discontinue the non-compliance, the action taken to mitigate its effects and the results of the actions. The non-compliance shall be documented and reported to the Project Manager in the monthly report. These reports shall be made available to DEA when requested.

The Project Manager shall ensure that an electronic filing system identifying all documentation related to the EMPr is established (see Section 3.3.4).

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

- Final EIR;
- EMPr;
- EA from the DEA;
- Final design documents and diagrams issued to and by the Contractor;
- All communications detailing changes of design/scope that may have environmental implications;
- Daily, weekly and monthly site monitoring reports;
- Complaints register;
- Medical reports;
- Training manual;
- Training attendance registers;
- Incident and accident reports;
- Emergency preparedness and response plans;
- Electronic copies of all relevant environmental legislation;
- Permits and legal documents, including letters authorising specific personnel of their duties as part of emergency preparedness teams e.g. fire teams, etc;
- Crisis communication manual;
- Disciplinary procedures;
- Monthly site meeting minutes during construction;
- Copies of all relevant permits; and
- All Method Statements for all phases of the project.

3.3.4 Document control

The Project Manager shall be responsible for establishing a procedure for electronic document control. The document control procedure should comply with the following requirements:

- Documents must be identifiable by organisation, division, function, activity and contact person;
- Every document should identify the personnel and their positions, who drafted and compiled the document, who reviewed and recommended approval, and who finally approved the document for distribution; and
- All documents should be dated, provided with a revision number and reference number, filed systematically, and retained for a two year period.

The contractor shall 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 EMPr are performed. All documents shall be made available to the independent external auditor.

3.3.5 Environment and health training and awareness

The ESO and/or ECO must be conversant with all legislation pertaining to the environment applicable to this contract and must be appropriately trained in environmental management and must possess the skills necessary to impart environmental management skills to all personnel involved in the contract.

The contractor shall ensure that adequate environmental training takes place. All employees shall have been given an induction presentation on environmental awareness. Where possible, the presentation needs to be conducted in the language of the employees. The environmental training should, as a minimum, include the following:

- The importance of conformance with all environmental policies;
- The significant environmental impacts, actual or potential, as a result of their work activities;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with the EMPr;
- The potential consequences of departure from specified operating procedures;
- The mitigation measures required to be implemented when carrying-out their work activities;
- The importance of not littering;
- The need to use water sparingly;
- Details of, and encouragement to, minimise the production of waste and re-use, recover and recycle waste where possible;
- Details regarding archaeological and/or historical sites which may be unearthed during construction and the procedures to be followed should these be encountered;
- The procedures which should be followed should a grave be encountered, or unearthed during the construction phase; and
- Details regarding fauna and flora of special concern, including protected/endangered plant and animal species, and the procedures to be followed should these be encountered during the construction phase.

In the case of permanent staff, the Contractor shall provide evidence that such induction courses have been presented. If required, the ESO can assist with presenting these environmental induction courses. In the case of new staff (including contract labour) the Contractor shall inform the Project Manager when and how he intends concluding his environmental training obligations.

Environment and health awareness training programmes should be targeted at three distinct levels of employment, i.e. the executive, middle management and labour. Environmental awareness training programmes should contain the following information:

- The names, positions and responsibilities of personnel to be trained;
- The framework for appropriate training plans;

- The summarised content of each training course; and
- A schedule for the presentation of the training courses.

The Contractor shall provide records to the ESO of all records and documentation control requirements as set out in this EMPr (refer to 3.3.3 and 3.3.4 above). The training records shall verify each of the targeted personnel's training experience. The ESO shall monitor the records and listed and undertake regular follow ups and be verified by the ECO.

3.3.6 Emergency preparedness

The Project Manager and or Contractor shall compile and maintain environmental emergency procedures to ensure that there will be an appropriate response to unexpected or accidental actions or incidents that will cause environmental impacts, throughout the life cycle of the project. Such activities may include, *inter alia*:

- Accidental discharges to water and land;
- Accidental exposure of employees to hazardous substances;
- Accidental veld or forest fires;
- Accidental spillage of hazardous substances; and
- Specific environmental and ecosystem effects from accidental releases or incidents.

These plans should include:

- Emergency organisation (manpower) and responsibilities, accountability and liability;
- A list of key personnel;
- Details of emergency services applicable to the various areas along the route that turbine components will need to be transported and for the site itself (e.g. the fire department, spill clean-up services, etc.);
- Internal and external communication plans, including prescribed reporting procedures where required by legislation;
- Actions to be taken in the event of different types of emergencies;
- Incident recording, progress reporting and remediation measures required to be implemented;
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release; and
- Training plans, testing exercises and schedules for effectiveness.

The contractor shall comply with the emergency preparedness and incident and accident reporting requirements, as required by the Occupational Health and Safety Act (OHSA, Act No. 85 of 1993) and the 2014 Construction Regulations (GN R 84), the NEMA (Act No 107 of 1998), the National Water Act (Act No. 36 of 1998) and the National Veld and Forest Fire Act (Act No. 101 of 1998) as amended and/or any other relevant legislation.

3.3.7 Corrective action for non-compliance

Non-compliance with the specifications of the EMPr and/or conditions of the EA, both of which will be present on-site at all times, constitutes a breach of contract for which the Contractor may be liable to pay penalties to be determined by the ECO for approval by the Project Manager. The Contractor is deemed not to have complied with the EMPr if:

- There is evidence of contravention of the EMPr specifications within the boundaries of the construction site, site extensions and haul/access roads;
- There is contravention of the EMPr specifications which relate to activities outside the boundaries of the construction site;
- Environmental damage ensues due to negligence;
- Construction activities take place outside the defined boundaries of the site; and/or
- The contractor fails to comply with corrective or other instructions issued by the Project

Manager and/or ECO within a specific time period.

The contractor shall act immediately when a notice of non-compliance is received and correct whatever was the cause for the issuing of the notice.

The ECO's decision with regard to what is considered a violation, its seriousness and the action to be taken against the contractor shall be final. Failure to redress the cause shall be reported to the relevant authority. The responsible provincial or national authorities shall ensure compliance and impose penalties relevant to the transgression as allowed for within its statutory powers.

3.3.7.1 Complaints Register

The Contractor will ensure that a dedicated complaints register is kept on site at all times (see Annexure C). The register will contain the details of the person who made the complaint, the nature of the complaint received, the date on which the complaint was made and the response noted with the date and action taken. The register will be kept in accordance with the requirements of the ECO. This record shall be submitted with the monthly reports and an oral report given at the monthly site meetings.

Please see the "Grievance Procedures" chapter (Chapter 9) for specific instructions regarding the different actions to be taken in the event of a grievance.

3.3.7.2 Inspections

Ongoing visual inspections will be conducted daily by the ESO. The ESO will spend the bulk of his/her time on site on the lookout for any unsafe acts and activities that transgress the requirements as specified in the EMPr. The ESO compiles the site register and the ECO maintains the complaints register and any other records required in the environmental authorisation (the ESO would also have input into this as well, as he/she would be site-based).

3.3.7.3 Spot Fines

The ESO and ECO shall be authorised to impose spot fines for any of the transgressions detailed below:

- Littering on site;
- Lighting of illegal fires on site;
- Any persons, vehicles or equipment related to the contractor's operations found within the designated 'no-go' areas (especially for significant cultural resources such as nearby graves etc.);
- Creating dust or noise;
- Possession or use of intoxicating substances or weapons on site;
- Trapping, hunting or trading of fauna and / or plants on site;
- Any vehicles being driven in excess of designated speed limits;
- Unauthorised removal and/or damage to fauna, flora or cultural or heritage objects on site; and
- Urination and defecation anywhere other than using the toilet facilities that have been provided.

These activities, along with the appropriate guidelines to determining the fines, shall be agreed to by Brandvalley Wind Farm (Pty) Ltd, the Project Manager and the Contractor. Such fines will be issued in addition to any remedial costs incurred as a result of non-compliance with the environmental specifications and or legal obligations. Brandvalley Wind Farm (Pty) Ltd will inform the contractor of the contravention and the amount of the fine.

3.3.7.4 Penalty Fines

Where environmental damage is caused or a pollution incident, and/or failure to comply with any of the environmental specifications contained in the EMPr, the Contractor shall be liable to pay a penalty fine. The following transgressions should be penalised:

- Hazardous chemical/oil spill;
- Damage to sensitive environments;
- Damage to cultural and historical sites;
- Unauthorised removal/damage to indigenous trees and other vegetation, particularly in identified sensitive areas;
- Uncontrolled/unmanaged erosion;
- Unauthorised blasting activities; and
- Violation of environmental authorisation conditions.

These activities, along with the appropriate guidelines to determining fines, shall be agreed to by Brandvalley Wind Farm (Pty) Ltd, the Project Manager and Contractor, and will be included within the final EMPr. In addition to penalties, the Project Manager has the power to remove from site any person who is in contravention of the EMPr, and if necessary, the engineer can suspend part of or all of the works, as required.

3.3.7.5 Audits

Where the monitoring data and the inspections highlight any problems, an internal audit will be initiated by the ECO. The purpose of the audit is to ascertain the source of the problem and to define what action shall be taken to rectify the problem and prevent its reoccurrence.

Audit reports shall conform to the requirements as per the 2014 EIA regulations, namely:

Environmental Audit Report

1. The environmental audit report must provide for recommendations regarding the need to amend the EMPr.

Objective of the environmental audit report

2. The objective of the environmental audit report is to-
   a. report on-
      (i) the level of compliance with the conditions of the environmental authorisation and the EMPr , and where applicable, the closure plan; and
      (ii) the extent to which the avoidance, management and mitigation measures provided for in the EMPr, and where applicable, the closure plan achieve the objectives and outcomes of the EMPr, and closure plan.
   b. identify and assess any new impacts and risks as a result of undertaking the activity;
   c. evaluate the effectiveness of the EMPr, and where applicable, the closure plan;
   d. identify shortcomings in the EMPr, and where applicable, the closure plan; and
   e. identify the need for any changes to the avoidance, management and mitigation measures provided for in the EMPr, and where applicable, the closure plan.

Content of environmental audit reports

3. (1) An environmental audit report prepared in terms of these Regulations must contain-
   (a) details of-
      (i) the independent person who prepared the environmental audit report; and
      (ii) the expertise of independent person that compiled the environmental audit report;
   (b) a declaration that the independent auditor is independent in a form as may be specified by the competent authority;
   (c) an indication of the scope of, and the purpose for which, the environmental audit report was prepared;
   (d) a description of the methodology adopted in preparing the environmental audit report;

(e) an indication of the ability of the EMPr, and where applicable, the closure plan to-
(i) sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an on-going basis;
(ii) sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the closure of the facility; and
(iii) ensure compliance with the provisions of environmental authorisation, EMPr, and where applicable, the closure plan;
f. A description of any assumptions made, and any uncertainties or gaps in knowledge;
g. a description of any consultation process that was undertaken during the course of carrying out the environmental audit report;
j. a summary and copies of any comments that were received during any consultation process; and
k. any other information requested by the competent authority.

The frequency of environmental audits will be determined in the EA.

3.3.7.6 Incident Reporting and Remedy

If a leakage or spillage of hazardous substances occurs on site, the local emergency services must be immediately notified of the incident (within 24 hours). The following information must be provided:

- The location;
- The nature of the load; and
- The status at the site of the accident itself (i.e. whether further leakage is still occurring, whether the vehicle or the load is on fire).

Written records must be kept on the corrective and remedial measures decided upon and the progress achieved therewith over time. Such progress reporting is important for monitoring and auditing purposes. The written reports may be used for training purposes in an effort to prevent similar future occurrences. Annexure D provides an example of an environmental incidents register.

3.3.7.7 Verbal instructions

Verbal instructions are likely to be the most frequently used form of corrective action and are given in response to transgressions that are evident during routine site inspections by the ESO and/or ECO. Verbal instructions are also used to create further awareness amongst employees as often transgressions are a function of ignorance rather than vindictiveness. Workers must obey verbal instructions through formally recording the actions taken to resolve the matter so that the instruction could be successfully finalised and recorded. Maximum allowable response time: two working days.

3.3.7.8 Written instructions

Written instructions will be given following an audit. The written instructions will indicate the source or sources of the problems identified on site and propose solutions to those problems. The implementation of solutions will be assessed in a follow-up audit and further written instructions issued if required. Maximum allowable response time: four working days.

3.3.7.9 Public Communication and Liaison with Interested and Affected Parties

The contractor shall comply with the requirements for public consultation as required by the Constitution Act (Act No. 108 of 1996) and the NEMA (Act No. 107 of 1998).

During the construction phase of the project, the contractor shall be responsible for erecting information boards, in the position, quantity, design and dimensions approved by the Project Manager. The information boards shall contain relevant information regarding the construction activity and the relevant contact details to assist persons who wish to submit complaints regarding construction activities.

3.4 Review and Amendment of the EMPr

A formal management review needs to be conducted on a regular basis in which the audit reports written by the ECO based on frequent inspections and interactions with the ESO, will be reviewed. The purpose of the review is to critically examine the effectiveness of the EMPr and its implementation and to decide on potential modifications to the EMPr as and when necessary. The process of management review is in keeping with the principle of continual improvement.

Amendments of the EMPr can be undertaken in terms of Sections 34-37 of the 2014 EIA Regulations. Any amendments requiring approval, shall be submitted to the Department of Environmental Affairs (DEA) as the competent authority.

4. ENVIRONMENTAL SPECIFICATIONS FOR THE PROJECT LIFE-CYCLE

This Chapter of the EMPr outlines the environmental specifications which are required to be implemented for the design, construction, operation and rehabilitation phases by the various parties. The specifications contained here-in are based on the mitigation measures recommended in the EIA Report.

Comprehensive environmental audits are to be undertaken periodically during the construction and operation phases, in order to verify compliance with the measures listed below, the recommendations contained within the EIA Report and all applicable environmental legislation. If compliance with any of these measures cannot be met, it will be the responsibility of the Contractor to motivate for this non-compliance.

In order to meet the commitments detailed within the EIA, Brandvalley Wind Farm (Pty) Ltd developed environmental objectives and outcomes (targets). The necessary actions (mitigation measures), person responsible and timeframes were identified.

4.1 Planning and design phase mitigation measures

Table 4-1. Planning and design phase mitigation measures.

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
1	Design of the WEF	Ensure the design of the WEF responds to the identified environmental sensitivities	The WEF design does not take into consideration the specialist recommendations and impact on sensitive features that could have been avoided.	1. The final optimised layout must be submitted to DEA for approval.	The design fully responds to the recommendations of the specialists.	Final layout submitted to DEA for approval. No monitoring required.	Holder of the EA	Prior to commencement of construction
2			Habitat destruction from clearance of vegetation; Avifaunal mortality associated with 33kV power lines and turbine blades	2. Leave 100m gap between successive turbines across saddles; 3. At the saddle between the two Snydersberg plateaux and the col in the ridge between the Ou Mure and Fortuin farm valleys no turbines should be erected within 100 m of the lowest point in the saddle/col and overhead lines should have bird diverters of a type visible by day and night set at 2 m intervals along the line. 4. Avoid elevated power lines across saddles and cols where possible. If not avoidable, all overhead 33kV power lines on saddles and cols away from the two abovementioned locations should have diverters at 5m intervals on the lines.	Turbine placement takes into account the avifaunal sensitivities	Turbine, power line placement and diverter design follow the recommendations. No monitoring required.	Holder of the EA	Design phase
3			Bat mortality and impacts from turbine blade movement	5. The current EIA layout avoid all high sensitive areas. Turbines must be sited and positioned during the optimisation process in	WEF design is optimal to mitigate bat impacts	Zero turbines in high sensitive no-go zones No monitoring required.	Holder of the EA	Design phase

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
				accordance with specialist recommendations based on the 12-month pre-construction monitoring outcomes. 6. The design should be done in such a manner to reduce the need for blasting as far as possible.				
4			Loss of sensitive vegetation and fauna, loss of SCC as a result of vegetation clearances., Erosion impacts, Hydrological disturbance	7. Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are be avoided where possible through micro-sitting. 8. Should there be a need to remove and or a recommendation to transplant any protected species affected by the final optimised layout, the relevant permits must be obtained. 9. The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas. 10. Any permanent roads should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 11. Development within the very high ecological sensitivity areas should proceed with caution with specific attention to avoiding impact on plant species of conservation concern that may be present. 12. It is recommended that pre-construction monitoring of key	The final layout avoids protected plant species as far as possible.	Report documenting the findings of the final site walkthrough. Copied of the relevant permits in terms of NEM:BA, if required.	Independent Ecologist and the Holder of the EA	Prior to construction commencing

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
				fauna within the Snydersberg area be conducted to improve our understanding of the impacts of wind turbines on fauna and inform mitigation for future wind development in the country. 13. Appropriate stormwater structures must be designed and implemented for all new infrastructure (e.g. roads, turbine bases etc.). 14. Development on steep slopes should be avoided as much as possible and specific additional mitigation may be required where this cannot be avoided. 15. Disturbance near drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas. 16. Runoff management and erosion control should be integrated into the project design. 17. Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.				
5			Increased erosion as a result of vegetation clearing and impact to surface water features	18. Appropriate stormwater structures must be designed and implemented. 19. All infrastructure situated on slopes must incorporate stormwater diversions. 20. Where possible culvert bases must be placed as close as	Appropriate stormwater structures incorporated in design	• Final layout design. No monitoring required.	Holder of the EA	Prior to construction commencing

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
				possible with natural levels in mind so that these don't from additional steps / barriers. 21. Sediment traps may be necessary to prevent erosion and soil movement if there is topsoil or other waste heaps present during the wet season.				
6			Loss of high potential agricultural land	22. Avoid developing on high potential agricultural land (like irrigated areas, croplands, etc.). If unavoidable, ensure that all development footprints are kept at a minimum.	Cultivated fields avoided as far as possible	Final layout design. No monitoring required.	Holder of the EA	Prior to construction commencing
7			Irreparable damage to archaeological resources on-site	23. An archaeological heritage walk-through survey must be conducted if any changes to the positions of the wind turbines, associated infrastructure and roads outside the scope of this study are made for the final layout and further recommendations and mitigation measures be suggested if necessary. 24. No turbines are to be located on Tafelkop or Spitskop. 25. If any of the old farm buildings are intended for demolition a qualified and experienced professional (historical archaeologist / historical architect) must be consulted along with heritage Western Cape or SAHRA. 26. Proposed access road upgrade affecting the rock shelter (BV_SA_RS1) and the stone packed dwelling (BV_SW15) in the Barendskloof valley to be	Impacts to heritage features avoided or managed as per specialist recommendations	• Final site layout. No monitoring required.	Holder of the EA	Prior to construction commencing

Planning and Design Phase								
#	Aspect	Objectives	Potential Impact	Mitigation measures	Outcomes	Indicator and monitoring	Responsibility	Timeframe
				diverted to between 20 m – 30 m either east or west of BV_SW15 owing to site being right next to the internal access road. 27. A 30 m buffer be established around the stone packed walling feature (BV_SW1) and clearly demarcated to avoid any damage by the construction camp activities and other possibly negative human impact.				
				28. Heritage report must be submitted to Heritage Western Cape (HWC), the heritage authority for any Western Cape developments, and as a commenting authority in terms of the National Heritage Resources Act 25 of 1999, Section 38. 29. Heritage report must be submitted to the South African Heritage Resources Agency (SAHRA) to comment on the portion of the proposed development that occurs within the Northern Cape Province. Nine proposed turbines are situated on the Farm Rietfontein 197 in the Karoo Hoogland Local Municipality, Namakwa District Municipality, Northern Cape Province. No archaeological or other heritage resources were documented within this area. No further studies or mitigation is required, unless the layout of these nine turbines and associated infrastructure and	Input obtained from heritage authorities	Comments obtained from HWC and SAHRA. No monitoring required.	EAP and Applicant	During the EIA process.

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
				access roads change.				
8			Social disruptions in terms of Noise and Shadow flicker	30. Undertake noise modelling to inform the final site layout once the turbine model is confirmed. 31. If the turbines are located within 800m of an existing occupied dwelling, mitigation measures will be required. 32. The final route selection of the power lines and location of the substation should be informed by current location of farm dwellings on the site and the findings of the other specialist studies. 33. The proposed establishment of suitably sited renewable energy facilities within the KHLM, LLM and WLM should be supported.	Social impacts in terms of noise and shadow flicker managed	Noise modelling undertaken	Holder of the EA	Once turbine model and optimised layout is confirmed
9	Social environment	Manage relationships with affected landowners and the community	Social impacts affecting landowners	34. The proponent should enter into an agreement with the landowners on whose property the WEF is located, whereby damages to farm property etc. during the construction phase that are proven to be associated with the construction activities for the WEF will be compensated for.	Clear communication channels established	• The agreement should be signed before the construction phase commence. No monitoring required.	Holder of the EA	Planning phase
10			Uninformed community or miscommunication resulting in social impacts	35. Establish a communication process. 36. Appointment of Community Liaison Officers to manage communication with the local community. 37. Develop a grievance policy (see Chapter 9).		Communication plan and grievance policy in place. Community Liaison Officer appointed.	Holder of the EA	Prior to commencement of construction
11		Promote fair employment	Unfair employment	***This section is a recommendation only. The IPP**	Fair employment practises in place	• Employment policy in place.	Holder of the EA	Prior to construction

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
		practices	practices resulting in social unrest and project disruption	***Procurement Program under the authority of the Department of Energy deals extensively with social aspects of a renewable energy development.*** 1. Without compromising construction and operation activities and schedules, local labour should be employed as far as possible. • Develop a training programme to ensure that those successful in obtaining employment will be provided with the appropriate skills development and training. • Develop an employment policy to be implemented by all Contractors.		No monitoring required.		and throughout the project lifecycle
12	Securing required services and preparing for site establishment	Manage the securing of services and site establishment	Mismanagement during the construction phase	38. All required permits and approvals specified in Section 2.2 obtained and copies thereof and this EMPr made available to all relevant Contractors.	Compliance to all legislative requirements	Copies of all approvals and permits available	Holder of the EA	Prior to commencement of construction
				39. Assign roles and responsibilities in line with this EMPr 40. The contractor shall submit to the Project Managers for review and to the ECO for approval, Method Statements and layout plans detailing the following:- 41. Site access (including entry and exit points). 42. Access and haulage routes in line with a transport management plan.	Site establishment undertaken in line with the requirement of the EMPr	Site layout plan and Method Statements reviewed by Project Manager and approved by ECO	Project Manager, ECO	At the conclusion of the design phase, prior to the construction phase commencing

Planning and Design Phase								
#	Aspect	Objectives	Potential Impact	Mitigation measures	Outcomes	Indicator and monitoring	Responsibility	Timeframe
				43. Location of eEquipment storage areas (including storage areas for hazardous substances such as fuel and chemicals). 44. Construction offices and other structures (accommodation for staff, where required and considered appropriate). The site offices should not be placed in close proximity to steep areas. Preferred locations would be flat areas within the proposed project area. 45. Areas where construction vehicles will be serviced. 46. Security requirements (including temporary and permanent fencing, and lighting) and accommodation areas for security staff. 47. Areas where vegetation will be cleared. 48. The locality as well as the layout of the temporary waste storage facilities for litter, kitchen refuse, sewage and workshop-derived effluents. Waste storage facilities for sewage, grey water and workshop-derived effluents, where no formal facilities exist. 49. Provision of potable water and temporary ablution facilities. 50. Potential pollution hazards and mechanisms to manage these. 51. Preconstruction environmental induction for all construction staff on site to ensure that				

Planning and Design Phase								
#	Aspect	Objectives	Potential Impact	Mitigation measures	Outcomes	Indicator and monitoring	Responsibility	Timeframe
				basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. 52. Particular reference in the site establishment plan shall be given to the management of sewage generated at the site offices, and on-site facilities for labour. Sanitary arrangements should be to the satisfaction of the ESO and/or ECO, the local authorities and all applicable legal requirements. 53. The necessary ablution facilities for all his employees. These must be easily accessible (within 500m of any point of work), transportable and there should be a minimum of 1 toilet per 10 persons. 54. Detailed, electronic colour photographs shall be taken of the proposed site before any clearing may commence. These records are to be kept by the Project Manager for consultation during rehabilitation of the site. 55. As far as possible construction activities should be kept to a minimum in terms of space and time.				

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
13			Human consumption water not available, hydrological disturbance	56. All required permits and approvals to be obtained to secure potable water for human consumption.	Potable water sourced in accordance with the requirements of the NWA	Water source secured	Project Manager	Prior to the construction phase commencing
14	Ecological	Manage the natural resources including fauna, flora and soil on site in order to sustain ecological activity on site as far as possible	Soil erosion, habitat loss, faunal disturbance and mortality, runaway fires	57. A large proportion of the impact of the development stems from the access roads and the number of roads should be reduced to the minimum possible and routes should also be adjusted to avoid areas of high sensitivity as far as possible, as informed by a preconstruction walk-though survey. 58. All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition. 59. An Open Space Management plan should be developed for the site, which should include management of biodiversity within the affected areas, as well as that in the adjacent rangeland. 60. Development on steep slopes should be avoided as much as possible and specific additional mitigation may be required	Open space management plan implemented; Pre-construction walk through conducted, sensitive areas demarcated; Erosion plan implemented and hydrological measures in place	• Entire site demarcated in terms of sensitivity; • Laydown areas determined and place in low sensitivity regions; • Once off monitoring by ECO prior to construction	PM, PC, ECO	Design phase

Planning and Design Phase								
#	Aspect	Objectives	Potential Impact	Mitigation measures	Outcomes	Indicator and monitoring	Responsibility	Timeframe
				where this cannot be avoided. 61. Development within the Very High Sensitivity areas should proceed with caution with specific attention to avoiding impact on plant species of conservation concern that may be present. 62. Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. 63. Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are be avoided where possible. 64. Although the current wetlands are impacted upon by the present farming activities, dams and roads, the project could improve the situation by placing the upgraded structures within the crossing that won't impede the flows. 65. It is also advised that an Environmental Control Officer, with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations				

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
				with regards to the re-vegetation of the newly completed / disturbed areas, using selected species detailed in this report. 66. Where new water course crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (reduce footprint as much as possible). 67. Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't from additional steps / barriers. 68. Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.				
15	Agricultural	Manage soil and water fertility, quality, quantity and future land use	Loss of soil fertility, erosion, water pollution	69. Appropriate stormwater structures must be designed and implemented. 70. All infrastructure situated on slopes must incorporate stormwater diversions. 71. Develop a Rehabilitation and Monitoring Plan to monitor stockpiles. 72. Avoid developing on high potential agricultural land (like	Appropriate stormwater structures incorporated in final design, Key sensitive areas avoided	• All stormwater options reviewed and appropriate options selected prior to construction, • Stockpile method statements received and approved prior to	PC, ECO	Design phase

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
				irrigated areas, croplands, etc.).If unavoidable, ensure that all development footprints are kept at a minimum.		construction; • Once off monitoring prior to construction by ECO		
16	Bats & Birds	Plan for minimal bird and bat fatalities from the facility		73. Adhere to the sensitivity map during turbine placement. Blasting should be minimised and used only when necessary. 74. Adhere to the sensitivity map. 75. Apply proposed mitigations to any further layout revisions, 76. Preferably attempt to avoid placement of turbines in Moderate sensitivity areas, where possible. 77. Powerlines should avoid the two identified avifauna high sensitivity areas as far as possible. 78. Where overhead 33kV powerlines are required, these should preferably not cross valleys and if they do so must have bird diverters at 5 m intervals along the line. 79. An environmental control	Turbine placement takes into account bat and bird sensitive areas	• Turbine placement takes into account bat sensitivities, • Once off monitoring prior to construction commencing	Holder of the EA	Design phase

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
				officer, with a brief that includes minimization of habitat destruction, should be appointed. 80. Blades higher off ground 81. Bury powerlines where possible. 82. Minimize powerline crossing of valleys				
17	Paleontological	Manage paleontological planning to reduce potential future harm to this resource	Irreparable loss to paleontological resources	83. The palaeontologist concerned with mitigation work will need a valid fossil collection permit from Heritage Western Cape (sites in the Western Cape) or SAHRA (sites in the Northern Cape) and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). 84. All palaeontological specialist work would have to conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2	Appropriate permits and qualifications obtained prior to work commencing, ECO appointed and briefed	• All necessary permits obtained prior to construction commencing.	Contractor, ECO	Design phase

Planning and Design Phase								
#	**Aspect**	**Objectives**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and monitoring**	**Responsibility**	**Timeframe**
				palaeontological studies developed by SAHRA (2013). 85. The Environmental Control Officer (ECO) responsible for the WEF development should be made aware of the potential occurrence of scientifically-important fossil remains within the development footprint.				
18	Visual	Reduce visual impact of project	Visual impact from proximity to turbines	86. Due to access road 1 having a smaller footprint and viewshed, it should be the preferred access road option. 87. Substation alternative 1 should be the preferred alternative due to it having the smallest viewshed. However, they are all four rated equally using the assessment methodology and therefore the other three locations can also be constructed if substation 1 is not technically feasible. 88. We recommend that if the turbine layout is adjusted and it is found that an occupied building is located within 800m of a wind turbine, then the potential for shadow flicker	Appropriate siting of turbines	Appropriate siting of turbines, Once off monitoring by ECO prior to construction commencing	Holder of the EA	Design phase

Planning and Design Phase								
#	Aspect	Objectives	Potential Impact	Mitigation measures	Outcomes	Indicator and monitoring	Responsibility	Timeframe
				should be assessed. A building should not be affected for more than 30 hours per year, or for longer than 30 minutes in a day (Parsons Brinckerhoff, 2011).				

4.2 Construction phase mitigation measures

Table 4-2. Construction phase mitigation measures

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
19	Environmental training and awareness	All staff to be aware of environmental requirements	Staff not fully aware of the EMPr requirements could result in avoidable impacts to the environment	89. The Contractor shall inform all staff of the need to be vigilant against any practice that will have a harmful effect on vegetation. This information shall form part of the Environmental Education Programme to be effected by the Contractor. 90. All staff shall attend environmental awareness training. 91. Proof of attendance for all staff members shall be submitted by the Contractor to the ESO. 92. Refresher courses for permanent staff members shall be attended on a regular basis as required by the ECO and Project Manager 93. All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.	All staff members are aware of the EMPr requirements relevant to them	Attendance registers	Contractor	All staff to attend once session of environmental awareness training before accessing the site
20	Habitat clearance	Manage impacts to fauna and flora	Loss of sensitive vegetation, loss of SCC, Erosion impacts, Hydrological disturbance	94. The natural vegetation encountered on the site is to be left as intact as far as possible. 95. Keep removal of vegetation to a minimum. 96. Vegetation to be cleared on a needs basis to avoid large tracks of land laying bare for long periods of time 97. All no-go areas as indicated in the sensitivity map included in	Impacts managed according to the recommendations of this EMPr	Habitat clearances monitored by the ESO where required	Contractor, ESO	At onset of construction phase and for the remainder of the phase

Construction Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and responsibility	Responsibility	Timeframe
				the previous chapters, must be avoided, demarcated if works are proposed in close proximity. 98. Ongoing re-vegetation of disturbed areas no longer used must be undertaken with indigenous species and in accordance with the instructions issued by the ECO. 99. An approved Method Statement shall be in place prior to clearing the natural vegetation and soil. The plan shall contain a photographic record of the areas to be disturbed. 100. The contractor shall be responsible for the re-establishment of vegetation all areas disturbed during construction, operation and decommissioning phases. 101. Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development. 102. The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone expect landowners with the appropriate permits where required. 103. A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.				

Construction Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and responsibility	Responsibility	Timeframe
				104. A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover. 105. All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow. 106. All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares. Speed limits should apply within the facility as well as on the public gravel access roads to the site. 107. All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. 108. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 109. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to				

Construction Phase								
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				the nature of the spill. 110. All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 111. All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. 112. Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. 113. Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. 114. Avoid impact to potential corridors such as the riparian corridors associated with the larger drainage lines within the facility area. 115. Demarcate all areas to be cleared with construction tape or similar material. However caution should be exercised to avoid using material that might entangle fauna. 116. Disturbance near to drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas.				

Construction Phase								
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				117. During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. 118. Dust suppression and erosion management should be an integrated component of the construction approach. 119. Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible. 120. Erosion management at the site should take place according to the Erosion and Rehabilitation Plan. 121. If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs), which do not attract insects and which should be directed downwards. 122. If parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside. 123. No dogs or cats should be				

Construction Phase								
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				allowed on site apart from that of the landowners. 124. No fires should be allowed within the site as there is a risk of runaway veld fires. 125. No fuelwood collection should be allowed on-site. 126. No unauthorized persons should be allowed onto the site and site access should be strictly controlled and vehicles which need to roam around the site should be accompanied by the ECO or security personnel. 127. Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season. 128. The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site. 129. Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 130. Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as Prosopis are already present in the area				

Construction Phase								
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				and are likely to increase rapidly if not controlled. 131. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible. 132. Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems. 133. Regular monitoring for erosion problems along the access roads and other cleared areas. 134. Runoff management and erosion control should be integrated into the project design.				
21	Alien invasive species		Establishment of alien invasive species	135. Any proclaimed weed or alien species that germinates during the contract period shall be managed according to the invasive species management plan (see Chapter 5). 136. A strict monitoring plan must be implemented to prevent the additional spread and the continued removal of alien species, which were already present on site or that become established on areas that were disturbed during construction.		Regular monitoring by the ESO		
22	Construction activities disturbing fauna		Impacts and or loss of sensitive fauna, loss of SCC.	137. During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible. Only necessary damage may be caused and, for example, unnecessary driving around in the veld or		• All permits obtained prior to construction commencing; • Monitoring weekly by the	ESO	During the construction phase

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				bulldozing natural habitat outside of the development footprint are not allowed. 138. Construction activities must remain within defined construction areas. No construction / disturbance will occur outside these areas. 139. The extent of lay down areas must be minimised. 140. If any fencing is to be done; the fences should have enough space between wires for small animals to freely move underneath them. 141. Where applicable, the necessary permits will be applied for and obtained prior to removing any animals listed in the relevant schedules promulgated in terms of any relevant legislation. 142. The trapping of any animal is strictly prohibited. Any animal killed as a result of trapping or hunting or found in the possession of an employee of the Contractor will be subject to corrective action described in Section 3.3.7. 143. No domestic pets or livestock will be permitted on site during the construction period. 144. Any potentially dangerous fauna such snakes or fauna threatened by any project activities should be removed to a safe location.		ESO.		
23	Solid and liquid waste	Manage waste safely and in an environmentally friendly	Hazardous substance leakage, environmental contamination,	145. The Contractor's intended methods for waste management and waste minimisation must be implemented at the outset of the contract, and approved by the ECO.	All waste managed according to approved Method Statement	• Method Statement for waste management approved	Contractor	At the onset and throughout the construction phase

Construction Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and responsibility	Responsibility	Timeframe
		manner	health and safety implications	146. All personnel shall be instructed to dispose of all waste in the proper manner. Contractors must also provide disposal records to prove that waste was not just dumped somewhere. These disposal certificates must be kept on file by the ESO. 147. No waste from construction or otherwise, may be disposed of or burned on site. 148. Hazardous waste must be managed as per the Hazardous substances plan below (Chapter 8). 149. All waste generated on site, must be removed from the site and disposed of at a licensed waste disposal site. In this regard, adequate litter drums or other suitable containers must be located on site to ensure that waste generated on site is disposed of in suitable and timeous manner. 150. Where possible, some of the construction waste should be recycled. 151. Solid waste shall be stored in a designated area within the site area in covered, tip proof drums for collection and final disposal or recycling. 152. All refuse containers must be free of any holes and in good condition. A refuse control system shall be established for the collection and removal of refuse to the satisfaction of the ESO and/or ECO. 153. As far as possible, general waste (including paper, glass, plastics, aluminium, etc.) shall be				

Construction Phase								
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				sorted for recycling. 154. Any water contaminated by cement shall not be allowed to flow freely into the environment. Instead, it must be contained and solids allowed to settle out. Thereafter, the solid material shall be disposed of to a landfill site with other solid waste. 155. Hazardous waste such as bitumen, oils, oily rags, paint tins, chemicals etc. shall be disposed of at a registered hazardous landfill site. Special care should be taken to avoid spillage of hazardous waste from entering the ground or contaminating water. In the event of the above occurring, the affected areas shall be promptly cleaned to the satisfaction of the ESO/ ECO. Spill kits to be kept onsite. 156. In the event of a substantial spill, the ECO and Project Manager shall be notified immediately to provide input as required to the corrective action. 157. As far as possible, maintenance of machinery and vehicles on site should be avoided. Used oil, lubricants and cleaning materials from the maintenance of vehicles and machinery should be collected in a holding tank and returned to the supplier. 158. The Contractor shall ensure that an emergency preparedness plan is in place for implementation in the case of a spill or substances which can be harmful to an individual or the receiving environment. 159. All used filter materials should				

Construction Phase								
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				be stored in a secure bin for disposal off site. Hazardous waste shall not be stored or stockpiled in any area other than that designated on the construction site layout. 160. Any contaminated soil should be removed and replaced. Soils contaminated by oils and lubricants should be collected and disposed of at a facility registered to accept contaminated materials. 161. Washing of vehicles on the construction site should not be permitted as this is likely to result in release of hydrocarbon-contaminated wash water into the environment. 162. Storage areas must be located more than 50 m away from the watercourse.				
24	Litter		Environmental contamination from litter	1. No littering by construction workers must be allowed. 2. During the construction period, the facilities shall be maintained in a neat and tidy condition, and the site is to be kept free of litter. Fines shall be implemented for persons found littering. 3. Clean-ups shall be undertaken if required 4. Measures shall be taken by the Contractor to reduce the potential for litter and negligent behaviour with regard to the disposal of all refuse. 5. At all places of work, the Contractor shall provide litter collection facilities for later safe disposal at registered waste disposal site.		• • Monitoring reports from ESO to report on litter	Contractor,ESO , ECO	Monthly monitoring reports throughout the construction phase
25	Safety	Ensure that all	Wildfire spread,	6. No open fires should be	No unauthorised	• No incidences	ESO and	Throughout the

Construction Phase								
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		staff adhere to safety measures	vegetation and faunal damage and mortality; health incidents; OHSA implications	permitted on the site. 7. Where fires are unavoidable, the Contractor shall ensure the management of fires emanating from construction camps and that education of the work force concerning management of fires is undertaken. 8. The Contractor shall ensure that camp fires at construction sites are strictly controlled to ensure that no veld fires are caused. This is especially important where fires may affect sensitive habitats. 9. Fires shall only be allowed in facilities or equipment specially constructed for this purpose and these must be located in areas that are sheltered from the prevailing winds. 10. No smoking outside of designated smoking areas 11. Firefighting equipment must be present on site at all times. 12. A firebreak shall be cleared and maintained around the perimeter of the camp and office sites at all times. The location of this firebreak shall be decided with input from a local botanist and the ECO. 13. If parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive	open fires on site	to report on in the monthly ESO report	Contractor	construction phase

Construction Phase								
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				behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside. 14. Ensure that all personnel are aware of the fire risk and the need to extinguish cigarettes before disposal, in appropriate waste disposal container. 15. The risk of fire is highest in the late summer and autumn months, during high wind velocities and dry periods. To avoid and manage fire risk the following steps should be implemented: 16. Have on site fire-fighting equipment and ensure that all personnel are educated how to use it and procedures to be followed in the event of a fire. 17. Identify the relevant authorities and structures responsible for fighting fires in the area and shall liaise with them regarding procedures should a fire commence. 18. Ensure that all the necessary telephone numbers etc. are posted at conspicuous and relevant locations in the event of an emergency. 19. Should a contractor be found responsible for the outbreak of a fire, he shall be liable for any associated costs. 20. No open fires shall be allowed on site for the purpose of cooking or warmth. Bona fide braai fires (such braai fires shall				

Construction Phase								
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				be limited to the traditional "month end" braais and not individual daily cooking fires) may be lit within the construction camp or site. 21. The Contractor shall take all reasonable steps to prevent the accidental occurrence or spread of fire. 22. The Contractor shall appoint a fire officer who shall be responsible for ensuring immediate and appropriate action in the event of a fire. 23. The Contractor shall ensure that all site personnel are aware of the procedure to be followed in the event of a fire. The appointed fire officer shall notify the Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his / her control. 24. The Contractor shall ensure that there is basic fire-fighting equipment on site at all times. This equipment shall include fire extinguishers and beaters. The Contractor shall pay the costs incurred by organisations called to put out fires started by himself/herself, his/her staff or any sub-contractor. The Contractor shall also pay the costs incurred to reinstate burnt areas as deemed necessary by the PM. 25. Any work that requires the use of fire may only take place at that designated area and as approved by the PM. Fire-				

Construction Phase								
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				fighting equipment shall be available in these areas. 26. The Contractor shall ensure that the telephone number of the local Fire and Emergency Service are displayed at the site offices. 27. The Independent Contractor is to ascertain the fire requirements and shall submit a fire contingency plan Method Statement to the PM and ECO.				
26	Topsoil	Manage soil to conserve fertile topsoil removed during construction for reuse during the rehabilitation phase	Topsoil will be required during the rehabilitation phase. By storing topsoil removed during the construction phase for reuse will eliminate the need to import topsoil material which could contain invasive plant seeds.	28. Topsoil shall be removed from all areas where physical disturbance of the surface would occur and shall be stored and adequately protected. 29. Topsoil is considered to be the natural soil covering, and to include all organic matter. Depth may vary at each site, and must be determined on a site-specific basis and removed accordingly. The areas to be cleared of topsoil shall include the storage areas and site camps. 30. All topsoil stockpiles and windrows shall be maintained throughout the contract period in a weed-free condition. Weeds (only) appearing on the stockpiled topsoil shall be removed by hand and disposed of appropriately. The topsoil stockpiles shall be stored, shaped and sited in such a way that they do not interfere with the flow of water such that damming or erosion is caused, or itself be eroded through the action of water.	Topsoil and subsoil stockpiled and maintained weed-free	• Erosion protection in place for exposed stockpiles, using either natural vegetation growth (not weeds), or cloth sheeting; • ESO monitoring weekly	Contractor and ESO	At the onset and throughout the construction phase

Construction Phase								
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				31. Stockpiles of topsoil shall not exceed a height that is unstable, and if they are to be left for longer than 6 months shall be analysed and, if necessary, nutrient levels replenished before replacement. 32. The Contractor shall ensure that minimal amounts of topsoil are lost due to erosion, either by wind or water. This can be facilitated through the grassing of topsoil stockpiles. Areas to be top-soiled and grassed shall be done so systematically to allow for quick cover and reduction in the chance of heavy topsoil losses due to unusual weather patterns.				
27	Surface water features	Manage impacts to surface water features	Hydrological disturbance; environmental contamination	33. The quality, quantity and flow direction of any surface water runoff shall be established prior to disturbing any area for construction purposes. Cognisance shall be taken of these aspects and incorporated into the planning of all construction activities. 34. Before a site is developed or expanded, the effect on the drainage pattern as a result of this development or expansion shall be established. 35. Recognised water users/receivers must not be adversely affected by the expansion or re-development. 36. No water source shall be polluted in any way due to proposed changes. 37. Streams, rivers, pans, wetlands,	Impacts to surface water features minimised	• Method Statements approved. • All required water rights obtained prior to commencement of construction • No water pollution from construction activities, as determined by ECO; • Weekly monitoring by ESO	Project Manager, Contractor, ESO and ECO	At the onset and throughout the construction phase, as well as the operation phase. Rehabilitation in closure phase

Construction Phase								
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				dams, and their catchments shall be protected from erosion, direct or indirect spillage of pollutants such as refuse, garbage, cement, concrete, sewage, chemicals, fuels, oils, aggregate, tailings, wash water, organic materials and bituminous products. 38. The Contractor shall submit in writing to the Project Manager and ECO his proposals for prevention, containment and rehabilitation measures against environmental damage of the identified water and drainage systems that occur on the site. Consideration shall be given to the placement of sedimentation ponds or barriers where the soils are of a dispersive nature, or where toxic fluids are used in the construction process. The sedimentation ponds must be large enough to contain runoff such that they function correctly under heavy rain conditions. 39. Measures shall be put in place to protect the hill slopes on site against erosion as a precaution in areas affected by the exposing of unconsolidated soils during construction of the wind energy facility. 40. Storage containers must be regularly inspected so as to prevent leaks. 41. Weather forecasts from the South African Weather Bureau of up to 7 days in advance must be monitored on a weekly basis to avoid exposing soil or building				

Construction Phase								
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				works or materials during a storm event and appropriate action must be taken in advance to protect construction works should a storm event be forecasted. 42. All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more than 50m from any demarcated water courses. 43. All solid waste collected must be disposed of at a registered waste disposal site. A certificate of disposal must be obtained and kept on file. The disposal of waste must be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site. 44. All stored fuels to be maintained within a bund and on a sealed surface. 45. An incident/complaints register must be established and maintained on-site.				

Construction Phase								
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				46. Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility. 47. Any excavation, including those for cables, must be supervised by the ECO. Disturbance of vegetation and topsoil must be kept to a practical minimum. 48. Any spills must receive the necessary clean-up action. If required, bioremediation kits are to be kept on-site and used to remediate any spills that may occur. Appropriate arrangements to be made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils (in accordance with a waste management plan). 49. Any storage and disposal permits/approvals which may be required will be obtained, and the conditions attached to such permits and approvals must be complied with. 50. Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility. 51. Construction contractors must provide specific detailed waste management plans to deal with all waste streams. 52. Construction equipment must be refuelled within designated refuelling locations, or where				

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				remote refuelling is required, appropriate drip trays must be utilised. 53. Construction machinery must be stored in an appropriately sealed area. 54. Corrective action must be undertaken immediately if a complaint is received, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures. 55. Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors. 56. Documentation (waste manifest) must be maintained detailing the quantity, nature and fate of any hazardous waste. 57. Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function. 58. Hazardous and non-hazardous waste must be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered. 59. Hydrocarbon waste must be contained and stored in sealed containers within an				

Construction Phase								
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				appropriately bunded area. 60. Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling) 61. Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region 62. In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents. 63. Install properly sized culverts with erosion protection measures at the present road / track crossings 64. Manage grazing or exclude livestock from watercourses that are showing signs or erosion or bank instability. 65. Oily water from bunds at the substation must be removed from site by licensed contractors. 66. Routine servicing and maintenance of vehicles is not to take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be				

Construction Phase								
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				used to contain any fuel or oils. 67. Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap) and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control. 68. Spilled cement or concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site. 69. Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 50 m away from water courses. Limit the height of stockpiles as far as possible in order to reduce compaction. 70. Storage areas must be located more than 50 m away from the watercourse. 71. Strict control over the behaviour of construction workers. 72. Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.). 73. Strict management of potential				

Construction Phase								
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				sources of pollution. 74. Strict use and management of all hazardous materials used on site. 75. Supply waste collection bins at construction equipment and construction crew camps. 76. The storage of flammable and combustible liquids such as oils must be in designated areas which are appropriately bunded, and stored in compliance with MSDS files, as defined by the SHE Representative / ECO. 77. Transport of all hazardous substances must be in accordance with the relevant legislation and regulations. 78. Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. 79. • Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal. 80. • Waste disposal records must be available for review at any time. 81. • Where possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site				

Construction Phase								
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				for collection, separation and storage of waste streams (such as wood, metals, general refuse etc).				
28	Excavation, hauling and placement	Manage erosion potential from excavations, spoil sites and stockpiles	Vegetation impacts and harm, hydrological disturbance, erosion increase	82. The contractor shall provide the Project Manager and ECO with detailed plans of his intended construction processes prior to starting any excavations. 83. The plans shall detail the number of personnel and plant to be used and the measures by which the impacts of pollution (noise, dust, litter, fuel, oil, sewage), erosion, vegetation destruction and deformation of landscape will be prevented, contained and rehabilitated. Particular attention shall also be given to the impact that such activities will have on the adjacent built environment, including nearby houses. 84. The contractor shall demonstrate his "good housekeeping", particularly with respect to closure at the end of every day so that the site is left in a safe condition from rainfall overnight or over periods when there is no construction activity.	Construction Method Statements received and approved prior to construction commencing and adhered to	• Excavation Method Statements approved prior to excavation commencing; • Once off monitoring by ESO	Contractor, ESO, Project Manager and ECO	At the onset and throughout the construction phase;
29	Spoil sites		Hydrological disturbance; environmental contamination; soil erosion	85. The Contractor shall be responsible for the safe siting, operation, maintenance and closure of any spoil site he uses during the contract period, including the defects notification period. This shall include existing spoil sites that are being re-entered. Before spoil sites may be used, proposals for their locality, intended method of		• Zero spoil sites within 500m of drainage channels or water features for construction phase; • Monthly ECO monitoring	Contractor, ESO, Project Manager and ECO	At the onset and throughout the construction phase;

Construction Phase								
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				operation, maintenance and rehabilitation shall be given to the Project Manager for review and ECO for approval. 86. No spoil site shall be located within 500m of any watercourse. A photographic record shall be kept of all spoil sites for monitoring purposes. This includes before the site is used and after revegetation. 87. The use of approved spoil sites for the disposal of hazardous or toxic wastes shall be prohibited. The same shall apply for the disposal of solid waste generated from the various camp establishments. 88. Ideally, the storage of excavated material on site should be minimised to avoid unnecessary impacts to the local environment. As soon as practical after excavation, if not simultaneously, all excavated material that is not required for construction or rehabilitation shall be removed from the site for disposal at an appropriate location. This location must be agreed between the Holder of the EA, Project Manager and local municipal officials prior to initiation of excavation.				
30	Stockpiles		Hydrological disturbance ; environmental contamination ; soil erosion	89. The Contractor shall plan his activities so that excavated materials, in so far as possible, can be transported direct to and placed at the point where it is to be used. However, should temporary stockpiling become necessary, the areas for the		• Zero hydrological incidents from stockpiles sites within 500m of drainage channels or water features for	Contractor, ESO, Project Manager and ECO	At the onset and throughout the construction phase; rehabilitation at closure phase

Construction Phase								
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				stockpiling of excavated and imported material shall be indicated and demarcated on the site plan submitted in writing to the Project Manager and ECO for their approval, together with the Contractor's proposed measures for prevention, containment and rehabilitation against environmental damage. Care shall be taken to preserve all vegetation in the immediate area of these temporary stockpiles. During the life of the stockpiles the contractor shall at all times ensure that they are: 90. Positioned and sloped to create the least visual impact; 91. Constructed and maintained so as to avoid erosion of the material, generation of dust and contamination of surrounding environment; and 92. Kept free from all alien/undesirable vegetation.		construction phase; • Monthly ECO monitoring		
31	Blasting	Reduce blasting risk and faunal disturbance	Health and safety considerations; faunal impacts	93. Wherever blasting activity is required on the site the contractor shall rigorously adhere to the relevant statutes and regulations that control the use of explosives. In addition, the contractor shall, prior to any drilling of holes in preparation for blasting, supply a locality plan of the blast site on which shall be shown the zones of influence of the ground and air shock-waves and expected limits of fly-rock to the Project Manager for review and ECO for approval. 94. The plan shall show each	Blasting Method Statement submitted and approved prior to blasting commencing	• Blasting plan submitted and approved prior to blasting commencing; once-off monitoring ECO	Project Manager, ECO and Contractor	At the onset and throughout the construction phase;

Construction Phase								
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				dwelling, structure and service within the zones of influence and record all details of the dwellings/structures/services including existing positions, lengths and widths of cracks, as well as the condition of doors, windows, roofing, wells, boreholes etc. The contractor, alone, shall be responsible for any costs that can be attributed to blasting activities, including the collection of fly-rock from adjacent lands and fields. The submission of such a plan shall not in any way absolve the contractor from his responsibilities in this regard, but to ensure due regard was applied satisfactorily prior to blasting commencing. 95. The Contractor shall also indicate to the Project Manager the manner in which he intends to advertise to the adjacent communities and/or road users the times and delays to be expected for each individual blast. The Contractor shall be responsible for obtaining all necessary permits required for blasting activities.				
32	Batching	Reduce pollution risk from batching	Health and safety considerations; faunal impacts; environmental contamination; hydrological disturbance	96. Asphalt plants are considered scheduled processes listed in the second schedule to the Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965). Should the use of an asphalt plant be considered on site, the contractor shall be responsible to obtain the necessary permit from the DEA,	Batching plant managed according to approved Method Statement	• No environmental incidents ; appropriate batching plant siting ; Blasting plan received and approved prior to activities commencing;	Project Manager, ECO and Contractor	At the onset and throughout the construction phase; rehabilitation once material sources are closed (rehabilitation phases)

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				regardless of where they are sited. 97. Crushing plants and concrete batching plants shall be subject to the requirements of the applicable industrial legislation that governs gas and dust emissions into the atmosphere. Such sites will be the subject of regular inspections by the ECO and relative authorities during the life of the project. The Contractor shall provide plans that take into account such additional measures as concrete floors, bunded storage facilities and linings to drainage channels. All sites shall adhere to the following requirements: 98. The batching activity shall be located in an area of low environmental sensitivity to be identified and approved by the ECO. 99. No batching activities shall occur on unprotected substratum of any kind (i.e. directly on the ground). 100. All wastewater and runoff from batching areas shall be strictly controlled, and cement-contaminated water shall be collected, stored and disposed of at a site approved by the ECO. Mixing trays shall be used at all mixing and supply points. 101. Contaminated water shall be disposed of at a waste disposal site approved by the ECO. 102. Effluent from concrete batch plants and crusher plants should		monthly inspection ECO		

Construction Phase								
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				be treated in a suitable designated sedimentation dam to the legally required standards to prevent surface and groundwater pollution. The designs of such a facility should be submitted to the ECO for approval. 103. Contaminated water storage facilities shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented. 104. Unused cement bags are to be stored so as not to be affected by rain or runoff events. 105. Used bags shall be disposed of by the Contractor in the appropriate manner. 106. Care shall be taken to collect contaminated wash-water resulting from cleaning activities of equipment and flushing of mixers, and dispose of it in a manner approved by the ECO. 107. Suitable screening and containment shall be in place to prevent wind-blown contamination associated with bulk cement silos, loading and batching. 108. All visible remains of excess concrete shall be physically removed on completion of the plaster or concrete pour section and disposed of. All excess aggregate shall also be removed. 109. Ultimate approval of these measures shall be from the relevant national authority, as				

Construction Phase								
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				shall approval of closure. The Project Manager will assist the contractor in his submissions to the relevant authority.				
33	Spillages	Avoid or reduce site contamination	Hydrological disturbance ; environmental contamination ; soil erosion	110. Streams, rivers and dams shall be protected from direct or indirect spillage of pollutants such as refuse, garbage, cement, concrete, sewage, chemicals, fuels, oils, aggregate, tailings, wash water, organic materials and tar or bituminous products. In the event of a spillage, the contractor shall be liable to arrange for professional service providers to clear the affected area. 111. Responsibility for spill treatment lies with the contractor. The individual responsible for, or who discovers a hazardous waste spill must report the incident to his/her ESO, ECO or to the Project Manager. 112. The ESO will assess the situation in consultation with the Project Manager and act as required. In all cases, the immediate response shall be to contain the spill. The exact treatment of polluted soil / water shall be determined by the contractor in consultation with the ESO, ECO and the Project Manager. Areas cleared of hazardous waste shall be re-vegetated according to the Project Manager's instructions 113. Should water downstream of the spill be polluted, and fauna and flora show signs of deterioration or death, specialist hydrological	All hazardous substances managed according to approved Method Statement	• Zero contamination of wetlands, streams or drainage channels of any pollutant throughout construction phase; Weekly ESO inspection	ESO, Contractor	Throughout all project phases

Construction Phase								
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				or ecological advice will be sought for appropriate treatment and remedial procedures to be followed. The requirement for such input shall be agreed with the Project Manager. The costs of containment and rehabilitation shall be for the contractor's account, including the costs of specialist input.				
34	Dust	Reduce dust liberation through pro-active management and planning	Floral and faunal impacts ; Health and safety implications impact on SKA, SAAO and SALT	114. Appropriate dust-suppression techniques as approved by the Project Manager and ECO shall be implemented on all exposed surfaces during periods of high wind. Such measures shall include; wet suppression, chemical stabilisation, use of wind fence covering surfaces with straw or chippings, and the re-vegetation of open areas. 115. Water used for dust suppression must be applied in quantities small enough not to generate run-off and result in soil erosion. 116. Mitigation actions such as the reduction of vehicle speed and proper signage shall also be implemented. 117. Blasting must be restricted to periods of calm wind conditions to minimise the potential for dust dispersion. 118. Vegetation cover should be maintained and vegetation cover only removed until such time as soil stripping is required. 119. Exposed soil that has the potential for generating dust shall be re-vegetated or stabilised as soon as possible	All approved Method Statements for vegetation clearing approved and adhered to	• Less than 2 dust nuisance complaints per week; • Weekly ESO monitoring; monthly ECO monitoring	Contractor, ESO and ECO	Throughout all project phases

Construction Phase								
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				after construction work is completed, or kept damp until re-vegetation occurs. 120. Excavation, handling and transport of topsoil and spoil shall be avoided during periods of excessive wind as far as possible. 121. Adequate water carts shall be available on site to meet demands throughout the duration of the contract. 122. The Contractor shall ensure that loose building materials and excavated material stockpiles are adequately protected against the wind by a covering of some description, such as canvas. 123. Stockpiles may also be dampened to minimise dust generation. 124. Construction vehicles and machinery will be serviced on a monthly basis, with a major service every six months. 125. Construction vehicles and machinery shall be inspected for excessive emissions.				
35	Archaeological, heritage and palaeontological sites	Promote conservation of heritage resources on-site	Loss of irreplaceable heritage features	126. If an artefact on site is uncovered, work in the immediate vicinity shall be stopped immediately. The contractor shall take reasonable precautions to prevent any person from removing or damaging any such article and shall immediately upon discovery thereof inform the Project Manager of such discovery. 127. The South African Heritage	Impacts to heritage resources managed and avoided as far as possible	• Zero damage to heritage resources throughout construction phase; • Monthly ECO monitoring; Contractor to provide a Method Statement of any work undertaken in close proximity	All parties, including construction crew and subcontractors	Throughout all project phases

Construction Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and responsibility	Responsibility	Timeframe
				Resources Agency (SAHRA) or Heritage Western Cape (HWC) shall be contacted and they will appoint an archaeological consultant to record the site and excavate if necessary. Work may only resume once clearance is given in writing by the archaeologist. 128. No development should occur within 20 m – 30 m of these features (Stone Walling Features (BV_SW1 - BV_SW17) and associated Historical Artefact Scatters (BV_Hist1 – BV_Hist3). The features should be clearly demarcated before any development activities begin to avoid any negative impact. The layout of any infrastructure should be reconsidered to preserve these heritage resources. 129. The graveyard is already fenced off, however, the area should be clearly demarcated and the upgrade of the road be to the west or the road be diverted further away to avoid any possible negative impact to the graveyard.(Graves (formal and informal burials) (HV_G1 – BV_G2)) 130. No turbines are to be located on Tafelkop or Spitskop. 131. During the construction phase all major clearance operations (e.g. for new access roads, turbine placements) and deeper (> 1 m) excavations should be monitored for fossil remains on an on-going		to a heritage resource		

Construction Phase								
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				basis by the ECO 132. Should substantial fossil remains - such as vertebrate bones and teeth, or petrified logs of fossil wood - be encountered at surface or exposed during construction, the ECO should safeguard these, preferably in situ. They should then alert the relevant provincial heritage management authority as soon as possible - i.e. Heritage Western Cape for the Western Cape (Contact details: Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 086-142 142. Fax: 021-483 9842. Email: hwc@pgwc.gov.za) and SAHRA for the Northern Cape (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za). 133. The occurrence of very rare tetrapod burrows and associated skeletal remains within the Abrahamskraal Formation along the Kabeltou Pass (Muishond Rivier 161) represents a highly sensitive area (outlined in green in Fig. 2 in the Paleontological Impact Assessment report), which lies within the Western				

Construction Phase								
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				Cape and outside the WEF development footprint, should not be disturbed.				
36	Fossil site		Heritage impacts	134. Specialist palaeontological mitigation for this project is not deemed necessary or recommended. In the unlikely event of a fossil discovery the chance find procedure as detailed above must be implemented and the appropriate provincial authority notified.		• Zero damage to fossil resources throughout construction phase; • Monthly ECO monitoring	All parties, including construction crew and subcontractors	Throughout all project phases
37	Graves and middens		Graves disturbed which could result in social impacts	135. If a grave or midden is uncovered on site, or discovered before the commencement of work, then all work in the immediate vicinity of the graves/middens shall be stopped and the Project Manager informed of the discovery. The Project Manager shall contact the ECO and HWC or SAHRA to determine the way forward.	Minimal damage to graves	• Zero damage to graves and middens throughout construction phase; • Monthly ECO monitoring	All parties, including construction crew and subcontractors	Throughout all project phases
38	Erosion and agricultural	Reduce erosion potential on site	Erosion increase	The following areas should also be regarded as being of high erosion risk: 136. Slopes > 20 degrees 137. Slopes with convergent sub-surface drainage (percolines). 138. Road culverts. 139. Cut and fill slopes in areas of slope instability or erodable geology. 140. The removal of the natural vegetation cover must be avoided and where this cannot be done, minimised. 141. Agricultural drainage methods must be used in fill materials to	Erosion minimised and due care illustrated throughout project life cycle	• All mitigation measures are to be implemented strictly and as far as possible; • Efforts of implementation of these measures must be indicated; • Weekly monitoring ESO unless a strong rainfall event occur. Should this happen, the	Contractor, ESO and ECO	Throughout all project phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				remove water that could trigger slumping. 142. Perched water tables must be identified early and adequate drainage for these trigger-points provided. 143. The disturbance of the natural soil structure must be prevented and excavations planned carefully. 144. The moving of heavy machinery into areas unnecessarily must be avoided. 145. All fill material must be very well compacted and innovative use of geo-textile materials in the retention of soil fill areas made. 146. Rainwater runoff from cut slopes must be prevented as far as possible. 147. Sufficient storm water take off points must be created in such a way that water does not have an opportunity to gather momentum. 148. Storm water ditches must contain structures that will reduce velocity of the run off. 149. The use of vegetated swales must be investigated in less steep areas. 150. Particular care must also be taken to ensure that no existing infrastructure such as water and sewerage reticulation lines is damaged during construction activities. 151. Machinery must be properly maintained to keep oil leaks in		ECO should monitor thereafter as soon as possible.		

Construction Phase								
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				check. 152. If a spill occurs on a permeable surface (e.g. Soil), a spill kit must be used to immediately reduce the potential spread of the spill. 153. If a spill occurs on an impermeable surface such as cement or concrete, the surface spill must be contained using oil absorbent materials. 154. Contaminated remediation materials must be carefully removed from the area of the spill so as to prevent further release of hazardous chemicals to the environment, and stored in adequate containers until appropriate disposal in a licenced landfill site. 155. Ensure that all personnel are aware of the fire risk and the need to extinguish cigarettes before disposal, in appropriate waste disposal containers. 156. Smoking will only be allowed in demarcated areas with easy access to firefighting equipment. 157. Welding and other construction activities requiring open flames shall be done in a designated area containing firefighting equipment. 158. The risk of fire is highest in the late summer and autumn months, during high wind velocities and dry periods. To avoid and manage fire risk the following steps should be implemented: 159. Have on site fire-fighting				

Construction Phase								
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				equipment and ensure that all personnel are educated how to use it and procedures to be followed in the event of a fire. 160. Identify the relevant authorities and structures responsible for fighting fires in the area and shall liaise with them regarding procedures should a fire commence. 161. Ensure that all the necessary telephone numbers (including local Farmers Association Fire Marshall) to use in a case of an emergency are displayed at conspicuous and relevant locations. 162. No open fires shall be allowed on site for the purpose of cooking or warmth. Cooking fires must only be lit in designated cooking areas. 163. The contractor shall take all reasonable steps to prevent the accidental occurrence or spread of fire. 164. The contractor shall appoint a fire officer who shall be responsible for ensuring immediate and appropriate action in the event of a fire. 165. The contractor shall ensure that all site personnel are aware of the procedure to be followed in the event of a fire. The appointed fire officer shall notify the Fire and Emergency Services in the event of a fire and shall not delay doing so until such time as the fire is beyond his / her control. 166. The contractor shall ensure that				

Construction Phase								
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				there is basic fire-fighting equipment on site at all times. This equipment shall include fire extinguishers and beaters. 167. Any work that requires the use of fire may only take place within designated areas. Fire-fighting equipment shall be available in these areas. 168. Develop and implement a Rehabilitation and Monitoring Plan to monitor rehabilitated areas. 169. Ensure that topsoil does not get buried by subsoil during stockpiling. Failure to comply may result in topsoil sterilisation. 170. mplement measures such as wind-breaks, swales and watering as required aiding the initial grown of primary vegetation. 171. Fertile topsoil must not be stockpiled for periods exceeding 12 months or exceeding 2m in height to avoid topsoil sterilization. If unavoidable, the appointed ECO must monitor topsoil stockpile fertility to avoid sterility of soils. 172. Topsoil may be supplemented with an indigenous seed mix. 173. The upper 15-20 cm of top soil must be stripped and stockpiled as topsoil where possible. It should be retained for re-spreading over disturbed surfaces during rehabilitation. 174. All other soil excavated will be stockpiled separately from				

Construction Phase								
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				topsoil as subsoil. 175. Ensure that topsoil does not get buried by subsoil during backfilling. Failure to comply may result in topsoil sterilisation. 176. An ECO must monitor all excavations to ensure backfilling with subsoil first and then topsoil afterwards takes place. 177. An ECO must monitor depth and cover of topsoil spreading during rehabilitation to ensure a 20cm depth in valleys. Rocky areas do not require topsoil but must be monitored by the ECO during rehabilitation. 178. Topsoil allocated for rehabilitation must not be mixed with other materials, such as building rubble, rock, subsoil, etc. 179. Topsoil stockpiles are to be handled only twice – once during clearing and stockpiling and once during rehabilitation/backfilling unless input is required as advised by the ECO. 180. Construction activities must only occur within the demarcated construction footprint. 181. The construction footprint must be approved by the landowner/occupier prior to commencement of construction activities. 182. All run-off water from hard surface areas (e.g. roads, hardstands etc.) and construction impacted areas				

Construction Phase								
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				must be collected, channelled and disposed of in an appropriate manner. 183. Anti-erosion features must be installed where required. 184. Ensure that all cleared and impacted land is rehabilitated and re-vegetated.				
39	Birds	Reduce bird impacts from the construction activities	Clearance of vegetation, impacts birds through elevated collision risk and habitat destruction	185. As far as possible construction activities should be kept to a minimum in terms of space and time. 186. During construction habitat destruction should be kept to a minimum, especially so in the valley bottoms and lower slopes where resources, and so bird numbers, are greatest. An ECO, with a brief that includes minimization of habitat destruction, should be appointed to manage this. 187. Disturbance is inevitable during the construction period. As far as possible construction activities should be kept to a minimum in terms of space and time. Construction of sub-stations in the valleys, where in this region most birds occur, should as far as possible, be timed to avoid the main breeding season for local birds which is the period August to October inclusive. 188. Construction of sub-stations in the valleys, where in this region most birds occur, should as far as possible, be timed to avoid the main breeding season for local birds which is the period August to October inclusive.	Manage vegetation clearing to minimise impacts on avifauna	Method Statement for vegetation clearing adhered to	ECO, Contractor	Construction phase

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				189. At 1) the saddle between the two Snydersberg plateaux and 2) the col in the ridge between the Ou Mure and Fortuin farm valleys, no turbines should be erected within 100 m of the lowest point in the saddle/col and b) overhead lines should have bird diverters of a type visible by day and night set at 2 m intervals along the line. 190. Away from these two localities, where overhead powerlines cross valleys, bird flight diverters should be placed on the line at a spacing of 5m 191. Lines across the two specified localities to have day-night diverters at 2 m intervals 192. Lines across valleys to have diverters at 5 m intervals				
40	Bats	Reduce bat fatalities from the construction activities	High faunal mortality and impacts from turbine blade movement	193. Keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles and keep to designated roads with all construction vehicles. 194. avoid areas of High bat sensitivity and their buffers as well as preferably avoid areas of Moderate bat sensitivity and their buffers. 195. See Adhere to the sensitivity maps	Appropriate siting of turbines as per the approved design;	• Turbine siting appropriate, as per bat specialist specification (contained here); • Feather, curtailment implemented at environmental conditions as specified by bat specialist report (contained here); • Weekly monitoring by ECO	PC, ESO, ECO	Siting during design phase, and for all of the construction and operation phases
41	Invasive alien plants	Maintenance management of existing invasive alien	Ecological impacts from greater fitness of exotic invasive	196. Invasive species management plan approved and implemented (Chapter 6)	Implementation of Invasive Species Management	• Clearing undertaken as required • Weekly	ECO, ESO and Contractor	Construction, operation and rehabilitation phases

Construction Phase								
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		plants on site, management measures implemented to avoid increase or introductions of new species	species		Plan	monitoring by ESO and monthly by ECO;		
42	Noise and light	Manage on-site noise and light production to acceptable levels	Disturbance from excessive noise levels and excessive lighting	197. No construction piling should occur at night. Piling should only occur during the daytime. 198. All noise-making equipment shall be turned off when not in use. 199. All equipment shall be kept in good working order. 200. All equipment shall be operated within specifications and capacity (i.e. do not overload machines). 201. The Contractor will familiarise himself or herself with, and adhere to, any local bylaws and regulations regarding the generation of noise. 202. The Contractor will endeavour to keep noise generating activities associated with construction activities to a minimum. 203. Modern low noise emission vehicles and equipment shall be favoured on site. The details of all construction machinery and vehicles must be determined prior to construction in order to identify potentially noisy machinery and to seek possible alternatives. These details will include the manufacturer, type and noise emission data of each machinery/vehicle and how many will be used at any time. 204. The size of explosive charges	Noise and lighting managed according to approved Method Statement	• Less than three noise complaints per month; • Appropriate blasting charge sizes used • No piling after sunset; weekly ESO monitoring	ESO and ECO, Project Manager, Contractor	Construction and operation phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				used for blasting (if required) should be optimised so as to balance breaking capacity against minimising any vibration impact and fly-rock. 205. Construction operations should only occur during daylight hours as far as possible. 206. No construction piling should occur at night where possible. Piling should only occur during the day to take advantage of unstable atmospheric conditions. 207. Construction staff should receive "noise sensitivity" training. 208. An ambient noise survey should be conducted during the construction phase 209. Night lighting of the construction sites should be minimised within requirements of safety and efficiency. 210. Lighting should be designed to minimise light pollution without compromising safety. Investigate using motion sensitive lights for security lighting. Turbines are to be lit according to Civil Aviation regulations. 211. If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs), which do not attract insects and which should be directed downwards.				
43	Pedestrian and vehicle safety	Ensure road safety	Road accidents from reckless driving	212. The Contractor shall ensure that signage, which should be pictorial and in vernacular (where possible, otherwise in	Safety measures in place throughout all phases	• Zero traffic incidents • zero damage to property, persons	All parties, including staff and subcontractors	All project phases

Construction Phase								
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				English and Afrikaans), is erected on all boundary fences warning against entering the construction area. 213. Public awareness programmes shall be developed by the Contractor with the community to identify areas of particular risk and approaches to reduce risk. 214. Traffic calming and speed control measures for access to construction sites shall be instigated in consultation with the local authorities.		or animals from construction vehicles, transport trucks or project related vehicles • Weekly monitoring of the complaints log by the ESO. Additionally, should accounts be communicated to the project team, this shall be captured in the complaints register and made note of that the compliance of this action has failed		
44	Access roads	Reduce access road footprint as far as possible	Vegetation clearance for the access roads of the project	215. No access/haul roads other than those required for construction purposes shall be developed. As far as possible, existing roads shall be used for access/haulage purposes. All new temporary access/haul roads as approved by DEA shall also be approved by the Contractor in consultation with the ESO and ECO. Prior to the construction of new access/haul roads, topsoil shall be `stripped and stockpiled as discussed under the stockpiling section.	Access road footprint minimised where possible	• Design takes into account the need to reduce access roads where possible; • No access roads created where not planned and approved prior to construction commencing ; • Monthly monitoring by ECO	All parties, including staff and subcontractors	All project phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
45	Landscape and visual	Reduce visual impact of the project	Visual impacts	216. The Contractor shall ensure that construction activities are expedited in the construction phase reducing the temporal scale thereby reducing the visual exposure time. 217. The Contractor shall write design and placement guidelines for structures and infrastructure i.e. signage, communication, lighting etc. for approval by the ECO and these must consider: 218. Use of appropriate materials; 219. Massing, i.e. cluster activities where possible; 220. The Contractor shall ensure the establishment of appropriate setbacks/buffers from adjacent sensitive land uses, especially residential and tourism; 221. The Contractor with the approval of the Project Manager shall ensure that building structure has modest scale, height and form of simple rectangular nature; 222. The Contractor with the approval of the Project Manager shall ensure that structures to be as 'transparent' as possible to 'melt' / integrate into the landscape- make use of slender structures where appropriate; 223. Signage and temporary structures (toilet facilities etc), to be kept to a minimum (while still being sufficient; 224. New road construction should be minimised and existing roads used where possible.	Visual impacts associated with construction phase minimised	• Design and placement guidelines approved by project manager and ECO prior to construction commencing; • Night lighting only placed at necessary areas – as determined by the ECO; • Zero lighting and visual impact non-compliance reports per month, as determined by the ECO;	Contractor, Project Manager, ECO and ESO	All project phases

Construction Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and responsibility	Responsibility	Timeframe
				225. The Contractor should maintain good housekeeping on site to avoid litter and minimise waste. 226. Clearance of indigenous vegetation should be minimised and rehabilitation of cleared areas should start as soon as possible. 227. Erosion risks should be assessed and minimised as erosion scarring can create areas of strong contrast which can be seen from long distances. 228. Stockyards should be located in low visibility areas (e.g. valley between the ridges) and existing vegetation should be used to screen them from views. 229. Night lighting of the construction sites should be minimised within requirements of safety and efficiency. 230. Fires and fire hazards need to be managed appropriately. 231. Signs near wind turbines should be avoided unless they serve to inform the public about wind turbines and their function. Advertising billboards should be avoided. 232. Lighting should be designed to minimise light pollution without compromising safety. Investigate using motion sensitive lights for security lighting. Turbines are to be lit according to Civil Aviation regulations. 233. The construction contractor should clearly demarcate construction areas so as to				

Construction Phase								
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				minimise site disturbance. 234. Treat roads to reduce dust emissions. 235. The site should be kept neat and tidy. Littering should be fined and the ECO should organise rubbish clean-ups on a regular basis. 236. Construction Camp Alternative 1 should be the preferred option due to it having the smallest viewshed.				
46	Transportation	Manage traffic flow on site such to minimise obstructions	Road condition, community safety impacts	237. Transport of components will be arranged in conjunction with local traffic authorities to ensure safe transit and minimise disruption to normal traffic flow on these important roads. Turbine components may be transported at night when traffic volume on the roads is less. Traffic routes must be in accordance with the traffic management plan, as attached to this application. 238. An appropriate traffic management strategy will be developed prior to construction and if the developer receives preferred bidder status that will	A traffic management strategy developed and implemented throughout the construction and operation phases.	• Transport and Traffic Method Statement approved prior to commencement of construction and adhered to	Project Manager, ECO, Contractor	Throughout all project phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				determine route and potential road requirements. This will also incorporate a traffic management strategy for construction plant and vehicles so as to minimise these impacts on national and provincial roads. Access roads will need to be constructed that link the turbines and the substation. The access roads will join the public roads network at various points within the vicinity of the site. SANRAL have been approached for comment in this regard. Their recommendations and requirements will need to be considered during the detailed design phase.				
47	Traffic – General	Manage traffic flow on site such to minimise obstructions	Road condition, community safety impacts	239. Adequate traffic accommodation must be implemented during transportation of turbine component to the site. 240. All relevant road traffic and other legislation must be adhered to when transporting abnormal loads to the site. 241. The Contractor shall ensure that all construction personnel and vehicles are clearly visible. 242. The safety of both workers on site and road users is to be ensured at all times. 243. All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares. Speed limits should apply within the facility as well as on the public gravel access	A traffic management strategy developed and implemented throughout the construction and operation phases.	• Traffic management strategy reviewed and approved by ECO and PM prior to vehicles arriving on site	Project Manager, ECO, Contractor	Throughout all project phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				roads to the site.				
48	Traffic – Compliance with traffic rules	Manage traffic flow on site such to minimise obstructions	Road condition, community safety impacts	244. A Traffic Control Officer or Officers must be appointed. 245. All construction vehicles and vehicles associated with the project must comply with the relevant traffic and transport licencing requirements. 246. Operators and drivers must have the relevant licences / permits to operate the vehicles. 247. All contractors and construction vehicles must comply with traffic rules on public and other roads within the project area. 248. Where construction will obstruct existing access alternative temporary access routes must be provided. 249. Arrangements for abnormal loads to be authorised by the relevant authorities, and the local population to be informed of routes and times of deliveries. 250. A disciplinary procedure to address incidents of speeding or other traffic offences by site personnel and subcontractors, including the possibility of dismissal for repeat offences. 251. Traffic safety procedures, transport routes and construction schedules intended to be applied during the construction phase must be in consultation with members of the local community, the local authority and affected landowners prior to the common concrete of construction activities. The scope of such	A traffic management strategy developed and implemented throughout the construction and operation phases	• Traffic management strategy reviewed and approved by ECO and PM prior to vehicles arriving on site	Project Manager, ECO, Contractor	Throughout all project phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				engagement should include the designation of routes for construction vehicles, procedures for complaints and emergency procedures shall be concluded in consultation with local community members, affected land owners and local emergency and traffic authorities. In this regard, appropriate measures shall be taken to ensure that: 252. The routes used by construction vehicles (as far as possible) avoid areas of high pedestrian traffic; 253. adequate signage is used to warn local community members of hazards (e.g. site access, construction vehicles turning); 254. information dissemination and awareness is conducted to inform community members of increased traffic risks and appropriate precautionary measures; and 255. Community members are aware of the Contractors' construction (and delivery) schedules. 256. Routes used do not deteriorate roads to the extent that they become unsafe or defunct, especially on dirt road sections or during high rainfall periods.				
49	Traffic signage	Manage traffic flow on site such to minimise obstructions	Road condition, community safety impacts	257. Traffic signage is to be securely erected at appropriate points (ensuring visibility) along all access roads, and public roads (in consultation with the relevant traffic authorities) to indicate the following:	A traffic management strategy developed and implemented throughout the construction and	• Traffic management strategy reviewed and approved by ECO and PM prior to vehicles arriving on site	PM ; Proponent ; PC	Throughout all project phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				258. Road hazards such as blind corners or loose gravel; 259. appropriate speed limits; 260. turning traffic; 261. the Site access; 262. routes to be used by construction vehicles, where appropriate; 263. that caution should be taken by motorists or pedestrians; 264. no-go areas for vehicles; and 265. Any relevant traffic control information.	operation phases.			
50	Roads and road maintenance	Roads maintained sufficiently to allow for good safety conditions and all transport requirements	Road condition, community safety impacts	266. All access roads must be clearly demarcated and signs must clearly indicate those roads that may or may not be used by contractors or delivery vehicles, or members of the public. 267. Make use of existing roads and tracks where feasible, rather than creating new routes. 268. Routes should not traverse slopes with gradients in excess of 8%. Where this is unavoidable the road surface must be stabilised using methods approved by the Project Manager. 269. Avoid routes through drainage lines and riparian zones wherever possible. Where access through drainage lines and riparian zones is unavoidable, only one road is permitted, constructed perpendicular to the drainage line. Avoid roads that follow drainage lines within the	A traffic management strategy developed and implemented throughout the construction and operation phases.	• All roads clearly marked where appropriate; • Zero traffic incidents per month as recorded in the complaints register; • Less than three potholes on all access roads per month, as determined by ECO; • Weekly inspection by ESO	PM ; Holder of the EA ; PC	Throughout all project phases

Construction Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and responsibility	Responsibility	Timeframe
				floodplain. 270. Allow for safe pedestrian crossing where necessary. 271. All the necessary temporary road traffic signs should be erected to ensure safe traffic flow conditions. 272. Where temporary road closures are necessary the dates and durations of the closures must be signposted well in advance at the entrances and exits of the affected roads, and alternative routes clearly indicated. 273. A procedure for reporting and addressing hazards, accidents and other emergency situations shall be implemented. 274. Clean and make good any damage to private roads caused by the Contractor during the construction phase. 275. Should any damage occur on private access roads these roads must be rehabilitated to a pre-construction state. 276. Dust suppression on gravel roads and control of material being transported to and from the site must be managed to reduce the impact of dust to surrounding landowners. 277. The provincial roads department must be informed of any damage to public roads that occurs as a result of use by construction traffic. 278. Where possible, existing roads on Site shall be used as access roads.				

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				279. Maintain all access routes and roads adequately in order to minimise erosion and undue surface damage. 280. Repair rutting and potholing and maintain stormwater control mechanisms. 281. Spillages of materials on public roads must be cleaned up immediately after they have occurred.				
51	Project Vehicles	Manage traffic flow on site such to minimise obstructions	Road condition, community safety impacts	282. Enforce speed limits at all times on site roads. The movement of construction vehicles shall not be undertaken during peak morning and afternoon traffic times so as to avoid causing an impact on commuters. Materials and labour shall, as far as possible, be sourced locally in order to minimise transport related impacts and transport safety risks. 283. Vehicles may not leave the designated roads and tracks, and turnaround points must be limited to specific sites. 284. Restrictions on the times at which heavy vehicles are permitted to travel on public roads. As far as possible heavy traffic should avoid morning and evening peak traffic periods. Heavy vehicles should as far as possible travel on public roads only during weekdays. High volumes of heavy vehicles should be avoided on Saturday mornings, and no heavy vehicles should travel on public roads on Saturday afternoons, all day	Speed limits enforced at all times	• Zero speed incidents on site; • Weekly feedback from all parties from ECO; • Zero complaints register entries for speed on site;	PM ; Proponent ; PC	Throughout all project phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				Sunday and on public holidays. 285. Abnormal loads must, as far as possible, be scheduled to avoid peak hours, to minimise disruption to peak-hour traffic. 286. The contractor must provide high-occupancy transport for as many of its workers as possible to reduce the number of peak-hour vehicle trips.				
52	Vehicle maintenance	Maintain vehicles used on site to reduce noise and safety risks	Road condition, community safety impacts	287. All vehicles and machinery used during the Project shall be regularly maintained and repaired where necessary. 288. Passenger vehicles must be inspected on a regular basis to ensure that they are in good working order and are not overloaded.	Vehicles repaired as per the approved Method Statement for vehicles management	• Less than three non-compliant vehicles on site per week, as determined by ESO; • Weekly monitoring by ESO; • Zero breakdown incidents of any construction vehicle on site (from negligence and maintenance neglect)	PC ; ESO ; ECO	All project phases
53	Transportation of construction equipment and vehicles	Ensure haulage transported safely to and from site	Road condition, community safety impacts	289. Construction equipment and materials must be properly secured to / contained in the appropriate vehicle. 290. The weight bearing capacity of construction vehicles must be adhered to.	No road safety incidents		PC ; ESO ; ECO	All project phases
54	Passenger Safety	Manage safety of all staff members while commuting on site	Road condition, community safety impacts	291. The carrying capacity of passenger vehicles must be adhered to; 292. No employee shall be transported on the back of open trucks;	No road safety incidents	• Zero incidents of vehicles carrying more people than allowed, as determined by ECO;	PC ; ESO ; ECO	All project phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				293. Assembly points for construction workers to be located in a safe area (reasonable distance from high volume traffic or danger zones); 294. The contractor is to conduct vehicle and passenger safety training, emphasizing any risks/dangers of construction traffic and explain precautionary measures to be taken.		• Assembly points all located in safe locations, as determined by ECO; • Weekly inspection by ECO.		
55	Storm water	Manage surface water flow on site to reduce erosion and damage to property or persons during heavy rainfall	Erosion increase, environmental contamination, personnel safety considerations	295. Implement the storm water management plan (SWMP) included in Chapter 7.	SWMP provided and accepted prior to construction commencing; SWMP implemented	• SWMP implemented; • Monthly monitoring by ECO	PC ; ESO ; ECO	All project phases
56	Search and rescue	Implement the findings from the ecology final site walkthrough	Clearing of vegetation may destroy certain SCC found on site	296. If the ecologist recommends a search and rescue operation for plants of specific concern in light of the final site walkthrough, then a search and rescue plan needs to be compiled and approved. 297. The plant S&R plan should be developed with the objective of establishing which plants are to be harvested from the turbine laydown area, access roads and power lines, in order to: 298. Collect important pioneer plants that can be transplanted, kept under nursery conditions and utilised for re-vegetation after construction as part of rehabilitation activities 299. Collect and transplant, plant species of special concern that have a high conservation value or apply for destruction permits	If recommended by the ecologist, plants search and rescue undertaken in line with the approved plan	• Search and rescue plan implemented; • Monthly monitoring ECO	PC; ECO	Prior to and throughout construction phase

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				where transplanting will not be possible 300. Locate on-site nursery where minimal construction disturbance will be experienced. 301. Utilise the topography and of the site to take advantage of the protection and micro-climate afforded by the surrounding hillocks and valleys. 302. If livestock or wildlife is present on the property, it will be necessary to fence in the nursery area using a 1,2m high fence. A gate should be provided for vehicle access and deliveries. 303. Where necessary, equip the nursery with its own designated water tank for irrigation purposes (a 2000 litre plastic reservoir on a tank stand will suffice). 304. Install hose lines as required. 305. Ensure that procured plants arrive at the nursery in a condition suitable to ensure successful growth. 306. All harvested seeds and seedlings, as well as plants removed for transplanting, are the responsibility of the Contractor and must be kept under approved nursery conditions. 307. For plants in containers held in the nursery, use 2 parts of topsoil that has been excavated from the site (to emulate site conditions) to 1 part of compost (produced from mulching the cleared vegetation, or a suitable				

Construction Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and responsibility	Responsibility	Timeframe
				commercial mulching solution). 308. All specified species lifted from open ground must be retained in containers or bags as specified. 309. Ensure that the nursery is properly equipped with the necessary implements, containers, fertilisers and other equipment necessary to function efficiently. 310. All plants must be fully maintained by staff dedicated from the date of receipt until the end of the Rehabilitation Period. A horticulturalist must be consulted to assist with management of the nursery plants. This includes watering, weeding, fertilising, etc 311. All plants must be regularly watered and fertiliser applied, as required. 312. All plants must be protected against wind, frost and direct sunlight, until such time as they are fully acclimatised. Provide shade net or a shade house as required for this purpose. 313. Plants held in the nursery for more than one year, must be replanted into larger containers. 314. The Contractor will be held liable for the replacement of plants lost due to his negligence or mismanagement.				
57	Open space	Manage open space	Habitat loss, faunal and floral demarcation	315. Open space areas should be kept as contiguous blocks of vegetation as far as possible and no additional barriers (except for approved roads and fences)	Environmental awareness training completed and open space	• Alien clearance plan conducted, • Search and rescue plan conducted	PC; ECO	All project phases

Construction Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and responsibility**	**Responsibility**	**Timeframe**
				should be constructed that may impede faunal movement; 316. All open space areas must be kept alien and weed free; 317. Only indigenous species from a list approved by the ECO may be used for any rehabilitation work in open space areas; 318. No waste should be disposed of in open space areas, including but not restricted to cigarette butts and uneaten foodstuffs (i.e. fruit cores and peels) that may attract scavengers. It is recommended that receptacles be placed strategically to minimise this, especially during the construction phase; 319. A search and rescue operation must be undertaken by a qualified botanist/ horticulturalist if recommended by an ecologist prior to construction commencing and species of special concern identified within the development footprints transplanted to a refuge area. 320. Vegetation cleared from development footprints must not be piled onto adjacent intact vegetation outside of the designated footprint, even for temporary storage. 321. No collection of indigenous plants may be allowed on the property outside of those undertaken by the designated person(s). 322. Employees should undergo environmental awareness training and be sensitised to the	managed well	• Environmental training conducted • Weekly inspection by ECO		

Construction Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and responsibility	Responsibility	Timeframe
				need to avoid disturbance to the indigenous vegetation outside the development footprints. 323. Rehabilitation guidelines for the development as a whole must prioritise the use of indigenous grass, tree and shrub species are to be used in the soil stabilisation landscaping of the development once construction is completed, if required. 324. The following is recommended for the conservation of wetland, river and dam habitat on the site: 325. A buffer of 32 m from the channel edge to be kept free of hard standing surface, including for roads and cable crossings. 326. Any stormwater management features must be suitably designed and constructed to maintain stormwater flow to acceptable levels and minimise risk of erosion and scouring. 327. No storm-water runoff should be discharged directly into the drainage line/seep, where it could lead to erosion. 328. The exotic vegetation growing within the water courses and wetlands and/or buffers directly adjacent to the proposed development should be removed as soon as possible and these areas should be kept weed free.				

4.3 Operation phase mitigation measures

Table 4-3. Operation phase mitigation measures.

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
58	Birds	Manage site so as to reduce bird fatalities	Avifaunal impacts and mortality	329. Due to the potential fatalities of birds resulting from the proposed project, the developer shall take every precaution in reducing the number of these birds that die as a result of the wind turbines and associated infrastructure. The following mitigation measures should be used to reduce the number of mortalities: 330. Intermittent lighting must be used if possible (i.e. if it does not contradict aviation regulations), as well as red light which is less attractive than white light. 331. Monitoring for at least the first two years of operation should take place by an independent specialist. If high bird mortalities are recorded then the operator of the wind farm must investigate additional mitigation measures such as emitting broadcasts of a certain radio frequency to discourage birds from entering high collision areas. 332. The bird monitoring programme, shall be conducted according to AR Jenkins et al, 3rd Ed 2015), and include: 333. A suitably qualified avifaunal specialist should supervise the monitoring programme, train the necessary observers, collate, analyse, report and publish data. 334. The first step for the appointed specialist will be to identify the key information required in the protocol below. This will be best done through a short site visit, which will also serve to train the identified observers and generally iron out any teething problems with the	Bird monitoring undertaken	• Monitoring implemented as per monitoring programme and guides; • Monthly ECO compliance inspections	Brandvalley Wind Power (Pty) Ltd	Throughout operation phase

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				methodologies. 335. The bulk of the actual work involved should be done by trained observers, under the guidance and supervision of a qualified and experienced ornithologist. This role could be filled by a number of people or entities, but will need to be the same entity for the duration of the programme. 336. The specialist could advise the developer on available options to source observers. 337. The monitoring protocols that are available from Europe and the USA are mostly aimed at estimating population densities of small passerines in a relatively small study area. In southern Africa, the majority of priority species are large species that are relatively thinly distributed. Specific challenges in a local context are the following: 338. Some priority species are sparsely distributed with large territories, e.g. many of the large raptors, vultures and cranes. These species could easily be missed during surveys. 339. Some priority species are nomadic with fluctuating densities related to habitat conditions, particularly rainfall, e.g. bustards. To cover all possible conditions in the study area would require an effort which will be impractical, both in terms of resources and length of monitoring time. 340. Limited availability of suitably experienced individuals that can do monitoring. 341. The suggested monitoring protocol is an attempt to address the challenges listed above whilst still maintaining a measure of practical realism as to what is possible				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				with limited resources so as to: 342. Estimate an abundance index for all the priority species within the wind farm area as a baseline to measure potential displacement due to the construction and operation of the wind farm. 343. Estimate the risk of priority species colliding with the wind turbines by recording flight behaviour. The recommended method is vantage point observations. 344. The risk of collision mortalities can be mitigated by leaving a 100 m gap between successive turbines across saddles and avoidance of elevated powerlines across saddles and cols where possible 345. If not avoidable all overhead 33 KV powerlines on these saddles and cols should have diverters at 5 m intervals on the lines.				
59	Social	Mange social unrest and maximise employment benefits of the project	Social unrest	346. An accredited training and skills development programme aimed at maximising the opportunities for local workers to be employed in the low and semi-skilled positions should be initiated prior to the initiation of the construction phase. In this regard the programme should be aimed at community members from Laingsburg and Sutherland. The programme should be developed in consultation with the KHLM and LLM and possibly the Department of Labour. The recommended targets of 50% and 30% of low and semi-skilled positions respectively should be taken up by local community members. Due to the low skills levels in the area, the majority of semi-skilled and skilled posts are likely to be filled by people from outside the area;	Maintain a locals first recruitment policy as far as possible, reduced social impact from development	• Training programme implemented, • Recruitment committee commissioned and active	Holder of the EA	Construction phase

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				347. The recruitment selection process for the training and skills development programme should seek to promote gender equality and the employment of women wherever possible; 348. Before the construction phase commences the proponent should meet with representatives from the KHLM, LLM and WLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase; 349. The local authorities and relevant community representatives should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project; 350. Where reasonable and practical the proponent should appoint local contractors and implement a _locals first' policy, especially for semi and low-skilled job categories. Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria; 351. The contractor should liaise with the KHLM, LLM and WLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				tender process and invited to bid for project-related work; 352. Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information. 353. The KHLM, LLM and WLM, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project. 354. The proponent in consultation with the contractor should investigate the option of holding a workshop/s with local farmers and representatives from KHLM, LLM and WLM to discuss options for installing small-scale wind energy facilities and the technology and costs involved. 355. The proponent should consider the implementation of an accredited training and skills development programme aimed at maximising to opportunity for local workers to be employed for the low and semi-skilled positions prior to the initiation of the construction phase. In this regard the programme should be aimed at community members from Laingsburg and Sutherland. The programme should be developed in consultation with the Department of Labour and the KHLM and LLM. The recommended targets are 50% and 30% of low and semi-skilled positions respectively should be taken up by local community members. Due to the current low skills levels in the area, the majority of semi-skilled and skilled posts are likely to be filled by people from outside				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				the area; 356. The recruitment selection process for the training and skills development programme should seek to promote gender equality and the employment of women wherever possible; 357. The proponent should establish a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should be established before the construction phase commences, and should include key stakeholders, including representatives from the LLM, farmers and the contractor(s). The MF should also be briefed on the potential risks to the local community and farm workers associated with construction workers; 358. The proponent and the contractor(s) should, in consultation with representatives from the MF, develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation; 359. The proponent and contractor (s) should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; 360. The contractor should provide transport to and from the site on a daily basis for low and semi-skilled construction workers. This will enable the contractor to effectively manage and monitor the movement of construction workers on and off the site; 361. Where feasible, the contractors should				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				make the necessary arrangements to transport workers from other local towns in the area, such as Worcester and Paarl, home over weekends. This will reduce the risk posed to local family structures and social networks in Laingsburg and Sutherland; 362. No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site. 363. The proponent should implement a —locals first‖ policy, specifically with regard to unskilled and low skilled opportunities. This locals first policy needs to be communicated widely when employment opportunities are advertised; 364. The proponent should implement a policy that no employment will be available at the gate and or in Sutherland and Laingsburg (except for local residents). 365. The proponent should enter into an agreement with the landowners on whose property the WEF is located, whereby damages to farm property etc. during the construction phase that are proven to be associated with the construction activities for the WEF will be compensated for. The agreement should be signed before the construction phase commences; 366. The movement of construction workers on the site should be confined to regulated areas; 367. All landowners on and in the immediate vicinity of the site should be contacted to discuss timing of construction related activities in the vicinity for his cropping areas;				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				368. Contractors appointed by the proponent should provide daily transport for workers to and from the site. This would reduce the potential risk of trespassing onto adjacent properties; 369. Movement of vehicles should be confined to designated roads and construction workers must be informed of the need to keep farm gates closed; 370. The relevant owners should be consulted prior to the commencement of the construction phase to identify the location of the irrigation infrastructure so as to ensure that it is not damaged during the construction phase; 371. Damage to irrigation infrastructure caused by construction related activities should be repaired within 24 hours by the contractor; 372. The proponent should consider the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site; 373. The proponent should hold contractors liable for compensating farmers in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				below); 374. The Environmental Management Programme (EMPr) should outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested; 375. Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. 376. Contractors appointed by the proponent must ensure that construction workers who are found guilty of trespassing, stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation; 377. No construction staff, with the exception of security staff, to be accommodated on site overnight. 378. The proponent should enter into an agreement with the local farmers who potentially stand to be impacted by the proposed project, including WEF landowners and adjacent property owners, whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities for the WEF will be compensated for. The agreement should be signed before the construction phase commences; 379. Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				380. Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months; 381. Contractor to provide adequate fire fighting equipment on-site; 382. Contractor to provide fire-fighting training to selected construction staff; 383. No construction staff, with the exception of security staff, to be accommodated on site overnight; 384. As per the conditions of the Code of Conduct, in the event of a fire proven to be caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire fighting costs borne by farmers and local authorities. 385. As far as possible, the transport of components to the site along the N1, R354 and R356, should be planned to avoid weekends and holiday periods; 386. Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis, adhering to speed limits and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers; 387. Steps must be taken to minimise the potential impact of dust generated by construction vehicles on the vegetable				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				seed cropping operations on Fortuin. These include regular wetting of the section of road adjacent to the seed cropping area and strict enforcement of speed limits. The timing of the movement of construction vehicles should be discussed with Mr le Roux, the owner of Fortuin; 388. All workers should receive training/ briefing on the reasons for and importance of closing farm gates and driving slowly; 389. The contractor must ensure that damage caused by construction related traffic to local farm roads is repaired on a regular basis throughout the construction phase. The costs associated with the repair must be borne by the contractor; 390. All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits; 391. The location of wind turbines, access roads, laydown areas etc. should be informed by the findings of a soil study. In this regard high potential grazing and seed cropping areas should be avoided; 392. The location of wind turbines, access roads, laydown areas etc. should be discussed with the locally affected landowner; 393. The footprint areas for the establishment of individual wind turbines should be clearly demarcated prior to commencement of construction activities. All construction related activities should be confined to the demarcated areas and minimised where possible; 394. An Environmental Control Officer (ECO) should be appointed to monitor the				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				establishment phase of the construction phase; 395. All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. The rehabilitation plan should be informed by input from a botanist with experience in arid regions; 396. The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up the Environmental Consultants appointed to undertake the EIA; 397. The implementation of the Rehabilitation Programme should be monitored by the ECO; 398. All workers should receive training/ briefing on the reasons for and importance of not driving in undesignated areas; 399. EMP measures (and penalties) should be implemented to strictly limit all vehicle traffic to designated roads and construction areas. Under no circumstances should vehicles be allowed to drive into the veld; 400. Disturbance footprints should be reduced to the minimum.				
60	Bats	Minimise the impact on Bats	Habit destruction; poor rehabilitation	401. Utilise lights with wavelengths that attract less insects (low thermal/infrared signature). 402. If not required for safety or security purposes, lights should be switched off when not in use or equipped with passive motion sensors. 403. Employ mitigation measures as indicated	Areas of disturbance minimised	• No less than 90% of the disturbed areas revegetated after decommissioning	PC; ECO	Throughout operational phase

Operation Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and Monitoring	Responsibility	Timeframe
				in the table below, in order to reduce bat mortality. The times of implementation of mitigation measures is preliminarily recommended (considering more than 80% bat activity, normalised data) as follows:				

	Terms of mitigation implementation
Spring peak activity (times to implement curtailment/ mitigation)	Snydersberg: Month of October 21:00 – 02:00
Environmental conditions in which to implement curtailment/ mitigation	Below 5m/s measured at nacelle height Above 9°C
Autumn peak activity (times to implement curtailment/ mitigation)	SM4: 1 -15 March Sunset – 22:00
Environmental conditions in which to	Below 7m/s measured at nacelle

Operation Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and Monitoring	Responsibility	Timeframe
				implement curtailment/ mitigation: height Above 17°C Summer peak activity (times to implement curtailment/ mitigation): Barendskraal NW: 1 December – 10 January; 1 December – 15 January; 20:00 – 01:00 Environmental conditions in which to implement curtailment/ mitigation: Below 9m/s measured at nacelle height Above 11°C				
61	Erosion	Manage on site soil to reduce erosion	Increased erosion	404. Vegetation of road verges and cut faces must be inspected and maintained on a regular basis. This is particularly important on steep slopes. 405. Stormwater runoff must be controlled to manage erosion through appropriate measures	Road verges maintained	• Verges cut every two weeks for duration of summer and spring, winter and fall mowing once every two months;	Brandvalley Wind Power (Pty) Ltd	Ongoing, throughout operation phase

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				406. Anti-erosion features must be installed where required. 407. Ensure that all cleared and impacted land is rehabilitated and re-vegetated.		• Monthly monitoring by ECO		
62	Ecological	Manage faunal and floral environmental on site respectfully to allow for least disturbance and greatest ecological viability	Habit destruction, faunal disturbance and mortality	408. Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible. 409. Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems. 410. Regular monitoring for alien plants within the disturbed areas for at least two years after decommissioning. 411. Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. 412. Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.	Erosion problems managed appropriately, invasive species controlled	• Development only in Ecological specialist sanctioned very high sensitivity areas; • Environmental induction prior to construction conducted and approved by PM and ECO; • Weekly monitoring by ECO	Brandvalley Wind Power (Pty) Ltd	Throughout planning phase
63	Noise	Reduce noise levels during operation	Nuisance noise impacts, disturbance to fauna and people	413. The noise impact from the wind turbine generators should be measured once off during the operational phase, to ensure that the impact is within the required legal limits. 414. The noise impact from the wind turbine generators should be measured during the operational phase, to ensure that the impact is within the required legal limit. 415. Wind turbine generators should be maintained to ensure the noise emissions are within the legal and design specifications. 416. An ambient noise survey should be conducted at the noise sensitive	Noise kept within acceptable levels	• Less than three noise complaints per week; • monthly monitoring by ECO	PC; ECO	Construction phase

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				receptors closest to the turbines during the operational phase 417. Re-modelling of the noise impacts will need to conducted on the final layout (when the final turbine is selected should the layout change). 418. The noise impact from the wind turbine generators should be measured during the operational phase, to ensure that the impact is within the required legal limits.				
64	Social	Manage the social impacts of the project	Social unrest, unfair employment practices	419. Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; 420. Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project. 421. Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the WEF. 422. Use the project to promote and increase the contribution of renewable energy to the national energy supply; 423. The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project;	Social impacts managed appropriately	• Manage the social impacts of the project to ensure fair employment and community benefit from the project, and to reduce social unrest risk	Social unrest, unfair employment practices	Social

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				424. The proponent, in consultation with the KHLM, LLM and WLM, should investigate the options for the establishment of a Community Development Trust (see below). 425. The local landowners have entered into agreements with the applicant regarding revenue streams generated from wind turbines located on their properties. 426. The KHLM, LLM and WLM should be consulted as to the structure and identification of potential trustees to sit on the Trust. The key departments in the KHLM, LLM and WLM that should be consulted include the Municipal Managers Office, IDP Manager and LED Manager. 427. Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; 428. Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the WEF. 429. Use the project to promote and increase the contribution of renewable energy to the national energy supply; 430. Implement a training and skills development programme for locals				

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project. 431. The final placement of wind turbines associated with the Brandvalley WEF should be discussed with the affected landowners, specifically Mr Le Roux, who is the only landowner that lives permanently in the area; 432. The recommendations of the VIA should be implemented.				
65	Fire	Reduce fire risk on site	Runaway fire, habitat loss, health and safety impacts, loss of life, faunal mortality, air pollution	433. Any requirements of the local Fire Protection Association must be adhered in consultation with the relevant landowners as per the requirements of the National Veld and Forest Fire legislation which may include: 434. Formation of a Fire Protection Association (FPA); 435. Duty to prepare and maintain firebreaks; 436. Requirements for firebreaks; 437. Readiness for firefighting; 438. Actions to fight fires. 439. In areas other than designated development footprints within the Open Space area, a network of firebreaks must be maintained and overlap with any firebreaks managed by the landowners to ensure that fires are not able to spread over the development; 440. All road reserves will serve as firebreak; 441. All firebreaks must be maintained as	Fires controlled on site	• Zero runaway fires; • Zero uncontrolled fires on site; • Zero unauthorised fires on site; • ECO monitoring weekly	PC, ECO	Throughout operation phase

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				required by the local Fire Chief; 442. Firebreaks are to be positioned and prepared in such a way as to cause the least disturbance to soil and biodiversity. Firebreaks should be free from combustible material, e.g. pruning's and leaf litter. 443. Ensure firefighting equipment is maintained and in good working order before the start of each fire season. 444. Smoking outside of designated safe areas must not be permitted. Flicking of cigarette butts into adjacent vegetation will not be permitted. 445. Suitable signage must be provided on site, including entrance warning of fire risk and warnings not to flick cigarette butts into vegetated areas.				
66	Agricultural and erosion	Manage site to maintain soil quality, quantity and fertility as best as possible	Increased erosion from wind and surface water flow	446. Stormwater runoff must be controlled to manage erosion through appropriate measures 447. Anti-erosion features must be installed where required. 448. Ensure that all cleared and impacted land is rehabilitated and re-vegetated. 449. Fencing of WEF infrastructure should be limited as far as possible to allow for maximum grazing and movement of livestock and game within the site. 450. All alien plant re-growth must be monitored and should it occur these plants should be eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor. 451. Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities 452. Containment of all contaminated water	Appropriate stormwater structures maintained	• Rehabilitation initiated on cleared land within 5 working days of land remaining fallow	PC; PM; ECO	For duration of operation phase

Operation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				by means of careful run-off management on the development site. 453. Upon the completion of construction, the area will be cleared of potentially polluting materials.				

4.4 Rehabilitation phase

Table 4-4. Rehabilitation phase mitigation measures.

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
68	Topsoil	Manage topsoil to reduce erosion and maintain soil fertility	Increased Erosion	454. A rehabilitation plan following construction involves primarily the following aspects: a) Soil stabilisation and remediation (composition, pH level, nutrients, etc.), b) Re-vegetate using appropriate natural successional species. c) Monitor: removal of aggressive indigenous plant, follow up on alien invasive plant species, successful establishment of re-vegetated areas. 455. Topsoil removed during construction must be stored on site for rehabilitation and re-vegetation. When construction is complete the topsoil must be spread over the disturbed site and covered with mulch. The soil must be stabilised using materials such as netting or geotextiles. 456. During the operational and decommissioning phase, monitor culverts to see if erosion issues arise and if any erosion control is required. 457. Rehabilitate disturbance areas as soon as construction in an area is completed. 458. Since the plant material (grasses and herbs) removed from the site should be mixed into the topsoil and will supplement the organic	Rehabilitation plan received and approved prior to operation phase ceasing. Rehabilitation plan implemented	• Topsoil replacement as per rehabilitation plan; • Weekly inspection by ECO	PC ; ESO ; ECO	Throughout rehabilitation phase

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				nutrient content of the soil, no further soil conditioning in terms of fertilising is deemed necessary. 459. After the stockpiled material has been removed, the site shall be re-instated to its original condition as far as possible. No foreign material generated / deposited during construction shall remain on site. Areas affected by stockpiling shall be landscaped, top soiled, grassed and maintained at the contractor's cost until clearance from the Project Manager is received. In all cases, the ECO shall approve the areas for stockpiling and disposal of construction rubble before any operation commences and shall approve their clause only when they have been satisfactorily rehabilitated.				
69	Revegetation	Manage revegetation to promote regrowth and rehabilitation of site as best as possible	Increased Erosion; loss of faunal habitat; loss of SCC	460. The species to be used for planting must is based on: • Successful growth of indigenous seed, sods and slips collected from the indigenous and riparian vegetation in the project area. • Red List species, Species of Concern and protected species that have been collected 461. The following procedures must be used for out planting of vegetation intended for rehabilitation: **Plot preparation** The plots will be prepared as follows: 1. Prior to	Rehabilitation conducted in accordance with rehabilitation Method Statement	• Mitigation measures mentioned for this objective are to be implemented as described; • Weekly monitoring by ECO	PC ; ESO ; ECO	Throughout rehabilitation phase

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				rehabilitation of the site, all remnants of foreign debris shall be removed from the site 2. Compacted soil shall be ripped to a depth of greater than 250mm 3. The final prepared surface shall not be smooth but furrowed to follow the natural contours of the land. 4. All plots will be covered with top soil. Topsoil will be manually spread evenly over the surface. Topsoil must be spread to the original depth and deeper where sufficient top soil remains 5. All the plots will be mulched. The vegetation stripped, chipped and stockpiled during site preparation must be spread in a single layer across the plots as mulch.				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				6. All plots will be treated with Nitrogen-fixing bacteria (important for legumes), *Trichoderma* sp. and mycorrhizal products as a natural form of soil remediation **<u>Plant Preparation</u>** Plants must undergo a period of 'hardening-off' during which they have been exposed to full, direct sunlight and been under a reduced watering regime. The individual plants destined for each plot will be grouped into plot-specific, marked baskets, before they leave the nursery. Each plant will be labelled with an aluminium label, giving species code, and a specific numeral identifying the plot Before the out-planting commences, the equipment necessary for the proper handling and placing of all required materials shall be on hand, in good				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				condition and to acceptable approved standards. Shrubs and trees • Planting should preferably be done during the rainy season (summer). • Unless otherwise specified by the EO / ECO, excavate square holes of 800mm x 800mm x 800mm on average for trees and 500mm x 500mm x 500mm on average for shrubs. • Backfill planting holes with excavated material / approved topsoil, thoroughly mixed with weed free manure or compost (per volume about one quarter of the plant hole), one cup of 2:3:2 fertiliser and an approved ant and termite poison. • As much of the soil from container plants as possible must be retained around the roots				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				of the plant during planting. • The soil must cover all the roots and be well firmed down to a level equal to that of the surrounding in situ material. • After planting, each plant must be well watered, adding more soil upon settlement if necessary. • Add mulch to the surface area of the bermed basin in order to sustain soil moisture. • Stake all trees using three weather resistant wooden or steel stakes anchored firmly into the ground. Two of the three stakes are to be located on the windward side of the plant. Galvanised wire binding, 3 mm thick, covered with a 20mm diameter plastic hosepipe must be tied tightly to the stakes, half to two thirds the height of the tree				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				above the ground and looped around the trunk of the tree. • Place stakes at least 500mm apart and away from the stem and roots of the tree, so as not to damage the tree or its roots. • Thoroughly water plants as required until the plants are able to survive independently (i.e. depending on the rainfall). • A raised circular 200mm high subsoil berm, placed 500mm (shrubs) to 750mm (trees) from the plant's stem must be provided for the watering. Do not simply leave the excavated plant hole partially backfilled for this purpose – the berm must be raised above the natural soil level. • Water aloes and bulbs once directly after transplanting to settle the soil.				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				• Remove stakes and wire binds over time as required, as plants become established. Grassing using sods • Sodding is defined as the laying of grass sods. • Sodding may be done at any time of the year. • The soil should be uniformly wet to a depth of at least 150mm before planting of grass sods. • Protect sods against drying out: keep these moist from the time of harvesting until final placement. • Rake or spike the plot area to give a loose surface to a depth of 100mm. • Lay two rows of sods in a straight line or following a contour, starting at the bottom of a slope, where possible. • Place the next two rows of sods in the same				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				direction, 5 metres away, until the full area is covered with rows of sods. • Tightly butt sods together, taking care not to stretch or overlap sods. • Where a good fit cannot be obtained, the intervening spaces may be filled with parts of sods or topsoil. • After planting, water sods to prevent drying out. • Irrigate as required until the grass is able to survive independently (i.e. depending on the rainfall). Grassing using Runners • Plant grass runners evenly by hand or by mechanical means at a rate of at least 400 runners per hectare (i.e. at 250mm centres). • Use only fresh runners, avoiding grass runners that have been				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				allowed to dry out. • Rake or spike the area to give a loose surface to a depth of 100mm. • The soil should be uniformly wet to a depth of at least 150mm before planting of grass runners. • After planting, runners must be given copious amounts of water and, when sufficiently dry, must be rolled with a light agricultural roller and re-watered. • Irrigate as required until the grass is able to survive independently (i.e. depending on the rainfall). Grassing using hand seeding • All seed should be collected from the project area during vegetation clearing or neighbouring veld. • Seeding must be done during the summer when the germination				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				rate is better. • The soil should be loose and uniformly wet to a depth specified by the EO/ECO, before any seeding commences. • Halve the seed and fertiliser mixture as specified and apply evenly in two immediate successive applications perpendicular to each other. • The seeded area must be raked over after seed application and well-watered. • Irrigate as required until the grass is able to survive independently (i.e. depending on the rainfall). **Maintenance** • Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular,				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				pedestrian and livestock access. • Delay the re-introduction of stock to all rehabilitation areas until an acceptable level of re-vegetation has been reached. Fencing may be used, or the area may be covered by branches. • Re-vegetation must match the vegetation type which previously existed, unless otherwise indicated in the Contract or specified by the EO/ECO. • Water all transplanted, planted and grassed areas as specified • Watering must commence and continue immediately after the seeds have germinated and growth begins. • Mow lawns regularly to a height of 50 mm above ground level. This promotes				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				adequate coverage. • Mowing of veld grass is to take place once a year after the grass has shed its seed and not before the grass has fully grown: fire breaks are important • Check all plants for pests and diseases on a regular basis and treat the plants accordingly, using approved method and products as per manufacturers specifications. • Control weeds by means of extraction, cutting or other approved methods. • For planted areas that have failed to establish, replace plants with the same species as originally specified. The same species as originally specified must be used unless otherwise specified by the				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				EO / ECO. • A minimum grass cover of 80% is required, and individual plants must be strong and healthy growers at the end of the Maintenance Period. • In the case of sodding, acceptable cover entails that 100% cover is attained by the specified vegetation. It is recommended that the success of the rehabilitation exercise be monitored from the commencement date of rehabilitation activities and for a period of 18 months after the rehabilitation has been completed. The Environmental Control Officer will compile a monthly monitoring report including the following information: • Establishment success (presence, percentage cover or absence) of plant cover per plot, supported by photo images. • Water used for irrigation. Monitoring must be undertaken once a month for the first 6 months and then quarterly thereafter for 12 months or until rehabilitation has been deemed successful. Rehabilitation will be deemed successful once primary grass cover has been established, and there is no further requirement for management of alien species.				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
70	Ecological	Manage faunal and floral environmental on site respectfully to allow for least disturbance and greatest ecological viability	Habit destruction, faunal disturbance and mortality	462. All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact. 463. All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow. 464. There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures. 465. The recovery of the indigenous shrub layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas. 466. All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. 467. Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be	Rehabilitation implemented and effective; Alien clearing plan implemented and effective	Monthly monitoring by ECO	PC; PM; ECO	Throughout planning phase

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				implemented until a cover of indigenous species has returned. 468. All temporary roads no longer required shall be decommissioned and the land rehabilitated. 469. All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact. 470. Regular monitoring for alien plants within the disturbed areas for at least two years after decommissioning. 471. The recovery of the indigenous shrub layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas. 472. There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures.				
71	Social	Manage the social impacts of the project	Social unrest, unfair employment practices	473. All structures and infrastructure associated with the proposed facility that can no longer be used by farmers or Eskom/ other IPPs should be dismantled and transported off-site on decommissioning;	Thorough consultation with communities	• Negotiations entered into and mediation affected where social unrest occurs; • Weekly	Monitoring forum, PM, ECO	Throughout all project phases

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				474. The proponent should ensure that all retrenchments conform with South African Labour Law legislation, including provision of retrenchment packages where applicable, when the WEF is decommissioned; 475. The proponent should investigate the option of establishing an Environmental Rehabilitation fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 20 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. Alternatively, the funds from the sale of the WEF as scrap metal should be allocated to the rehabilitation of the site. 476. should be addressed in the Integrated Development Planning process undertaken by the KHLM and LLM. 477. The Western and Northern Cape Provincial Governments, in consultation with the KHLM, LLM and WLM and the proponents involved in the development renewable energy projects in the Komsberg REDZ, should		monitoring by Monitoring Forum		

Rehabilitation Phase								
#	Aspect	Objective	Potential Impact	Mitigation measures	Outcomes	Indicator and Monitoring	Responsibility	Timeframe
				consider establishing a Development Forum to co-ordinate and manage the development and operation of renewable energy projects in the Komsberg REDZ, with the specific aim of mitigating potential negative impacts and enhancing opportunities. This would include identifying key needs, including capacity of existing services, accommodation and housing and the implementation of an accredited training and skills development programmes aimed at maximising the opportunities for local workers to be employed during the construction and operational phases of the various proposed projects. These issues 478. The proponent should ensure that all retrenchments conform with South African Labour Law legislation, including provision of retrenchment packages where applicable, when the WEF is decommissioned; 479. All structures and infrastructure associated with the proposed facility that can no longer be used by farmers or Eskom/ other IPPs should be dismantled and transported off-site on decommissioning; 480. The proponent should investigate the option of establishing an Environmental Rehabilitation fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The fund should be funded by a percentage of the revenue				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				generated from the sale of energy to the national grid over the 20 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. Alternatively, the funds from the sale of the WEF as scrap metal should be allocated to the rehabilitation of the site.				
72	Rehabilitation	Manage rehabilitation to ensure as much ecological functioning after the development as possible	Soil erosion, habitat loss	481. Rehabilitation of disturbed and heavily impacted environments is closely linked to ecological successional theory (van Ardel & Aronson, 2005). Succession can be described as a change of species, or patterns of species abundance, over time. Directional, continuous and sequential patterns of colonisation by various species are indicators of successional stages of a particular environment. The first sequence of succession (e.g. after a disturbance) is the initial colonisation of an area of fast-growing, aggressive pioneering species, which are often short-lived, perennial species and grasses. These plant species are responsible for changing soil properties and creating micro-niches for further colonisation. The initial sequence of pioneer species	Revegetation and rehabilitation conducted in accordance with this plan	• Natural species used • No less than 80% vegetation cover (i.e. such as is natural and undisturbed adjacent to the project) after one year regrowth; • Monthly ECO monitoring during rehabilitation, once every six month monitoring after the first year of rehabilitation.	PC; ECO	Throughout rehabilitation phase

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				is then followed by early and late successional species migrating into the area, resulting in a climax community. When considering the rehabilitation of an environment that has been disturbed, the "4 R" approach is often employed and includes: • Restoration • Rehabilitation • Replacement or re-vegetation • Reservation (Conservation) Methods to restore, rehabilitate and re-vegetate are suggested in the body of this report. It is important to note that these activities begin with soil stabilisation and soil preparation or remediation. Soil remediation includes activities such as improvements to soil stabilisation, soil structure and soil fertility. The success of rehabilitating the community/population within a designated area is dependent on the satisfactory establishment of the chosen plant species. To ensure that the process is optimised, the correct plant species in the correct densities and combinations should be utilised. Monitoring of the rehabilitation process is imperative to ensure that aggressive plant species and herbivores are controlled and slopes/banks remain stable. The general aim of the implementation of a rehabilitation programme is to recreate a natural ecosystem. In this regard, the rehabilitation will be outlined in three phases, which would be				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				required, namely: • Soil stabilisation and remediation (composition, pH level, nutrients, etc.), • Re-vegetate using appropriate natural successional species. • Monitor: removal of aggressive indigenous plant, follow up on alien invasive plant species, successful establishment of re-vegetated areas. Current natural state of vegetation The current state of the landscape, prior to construction is the reference point against which to assess rehabilitation success. The majority of the site is covered by natural or near to natural vegetation, having generally been disturbed to a small degree (i.e. roughly 99% intact). The majority of the development footprint falls within Central Mountain Shale Renosterveld, with no turbines within the Koedoesberge-Moordenaars Karoo which occurs in the low-lying areas. The Komsberg area is also a recognized centre of plant diversity and endemism and the majority of this diversity is associated with the high elevation areas of Central Mountain Shale Renosterveld (Clark et al. 2011). In addition, the sites of natural vegetation are located near river and drainage line edges, with elevated ecological sensitivity due to the potential presence of species of conservation concern. The majority of the site is currently free or has low abundance of alien species. There are however disturbed areas				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				around farmsteads, old croplands and livestock watering points which harbour a variety of alien species. *Mesquite*, *Prosopis* spp. is common at most farmsteads and is a potential problem especially in lowlands habitats around the site and is a potentially significant invader as it can alter hydrological function under dense invasion. Other common invasive and indigenous weedy species observed at the site include *Bromus* spp., *Lolium* spp. *Avena fatua*, *Salsola kali*, *Dittrichia graveolens*, *Amsinckia retrorsa* and *Conyza bonariensis*. Based on the current state, re-vegetation required by the developer requires the Brandvalley Wind Energy Facility should keep removal of indigenous vegetation to a minimum. As the site is generally very well conserved and in-tact, preserving the status quo as far as possible is the aim of the rehabilitation plan. As such, the majority of the effort is to be aimed at controlling establishment and spread of invasive species of initial vegetation clearance and disturbance. The precise control is discussed in greater detail in the invasive species management plan. Soil stabilisation and remediation Topsoil removed during construction must be utilised in the nursery and stored on site for rehabilitation and re-vegetation. When construction is complete the topsoil must be spread over the disturbed site and covered with mulch. The soil must be stabilised using materials such as netting or geotextiles.				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				Since the plant material (grasses and herbs) removed from the site should be mixed into the topsoil and supplements the organic nutrient content of the soil, no further soil conditioning in terms of fertilising is deemed necessary. Re-vegetation procedure These measures are to be adhered to for compliance with this plan. Rehabilitation Monitoring It is recommended that the success of the rehabilitation exercise be monitored from the commencement date of rehabilitation activities and for a period of 18 months after the rehabilitation has been completed. The Environmental Control Officer will compile a monthly monitoring report including the following information: • Establishment success (presence, percentage cover or absence) of plant cover per plot, supported by photo images. • Water used for irrigation. Monitoring must be undertaken by the ECO once a month for the first 6 months and then quarterly thereafter for 12 months or until rehabilitation has been deemed successful. Rehabilitation will be deemed successful once primary pioneer species have been established, and management of alien species is at a maintenance level. This level is determined by the need to only control plants that exist, and spread is				

Rehabilitation Phase								
#	**Aspect**	**Objective**	**Potential Impact**	**Mitigation measures**	**Outcomes**	**Indicator and Monitoring**	**Responsibility**	**Timeframe**
				contained.				
73	Agriculture	Prepare land use of site during rehabilitation phase to conform to expected future land use	Poor rehabilitation making land less useful for future land use	482. All impacted agricultural land should be rehabilitated for future agricultural use.	Land rehabilitated for future land use	• Rehabilitation conducted as per EMP • Monthly ECO monitoring	PC; ECO	Rehabilitation phase
74	Bats	Minimise the impact of decommissioning vehicles and staff during rehabilitation	Habit destruction; poor rehabilitation	483. Damaged areas not required after construction should be rehabilitated by an experienced vegetation succession specialist.	Areas of disturbance minimised	• No less than 90% of the disturbed areas revegetated after decommissioning	PC; ECO	Throughout rehabilitation phase
75	Heritage	Manage heritage resources for least impact and conservation for future generations	Irreparable loss to heritage resources	484. Effective rehabilitation of the landscape after decommissioning.(cultural landscape impact.	Appropriate planning for rehabilitation	Professional used for rehabilitation, Once off monitoring	PC, ECO	Design takes into account the correct siting and sensitivities mentioned here

5. SPECIFIC MANAGEMENT PLANS

DEA required the following management plans to be included into the EMPr (this document):

- Recommendations and mitigation measures recorded in the EIAr and specialist studies (see Chapter 4);
- A final site layout map (see Chapter 1);
- Measures as dictated by the final site layout map and micro-siting (see Chapter 1 and 4);
- An environmental sensitivity map (see Chapter 1);
- A environmental sensitivity map overlaid with the final layout (see Chapter 1);
- An invasive alien species management plan (see Chapter 6);
- A plant rescue and protection plan (see Chapter 4);
- A re-vegetation and habitat rehabilitation plan (see Chapter 4);
- An open space management plan (see Chapter 4);
- A traffic management plan (see Annexure E);
- A transportation plan (see Annexure E);
- A storm water management plan (see Chapter 7);
- A fire management plan (see Chapter 4);
- An erosion management plan (see Chapter 4);
- A hazardous substance monitoring and management plan (see Chapter 8);
- Measures to protect hydrological features (see Chapter 4 and 8).

A traffic impact assessment and transport management plan is attached as Annexure E below. The remainder of the acceptance conditions are contained within this report, under the appropriate measures in the environmental specifications for the project lifecycle chapter (Chapter 4).

6. INVASIVE SPECIES MANAGEMENT PLAN

6.1 Background and legislative framework

The Department of Environmental Affairs (DEA) manages Invasive Alien Species under the National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA). In addition, there are regulations published in the Government Gazette on 1 August 2014, which stipulate categories for the classification of invasive potential (and thus risk), of the different known problem species in the country. These classes loosely model that of Henderson (2001), which provides the invasive status classification, as outlined in the Conservation of Agricultural Resources Act (No. 43 of 1983a). These plants can be classified as Category 1, 2 or 3 species, and as a 'Declared Weed' or 'Declared Invader' according to their level of invasiveness in South Africa. The description of the abovementioned classifications are:

- **Category 1a:** invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. Category 1a species include, for example, the yellow water lily (Nuphar lutea), yellow flag (Iris pseudocorus), bur cactus (Opuntia salmiana), hop wattle (Acacia stricta) and kangaroo wattle (Acacia paradoxa).
- **Category 1b:** Invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway.
- **Category 2** plants: (Commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread
- **Category 3** plants: (Ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading there of, except within the floodline of watercourses and wetlands
- **Declared weed** (category 1): Prohibited on any land or water surface in South Africa, Must be controlled, or eradicated where possible (except in biological control reserves)
- **Declared invader** (category 2): Allowed only in demarcated areas under controlled conditions, Import of propagative material and trading allowed only by permit holders, Outside demarcated areas must be controlled, or eradicated where possible (except in biological reserves), Prohibited within 30 m of the 1:50 year floodline of watercourses or wetlands unless authorization obtained.
- **Declared invader (category 3):** No further plantings allowed (except with special permission)**,** No trade of propagative material**,** Existing plants may remain but must be prevented from spreading**,** Prohibited within 30m or the 1:50 year floodline of watercourses or wetlands, or as directed by the executive officer.

It is essential that alien invasive species be removed from the study area. Following the Working for Water guidelines for effective alien vegetation removal (DWAF, 2009), an alien removal programme should consist of the following three phases:

1. Initial control: Clearing and eradication of alien invasive stands so as to drastically reduce the existing population;
2. Follow-up control: Control of re-growth (including seedlings, root suckers and coppice growth); which should be conducted annually for the first 5 years.
3. Maintenance control: Sustain alien plant numbers with on-going annual monitoring for the life of the project, and if necessary implement additional control methods to avoid re-establishment of alien invasive stands.

6.2 Potential Alien Invasive Plant Species at the site

A few alien plant species were recorded on-site, which require management. These species are indicated in Table 6-1 below, with their common names and their risk classification.

Table 6-1. List of alien invasive species recorded at the site.

Species name	Common name	Classification*
Prosopis spp.	Mesquite	1b species in Western Cape, category

		3 in the Northern Cape.
Bromus spp.	Cheat grass / ripgut	Naturalised invader, not listed
Lolium spp.	Perennial rye grass	Naturalised invader, not listed
Avena fatua	Wild Oat	Naturalised invader, not listed
Salsola kali	Tumbleweed	1b
Dittrichia graveolens	Stinkwort	Naturalised invader, not listed
Amsinckia retrorsa	Rigid fiddleneck	Naturalised invader, not listed
Conyza bonariensis	Hairy Fleabane / Horseweed	Naturalised invader, not listed

*Classification according to the National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species List, 2014.

6.3 General requirements

- Cuttings must be burnt in an open clearing where the risk of spreading fire is minimal, in order to kill the seeds on the plants.
- For these species, follow up clearing must be conducted every two months to remove upcoming seedlings. This is the Holder of the EA's responsibility.
- In cases where large scale alien plant removal has been conducted, measures to stabilise the soil from wind and water erosion must be taken. Soils may be mulched and planted with indigenous pioneer species.
- Continued ESO/ECO monitoring throughout the life of the project will be required as the risk of alien plant species invasion is never eliminated.

6.4 Weed removal as part of initial control programme

There are a number of possible methods which can be used to control alien invasive species; these include mechanical, chemical and biological control. The sections below outline possible techniques used in mechanical and chemical control methods. Table 6-2 (below) outlines specific management details for each of the alien invasive species identified on site.

As the species identified in the ecological report for this region include mainly grasses and herbs, mechanical clearing methods are limited in efficacy. Cut stump and frill treatments are also traditionally reserved for woody plant species, and as such are not applicable in the treatment of species found in this particular instance.

According to Todd (2011), mowing, fire, herbicide application and grazing are the four general categories of grass control in South Africa. Fire and mowing are difficult practically for control, as it means that natural vegetation will suffer if not applied correctly. Often, circumstances do not allow for successful physical control of the region, and the only available option is herbicide application. Due to the good condition of the study area, with mainly natural vegetation of similar height to that of the invasive grasses (i.e. roughly knee height), mowing and fire are not practical options. Especially in the light of fire tolerance and fire adapted grass species, such as *Avena spp.,* for which fire may actually increase the reproductive potential of the species. It is for this reason that chemical control is the primary suggested control method for invasive alien species in the study area. Fire and mowing are not discussed, as they are not regarded feasible for the existing land use and for the effective control of the herbs.

6.5 Mechanical control methods

Mechanical methods for alien plant removal may include felling, removing or burning invading alien plants. The following mechanical methods for felling are recommended:

- Hand pulling: Grip the young plant low down and pull out by hand (using gloves).
- Ring barking: Bark is removed to from the bottom of the stem to a height of 0.75-1.0 m to below ground level. Bush knives or hatchets can be used for debarking.
- Frill or Ring-bark: Using an axe or bush knife, angled cuts are made downward into the cambium layer through the bark in a ring; herbicide is applied into the cuts.
- Cut stump treatment: Stems should be cut as low as practical as stipulated on the herbicide label. Chemical herbicides are applied in diesel or water as recommended. Applications in

diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label.

6.6 Chemical control methods

Chemical methods for alien plant removal include using a number of approved environmentally safe herbicides, which are applied to the leaves, stems or stumps of alien invader species (details of herbicides suitable for the various species are provided in Table 6-2.). All alien control measures to be approved by the ECO prior to undertaking it.

Table 6-2. Summary of potential methods to be used for removal of alien invasive species identified on site.

Species name	Hand pull or hoe*	Herbicide
Prosopis spp.	Seedlings and saplings	The chemical and mechanical control of Mesquite has been found to be unfeasible financially, as control costs outweigh property values (Zachariades, Hoffman & Roberts 2011). As such, biological control is suggested, under supervision of the Agricultural Research Council (ARC), employing approved insects. Should smaller populations occur on site, mechanical clearing of new growth, coupled with regular herbicidal treatment should continue until populations are at maintenance levels. Cut stump treatment with Picloram has been shown to be effective in SMALL populations in the past. • Basal Bark/Cut Stump Treatment The basal bark application of usually 'Garlon 600' mixed in diesel onto the bark from ground level to knee height all the way around the Stem, during the active growing season. Cut stump treatments on any size plant at any time of the year using similar herbicides are also useful. • Foliar (Overall) Spray Treatment Foliar sprays are best applied on dense thickets of seedlings less than 1.5 metres tall. The plants must be actively growing with a large area of foliage. A wetting agent must be added to the mix. Garlon, Grazon DS and Access are all herbicides that can be used.
Bromus spp.	Seedlings or entire plant	According to CABI (2016), a range of herbicide treatments has been successfully used for control of *B. diandrus* in South Africa: In cereals, pre-emergence applications of cyanazine + terbuthylazine, chlorsulfuron + terbuthylazine, and metribuzin (Dastgeib et al., 2003) or post-emergence applications of clethodim, haloxyfop (Nott, 2002); or sulfosulfuron (Agenbag and Crous, 1999). In legumes, post-emergence treatments fluazifop, quizalofop (le Roux et al., 1995) and simazine + paraquat (Leys and Plater, 1993).
Lolium spp.	Seedlings or entire plant	Foliar application during the active growing season of tepraloxydim (cyclohexanone) 50 g / L (Aramo® herbicide).
Avena fatua	Seedlings or entire plant	Pre-emergent soil application of Pyroxasulfone (Pyrazole) 850 g/kg (Sakura® herbicide). Care must be taken to not spray soil outside of the edges of current infestations, and to reduce spray drift and unintended exposure to other plants.
Salsola kali	Seedlings or entire plant	Nicosulfuron (sulfonyl urea) 750 g/kg (Accent®) as foliar spray, post-emergence. Contains 720 g / ℓ dimethenamid-P (Frontier® Optima) for pre-emergence application. Care must be taken to not spray soil outside of the edges of current infestations,

		and to reduce spray drift and unintended exposure to other plants.
Dittrichia graveolens	Seedlings or entire plant	The salt formulation of triclopyr (Garlon 3A®) in a post-emergence, foliar spray application while plants are still young. Waxes on mature leaves create uptake problems, and as such earlier control efforts will be more effective. For Stinkwort, this is generally just before or at the time of bolting. Triclopyr is selective and relatively safe on grasses, and may be also be used. Glyphosate (Roundup Pro) may also be used.
Amsinckia retrorsa	Seedlings or entire plant	Glyphosate (Round-Up Biactive®, Weedmaster Duo® (360 g/L); Metsulfuron-methyl (Brush-Off®, Associate ® (600 g/Kg)) or Metsulfuron-methyl + glyphosate (Trounce®, Cut-Out® (various formulations), applied during the active growing season. Different application rates are suggested for different size target plant. Further reading available at http://dpipwe.tas.gov.au/invasive-species-site/Pages/Amsinckia---Herbicides-for-Control.aspx
Conyza bonariensis	Entire plant	MCPA® and Sorgomil Gold 600®, or paraquat and glyphosate based products (though resistance has been shown). Treat plants using foliar spray soon after bolting.

*Avoid mechanically clearing during dry periods or when plants are desiccated, in particular tumbleweed. This is primarily due to the seed dispersal mechanisms for most grasses and tumbleweed being through dessication and wind-blow dispersal. Control should be focussed on new growth using chemical means, as more uptake will occur and greater absorption will lead to greater efficacy.

6.7 Visual manual for Alien Invasive Plant species identification

The following plates provide a guide to the alien invasive plant species potentially found within the WEF site. Each species is described in terms of how it looks, timing of flowering and/or fruiting.

PROSOPIS SPP. (Mesquite)

Scientific name	*P. glandulosa var. torreyana (honey mesquite) and P. velutina (velvet mesquite)*
Common name(s)	Mesquite
Description	*Prosopis glandulosa* exhibits drooping branches with feathery foliage and straight, paired spines. The species can grow up to 15 m, at a medium growth rate.
Leaves	Leaves are deciduous, twice compound, bright-green and feathery, with leaflets up to 5cm long and 7cm wide.
Flowers	Flowers have pale, yellow, elongated spikes with straight, yellow seedpods.
Fruits	Fruit display a long, yellowish brown pod at maturity, somewhat flattened and with slight constrictions between the seeds.

	
Proposed control methods	
Seedlings	Hand pull or hoe over small areas Foliar spray
Mature or large plants	Foliar spray Cut stump and herbicide Biological control (should only be conducted in cooperation with the department of agriculture).

(Pictures source: Wikipedia, 2016).

BROMUS SPP. (Ripgut)

Scientific name	*Bromus diandrus*
Common name(s)	Ripgut
Description	*B. diandrus* is an annual tufted grass with unbranched culms, occurring throughout much of the western cape, and southern part of the Northern Cape, flowering from September to January.
Leaves	Great brome leaves are rough, hairy, dull and often have visible purple stripes along the leaf veins. The leaf sheath is tubular, the ligule is prominent and membranous, and the stems are hairy
Flowers **Fruits**	Flowers are a loose, nodding panicle with long stalked spikelets
 Source: T. Rebelo, iSpot.co.za (2015)	 Source: S. Navie, Biosecurity Queensland (2016)

Proposed control methods	
Seedlings	Hand pull or hoe over small areas Foliar spray
Mature or large plants	Foliar spray Mowing at selective growth stages

LOLIUM SPP. (Perennial rye grass)

Scientific name	*Lolium perenne*
Common name(s)	Perennial ryegrass
Description	The plant is a low-growing, tufted, hairless grass, with a bunching growth habit.
Leaves	The leaves are dark green, smooth and glossy on the lower surface, with untoothed parallel sides and prominent parallel veins on the upper surface. The leaves are folded lengthwise in bud or rolled (*Lolium multiflorum*), and has an overall flat appearance. Leaf sheaths at the base are usually tinged pink and hairless. Stems grow up to 90 cm. (Wikipedia, 2016)
Flowers	The inflorescence is unbranched, with spikelets on alternating sides edgeways-on to the stem. The anthers are pale yellow. Perennial ryegrass has a fibrous root system, with thick main roots and thinner lateral branches. Roots are usually arbuscular mycorrhizal. (Wikipedia, 2016)
Fruits	
 Source: www.horsedvm.com, 2016	 Source: S. Navie, Biosecurity Queensland (2016)
Proposed control methods	
Seedlings	Hand pull or hoe over small areas Foliar spray
Mature or large plants	Foliar spray Mowing at selective growth stages

AVENA FATUA (wild oat)

Scientific name	*Avena fatua*
Common name(s)	Wild oat
Description	*A. fatua* is an annual tufted grass with erect culms, varying from 25 to 120 cm. (CABI, 2016)
Leaves	Leaf blades are dark green, up to 40 cm long and with a membranous ligule, which is 1 to 6 mm long and often irregularly toothed. Sheaths are smooth or slightly hairy, especially in younger plants. (CABI, 2016)
Flowers	The inflorescence of *A. fatua* is a loose, open panicle with 2 to 3-flowered pedicelled spikelets. (CABI, 2016)
Fruits	Grains are 6 to 8 mm long.

 Source: S. Navie, Biosecurity Queensland (2016)	 Source: S. Navie, Biosecurity Queensland (2016)
Proposed control methods	
Seedlings	Hand pull or hoe over small areas Foliar spray
Mature or large plants	Foliar spray Mowing at selective growth stages

SALSOLA KALI (common saltwort)

Scientific name	*Salsa kaoli*
Common name(s)	Common saltwort
Description	*S. kali* is a low herb, 5-50 cm tall, papillose to hispid or, occasionally, glabrous. Stems are erect to ascending, branching from the base (CABI, 2016).
Leaves	Leaves are alternate with linear blades, roughly 1-2 mm wide, fleshy, usually not swollen at base, apex acuminate, forming a firm spine, 1-1.5-2.2 mm long. (CABI, 2016)
Flowers	"Flowers with bracteoles free or becoming connate and adnate to perianth base; perianth segments with comparatively narrow wing, or in lower flowers occasionally wingless, with weak or firm, acute apex, glabrous; fruiting perianth 4-6(-8) mm diameter" (CABI, 2016)
Fruits	"Inflorescences interrupted at maturity, usually 1-flower per axil of bract; bracts alternate, not imbricate at maturity, reflexed, not distinctly swollen at base, apex narrowing into subulate spine" (CABI, 2016).
 Source: www.invasives.org.za, 2016	 Source: Eattheweeds.com, 2016

Proposed control methods	
Seedlings	Hand pull or hoe over small areas Foliar spray
Mature or large plants	Foliar spray Mowing at selective growth stages

DITTRICHIA GRAVEOLENS (Stinkwort)

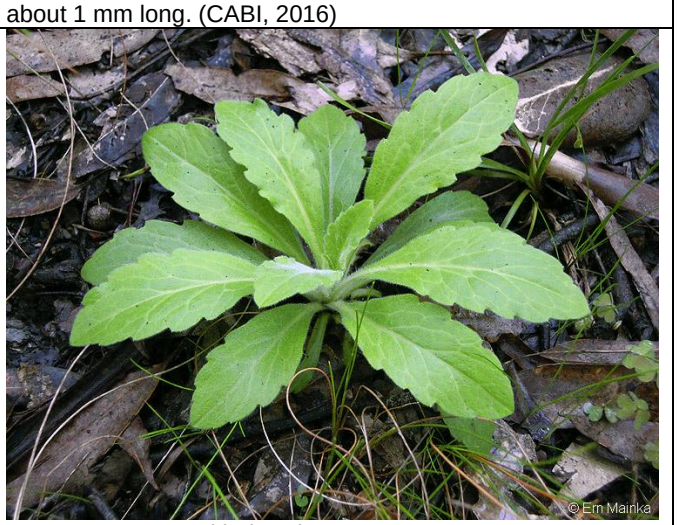
Scientific name	*Dittrichia graveolens*
Common name(s)	Stinkwort
Description	*Dittrichia graveolens* is a branching subshrub, growing to 130 cm tall, with a pungent smell. (Wikipedia, 2016)
Leaves	Leaves are long and narrow, pointed at each end, with small teeth along the edges and glandular hairs on the surfaces (Wikipedia, 2016).
Flowers	One plant can produce numerous yellow flower heads with as many as 16 ray florets and 40 disc florets (Wikipedia, 2016).
Fruits	
 Source: mundaringps.wa.edu.au (2016)	 Source: Wikipedia (2016)
Proposed control methods	
Seedlings	Hand pull or hoe over small areas Foliar spray
Mature or large plants	Foliar spray Mowing at selective growth stages

AMSINCKIA RETRORSA (Rough Fiddleneck)

Scientific name	*Amsinckia retrorsa*
Common name(s)	Rough fiddleneck
Description	Rigid fiddleneck is a colorful annual and weed. Plants have erect, simple to few-branched stems from 10- 100 cm high. The stems are covered with long, spreading, stiff hairs with and undercoat of shorter, softer hairs that point downwards. (http://science.halleyhosting.com/, 2016)
Leaves	The leaves are linear to linear-oblong in shape, measuring up to 12 cm long and up to 1 cm wide. The herbage of the leaves is similar to that of the stems, but the hairs may be more appressed. The basal leaves are more numerous and crowded, while those of the stems are more widely spaced and are reduced in size. (http://science.halleyhosting.com/, 2016)
Flowers	The inflorescence consists of a scorpioid spike which uncoils and elongates with age. The 5 sepals are generally equal in size and shape and measure from 5-12

Fruits	mm long. Individual sepals are linear to linear-lanceolate in shape and measure from 7-10 mm long. The corolla consists of a tube from 5-8 mm long that is barely exserted from the calyx while the limbs or lobes of the corolla range from 1.5-5 mm long. The corolla is typically orange or orange-yellow with reddish markings in the open throat. (http://science.halleyhosting.com/, 2016)
 Source: www.tss.oregonstate.edu, 2016	 Source: malag.aes.oregonstate.edu, 2016.
Proposed control methods	
Seedlings	Hand pull or hoe over small areas Foliar spray
Mature or large plants	Foliar spray Mowing at selective growth stages

CONYZA BONARIENSIS (Hairy fleabane)

Scientific name	*Conyza bonariensis*
Common name(s)	Hairy fleabane
Description	*"C. bonariensis* is an erect annual with one or more stems from a basal rosette, up to 60 cm or occasionally 100 cm in height. All parts of the plant are finely pubescent and greyish in colour." (CABI, 2016)
Leaves	"Leaves linear to oblanceolate, mostly about 5 mm wide, entire, but often wavy-edged, with very short or hooked hairs less than 0.5 mm long." (CABI, 2016)
Flowers	The inflorescence has long branches resulting in an almost corymbose effect, with most flowering heads about the same level. Individual flower heads are greyish-green, 4-5 mm diameter when fresh (broader in pressed specimens) with cream-coloured disc florets and no ray florets. (CABI, 2016)
Fruits	The pappus is white or pinkish and 4-5 mm long; seeds are about 1 mm long. (CABI, 2016)
 Source: iSpot.co.za, 2016.	 Source: www.roundthebend.org.au, 2016.

Proposed control methods	
Seedlings	Hand pull or hoe over small areas Foliar spray
Mature or large plants	Foliar spray Mowing at selective growth stages

6.8 Monitoring

Due to their persistent nature and prodigious seeding and reproduction, invasive alien plants require coordinated, consistent monitoring and control efforts. For this project, where invasive species are likely to mainly be located along already disturbed regions such as farmsteads, roads, cattle feedstock's, pens, and farm dams, the monitoring efforts should be focussed on these areas. This is especially important as the majority of the project region is currently under good, natural veld with little invasion. Monitoring should be conducted by the ECO (contractually), and ESO (incidentally, or on an ad-hoc basis). The ESO and ECO should familiarise himself/herself with the identification of the species mentioned above, and be able to identify them in-field. Should any doubt exist, a professional botanist should be consulted.

The ESO shall survey all high priority regions (disturbed areas) every two weeks throughout the construction phase, and include in his/her monthly report finding from these surveys. The objective will be to identity the presence of absence of target species on-site, and to identify the efficacy and ongoing clearance control offered by the methods mentioned above. New occurrences of problem species must be noted for clearance, and included in the clearing teams' objective for clearing to commence within two weeks of positive identification.

During the operation phase, monitoring may be relaxed to a once every six months event, where surveys for all disturbed regions (i.e. all regions cleared and frequented by the construction efforts) is to be conducted. Findings shall be captured yearly and included in the rehabilitation reporting. Reports should be made available upon request.

6.9 General control efforts

In general, control efforts must:

- Avoid fire as a clearing / control method;
- Avoid mowing as a clearing / control method;
- All biocontrol measures must be conducted in consultation with the Plant Protection Research Institute (DoA – Pretoria), or another recognised IAP control organisation, in order to ensure the correct agent is being employed, and the region isn't at risk.
- A clearing roster must be drawn up by the ESO and approved by the Project Manager prior to clearing commencing, in order to allow for a work schedule for all invasive species occurrences on-site. This roster will be updated as clearing occurs and new instances are observed. This roster will be used to track progress and act as proof of clearing conducted and can be verified by the ECO;
- All clearance activities to be described in a Method Statement for approval by the ECO;
- Prioritise small populations over large populations;
- Prioritise less dense infestations to denser infestations;
- Ensure clearing of fringes of existing populations prior to the clearing of the centre (i.e. outside inward, not inwards to the outside clearing);
- Ensure all control teams are equipped with the appropriate Protective wear and do not conduct work without them on;
- Apply herbicide to plants at new growth, as opposed to mature plants (this improves uptake);
- Ensure the correct herbicide is selected for each species, and the correct dosage is used. Dosage must at all times follow that of the label;
- Ensure the correct clearing method is selected and used for each species;

- Clearing must be conducted every three months for herbaceous species, and once every six months for Mesquite. Once maintenance levels have been achieved, clearance may occur annually or as required for the duration of the operation phase.
- Should these clearing methods above prove ineffectual, a professional clearing organisation or botanist (Working for Water, or the City of Cape Town invasive Species Unit or similar) must be approached for a species-specific management plan, to be followed for each species.

7. STORM WATER MANAGEMENT PLAN

7.1 Introduction

Storm water includes any surface run-off and flows resulting from precipitation, drainage or other sources. A Storm Water Management Plan (SWMP) is implemented during the construction and operation of a facility and it ensures compliance with applicable regulations and prevent off site migration of contaminated storm water or increased soil erosion. The SWMP to be developed will include the construction of design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. In addition, drainage measures will be designed to promote the dissipation of storm water run-off and appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.

The purpose of this chapter is to provide a concept plan for the stormwater management measures that will be adopted during the construction and operation of the Brandvalley wind farm. The plan will ensure that the storm water is channeled in a controlled manner from the existing and new infrastructure such as roads, turbine platforms and the electrical substation towards the natural drainage lines, to avoid water logging, pollution or erosion.

The SWMP should consist of the following:

- Adoption of gravel roads and not asphalt roads in order to guarantee natural drainage trough the gravel.
- Adoption of proper drainages along the gravel roads of the steepest portions of the wind farm in order to channel storm water away, as shown in the following typical drainage works.
- Design an appropriate site preparation of the substation area with adequate slopes and side water outlets to disperse storm water which can runoff from the asphalt paved areas.
- Adopt a storm water abatement system in the area of the electrical substation, where the storm water may get in contact with debris or oil traces. This is done as an environmental precaution, as the risk of storm water pollution is negligible. The transformer is in fact equipped with double seal oil containment and the paved surface which can be driven by vehicles will be kept to minimum. Depending on Eskom's standard design protocol, the storm water drained from the substation could be collected in a decantation basin and is the purified by possible traces of oil prior to being reintroduced into the environment.

The engineering of the drainage works will be done during the project planning phase as decribed in Section 4.1. The present report will identify conceptual arrangements that will be used as the base of the detailed engineering. Precaution measures will be adopted during the detailed layout definition in order to avoid soil erosion, these may include, *inter alia*:

- Avoid alteration of the existing natural drainage lines during construction phase as far as feasibly possible, by adopting a buffer from both sides of each natural drainage line in order to avoid construction works close to the drainages.
- Use of existing crossings for cables lay down.

7.2 Management requirements

Typically, storm water run-off contains suspended sediments, metals, petroleum hydrocarbons, Polycyclic Aromatic Hydrocarbons (PAHs), coliform, etc (Table 7-1). In order to reduce the need for storm water treatment, the following should be applied:

- Storm water should be separated from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge.
- Surface run-off from process areas or potential sources of contamination should be prevented.

- Where this approach is not practical, run-off from process and storage areas should be segregated from potentially less contaminated run-off.
- Run-off from areas without potential sources of contamination should be minimised (e.g. by minimizing the area of impermeable surfaces) and the peak discharge rate should be reduced (e.g. by using vegetated swales and retention ponds).
- Oil-water separators and grease traps should be installed and maintained as appropriate at refueling facilities, workshops, parking areas, fuel storage and containment areas.
- Sludge from drains or treatment systems may contain elevated levels of pollutants and should be disposed of in compliance with local regulatory requirements.

Table 7-1. Major sources of common storm water pollutants.

Common Constituents	Major Sources Related to Urban Land Use
Sediment and Particulates	Construction, winter road sanding, vehicle emissions, pavement wear
Hydrocarbons (PAH's)	Spills, leaks, dumping, vehicle emissions, asphalt breakdown, wood preservatives
Pathogens (Bacteria, Viruses)	Illicit connection of septic systems to storm sewers, poor housekeeping (animal faeces, bird faeces from rooftops)
Nutrients (N, P)	Illicit connection of septic systems to storm sewers, detergents (car washing), lawn fertilizers
Cadmium	Tire wear, insecticides, wood preservatives
Zinc	Galvanized building materials, tire wear, motor oil, grease
Lead	Motor oil, lubricants, batteries, bearing wear, paint, vehicle exhaust
Copper	Wear of moving engine parts, metal plating, fungicides and insecticides
Manganese	Wear of moving engine parts
Nickel	Vehicle exhaust, lubricants, metal plating, wear of moving parts
Chromium	Metal plating, wear of moving parts
Iron	Steel structures, rusting automobile bodies
PCBs	Leaks from electrical transformers, spraying of highway right of ways, catalyst in tire construction

7.3 Design specification for storm water management

Storm water will naturally drain through the gravel access roads. In addition, in the steepest areas roads should be equipped with side drainages and culverts in order to channel the storm water in a controlled manner to the nearest natural drainage line. The outlets and the culverts should be planned and designed in such a way that water will not gather velocity and cause erosion.

Considering the locations of the turbines and the limited dimension of the foundation footprint, foundations will not require permanent drainages as such only temporary drainage works allowing water runoff during construction will be required. Typical examples of the side outlets and of the drainage works (culverts) are provided in Figures 7-1 and 7-2 below.

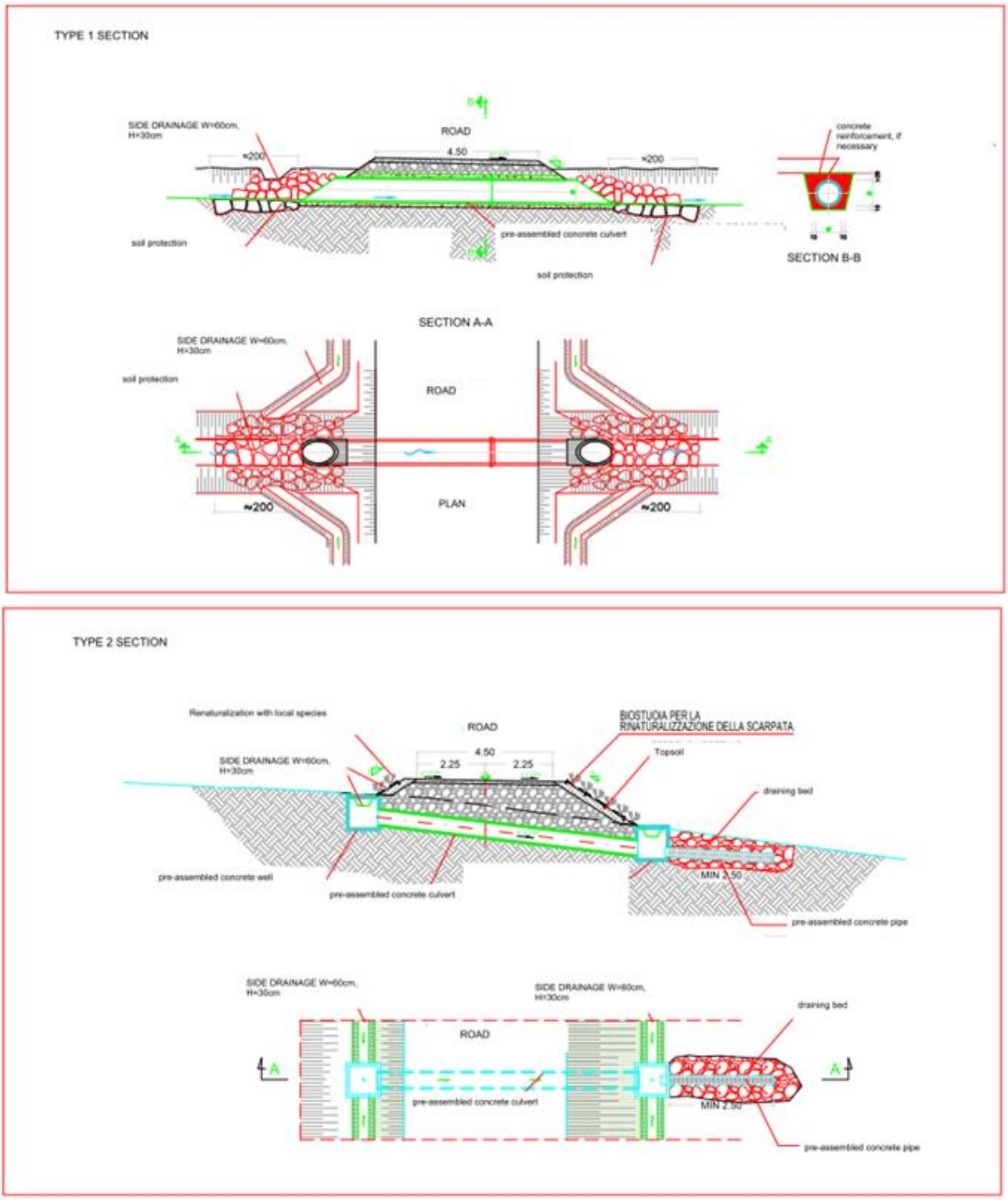


Figure 7-1. Typical drainage works for gravel roads.

Water Collection Works

Figure 7-2. Typical culverts and trenches conveying the storm water to the drainage.

An appropriate site preparation of the substation area with adequate slopes and side water outlets to disperse storm water will be designed, as per Figures 7-3. The storm water abatement system will be provided, consisting in:

- A drainage sump where the water is collected by gravity and receives a first separation
- A disoleatore where the water is separated from oil and debris through decantation and separation
- Final filter before discharge into the nearest natural drainage line.

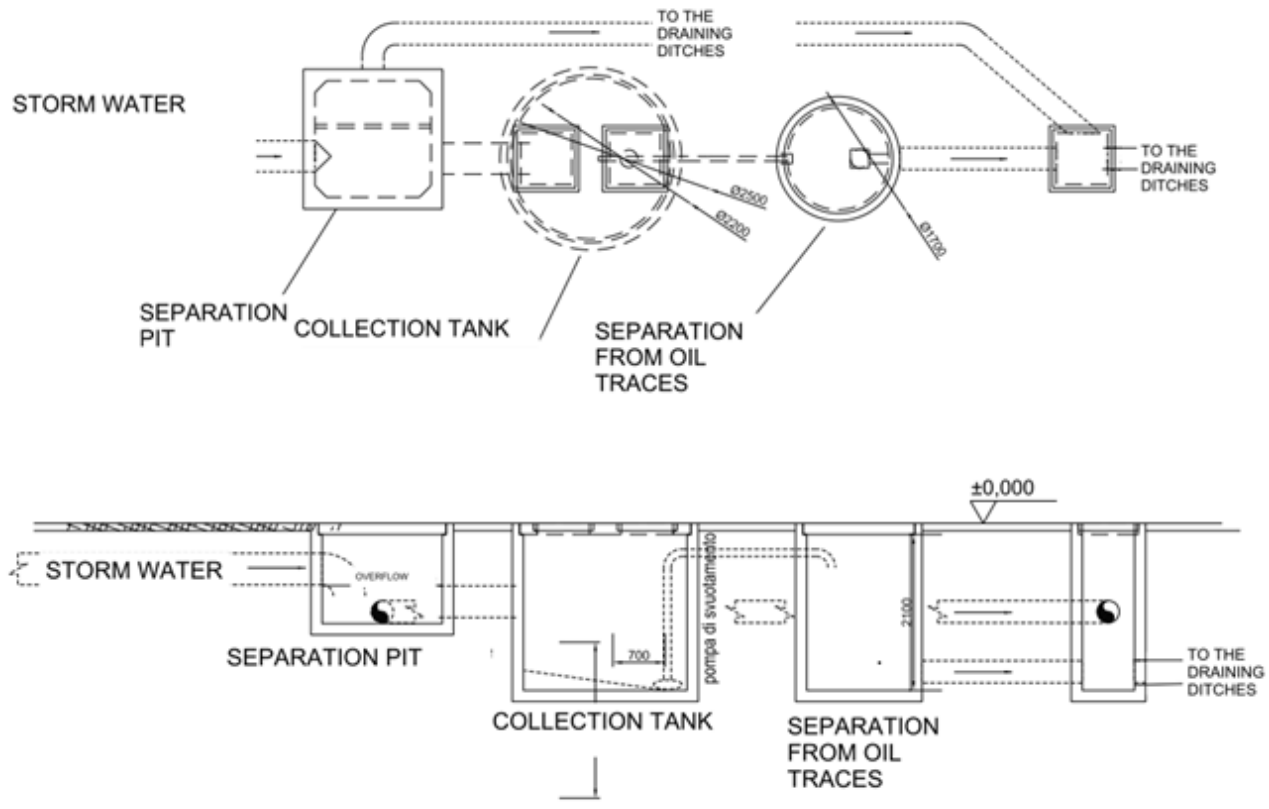


Figure 7-3. Contaminated storm water abatement system.

The oil-filled electrical transformer will be equipped by an oil containment basin (normally a concrete basin) so that, in case of a spill, the oil remains contained within the spill containment area without contamination of the ground. This completely eliminates the likelihood of storm water contamination from hydrocarbon spills from electrical transformers.

8. HAZARDOUS SUBSTANCES PLAN

The special mitigation measures pertaining to the hazardous substance bunding and monitoring have been included in the construction and operation measures, contained in Chapter 4 of this report. However, in general, the contractor shall be responsible for the implementation of hazardous substance management measures, as detailed below. The Project Manager shall ensure effective and accurate implementation of hazardous substance management, the ECO shall ensure compliance monitoring with below specifications and reporting thereon. The timeframe shall be the duration of the construction phase.

8.1 Training

Ensure that all personnel that use or handle hazardous material are trained:

- In the use and potential dangers of the materials.
- To understand what a Materials Safety Data Sheet (MSDS) is, and be able to interpret the information thereon.
- On emergency response procedures required to counter the nature and hazards of an accidental release.
- The handling and storage practices, for all containers with which they will come into contact.

8.2 Material types

- Use materials with low life cycle impact.
- Use materials with low embodied energy (i.e. materials that require less total energy to extract, manufacture, transport, construct, maintain and dispose of).
- Reduce materials containing volatile organic compounds and formaldehyde.
- Avoid xylene and toluene solvents in paints, glues and carpets as well as polyurethane.
- Where possible use water based paint.
- Do not use chlorofluorocarbons (CFCs), ppolychlorinated biphenyl (PCBs), persistent organic pollutants (POPs) (in pesticides), ozone depleting substances (ODSs) and materials containing asbestos.

8.3 Control planning for hazardous materials on site

- Document the types and quantities of hazardous materials present on the proposed project site, including the following information:
    - Name and description (e.g. composition of a mixture) of the hazardous material.
    - Classification (e.g. code, class or division) of the hazardous material.
    - Regulatory reporting threshold quantity of the hazardous material.
    - Quantity of hazardous material used per month.
    - Characteristic(s) that make(s) the hazardous material hazardous (e.g. flammability, toxicity, etc.).
    - Analysis of potential spill and release scenarios using available industry statistics on spills and accidents where available.
    - Analysis of the potential for uncontrolled reactions such as fire and explosions.
    - Analysis of potential consequences based on the physical geographical characteristics of the site, including aspects such as its distance to settlements, water resources, and other environmentally sensitive areas.
- Identify locations of hazardous materials and associated activities on an emergency plan site map.
- Detail the availability of specific personal protective equipment and training needed to respond to an emergency.
- Detail availability of spill response equipment sufficient to handle at least initial stages of a spill and a list of external resources for equipment and personnel, if necessary, to supplement internal resources.

8.4 Uncontrolled Releases

- Prevent uncontrolled releases of hazardous material to the environment or uncontrolled reactions that might result in fire or explosion using engineering controls (containment, automatic alarms, and shut-off systems) commensurate with the nature of the hazard.
- Implement management controls (procedures, inspections, communications, training, and drills) to address residual risks that have not been prevented and controlled through engineering measures.
- Store all hazardous (reactive, flammable, corrosive and toxic) materials in clearly identified, fit-for-purpose containers or vessels.
- Clean any accidental spills immediately, and treat the spilled material and use cleaning products as hazardous waste.
- Describe response activities in the event of a spill, release, or other chemical emergency in an incident report that must include, inter alia:
    - Internal and external notification procedures.
    - Specific responsibilities of individuals or groups.
    - Decision process for assessing severity of the release, and determining appropriate actions.
    - Facility evacuation routes.
    - Post-event activities such as clean-up and disposal, incident investigation, employee re-entry, and restoration of spill response equipment.

8.5 Reaction, fire and explosion prevention

Reactive, flammable, and explosive materials must be managed to avoid uncontrolled reactions or conditions resulting in fire or explosion. Such prevention practices include:

- Storage of incompatible materials (acids, bases, flammables, oxidizers, reactive chemicals) in separate areas, and with containment facilities separating material storage areas.
- Provision of material-specific storage for extremely hazardous or reactive materials.
- Use of flame arresting devices on vents from flammable storage containers.
- Storage of hazardous materials in an area of the facility separated from the main construction activities.

8.6 Planning coordination

Procedures should be prepared for:

- Informing the public and emergency response agencies.
- Documenting first aid and emergency medical treatment.
- Taking emergency response actions.
- Reviewing and updating the emergency response plan to reflect changes and ensuring that the employees are informed of such changes.
- Using, inspecting, resting and maintaining the emergency response equipment.

8.7 Storage of hazardous materials

- Locate chemicals stored in drums in areas with a secondary containment capacity of at least 25% of the maximum stored quantity of chemicals.
- Drum stack heights must not exceed two drum heights on pallets. All defective pallets must be replaced immediately. A minimum space of 80 cm must be left open between stacks and 100 cm between stacks and a wall.
- Chemical products must be secured when not needed to prevent tampering and vandalism.
- Provide warning notices, fire-fighting facilities and protection from weather damage.
- Keep products in their original containers unless they are not re-sealable, with all stored products and containers being labelled, and original labels and MSDS retained.

- Store acetylene, propane, and oxygen cylinders in dedicated areas where they will be protected from collision or ignition sources.
- Label containers so that the hazard nature of the material is clear.
- Ensure compliance with all national, regional and local legislation with regard to the storage, transport and use of hydrocarbons, chemicals, solvents, explosives and any other harmful and hazardous substances and materials.
- The Contractor must provide proof to the Project Manager that, if required, the relevant authorisation to store such substances has been obtained from the relevant authority. In addition, hazard signs indicating the nature of the stored materials must be clearly displayed on the storage facility or containment structure.
- Petrochemicals, oils and identified hazardous substances must only be stored under controlled conditions. All hazardous materials (e.g. bitumen binders) must be stored in a secured, appointed area that is fenced and has restricted entry. Storage of bituminous products must only be in suitable containers approved by the Project Manager.
- Keep a record of all hazardous substances stored on site for submission to the ESO and fro verification to the ECO.
- Store all hazardous substances in secure, safe and weatherproof facilities, underlain by a bunded concrete slab to protect against soil and water pollution.

8.8 Handling of hazardous materials

- Ensure that personnel who handle hazardous substances have been educated and trained in terms of the correct handling, use and disposal thereof.
- Empty containers in which hazardous substances were kept are to be treated as hazardous waste. Such containers must not be reused for any purpose.
- Obtain Material Safety Data Sheets (MSDS) for all hazardous chemical formulations before use and all materials must be handled according to the instructions.
- In response to and in addition to the information contained on the MSDS the following must also be determined:
    - What personal protective equipment (PPE) is required.
    - What emergency actions may be needed (i.e. first aid, firefighting media, etc.).
    - The weight of the container so that proper personnel and/or equipment will be utilised during handling.
    - Access and egress routes.
    - Containers holding flammable materials to be grounded during transfers of contents.

8.9 Transport of hazardous materials

- Provide for controlled loading/unloading areas, underlain by an impervious paving or PVC sheet to protect against soil and water pollution.
- All hazardous waste containers designated for off-site transport to be secured and labelled with the contents and associated hazards, be properly loaded and be accompanied by a shipping paper (i.e. manifest) describing the loads and its associated hazards.
- Transporters of hazardous materials must ensure that:
    - The vehicle is suitable and registered for the purpose it is being used.
    - The vehicle displays clear markings in English indicating the nature of the materials being carried, what to do in the event of an emergency, and an emergency telephone number (24 hour) of a responsible person who can provide advice in the event of an emergency.

8.10 Flammable liquids

- No combustible material (e.g. wood, rags, paper, carton boxes) are to be kept in the presence of flammable liquids.
- ‘No Open Flames’ and ‘No Smoking’ symbolic signs are to be displayed in the vicinity of the flammable liquid storage areas. Flammable liquids are to be issued only on a need-to-use

basis and strict control is to be exercised to ensure that persons do not draw more than what is needed for the specific job.

- An adequate number and type of fire-fighting equipment is to be available in the close vicinity of the flammable liquid store.
- Flammable liquid stores are to be equipped with approved flameproof electrical equipment.
- Flammable liquid containers in the flammable liquid stores are to be clearly marked/labelled as to their contents. They are to be provided with earthed drip trays.
- Locations are to display MSDS information and handling/storage instructions. MSDSs are to be available for all flammable/hazardous products at the location where such substances are present.
- The number of 200 litre drums containing flammable liquids is to be kept to a minimum and the position is to be strictly controlled. The necessary signs should be visible at these storage areas.
- Flammable liquid tanks are to be properly earthed in order to prevent static electricity accumulating.
- Drainage points on flammable liquid tanks are to be provided with threaded caps or blanking plates.
- Bund walls are to surround storage tanks containing flammable liquids and these must be able to contain the entire volume of the contents plus 10% in case of spillage.
- Adequate precautions must be taken, such as wearing relevant protective equipment when handling substances.

9. GRIEVANCE PROCEDURES

Whilst the mitigation measures contained within this EMPr aim to reduce and minimise harm to the environment, whilst facilitation and guiding the construction and rehabilitation efforts, grievances are likely to surface throughout the construction and operation phases. As such, mechanism for the effective processing, capture and management of grievances is required. This chapter thus aims to provide guidance measures, to be put in place by the construction crew and management team, in order to process and minimise grievances throughout construction and operation. All measures for grievance are required to be:

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

These grievance procedures do not negate the availability of legal action should that course be desired, however, it is rather aimed at avoidance of a potentially costly and time consuming legal process.

The following proposed grievance procedures are to be complied with throughout all project phases.

- An electronic copy of these grievance procedures shall be kept on site at all times, throughout all project phases for open access to any aggrieved person or general public.
- A representative will be appointed as the contact person for grievances. The name and contact details of the contact person will be provided to local landowners, communities and authorities or be contained within this document. The representative shall be either the Project Manager or the ESO.
- Project related grievances relating to the construction, operational and or decommissioning phase must be addressed in writing to the contact person.
- Should any party lack resources to submit grievances, the contact person will be required to facilitate as far as reasonable, the written recording and response to such grievance.
- Grievances received in writing shall be registered with the contact person, captured in the grievance register, and responded to within 2 working days of receipt of the grievance. Response shall entail contacting the complainant to discuss the grievance and agree on a suitable date and time for a meeting if required. The meeting shall be scheduled as soon as reasonable possible, with no undue delay in the processing thereof.
- The contact person shall communicate receipt of grievance to the complainant in writing within 7 calendar days of receipt. The receipt notification shall include the following details:
    - The name and contact details of the complainant;
    - The nature of the grievance;
    - Dates raised, received and for which the meeting was arranged; and
    - Persons elected to attend the meeting (which will depend on the grievance);
    - A clear statement that the grievance procedure is, in itself, not a legal process. Should such avenues be pursued, they must be conducted in a separate process.
- Draft copies of the meeting will be made available to all parties having attended the meeting, within 5 working days of the meeting.
- The meeting agenda shall be primarily the discussion of the grievance, avoidance and mitigation measures available and agreed by all parties, as well as a clear indication of the future actions and responsibilities, in order to effect the proposed measures and interventions.
- The commitments stated and recorded within the meeting minutes shall be held to by all parties.
- Should a grievance be satisfactorily resolved, the outcome shall be recorded and signed off by the relevant parties, recorded and stored electronically. A copy of the notice shall be issued in writing to all parties having attended the meeting. The notice shall include:
    - Date of the meeting, parties attending and the meeting agenda;
    - Meeting minutes;

  - Measures, roles and responsibilities identified and agreed to during the meeting;
  - The date and manner of completion of each of the agreed to measures;
  - A description of the current status of each measure and the overall compliance of the measures to the outcomes of the meeting;
- Should a dispute arise between the complainant and the Holder of the EA regarding the grievance, the option of appointing an independent mediator to assist with resolving the issue should be discussed.
- A record of the dispute shall be maintained and circulated to all parties having attended the meeting(s), in order to provide a paper trail of disputes.
- Should a mediator be required, the costs thereof shall be borne by the proponent.
- Should a dispute not be resolved, a draft report shall be compiled by the representative, summarising the nature of the grievance and the dispute, and include a recommendation by the mediator. The draft report shall be made available to all parties having attended the meeting(s), and is to be signed off by all parties. This document will be forwarded to all parties within 5 working days.

The way forward will then be informed by the recommendations of the mediator and the nature of the grievance.

10. CONCLUSION

Although all foreseeable actions and potential mitigations or management actions are contained in this document, the EMPr should be seen as a day-to-day management document. The EMPr thus sets-out the environmental and social objectives and outcomes, which would be required to avoid or minimise the negative impacts and maximise the positive benefits of the Brandvalley Wind Farm Project as detailed in the EIR and specialist reports. The EMPr could thus change based on adaptive management, and if managed correctly, lead to a successful implementation of the project.

Further guidance should also be taken from any conditions contained in the EA, if the project is granted approval. These DEA conditions must be incorporated into the final EMPr.

All attempts should be made to have this EMPr available, as part of any tender documentation, so that the engineers and contractors are made aware of the potential cost and timing implications needed to fulfil the implementation of the EMPr, thus adequately costing for these.

11. REFERENCES

Sowler S. and Stoffberg S. 2012. *South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments*. Wildlife & Energy Programme of the Endangered Wildlife Trust.

Aronson J., Clewell A.F., Blignaut J.N. & Milton S.J. 2006: Ecological restoration: A new frontier for nature conservation and economics [online].Available from http://repository.up.ac.za/bitstream/handle/2263/5809/Aronson_Ecological(2006).pdf?sequence=1 [Accessed 18.05.2016].

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ANNEXURE A: CV'S OF AUTHORS AND REVIEWERS

MR. MARC RICHARD HARDY

Born: May 1972

ACADEMIC QUALIFICATIONS

- 2001 - B.Soc.Sci. Development Studies (University of Cape Town)
- 2002 - B.Soc.Sci. (Hons) Environmental and Geographical Science (U.C.T.)
- 2009 - M.Phil Environmental Management (Stellenbosch University)

EMPLOYMENT HISTORY

- November 2009 – Present: Principal Environmental Consultant and Mozambique Country Manager: EOH Coastal and Environmental Services (Grahamstown office, Eastern Cape).
- January 2008 – October 2009: Senior Environmental Consultant: Stewart Scott International (SSI) Engineers and Environmental Consultants – now Royal Haskoning DHV (Johannesburg, Gauteng).
- January 2006 – December 2007: Principal Environmental Officer/Acting Assistant Director: Gauteng Provincial Department of Agriculture, Conservation and Environment – Environmental Planning and Impact Assessment Directorate (Johannesburg, Gauteng).
- January 2003 – December 2005: Environmental Consultant/Research Assistant: Various research organisations and consultancies (Cape Town, Western Cape).
- June – November 2004: Temporary Lecturer - Department of Environmental and Geographical Science, University of Cape Town.
- 1999 – 2002: Full time studies at the University of Cape Town.
- 1992 – 1998: Commercial Diver/Diving Supervisor: Commercial diving, marine and alluvial diamond recovery operations in South Africa, Namibia and Angola.
- 1990 – 1991: Learner Official Mining: mining engineering training programme (St. Helena Gold Mine – Welkom, Free State).

COURSES ATTENDED

- Institute of Environmental Management and Assessment (IEMA) Certificate course in ISO 14001 Auditing, June 2007.
- Certificate course in Project Management, U.C.T. Graduate School of Business, May 2009.
- Coastal setback line determination, Department of Port & Coastal Engineering, Stellenbosch University, September 2010.
- Achieving better resettlement outcomes in development projects, Rhodes University, July 2013 (NQF 6).

RESEARCH, CONSULTING & PROFESSIONAL EXPERIENCE

Subsequent to completing his full time studies Marc was involved in research projects through various organisations on behalf the Department of Marine and Coastal Management (MCM) pertaining to various fisheries along the South African coast as research team member for the following:

- On-board monitoring of rock lobster fishing vessels in the Hangklip concession area, False Bay as part of the MCM fishery monitoring program, Cape Town (Research Assistant);
- Compilation of a fishery permit holder database and implementation of a community-based catch monitoring system for the Cape South Coast oyster picking fishery for the MCM (Research Assistant);
- The identification and development of potential additional livelihood options, key intervention strategies, as well as the implementation of a community-based catch monitoring system for

the west coast Olifants River subsistence fisher community for the Environmental Evaluation Unit – U.C.T. (Research Assistant).

In the environmental management and assessment field Marc has been project manager or team member for the following projects and processes -

Regulatory

- Appointed to various panels tasked with developing Spatial Development Frameworks, Urban Edge Policy and Environmental Management Frameworks for local/provincial government while employed by GDACE;
- Team member of a unit tasked with the development of GDACE Departmental EIA review and Basic Assessment Report (BAR) format and reporting requirement guidelines in line with 2006 NEMA EIA Regulations.
- Review and management of all EIA applications for the Ekurhuleni region and associated intra-government consultation and forum representation related thereto;
- Joint reviewer for the Gautrain Rapid Rail Project variation alignment applications, as well as numerous linear, service supply and large infrastructure project applications while employed by GDACE, and represented the Department of the Gautrain Environmental Monitoring Committee.

Strategic environmental management processes

- The Ekurhuleni Metropolitan Municipality Environmental Management Framework (EMF), Gauteng Province;
- The Dinokeng EMF, Gauteng Province;
- The Tlokwe (Potchefstroom) EMF, North West Province;
- Strategic assessment and environmental risk analysis for 12 potential wind farm projects Western and Northern Cape provinces;
- Environmental risk assessment for a proposed cement manufacturing facility in Tete, Tete Province, Mozambique;
- Rapid Assessment Study for a proposed resettlement project for the Anadarko Petroleum Corporation, Palma District, Cabo Delgado Province, Mozambique;
- Environmental risk assessment for the proposed Kenmare Nataka titanium mineral sands mining expansion project, Nampula Province, Mozambique;
- Environmental risk assessment for Frontier RareEarths proposed graphite mining project in Cabo Delgado Province, Mozambique;
- Environmental risk assessment for the proposed Kenmare Pilivilli and Congolone mining expansion projects, Nampula Province, Mozambique.

Environmental monitoring, due diligence and compliance auditing

- New Vaal Colliery EMPr compliance audit, Vereeniging, Gauteng Province;
- Gauteng Freeway Improvement Project (GFIP) Construction EMP compliance audits, Johannesburg, Gauteng Province;
- Cerebos Salt due diligence audit, Coega IDZ, Eastern Cape Province;
- Komati Power Station return to service Construction EMP compliance audits, Mpumalanga Province;
- Camden Power Station return to service Construction EMP compliance audits, Mpumalanga Province;
- Grootvlei Power Station return to service Construction EMP compliance audits, Mpumalanga Province;
- Environmental due diligence assessment for Zone 5 of the Coega Industrial Development Zone, Eastern Cape Province;
- Port Alfred Waste Water Treatment works expansion project, Environmental Control Officer (ECO) and Construction EMP compliance audits, Eastern Cape Province;
- Egazini Memorial Precinct Project, ECO and Construction EMP compliance audits,

Grahamstown, Eastern Cape Province;
- Green Resources Forestry Company plantation and pole treatment works environmental and social due diligence audit against International Finance Corporation (IFC) Performance Standards (PS), Jinja and Lira, Uganda;
- Environmental and Social Due Diligence (ESDD) audit of a proposed photovoltaic solar electricity generation facility (against IFC PS and EHS guidelines) on behalf of the Standard Bank Group, De Aar, Northern Cape Province;
- ESDD of the ESIA and Draft Resettlement Action Plan (against IFC PS/EHS guidelines) for the Copperbelt Energy Company's proposed Kabompo Gorge Hydroelectric scheme on behalf of the Standard Bank Group, North-Western Province, Zambia;
- IFC PS deviation assessment for Kenmare mineral sands, Moma, Nampula Province, Mozambique;
- Construction EMP compliance audits for the Kenmare Namalope mineral sands expansion project, Moma, Mozambique;
- Construction phase compliance monitoring of the Solar Capital Ilanga Lethemba 1 photovoltaic facility, De Aar, Northern Cape Province;
- Kenmare titanium mineral sands mining project, Project Lender's Completion Test compliance audit, Moma, Nampula Province, Mozambique;
- Usutu Forestry plantation and pulp mill due diligence audit on behalf of the Deutsche Investions und Entwicklungsgesellschaft bank (DEG), Bhunya, Swaziland;
- Copperbelt Energy Corporation corporate Environmental and Social Management System IFC PS compliance review, Solwezi, North-Western Province, Zambia;
- Independent Environmental and Social Monitor (IESM) for the operation of the Kenya-Uganda (Mombasa to Kampala) railway line, on behalf of Rift Valley Railways Kenya Ltd. (RVRK) and Rift Valley Railways Uganda Ltd. (RVRU) as the IESM for the operation of the Kenya-Uganda railways line system of a total track length of approximately 2,350 km. The project involves an investment by various international investors including the IFC, the AfDB, the FMO, DEG, KfW, PROPARCO and the Equity Bank of Kenya;
- IFC PS Gap Analysis for the proposed Ossiomo Petrochemical Ammonia-Urea Project on behalf of SWEDFUND, Ologbo, Edo State, Nigeria;
- IFC PS Gap Analysis, First Quantum Minerals, Kalumbila Copper Project, North Western Province, Zambia;
- ESDD for Chikweti Forest of Niassa (Global Solidarity Forest Fund) operations on behalf of a potential investor, Lichinga, Niassa Province, Mozambique;
- Phase 1 Environmental Assessment on a South African based agro-chemical (pesticides and fungicides) manufacturer, importer and distributing entity on behalf of Winfield Land 'O Lakes, Texas, U.S.A.;
- ESDD for the proposed Graphit Kropfmühl graphite mining project situated in Ancuabe (Cabo Delgado Province), Mozambique on behalf of DEG;
- ESDD for the proposed Kabanga Nickel mine in, Kagera District, Tanzania, on behalf of the Independent Group;
- Construction phase compliance monitoring of the SCDA 3 photovoltaic facility, De Aar, Northern Cape Province;
- Environmental scans on 2 properties (Luanda, Angola and Beira, Mozambique) on behalf of the Church of Latter Day Saints;
- E&S Compliance monitoring for Green Resources AS forestry operations in Uganda, Tanzania and Mozambique;
- ESDD on Depthwize Limited, a shallow water and swamp barge oil and gas drilling contractor operating in the Delta region on behalf of the Africa Finance Corporation, Delta State, Nigeria.

Power generation, transmission and renewable energy projects

- Upgrade of the ashwater return process at Eskom's Arnot Power Station, Mpumalanga Province (Basic Assessment);
- 3MW alien invasive wood fired electrical energy project, Grahamstown, Eastern Cape Province, (Basic Assessment);

- EA Energy 13 MW photovoltaic electricity generation project, Coega IDZ, Eastern Cape Province, (Basic Assessment);
- Matla Power Station to Jupiter B-Sebenza 400kV overhead powerlines and Substations, Mpumalanga and Gauteng Provinces (Full EIA);
- Johannesburg East electricity supply strengthening project: 400/132KV overhead powerlines and Substations, Gauteng Province (EIA);
- Witkloof-Thuli 132kV overhead power line, Mpumalanga Province (EIA);
- Vryburg 400kV/132kV Substation and loop in lines North-West Province (EIA);
- Boulders-Malelane 132kV overhead power line, Mpumalanga Province (EIA);
- Tarlton-Magaliesburg 132kV overhead power line, North-West Province (EIA);
- Watershed-Sephaku 132kV overhead power line, North-West Province (EIA);
- Cookhouse wind energy project, Eastern Cape Province (EIA);
- Grahamstown wind energy project, Eastern Cape Province (EIA);
- Riebeeck East wind energy project, Eastern Cape Province (Scoping);
- Beaufort West wind energy project, Western Cape Province (Scoping);
- Poortjie Wes wind energy project, Western Cape Province (Scoping);
- Carolina wind energy project, Mpumalanga Province (EIA);
- Nanagha Hills wind energy project, Eastern Cape Province (Scoping);
- Brakkefontein wind energy project, Western Cape Province (Scoping);
- Vrede wind energy project, Eastern Cape Province (Scoping);
- Richards Bay wind energy project, Kwa-Zulu Natal Province (EIA);
- St Lucia wind energy project, Kwa-Zulu Natal Province (Scoping);
- Hluhluwe wind energy project, Kwa-Zulu Natal Province (EIA);
- Peddie wind energy project, Eastern Cape Province (EIA);
- Richards Bay wind energy project, Kwa-Zulu Natal Province (EIA);
- Mossel Bay wind energy project, Western Cape Province (EIA);
- Grassridge-Coega IDZ wind energy project, Eastern Cape Province (EIA);
- Brandvallei and Rietkloof wind energy project - Laingsburg, Western and Northern Cape (EIAs);
- Coega IDZ wind energy project, additional turbines and substations (Basic Assessment).

General

- Numerous meteorological monitoring masts for wind energy projects nationally (Basic Assessments);
- Coega IDZ (St Georges Interchange) filling stations, Eastern Cape Province (Scoping);
- Hopewell Private Game Reserve lodge expansion, Alexandria, Eastern Cape (Basic Assessment);
- Greys Gift lodge development, Makana, Eastern Cape (Basic Assessment);
- Egazini Memorial Precinct Project, Grahamstown, Eastern Cape Province (Basic Assessment);
- Pinedale eco-estate residential development, Bathurst area, Eastern Cape Province (EIA);
- EMP revision for the N2 highway bridge upgrades between Umtata and Butterworth, Eastern Cape Province (EMP);
- Improvement of National Route N2 from Caledon to Riviersonderend, Western Cape (Basic Assessment and construction phase ECO) on behalf of SANRAL;
- Ecological Fatal Flaw Assessment for the proposed Diaz Road Arterial from the Port Elizabeth CBD to Rocklands, Eastern Cape Province.

Waste management, large and bulk service infrastructure

- Ingagane Power Station domestic waste landfill closure, Newcastle, KZN Province (Basic Assessment and landfill closure permit);
- Regional Hazardous Waste Disposal Facility for the Coega IDZ, Port Elizabeth, Eastern Cape Province (Full EIA and Permit Application Report - PAR).
- Rooiwal Waste Water treatment Works (WWTW) infrastructure and sludge treatment works

upgrades, Pretoria Gauteng Province (Basic Assessment and waste permit application);
- Fishwater Flats Wastewater Treatment Works Upgrade, Port Elizabeth, Eastern Cape Province (Full EIA);
- Gansbaai Waste Water treatment Works (WWTW) EMP development, Western Cape Province (EMP);
- Regional Hazardous Waste Disposal Facility for the Coega IDZ, Port Elizabeth, Eastern Cape Province (Addendum EIA);
- Numerous potable water bulk supply pipeline applications for Rand Water, Gauteng Province (Basic Assessments);
- Environmental Management Plans (EMPs) for storm water management system upgrades, Port Elizabeth, Eastern Cape Province.
- Eskom multi products fuel transport infrastructure (rail and pipeline) from Milnerton refinery to Atlantis Power Station, Cape Town, Western Cape Province (EIA);
- Transnet New Multi Products Pipeline (NMPP), Jameson Park to Langlaagte route alignment, Gauteng and Mpumalanga Provinces (EIA);
- Biodiversity survey of area of concern on the proposed pipeline routes from the port of Saldanha to Ankerlig power station on behalf of the Central Energy Fund (CEF) and iGas, Western Cape;
- Socio-Economic Baseline Study on behalf of the Lesotho Highlands Development Agency (LHDA) for the proposed Polihali Dam - Phase 3 of the Lesotho Highlands Water Scheme – survey of 11 000 households in the catchment and downstream areas of the proposed dam – including Social Baseline and Income and Expenditure Reports, Mokhotlong, Lesotho;
- Biological Resources Baseline Study of the proposed Polihali Dam catchment area on behalf of the LHDA, Mokhotlong, Lesotho.

Mining

- Xstrata Ferrochrome bag filter plant upgrades, North-West Province (Basic Assessment);
- GS Cimentos cement factory in the Mozal IDZ and associated limestone mine, Maputo and Salamanga, Mozambique (Full ESIA).
- Kenmare Namalope mineral sands expansion project, Moma, Nampula Province, Mozambique (Addendum EIA);
- Kenmare Nataka expansion project, Nataka, Nampula Province, Mozambique (Full ESHIA to IFC PS);
- First Quantum Minerals, Kalumbila Copper Project, North Western Province, Zambia (Full ESIA and RAP to IFC PS);
- World Titanium Resources Toliara mineral sands project, Ranobe and Toliara, Madagascar (Full ESIA and RAP to IFC PS);
- Syrah Resources graphite mining project, Balama, Cabo Delgado Province, Mozambique (Full ESIA and RAP to IFC PS);
- Zirco mineral sands mine, Groenrivier, Northern Cape, South Africa (Full ESHIA to IFC PS);
- Kenmare Pilivilli and Congolone expansion projects, Nampula Province, Mozambique (Scoping);
- Baobab Resources iron ore mining project, Tete, Mozambique (Full ESHIA to IFC PS);
- Triton Minerals Nicanda Hill graphite mining project, Cabo Delgado Province, Mozambique (Full ESHIA to IFC PS);
- Triton Minerals Ancuabe graphite mining project, Cabo Delgado Province, Mozambique (Full ESHIA and RAP to IFC PS);
- MPC SPRL & Alphamin Resources Corporation Bisie tin mining project, Bisie, North Kivu Province, Democratic Republic of Congo (Socio-Economic Baseline Study);
- Alphamin Bisie Mining SPRL tin mining project, Bisie, North Kivu Province, DRC (Full ESHIA to IFC PS).

Commercial agriculture, plantations and biofuels

- Addax Bioenergy sugarcane to ethanol biofuel project, Makeni, Sierra Leone (Full

Environmental, Social and Health Impact Assessment – ESHIA – to IFC and RSB standards including the Resettlement Action Plan - RAP);
- Equatorial Palm Oil expansion projects, Butaw and Palm Bay, Grand Bassa and Sinoe Counties, Liberia (Full ESHIA and RAP– to AfDB and RSPO standards)
- Nedoil Lokomasama palm oil project, Port Loko District, Sierra Leone (Scoping);
- Green Resources Niassa forestry project, Lichinga, Niassa Province, Mozambique (Full ESIA);
- Green Resources Lurio forestry project, Nampula Province, Mozambique (Full ESIA and RAP);
- Eleqtra/Envalor sugarcane to ethanol biofuel project, Sena, Sofala Province, Mozambique (Socio-Economic Baseline Study);
- EcoFarm Mozambique (Ltd) organic sugarcane growing project, Chemba District, Sofala Province, Mozambique (Full ESIA);
- Balmed Holdings cocoa and coffee outgrowers scheme Kenema, Sierra Leone (Social and Environmental Assessment - SEA - as aligned with the Africa Agriculture and Trade Investment Fund - AATIF – environmental and social reporting requirements);
- Zambeef Holdings (Community Engagement and Biodiversity Management Plans for Zambeef's Zambian operations, notably, five major agricultural production estates situated throughout the country), Zambia;
- Envalor sugarcane to ethanol biofuel project, Sena, Sofala Province, Mozambique (ESIA);
- Crooke Brothers Ltd (Murrimo Farming Lda) - Resettlement Action Plan for the MFL Macadamia, Potato and Grains Project at Gurue, Zambezia Province, Mozambique;
- Ugandan Ministry of Agriculture Animal Industry and Fisheries - Buvuma Island vegetable oil development project, Lake Victoria, Uganda (Full ESHIA).

During the course of his professional career Marc has worked in Angola, Liberia, Sierra Leone, Madagascar, Mozambique, Namibia, Nigeria, Democratic Republic of Congo, Zambia, Swaziland, Lesotho, Kenya, Uganda, Tanzania and South Africa. Marc has been actively involved in lecturing and presenting environmental management training content over the last few years as a course presenter for the CES hosted annual EIA training courses, as well as the presenting of undergraduate and postgraduate environmental management course modules at Rhodes University.

SKILLS

Planning and management of projects and research/specialist teams or support staff; preparation and management of budgets in excess of $500 000; EIA and socio-economic impact reporting for linear, energy and bulk infrastructure, mining and renewable energy projects (to World Bank and International Finance Corporation Performance Standards); environmental and due diligence auditing, compliance monitoring; strategic policy planning and reporting. Business development and marketing functions concomitant with my current position are also fulfilled in a strategic and daily operational basis.

PROFESSIONAL MEMBERSHIP

- International Association for Impact Assessment (IAIAsa – Member No: 2416)

CHERIE-LYNN MACK

Date of Birth: 05-08-1980

QUALIFICATIONS

PhD Environmental Biotechnology (Rhodes University), M.Sc Environmental Biotechnology with distinction (Rhodes University), B.Sc Hons. Biotechnology (Rhodes University), B.Sc Microbiology & Biochemistry (Rhodes University)

Completed the SASS5 aquatic macroinvertebrate monitoring course (2012) conducted by Groundtruth (Dr Mark Graham)

MEMBERSHIP

- The Water Institute of Southern Africa (WISA)
- International Association for Impact Assessment (South Africa)

PROFESSIONAL EXPERIENCE

November 2009 – Present: Principle Environmental Consultant (Coastal & Environmental Services)

October 2008 – July 2009: Water Scientist (Golder Associates Africa)

January 2008 – June 2008: Postdoctoral Research student (Department of Microbiology, Stellenbosch University)

CONSULTING EXPERIENCE

October 2009 – present Principle Environmental Consultant, Coastal & Environmental Services

As a principle consultant, my role in the company is to manage and provide input into the compilation of Environmental Impact Assessments for a wide variety of clients, and for a wide variety of developments. To date, these projects have included:

Renewable Energy Projects

- Great Kei Wind Energy Facility
- Qumbu Wind Energy Facility
- Ngqamakhwe Renewable Energy Facility EIA
- Ncora Renewable Energy Facility EIA
- Qunu Renewable Energy Facility EIA
- Thomas River Renewable Energy Facility EIA
- Chaba Wind Energy EIA
- Lushington Park Wind Energy Facility EIA

Wastewater Specialist Assessments:

- Wastewater Specialist Impact Assessment for St Patricks Hospital Wastewater Treatment Works
- Environmental Management Plan as part of the Alfred Nzo District Municipality Effluent Management Plan
- Wastewater Specialist Impact Assessment for Jamestown Wastewater Treatment Works
- Wastewater Specialist Impact Assessment for Qolora Aquaculture Zone EIA
- All Saints Wastewater Treatment Works, Wastewater Specialist Impact Assessment
- Project Manager and Waste Specialist: Scoping and Environmental Impact assessment for Sunningdale Dairy Processing Facility

Water Quality Specialist Assessments:

- Surface and Groundwater Assessment Report. EcoFarm Sugar Plantation Project, Mozambique
- Water Quality Specialist Impact Assessment for the proposed abstraction works in the Lower Fish River. Ndlambe Local Municipality
- Surface Water and Groundwater Quality Annual Report, for Kenmare Mining, Mozambique
- Project Manager and Surface Water Quality Specialist: Surface and groundwater quality monitoring program for the East London Industrial Development Zone

Aquatic Ecology Specialist Assessments:

- Aquatic Ecology Baseline Survey and Impact Assessment (Macroinvertebrates and Water quality). Syrah Resources Graphite Mine, Mozambique.
- Aquatic Ecology Baseline Survey and Impact Assessment (Macroinvertebrates and Water quality). Baobab Iron Ore Mine, Mozambique.

Other:

- Waste License for the DAS Electro-coating Facility Wastewater Treatment Works EIA
- Eastern Cape Parks and Tourism Authority Upgrade of the Water and Wastewater Treatment works at Double Mouth Camp site EIA
- Department of Water Affairs: Lusikisiki Regional Bulk Water Supply Scheme EIA
- Ndlambe Local Municipality Bulk Water Supply Scheme EIA
- TNPA Foreshore Reclamation Project EIA, Port of East London
- Eskom Distribution Power line EIAs (x4)

October 2008 – July 2009 Water Scientist, Golder Associates Africa

Surface and Groundwater Specialist Assessments:

- Surface water specialist information gap analysis for LIFEX coal mine extension project for AngloCoal.
- Water quality trainee: Comprehensive reserve determination for the Lower and Middle Vaal Water Management Areas (DWAF).
- Water quality trainee: Intermediate reserve determination of the Crocodile (West) and Marico Water Management Areas (DWAF)

Other:

- The linear flow channel reactor for oxidation of sulphide in semi-treated acid mine drainage for the Water Research Commission (WRC)
- Construction and operation of an Integrated Managed Passive (IMPI) demonstration scale acid mine drainage treatment plant for BHP Billiton
- Metal removal using sulphate reducing bacteria (SRB) from acid mine drainage for Landau Colliery (AngloCoal)

RESEARCH & TEACHING EXPERIENCE

I have had my research published in peer-reviewed journals and have presented at various international conferences. A full list of publications is available upon request. My area of research is environmental biotechnology, with emphasis on industrial wastewater treatment technologies, particularly from the mining sector.

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GIDEON RAATH (M.Sc)

Date of Birth: 11-12-1987 in Johannesburg, South Africa.
Language: Proficient in English and Afrikaans.
Drivers licence: Code B.

QUALIFICATIONS

- M.Sc Geography and Environmental Science (University of Stellenbosch).
- B.Sc Hons. Ecology, Environment and Conservation (Wits University) cum laude.
- B.Sc Life and Environmental Sciences (University of Johannesburg).

MEMBERSHIPS

- Golden Key International Honour Society.
- IAIAsa (No. 3619)

EMPLOYMENT HISTORY

February 2015 – Present: Environmental Consultant (EOH Coastal and Environmental Services, Cape Town).

July 2014 – January 2015: Project Manager (Invasive Species Unit, Environmental Resources Management Department, City of Cape Town). Entrusted with the monitoring & evaluation project portfolio, which entailed the establishment of an invasive species monitoring & evaluation system for the ISU, as well as database management, quality assurance and reporting thereof.

March 2012 – July 2014: Department Assistant (University of Stellenbosch). Technical thesis formatting, data capturing and teaching assistant; obtained additional GIS experience through brief work conducted for the 'Centre for Geographical Analysis' (CGA).

February 2011 – December 2011: Teaching Assistant (Wits University). Assisted 1st year Health Sciences students with completion of biological laboratory practicals, including Microscopy, Virology, Histology, Genetics and Sensory Perception. Organised and supervised students during practicals; graded reports.

January 2006 – November 2010: Co-founder and member (Codeon Networking CC). Web designer and developer; small business owner.

RESEARCH, CONSULTING AND PROFESSIONAL EXPERIENCE

Integrated water use licence applications (numerous water uses):
- Zirco Resources Kamiesberg heavy mineral sand mine [2015].
- Boschendal Wine Estate hydro-electric power station [2015].
- Biotherm Energy Golden Valley Wind Energy Facility [2015].
- SANRAL N2 Section 3 road upgrade BAR [2016].

Botanical / Ecological specialist studies:
- SANRAL N2 Section 3 Ecological Impact Assessment [2016].
- City of Johannesburg nature reserve proclamation [2015].
- Central Energy Fund iGas integrated biodiversity report contributions [2015].
- Western Cape Government (PGWC) Bloekombos (Kraaifontein) botanical baseline and impact assessment report [2015].

GIS:

- City of Johannesburg nature reserve proclamation boundary verification [2015].
- CEF iGas desktop biodiversity-based route calculation [2015].
- G7 Renewable Energy (Pty) Ltd Brandvalley and Rietkloof EIA contributions [2015/2016].
- Mapping for numerous projects [2015].
- Triton Minerals Limited Ancuabe and Nicanda Hills contributions [2015].

Wetland specialist studies:
- Western Cape Government (PGWC) Bloekombos (Kraaifontein) wetland delineation and impact assessment report [2015].

Public participation involvement:
- G7 Renewable Energy (Pty) Ltd 132kV BAR [2016].
- SANRAL N2 Section 3 road upgrade BAR [2016].
- Kenhardt Northern Cape tin prospecting BAR [2015].
- Almenar Northern Cape tin prospecting BAR [2015].
- G7 Renewable Energies Fortuin WEF S&EIR [2015].
- SANRAL N2 section 3 road upgrade BAR [2015].
- Central Energy Fund iGas biodiversity survey faunal assistant [2015].

Authorisations and applications:
- G7 Renewable Energy (Pty) Ltd 132kV BAR [2016].
- Mosselbay Energy IPP (Pty) Ltd EA Amendment [2016].
- SANRAL N2 section 3 road upgrade BAR [2015].
- PRDW Cape Town harbour breakwater rehabilitation EMPr [2015].
- Mayfield Quarry Rehabilitation plan [2015].
- Woodbridge Island revetment exemption [2015].
- Boschendal Wine Estate S24G rectification application [2015].
- BioTherm Energy (Pty) Ltd ESAP [2015].
- Frontier Rare Earths Limited Risk Assessment report contributions [2015].

- Thesis for MSc: The study of the invasive plant species *Eucalyptus camaldulensis* along the Breede River in the Western Cape. The research evaluated the impact that high rainfall and flood events had on the spatial extent, density and dispersal of *E. camaldulensis* along the river channel, and made management recommendations to regional and national resource managers [2014].

- Thesis for Honours: An evaluation of the informal plant harvesting by surrounding communities near the Palabora Mining Company, with specific focus on the potential human health and plant conservation implications of such harvesting and plant use [2011].

SKILLS

- QGIS, ArcGIS, DNR garmin and GPS use.
- Statistical analysis using SPSS, MS Excel and ‘R’.
- Scientific research, report writing, presentations.
- Rudimentary photogrammetry - Exelis’ ENVI and PCI Geomatics’ OrthoEngine.
- Botanical specialist studies and taxonomy.
- Ecological specialist studies and taxonomy.
- Wetland delineation and impact assessment specialist studies.
- Planning and management of projects.
- Management of research/specialist teams and support staff.

- Proposals and budgets.
- EIA reporting and EMPr development.
- Integrated water use licence applications.

COURSES ATTENDED

- IAIAsa Public Participation Process Workshop [2016].
- EIA course, EOH Coastal and Environmental Services [2015].
- Water safety training, City of Cape Town [2014].
- Herbicide safety and application for weed control, City of Cape Town [2014].
- Snake awareness training, City of Cape Town [2014].
- Habitable Planet Workshop UCT [2011].

ANNEXURE B: EXAMPLE TRAINING PROGRAMME

HOW DO WE LOOK AFTER THE ENVIRONMENT?

- Report problems to your supervisor/ foreman
- Team work
- Follow the rules in the EMP

WORKING AREAS

Workers & equipment must stay inside the site boundaries at all times

RIVERS & STREAMS

- Do not swim in or drink from streams
- Do not throw oil, petrol, diesel, concrete or rubbish in the stream
- Do not work in the stream without direct instruction
- Do not damage the banks or vegetation of the stream

ANIMALS

- Do not injure or kill any animals on the site
- Ask your supervisor or Contract's Manager to remove animals found on site

TREES AND FLOWERS

- Do not damage or cut down any trees or plants without permission
- Do not pick flowers

SMOKING AND FIRE

- Put cigarette butts in a rubbish bin
- Do not smoke near gas, paints or petrol
- Do not light any fires without permission
- Know the positions of fire fighting equipment
- Report all fires
- Do not burn rubbish or vegetation without permission

PETROL, OIL AND DIESEL

- Work with petrol, oil & diesel in marked areas
- Report any petrol, oil & diesel leaks or spills to your supervisor
- Use a drip tray under vehicles & machinery
- Empty drip trays after rain & throw away where instructed

DUST

Try to avoid producing dust –

Use water to make ground & soil wet

NOISE

- Do not make loud noises around the site, especially near schools and homes
- Report or repair noisy vehicles

TOILETS

- Use the toilets provided
- Report full or leaking toilets

EATING

- Only eat in demarcated eating areas
- Never eat near a river or stream
- Put packaging & leftover food into rubbish bins

RUBBISH

- Do not litter – put all rubbish (especially cement bags) into the bins provided
- Report full bins to your supervisor
- The responsible person should empty bins regularly

TRUCKS AND DRIVING

- Always keep to the speed limit
- Drivers - check & report leaks and vehicles that belch smoke
- Ensure loads are secure & do not spill

EMERGENCY PHONE NUMBERS

Know all the emergency phone numbers:

- Ambulance:
- Fire:
- Police:

FINES AND PENALTIES

- Spot fines of between

  To be confirmed by Engineer

- Your company may be fined
- Removal from site
- Construction may be stopped

PROBLEMS - WHAT TO DO!

- Report any breaks, floods, fires, leaks and injuries to your supervisor
- Ask questions!

ANNEXURE C: ENVIRONMENTAL COMPLAINTS REGISTER

ENVIRONMENTAL COMPLAINTS REGISTER							
CONTRACT TITLE:							
CONTRACT NUMBER:							
DATE	**COMPLAINT**	**COMPLAINT MADE BY (Include Contact Details)**	**ACTION REQUIRED**	**RESPONSIBLE PERSON**	**ACTION IMPLEMENTED**	**DATE ACTION IMPLEMENTED**	**CHECKED BY ECO**

ANNEXURE D: ENVIRONMENTAL INCIDENTS REGISTER

ENVIRONMENTAL INCIDENTS REGISTER							
CONTRACT TITLE:							
CONTRACT NUMBER:							
DATE	**INCIDENT (What, where, how, possible impacts)**	**REPORTED BY**	**ACTION REQUIRED**	**RESPONSIBLE PERSON**	**ACTION IMPLEMENTED**	**DATE ACTION IMPLEMENTED**	**CHECKED BY ECO**

ANNEXURE E: TRAFFIC AND TRANSPORTATION MANAGEMENT PLAN

BRANDVALLEY & RIETKLOOF WIND ENERGY FACILITIES
TRAFFIC IMPACT ASSESSMENT

Reference: BV/RK-WEF
Prepared for: G7 Renewable Energies (Pty) Ltd
Revision: 4
16 May 2016

Document control record

Document prepared by:
Aurecon South Africa (Pty) Ltd
Aurecon Centre
1 Century City Drive
Waterford Precinct
Century City, Cape Town, 7441

T +27 21 526 9400
F +27 21 526 9500
E capetown@aurecongroup.com
W www.aurecongroup.com

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Current Revision		**4**				

Approval			
Author signature		Approver signature	
Name	Samuel Lombard	Name	Jannie Conradie
Title	Civil Engineer	Title	Technical Director

BRANDVALLEY & RIETKLOOF WIND ENERGY FACILITIES

Date 16 May 2016
Reference BV/RK-WEF
Revision 4

Aurecon South Africa (Pty) Ltd
Aurecon Centre
1 Century City Drive
Waterford Precinct
Century City, Cape Town, 7441
T +27 21 526 9400
F +27 21 526 9500
E capetown@aurecongroup.com
W www.aurecongroup.com

Contents

Figures

Tables

EXECUTIVE SUMMARY

This report details the investigation of the transport needs for the proposed Brandvalley and Rietkloof Wind Energy Facilities, located on the border between the Western Cape and Northern Cape Provinces, on the farms Barendskraal 76, Brandvalley 75, Fortuin 74, Kabeltouw 160, Muishond Rivier 161, Rietfontein 197 B, Hartjieskraal 77, Nuwerus 284, Rietkloof Annexe 88, Snyders Kloof 80, Vogelstruisfontein 81, and Wilgehout Fontein 87. The purpose of the investigation is to identify potential access routes, including site access, for the development of the facility. The general freight for the wind farm will comprise building materials, blades, nacelles, towers, hubs, cables and transformers.

The imported freight will preferably be transported from Saldanha Port to the site. The preferred freight route from Saldanha Port, via Moorreesburg (a distance of 342km), comprises surfaced roads for the majority of the way (only the final road section to the site consists of gravel roads). This route is predominantly on National or Provincial Roads, with suitable conditions for the transport of normal freight, or abnormal loads with permits. No toll fees are required on this route, however, abnormal permits will be required for the transport of the transformers and turbine components, irrespective of the final route determined by the logistics contractor.

Building materials will most likely be transported from Worcester, while certain elements will be transported from various manufacturing centres in South Africa - most likely Cape Town for tower sections and Johannesburg for transformers. The transport of elements from these manufacturing centres will be predominantly on National and Provincial roads, which presents no limitations for normal freight.

Due to the distance from Worcester to site (approximately 155km), significant reductions in heavy vehicle trips could be achieved by sourcing road building materials and concrete aggregate from new quarries or borrow pits in proximity to the site, provided that it is a feasible with respect to the target implementation programme. The possible siting of quarries and/or borrow pits will be confirmed prior to construction, once a geotechnical investigation has been conducted.

There is a limited risk of delays to the various deliveries required for the construction of the facility, due to potential routine maintenance works (such as repairs and reseals). The impact of such activities is dependent on the scheduling of deliveries and of roads contracts, and may be mitigated by the use of the alternative routes proposed in this report.

In general, no obvious problems were identified associated with the transport of freight along the proposed routes to the site, nor for the accesses required for the construction and maintenance of the facility. It will, however, be necessary to confirm certain aspects such as clearances, bridge capacities, etc., by the logistics contractor as part of their preparation as this will be dependent on the actual vehicles configuration used.

1 INTRODUCTION

G7 Renewable Energies (Pty) Ltd., has engaged Aurecon to prepare a Traffic Impact Assessment, with particular focus on the access to the site, for the proposed Brandvalley and Rietkloof Wind Energy Facilities (WEFs), in support of the environmental approval application. The sites are situated approximately 25km north of Matjiesfonein, on the border between the Western Cape and Northern Cape Provinces.

The site locations are indicated on the key and locality plan details for the Brandvalley and Rietkloof WEFs shown in Figure 1 and Figure 2 respectively:

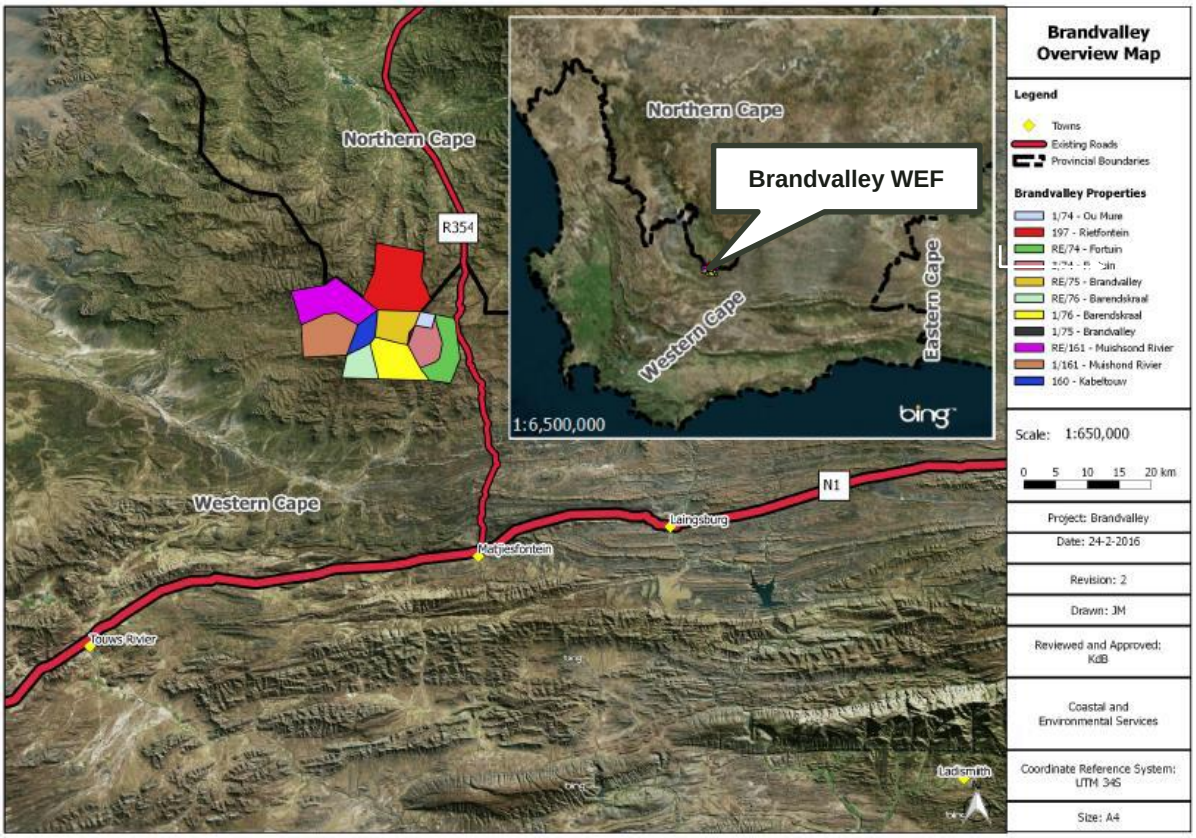


Figure 1: Brandvalley WEF Key Plan and Locality Plan detail (EOH Coastal & Environmental Services, 2016)

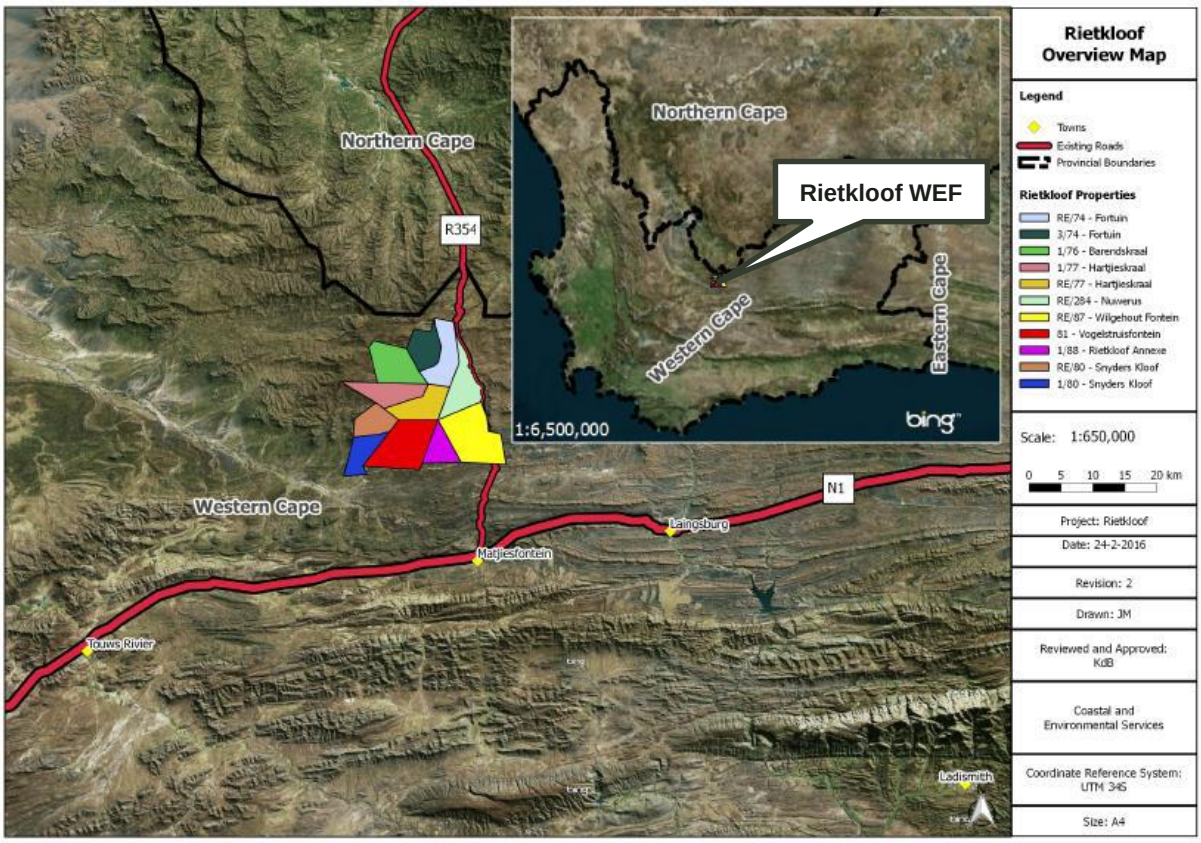


Figure 2: Rietkloof WEF Key Plan and Locality Plan detail (EOH Coastal & Environmental Services, 2016)

The proposed Brandvalley and Rietkloof WEFs is expected to comprise:

- Up to 70 Wind Turbine Generators (WTG's) per site
- Between 1.5 and 4MW per WTG
- Hub height of up to 120m
- Rotor diameter of up to 140m
- Capacity of up to 140MW per site

The scope of the study is to evaluate the transport requirements to implement the development of the Brandvalley and Rietkloof WEFs, with particular focus on the access to site from the N1.

The scope of the Transport Assessment Study includes, inter alia:

- Determine the access freight routes between point of delivery (i.e. the preferred port) and the wind farm, for the wind turbine generator (WTG) components.
- Confirm the associated clearances required for the necessary equipment to be transported from the point of delivery to the wind farm.
- Confirm freight requirements.
- Determine (abnormal) permit requirements, if any.
- Consider feasibility of alternative accesses to the site from the N1
- Propose traffic accommodation measures during potential upgrading of the access on the Provincial or National Roads.
- Determine the environmental effect of steel and/or concrete towers

2 BASIS AND ASSUMPTIONS

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

- Imported elements, including major turbine components, are shipped to and transported from the nearest or most practical South African Port to the site.
- Certain elements are transported from manufacturing centres within South Africa.
- Materials for concrete foundation structures and road construction are obtained locally from closest available commercial source, but could also be sourced from new borrow pits and quarries on the site, to limit carting of materials over long distances and at steep grades.
- The largest potential loads with respect to weight will be:
  - Transformer(s) with a payload of approximately 85t
  - Nacelle for each turbine – up to approx. 100t
- Long distance freight will be transported predominantly on surfaced roads.
- The geometric standards applied are such that blades up to 70m in length can be accommodated on the access roads to the proposed development.

Foundations will ultimately be dictated by site geotechnical conditions but generally comprise of large diameter (in the order of 15m to 22m) concrete bases supported on rock or suitable strata.

- The standard vehicle for the transportation of said turbine blades was assumed to have a wheel base of approximately 45m.
- A minimum road width of 4.5m with 0.25m rounding each side was assumed.
- The preliminary alignments were based on satellite imagery as the only available topographical information.
- The turbines will ultimately be removed from the site during the de-commissioning stage, while the turbine bases will be partially demolished to 1m below natural ground level.

3 ASSESSMENT

3.1 General Freight Requirements

3.1.1 Legislation

Currently, the general limitations on road freight transport are:

- Axle load limitation of 7.7t on front axle and 9.0t on single rear axles.
- Axle unit limitations are 18t for dual axle units and 24t for 3 axle units.
- Bridge formula requirements to limit concentration of loads and to regulate load distribution on the vehicle.
- Gross vehicle mass of 56t. This means a typical payload of about 30t.
- Maximum vehicle length of 22m for interlinks, 18.5m for horse and trailers and 13.5m for single units.
- Width limit of 2.6m.
- Height limit 4.3m with a 0.3m tolerance.

Abnormal permits are required for vehicles exceeding these limits, which will be required for this project.

3.1.2 Facility Freight

Materials and equipment transported to the site will comprise:

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

A breakdown of transport requirements for the respective phases of the project follows:

3.1.2.1 During the Construction Phase:

- Building materials, comprising reinforced concrete materials for turbine foundations and gravel materials for road layer works. These materials will be transported using conventional trucks, which are expected to adhere to legal limits.
- WTG components will most likely be transported by abnormal vehicles from the nearest suitable South African port, which is Saldanha Port (Section 3.3 refers). The number of loads will be a function of the number of turbines to be constructed.
- WTG towers will be manufactured locally, with steel towers shipped from Atlantis or Port Elizabeth, and concrete towers manufactured on site, or in Cape Town and transported to site in segments. Concrete towers can typically require 18 truckloads per turbine, whereas steel towers only require 4 truckloads.
- Power transformers will most probably be transported by abnormal vehicles from manufacturing centres in Johannesburg.

- 33/132kV OHL components will be transported from various manufacturing centres as well as ports for some the components. However all components will be transported by means of general freight. The number of loads will be a function of the final configuration.

3.1.2.2 During the Operational Phase:

- Potential replacement of WTG elements, which would require employment of cranes and transport equipment. However, this is expected to have a low probability of occurrence.

3.1.2.3 During the De-commissioning Phase:

- The removal of turbine components from the site to a suitable spoil / recovery / recycling site, which could potentially imply shipping items out of the country, and which would require abnormal transport to the approved recovery sites.
- Re-instatement of the disturbed areas, such as ripping of access roads and reinstating of vegetation, by use of suitable construction equipment.
- The turbine bases will have to be demolished partially, which will require heavy demolishing equipment.

Examples of the abnormal loads, which are most pertinent to the wind farm logistics, are illustrated in Figure 3 and Figure 4:

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

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

3.2 Traffic Statement

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

3.2.1 Traffic during the Construction Phase

3.2.1.1 Traffic during the Construction of the Wind Energy Facility

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

- Abnormal vehicles: 10 (turbine components)
- Heavy vehicles: 60 (reinforcement and concrete)
- Heavy Vehicles: 90 (road layer works)
- **TOTAL: 150 / 10 (Heavy / Abnormal) per turbine**

The wind farm capacity and the specific WTG model to be used has not yet been confirmed and it is therefore not possible to accurately calculate the total expected trips for the construction of the facility. However, the range of potential configurations for the wind farm, provides a basis for the estimation of the total trips that will be required. 140MW are considered to be the possible site capacity, while the options of 1.5-4 MW WTGs are considered as representing the outer limits of the range of possible machines to be utilised.

Based on the above, the total trips for one ultimate 70 turbine facility is estimated to be 700 abnormal and 10500 heavy vehicle trips, over an estimated period of 18-24 months. Should concrete towers be used, the number of abnormal loads would decrease, with heavy loads increasing substantially.

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

In the worst case, the number of heavy vehicle trips per day would be in the order of 15 to 20 round trips. The impact of this on the general traffic would therefore be of low significance, as the peak time traffic would be increased by 5 trips at most.

Based on previous experience, the personnel during construction is estimated to total 250 - 350 persons. The personnel will most likely reside in Sutherland, Matjiesfontein or Laingsburg as the closest communities. It is recommended that the majority of construction personnel be transported to and from site by means of busses.

This personnel transport will total approximately 15 to 25 daily trips. The impact of this on the general traffic would therefore also be considered to be of low significance, as the peak hour traffic would be increased by 10 trips at most.

3.2.1.2 Traffic during the Construction of Grids/Power lines

The grids/power lines to be constructed during the project will be 33/132kV power lines. The main components being the support mast, cables, connectors, transformers, etc. All the components will be transported by means of general freight. Aurecon is of opinion that the traffic impact for this construction activity will be minimal and that the additional generated traffic is negligible.

3.2.2 Traffic during the Operational Phase

After construction, the generated site traffic would be limited to maintenance support, with only a few light vehicles, transporting approximately 20 employees, will be accessing the site per day. Maintenance activities will be executed as and when required, but is not expected to have a low traffic impact.

3.2.3 Traffic during the De-commissioning Phase

Traffic is expected to be very similar to the construction phase. The impact of this on the general traffic would therefore also be considered to be of low significance.

3.2.4 Traffic Impact Rating

This technical study of traffic during the construction phase also has to inform the EIA phase, where an environmental significance scale is used to evaluate the importance of a particular impact. Table 1 below indicates the original identified impacts associated with the traffic and how their significance ratings have been affected by the respective impacts.

Table 1: Significance Statement Table

Impact	Mitigation	Effect			Likelihood	Significance
		Temporal	Spatial	Severity		
Traffic impact as a result of Concrete Towers	Without mitigation	Short term	Regional	Moderate	May Occur	Low (8)
	With mitigation	Short term	Regional	Slight	May Occur	Low (7)
Traffic impact as a result of Steel Towers	Without mitigation	Short term	Regional	Slight	May Occur	Low (7)
	With mitigation	Short term	Regional	Slight	May Occur	Low (7)
Traffic impact as a result of Operations	Without mitigation	Medium term	Localised	Slight	Definite	Low (8)
	With mitigation	Medium term	Localised	Slight	Definite	Low (8)
Traffic impact as a result of Maintenance	Without mitigation	Short term	Regional	Slight	May Occur	Low (7)
	With mitigation	Short term	Regional	Slight	May Occur	Low (7)

When looking at Table 1, it can be concluded that all impacts will have a “Low” significance. According to the significance rating scale, a low significance can be defined as: “*An acceptable impact for which*

mitigation is desirable but not essential. The impact itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in either positive or negative medium to short term effects on the social and/or natural environment" Except for the additional trips induced by using concrete towers, the difference in impact between using steel or concrete towers can be considered to be of low significance.

3.2.5 Summary of Traffic Statement

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

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

It can therefore be stated that the construction traffic and the post construction traffic would be low without any significant impact on the existing traffic flows on the N1 or provincial roads. It will also have a negligible impact on the pavement structures. Furthermore, the impact of the traffic on the provincial gravel access roads will also be of low significance with respect to service levels.

3.3 Access Route

3.3.1 Site Description

A summary of the site descriptions, as provided in Section 1, is given in Table 2 and Table 3:

Table 2: Summary of Brandvalley WEF Site Description

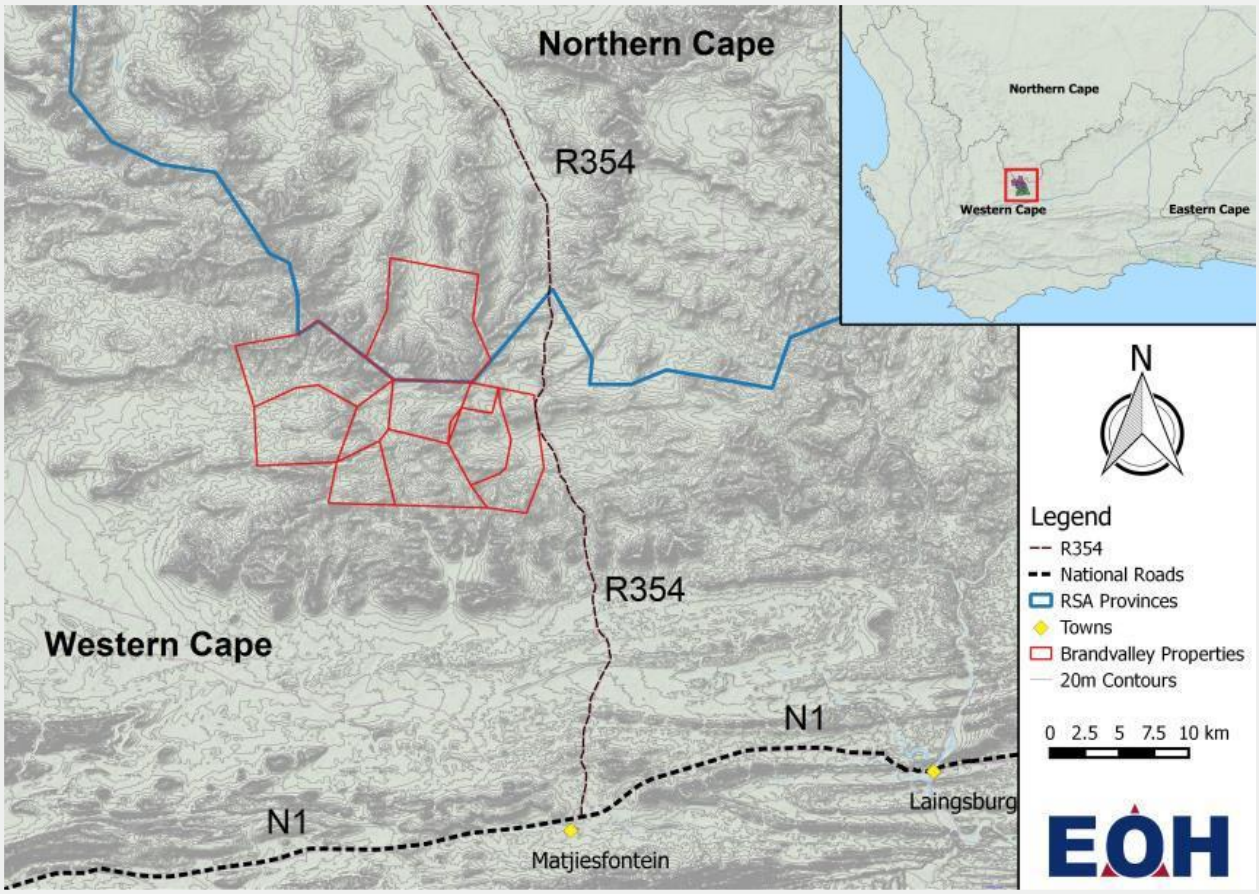


Figure 5: Brandvalley WEF (EOH Coastal & Environmental Services, 2016)

Location (Centre Point)	32° 58' 42.4" S 20° 28' 35.34" E
Distance of Centre Point N of Matjiesfontein	45km
Generation Capacity	140MW
Distance from Ports **Saldanha** **Cape Town** **Port Elizabeth**	 362km 279km 610km
Farms (farm/portion)	Barendskraal 76, Brandvalley 75, Fortuin 74, Kabeltouw 160, Muishond Rivier 161, Rietfontein 197

Table 3: Summary of Rietkloof WEF Site Description

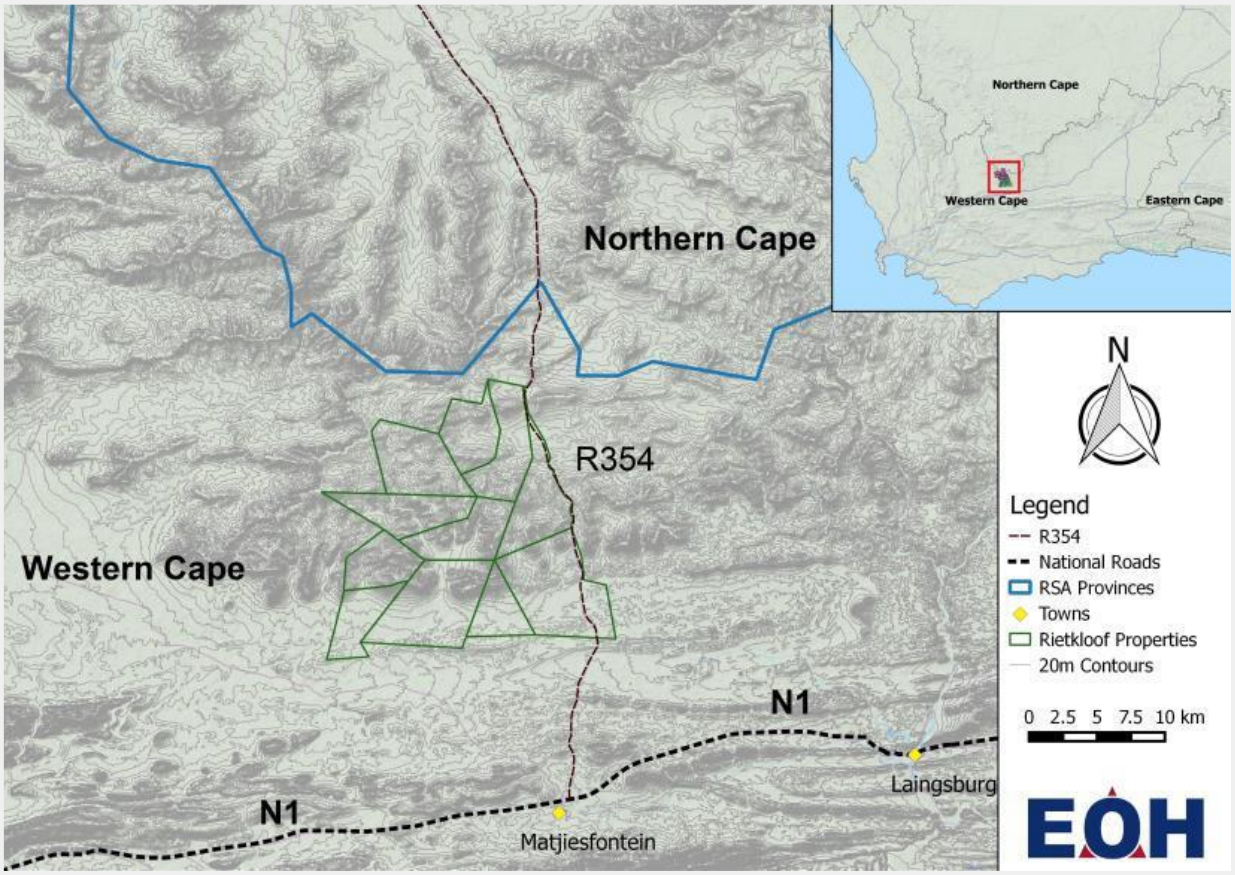


Figure 6: Rietkloof WEF (EOH Coastal & Environmental Services, 2016)

Location (Centre Point)	33° 02' 29.6" S 20° 30' 09.3" E
Distance of Centre Point N of Matjiesfontein	25km
Generation Capacity	140MW
Distance from Ports **Saldanha** **Cape Town** **Port Elizabeth**	 342km 259km 590km
Farms (farm/portion)	Barendskraal 76, Fortuin 74, Hartjieskraal 77, Nuwerus 284, Rietkloof Annexe 88, Snyders Kloof 80, Vogelstruisfontein 81, Wilgehout Fontein 87

3.3.2 Preferred Route from Port

The starting point of the route for the transportation of imported equipment is the port at either Saldanha, Cape Town or Port Elizabeth. Of these, Saldanha is the preferred port, with a route length of 342km, as indicated in Figure 7. Section views of the roads along the preferred route are shown in Appendix A, while urban section views along this route are shown in Appendix B.

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

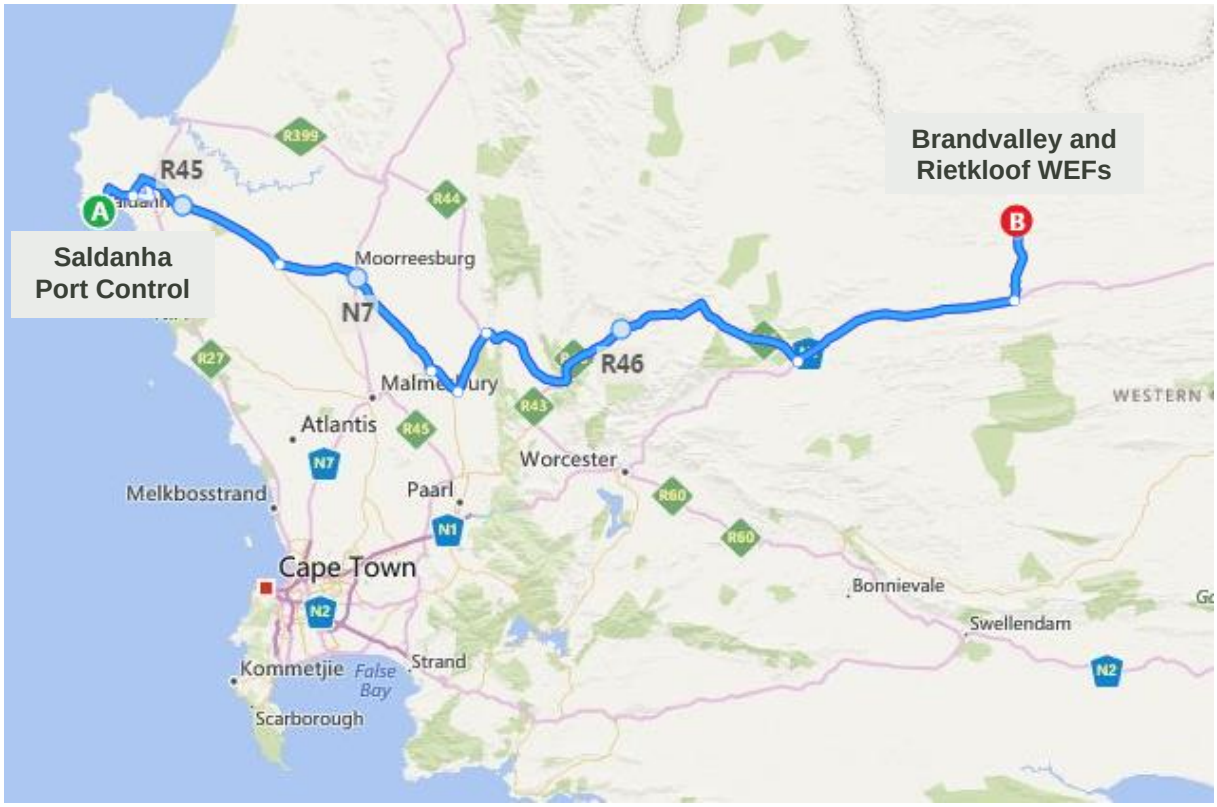


Figure 7: Preferred Freight Route

The route from the alternative port of Port Elizabeth is about 590km and is the least preferred route; however, it still offers an alternative, should Saldanha Port not be available for any reason. While Cape Town Port is the closest port to the site, it would most probably not be able to accommodate the imported turbine elements, due to current activities.

Alternatives to the preferred route exist and are shown in Figure 8.

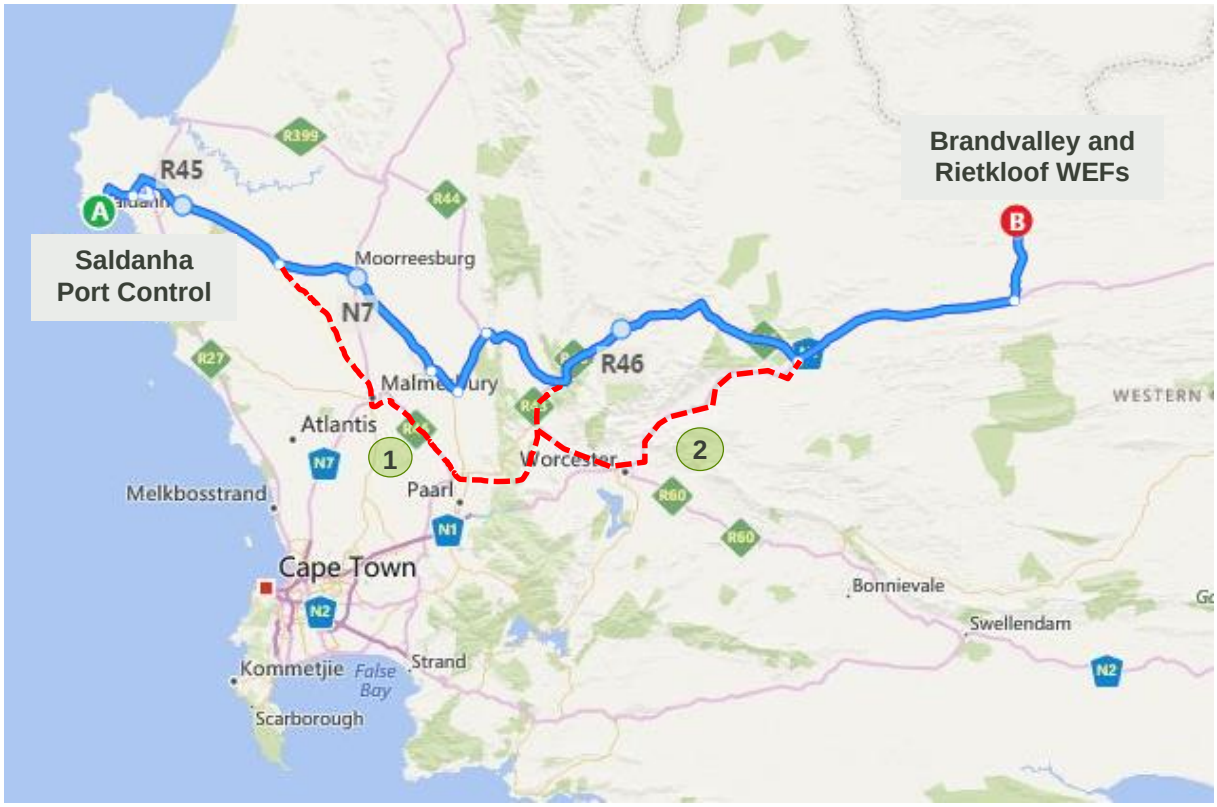


Figure 8: Alternative Freight Routes from Saldanha Port

The following is noted regarding deviations from the preferred route:

1. This alternative passes through the town of Malmesbury, where an urban intersection limits the maximum turning radius. This alternative will be restricted for abnormal loads that require a large turning radius (e.g. vehicles transporting wind turbine blades).
2. This alternative passes through Worcester and De Doorns, along the N1. However, one of the bridges over the N1, between Worcester and De Doorns, is of concern. It is estimated that the bridge is lower than 5m, limiting the maximum height of freight that can be transported along this route.

The alternatives shown in Figure 8 are presented for the cases where the preferred route of travel is unavailable due to maintenance, or any other reason. The alternatives that are presented have certain constraints (as mentioned) and may not be able to accommodate all of the abnormal loads. An alternative of accessing the site from Laingsburg was not considered, due to the excessive length of gravel roads along the route.

It is suggested that the transporting contractor executes a more detailed study before transporting any of the components, to confirm the preferred and alternative routes for each type of load configuration. Should any of the preferred sections be unavailable for any reason, a combination of routes should also be considered.

3.3.3 Route for Construction Materials

Material sources for road building and concrete works are available in Worcester and all material will most likely be transported from this town on the N1 and the R354. As stated earlier, to reduce traffic on the access roads, consideration could be given to sourcing material for road building and concrete

aggregate from new quarries/sources in the vicinity of the site, provided that it is feasible with respect to the target implementation programme. It is noted that the approval period for such quarries/sources is typically 12 to 18 months. The possible siting of quarries and/or borrow pits will be confirmed prior to construction, once a geotechnical investigation has been conducted.

The closest manufacturing centre will most likely be Cape Town, which is situated 256km from the site. For the largest part of the route from Cape Town, the N1 (which is surfaced) will be used. There are, however, toll fees present on this specific route, which can be avoided by use of alternatives.

3.3.4 Authority and Permit Requirements

The following is noted:

a) No toll fees are required on the routes from the Saldanha Port. On the routes from the other manufacturing centres, certain portions of the National Roads are tolled, but the related fees can be avoided by use of alternatives.

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

3.3.5 Route Limitations of the Preferred Route from the Port

The identified route has possible limitations that will necessitate more detailed investigations to determine the level of upgrading that will be required (if any) to accommodate the abnormal loads. All the possible limitations (apart from the capacity of the bridges on the R354, discussed in Section 3.3.6) will potentially be encountered on the gravel roads from the R354 intersection to the prospective site. Possible limitations, other than capacity of the bridges on the R354, that require investigation may include: motor grid gates with loading constraints, overhead power and telecommunication lines with an insufficient ground clearance, substandard geometry of roads and bridges, and drainage issues.

3.3.6 Capacity of Bridges

The section of the preferred route along the R354 between Matjiesfontein (N1) and Sutherland does not form part of a heavy freight route. Several bridges exist along this road that will have to be crossed by abnormal loads. Elevation and approach views of a typical bridge on the R354 are shown in Figure 9 and Figure 10.

Figure 9: Elevation View of Typical Bridge on R354

Figure 10: Approach View of Typical Bridge on R354

A high order investigation was performed to identify limitations on the loading capacity of the existing bridges along this section of road. Aurecon believes it is unlikely that there would be any problems with the loading capacity of these bridges with regards to the delivery of abnormal loads (provided the requirements of the Bridge Formula are met). However, a detailed investigation should be undertaken by the transport contractor, to confirm that the vehicle configuration is suited to the maximum axle loading for the bridges.

3.3.7 Site Access Road

Four viable alternatives for the final section of the route to the site exist for both Brandvalley WEF and Rietkloof WEF. These to the proposed site access point(s) are shown in Figure 11.

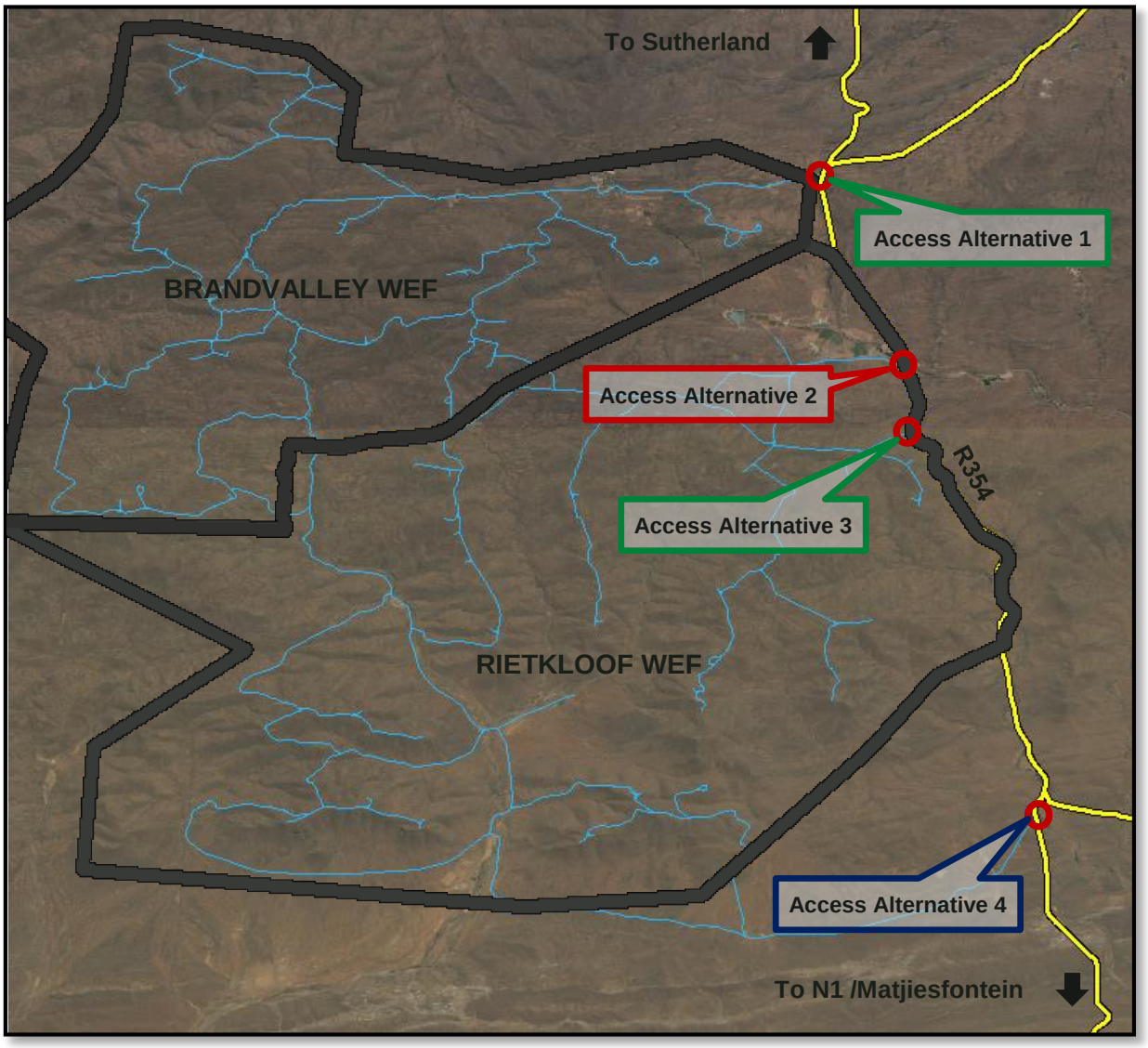


Figure 11: Access Positions to Brandvalley & Rietkloof WEF

The proposed site access positions are all situated on the R354 and close to the border between the Northern Cape and Western Cape and are to be approved by the Western Cape Provincial Government. The sufficiency of the sight distances (stopping and shoulder) at the proposed site entrance is to be reviewed and approved by the local authority. The four alternative routes from the R354 are discussed in the subsequent sections.

3.3.7.1 Road to Site Access Alternative 1

For this option, the site access point is located approximately 34 km from the R354 turn, shown in Figure 12. Following this turn-off, the remainder of the route to site consists of gravel roads.

Figure 12: Access Alternative 1

This access alternative is considered for both sites – Brandvalley and Rietkloof WEF – as a possible access point. It will also be considered in conjunction with the proposed Access Alternative 4 for Rietkloof WEF. Even though this alternative access is situated further away when compared to the proposed access alternative 4, it will be beneficial for Brandvalley WEFs seeing that trucks will not have to travel as long sections along gravel roads. Upgrades in the form of a bridge widening, addressing drainage issues and the widening of cattle grid gates are potentially required on this alternative.

3.3.7.2 Road to Site Access Alternative 2

A potential turn-off on to a newly proposed road is located approximately 26 km from the R354 turn-off. The location of the newly proposed road is shown in Figure 13.

Figure 13: Access Alternative 2

This access alternative is considered for both sites – Brandvalley and Rietkloof WEF – as a possible access point. It will also be considered in conjunction with the proposed Access Alternative 4 for

Rietkloof WEF. The proposed access road to be constructed is approximately 1 km in length before it joins up with an existing road. The benefit this option holds is that it does not pass any farm houses and that it can easily be utilised for both WEFs. Allowance for adequate turning radii are to be made, along with sufficient sight distances.

3.3.7.3 Road to Site Access Alternative 3

For this option, the site access point is located approximately 29 km from the R354 turn-off, shown in Figure 14. Existing roads will be utilised as far as possible, with upgrades to be performed where necessary. The possibility of a bypass has to be considered, seeing that the road passes a farm house. This will obviously have extra cost associated with it. This access alternative is considered for Rietkloof WEF only as a possible main access point. It will also be considered in conjunction with the proposed Access Alternative 4.

Figure 14: Access Alternative 3

3.3.7.4 Access Alternative 4

The proposed access position considered for Rietkloof WEF is located approximately 18 km from the R354 turn-off from the National Road 1 (N1). Figure 15 shows the turn-off from the R354. This access will be used in conjunction with the other preferred access alternatives to each site. The remainder of the route to site from this point consists of gravel roads. The Rietkloof road is planned to be upgraded.

Figure 15: Access Alternative 4

3.3.7.5 Preferred Access to Site – Brandvalley WEF

The preferred access to the proposed Brandvalley WEF is Access Alternative 1 for the more direct route to site.

3.3.7.6 Preferred Access to Site – Rietkloof WEF

The preferred access to the proposed Rietkloof WEF is Access Alternative 3 for the more direct route in conjunction with Access Alternative 4.

3.3.7.7 Internal Access Roads

Access roads between the turbines will be required for construction, and later for maintenance purposes. The internal access roads will be confirmed once the final positioning of the wind turbines are available and a more detailed design is required.

3.3.8 Accommodation of Traffic during Construction

SANRAL and Provincial Authority may require upgrading of the access intersection to the site from National or Provincial Roads. During upgrading of the access, traffic will have to be accommodated, as per SADC Road Traffic Signs Manual requirements. The typical minimum signage requirements, shown in Figure 16, will have to be implemented to ensure safety, should the closure of the road be required during construction.

The accommodation of traffic on the proposed access road, from the gravel road leading to the site, would require consultation with the farm users. As only one-way traffic is likely to be possible on this road, it will likely have to be closed to local traffic at times.

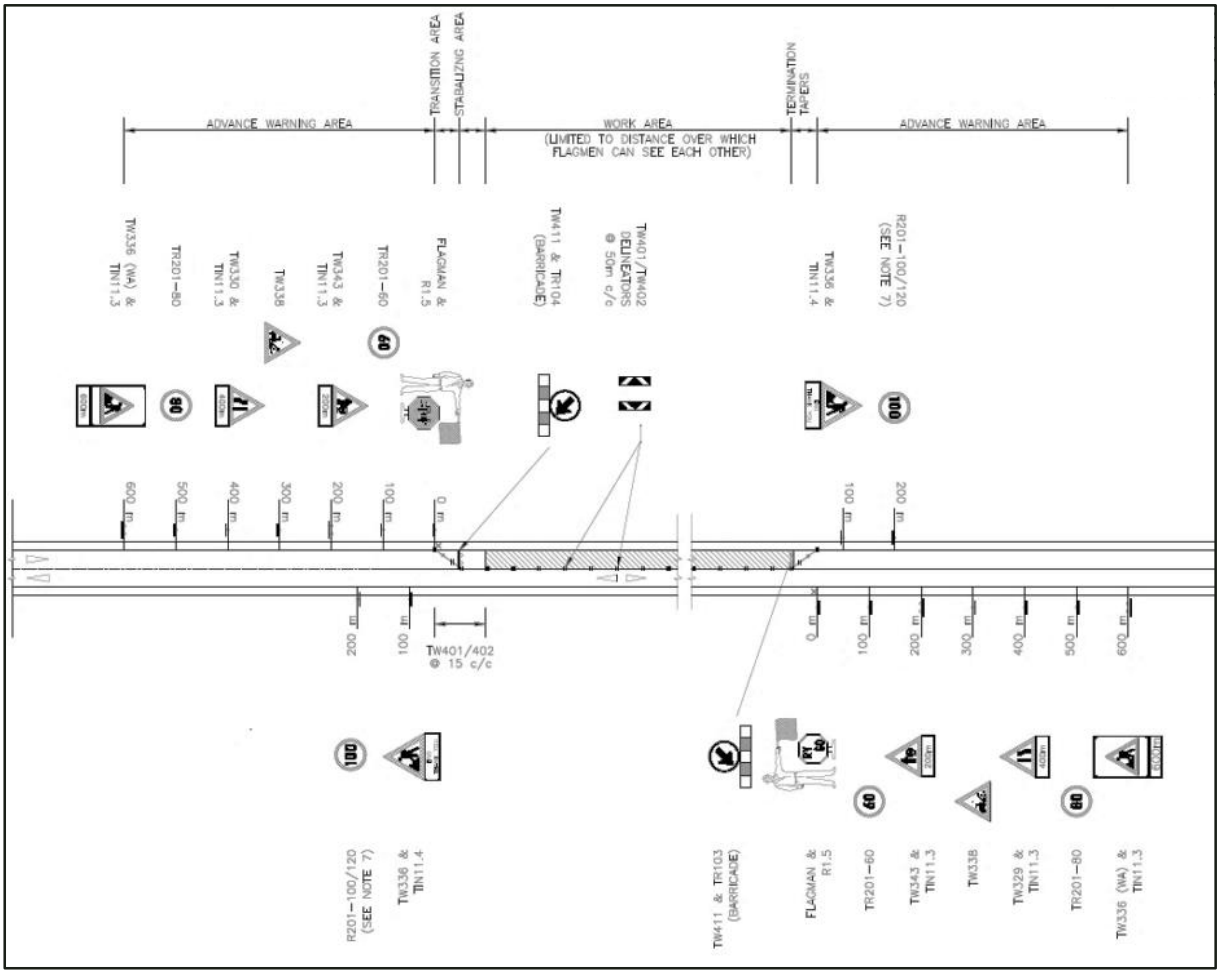


Figure 16: Accommodation of Traffic - Typical Layout

4 CONCLUSION

This report details the investigation of the transport needs for the proposed Brandvalley and Rietkloof Wind Energy Facilities, located on the border between the Western Cape and Northern Cape Provinces, on the farms Barendskraal 76, Brandvalley 75, Fortuin 74, Kabeltouw 160, Muishond Rivier 161, Rietfontein 197 B, Hartjieskraal 77, Nuwerus 284, Rietkloof Annexe 88, Snyders Kloof 80, Vogelstruisfontein 81, and Wilgehout Fontein 87. The purpose of the investigation is to identify potential access routes, including site access, for the development of the facility. The general freight for the wind farm will comprise building materials, blades, nacelles, towers, hubs, cables and transformers.

The imported freight will preferably be transported from Saldanha Port to the site. The preferred freight route from Saldanha Port, via Moorreesburg (a distance of 342km), comprises surfaced roads for the majority of the way (only the final road section to the site consists of gravel roads). This route is predominantly on National or Provincial Roads, with suitable conditions for the transport of normal freight, or abnormal loads with permits. No toll fees are required on this route, however, abnormal permits will be required for the transport of the transformers and turbine components, irrespective of the final route determined by the logistics contractor.

Building materials will most likely be transported from Worcester, while certain elements will be transported from various manufacturing centres in South Africa - most likely Cape Town for tower sections and Johannesburg for transformers. The transport of elements from these manufacturing centres will be predominantly on National and Provincial roads, which presents no limitations for normal freight.

Due to the distance from Worcester to site (approximately 155km), significant reductions in heavy vehicle trips could be achieved by sourcing road building materials and concrete aggregate from new quarries or borrow pits in proximity to the site, provided that it is a feasible with respect to the target implementation programme. The possible siting of quarries and/or borrow pits will be confirmed prior to construction, once a geotechnical investigation has been conducted.

There is a limited risk of delays to the various deliveries required for the construction of the facility, due to potential routine maintenance works (such as repairs and reseals). The impact of such activities is dependent on the scheduling of deliveries and of roads contracts, and may be mitigated by the use of the alternative routes proposed in this report.

In general, no obvious problems were identified associated with the transport of freight along the proposed routes to the site, nor for the accesses required for the construction and maintenance of the facility. It will, however, be necessary to confirm certain aspects such as clearances, bridge capacities, etc., by the logistics contractor as part of their preparation as this will be dependent on the actual vehicles configuration used.

5 REFERENCES

EOH Coastal & Environmental Services. (2016). *EIA FOR THE PROPOSED BRANDVALLEY WIND ENERGY FACILITY, NORTHERN AND WESTERN CAPE PROVINCES, SOUTH AFRICA.* Cape Town: EOH Coastal & Environmental Services.

EOH Coastal & Environmental Services. (2016). *EIA FOR THE PROPOSED RIETKLOOF WIND ENERGY FACILITY, WESTERN CAPE PROVINCE, SOUTH AFRICA.* Cape Town: EOH Coastal & Environmental Services.

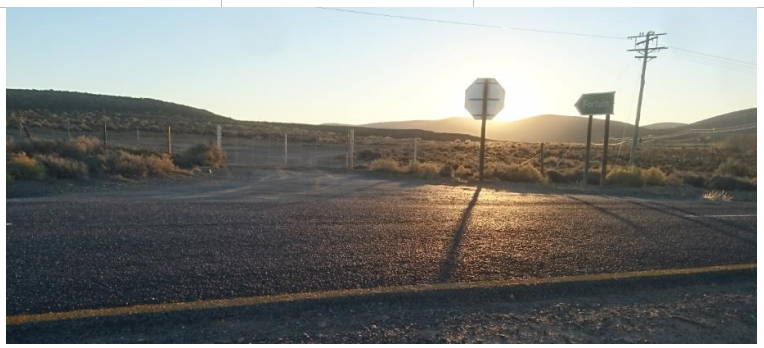
Appendix A: Elements of Preferred Route

Table 4: Elements of preferred route

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

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

Element	Route Name	From	To	Distance [km]	Type
7	N1	Touwsrivier	Matjiesfontein	56.7	Surfaced National Road
				The N1 is a single carriageway, two lane road with surfaced shoulders.	
8	R354	Matjiesfontein	Rietkloof Turn-Off	18.26	Surfaced Provincial Road
			New Proposed Road	26.0	
			Fortuin Turn-Off	29.47	
			Brandvalley/ Ou Mure Turn-Off	34.29	
				The R354 is a single carriageway, two lane road with gravel shoulders (surfaced shoulders in places). There are mountain passes along this section of the route.	
9A	OP06161	Rietkloof Turn-Off	Site	-	Gravel Road
				Provincial gravel road potentially requiring minor upgrades (improvement of vertical alignment, drainage, gate widenings, etc.) and routine maintenance.	

Element	Route Name	From	To	Distance [km]	Type
9B	-	New Proposed Road	Site	-	None
					
9C	OP08044	Fortuin Turn-Off	Site	-	Gravel Road
				Provincial gravel road potentially requiring minor upgrades (widening of bridges and cattle grids) and routine maintenance	
9D	OP08042	Brandvalley/Ou Mure Turn-Off	Site	-	Gravel Road
				Provincial gravel road potentially requiring minor upgrades (widening of bridges and cattle grids) and routine maintenance	

Appendix B: Urban Sections along the Preferred Route

Table 5: Urban sections on preferred route

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

Element	Route Name	Town	Type
6	R46	Ceres	Surfaced Provincial Road

Aurecon South Africa (Pty) Ltd
Aurecon Centre
1 Century City Drive
Waterford Precinct
Century City, Cape Town, 7441
T +27 21 526 9400
F +27 21 526 9500
E capetown@aurecongroup.com
W www.aurecongroup.com