ENVIRONMENTAL IMPACT REPORT

PROPOSED BOTTERBLOM WIND ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON THE REMAINDER OF THE FARM SOUS 226, NEAR LOERIESFONTEIN IN THE NORTHERN CAPE

September 2022

NAME OF APPLICANT: FE Botterblom (Pty) Ltd

PREPARED BY: Enviro-Insight CC

PROJECT DETAILS

REPORT TITLE:	PROPOSED BOTTERBLOM WIND ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON THE REMAINDER OF THE FARM SOUS 226, NEAR LOERIESFONTEIN IN THE NORTHERN CAPE
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APPLICANT:	FE BOTTERBLOM PTY LTD
ENVIRONMENTAL CONSULTANT:	ENVIRO-INSIGHT CC CORNÉ NIEMANDT PR.SCI.NAT. IAIASA MEMBER
ENVIRONMENTAL CONSULTANT:	ENVIRO-INSIGHT CC RONELL KUPPEN BSC (HONORS) GEOGRAPHY IAIASA MEMEBER
DATE	SEPTEMBER 2022

When referenced this report should be cited as: Enviro-Insight CC. (2022). Draft Environmental Impact Assessment Report for Botterblom Wind Energy Facility, Loeriesfontein, Northern Cape.

EXECUTIVE SUMMARY

Details of the proposed Botterblom Wind Energy Facility

Component	Description / Dimensions
Project Name	Botterblom Wind Energy Facility
Province	Northern Cape
Farm portion	A Portion of the Remainder of the Farm Sous 226
Extent (ha)	5 736 hectares
21-digit Surveyor General code	C01500000000022600000
Number of turbines	Up to 32
Hub height	150 m
Rotor diameter	175 m
Turbine capacity (MW)	between 4.5 and 7.5 MW
Contracted capacity of the facility (MW)	140
Length of blade	87.5 m
Dimensions of the turbine foundations	20X20X3m
Cabling	Underground up to 1m deep
Capacity of onsite substation	33/132kV (100mX100M)
Grid connection	Helios MTS
Width of internal roads	up to 10 m
Proximity to grid connection	Approximately 2 km
Laydown areas	Construction period laydown footprint (temporary): ± 6 ha Temporary hardstand area (boom erection, storage and assembly area): ± 15 ha

Introduction and Background

FE Botterblom (Pty) Ltd (hereafter the Applicant) is proposing the development of a wind energy facility (WEF) and associated infrastructure on a site located approximately 53 kilometers (km) north of Loeriesfontein in the Northern Cape province of South Africa. The proposed development, to be known as Botterblom WEF, will have a generation capacity of up to 240MW which will feed into the National Grid.

The proposed study area for the WEF development is located approximately 53km north of Loeriesfontein, 85 km west of Brandvlei and 160 km southeast of Springbok in the Northern Cape. The site can be reached via unsurfaced Granaatboskolk / Zout Dwaggas Road, which branches off the R357. The Botterblom WEF footprint is approximately 5 736 hectares (ha) and will be located on a Portion of the Remainder of the Farm Sous 226 (21-digit Surveyor General code: C01500000000022600000) The Khobab WEF is located directly north while Loeriesfontein2 WEF is located north-east of the study area.

The Botterblom WEF will consist of up to 32 wind turbines, with a generation capacity of between 4.5 and 7.5 MW per turbine, depending on the available technology at the time. Each turbine will have a hub height of up to 150m and a rotor diameter of up to 175m. The final turbine model to be utilised will only be determined closer to the time of construction, depending on the technology available at the time. Additional ancillary infrastructure to the WEF would include underground and above-ground cabling between project components, onsite substation/s, Battery Energy Storage Systems (BESS), foundations to support turbine towers, internal/ access roads (up to 10 m in width) linking the wind turbines and other infrastructure on the site, and permanent workshop area and office for control, maintenance and storage. As far as possible, existing roads will be utilised and upgraded (where needed) with the relevant stormwater infrastructure and gates constructed as required. The perimeter of the proposed WEF may be enclosed with suitable fencing. A formal laydown area for the construction period, containing a temporary maintenance and storage building along with a guard cabin will also be established.

The specific GPS coordinates for each turbine for the Preferred Layout is shown below.

Wind turbine coordinates for Preferred Layout for the proposed Botterblom Wind Farm project.

Wind Turbine layout number	**Latitude (S)**	**Longitude (E)**
WT01	30°26'43.08"S	19°27'19.80"E
WT02	30°26'50.71"S	19°27'41.27"E
WT03	30°26'57.14"S	19°28'3.47"E
WT04	30°27'5.67"S	19°28'24.08"E
WT05	30°27'11.46"S	19°28'47.02"E
WT06	30°27'17.02"S	19°29'11.77"E
WT07	30°27'23.22"S	19°29'33.82"E

WT08	30°27'31.02"S	19°29'54.40"E
WT09	30°27'37.82"S	19°30'20.46"E
WT10	30°27'43.95"S	19°30'40.31"E
WT11	30°27'59.07"S	19°30'58.42"E
WT12	30°28'15.57"S	19°31'12.44"E
WT13	30°28'28.87"S	19°31'29.91"E
WT14	30°28'41.26"S	19°31'44.25"E
WT15	30°27'53.56"S	19°31'31.10"E
WT16	30°27'51.21"S	19°32'9.16"E
WT17	30°28'6.76"S	19°32'22.15"E
WT18	30°28'22.61"S	19°32'35.99"E
WT19	30°28'33.31"S	19°33'1.73"E
WT20	30°27'24.67"S	19°33'2.35"E
WT21	30°27'40.56"S	19°33'31.55"E
WT22	30°27'41.00"S	19°33'56.50"E
WT23	30°28'9.82"S	19°34'25.62"E
WT24	30°28'6.02"S	19°33'30.93"E
WT25	30°28'25.72"S	19°33'33.04"E
WT26	30°27'50.21"S	19°29'16.39"E
WT27	30°27'58.83"S	19°29'40.18"E
WT28	30°28'10.35"S	19°30'17.29"E
WT29	30°28'52.59"S	19°30'45.85"E
WT30	30°29'10.65"S	19°31'3.69"E

Specialist studies were undertaken to address the key issues that require further investigation to address the impacts of the development on the receiving environment. The specialist studies involve the gathering of data relevant to identifying and assessing impacts that may occur as a result of the proposed project. The specialists will also recommend appropriate mitigation or optimisation measures to minimise potential negative impacts or enhance potential benefits, respectively.

Enviro-Insight has selected a team of highly experienced specialists in order to execute this in a professional and impartial manner. The project team, specifically the sub-consultants, is indicated below:

Specialist Assessment	Company	Professional Specialist
Terrestrial Biodiversity and Sensitive Animal Species	Enviro-Insight CC	Sam Laurence Luke Verburgt Alex Rebelo
Sensitive Plant Species	Enviro-Insight CC	Corné Niemandt
Heritage Impact Assessment and Palaeontological Impact Assessment	Beyond Heritage	Jaco van der Walt Ruan van der Merwe Prof Marion Bamford
Noise Compliance Statement and Screening Noise Report	Enviro Acoustic Research (EARES)	Morné de Jager Johan Maré
Site Sensitivity verification and Agricultural Compliance Statement	Johann Lanz Soil Scientist	Johann Lanz
Aquatic Specialist Biodiversity, Wetland and Riparian Assessment	WaterMakers	Willem Lubbe Bryon Grant
Social Impact Assessment	Wat se Horak Pty Ltd Trading as HCV Africa	Stephen George Horak
Transport Impact Assessment	Innovative Transport Solutions (ITS)	Christoff Krogscheepers, Pr. Eng Pieter Arangie Tarshia Williams
Visual Assessment	LOGIS	Lourens du Plessis
Avifauna Assessment	Enviro-Insight CC	Samuel Laurence Jason Tarr Low de Vries Justin Rhys Nicolau AE van Wyk
Bat Impact Assessment	Enviro-Insight CC	Low de Vries Luke Verburgt Alex Rebelo Samuel Laurence

Neither Enviro-Insight nor any of its sub-consultants are subsidiaries of *FE Botterblom Pty Ltd,* nor is *FE Botterblom Pty Ltd* a subsidiary to Enviro-Insight. Enviro-Insight, its sub-consulting specialists, do not have any interests in secondary or downstream developments that may arise out of the authorisation of the proposed project.

The potential impacts associated with the proposed Botterblom WEF and associated infrastructure are summarised below in Table 8-1. Should the mitigation provided in the tables in Section 7 and detailed in the Environmental Management Programme (EMPr) be implemented, post-migration impacts are anticipated to range between very low to medium negative significance, and up to highly positive.

Summary of Impact Assessment

Aspect	Impact	Post Mitigation
	Planning and Construction	
Terrestrial Biodiversity	Habitat Loss and Fragmentation	Low – Medium
	Loss of species of conservation concern	Low - Medium
	Alien and invasive plant species	Low
	Increased risk of erosion and flash floods.	Low
	Disturbances or displacement impacts on fauna including traffic, noise and dust.	Low
Avifauna	Habitat destruction	Low
	Destruction or disturbance of bird roosts	Low
Bats	Habitat destruction	Low
	The destruction or disturbance of bat roosts	Very Low
Aquatic	Sedimentation of watercourse	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Medium
	Exposure to erosion	
	Alt 1	Low
	Atl 2	Low
	Alt 3	Medium
	Potential increase in invasive vegetation	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Medium
	Pollution of water resources	

	Alt 1	Low
	Alt 2	Low
	Alt 3	Medium
Agricultural	Loss of agricultural potential by occupation of land	Medium
	Loss of agricultural potential by soil degradation	Low
	Dust impact	Low
	Enhanced agricultural potential through increased financial security for farming operations	High Positive
Visual	Visual impact of construction on sensitive visual receptors in close proximity to the proposed WEF	Low
	Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures	High
	Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.	High
	Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures	High
	Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures	Medium
	Visual impact of lighting at night on sensitive visual receptors.	Moderate
	Visual impact of the ancillary infrastructure.	Low
	The potential impact on the sense of place of the region.	Low
Heritage	Impact on Waypoint 20 and 22	Low
	Impact on other recorded heritage resources	Low
Social	Employment, business opportunities and skills development impact rating	High Positive
	Construction workers on site and in local area impact rating	Low
	Influx of job seekers to the area	Low
	Impacts on farms, farmers and their workers	Low
	Impact of construction vehicles	Moderate
	Impact on farming activities	Moderate
	Additional pressure on services	Low
	Loss of sense of place	High
	Noise, dust and visual impacts	Low
Traffic	Increased Traffic Volumes	

	Alt 1	Low
	Alt 2	Low
	Alt 3	Low
	Heavy Loads during the construction phase	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Low
	Stormwater Management	Low
	Hunting / Fishing by construction workers.	Low
	Degradation and contamination of the surrounding environment by construction activities, cement, hydrocarbons and other hazardous materials.	Low
	Potential disturbance or unearthing of graves or disturbance to other heritage resources during the construction phase.	Low
	Improper storage and disposal of solid waste.	Low
	Littering around the site.	Low
General	Improper disposal of rubble i.e.: burying or neglecting building rubble resulting in direct mechanical damage to surrounding vegetation and untidiness of the site.	Low
	Lack of toilet facilities resulting in unsanitary conditions.	Low
	Improper disposal of toilet waste from chemical toilets resulting in contamination of the surrounding environment	Low
	Increase waste to landfill site.	Low
	Risk of spills from construction equipment (oils, fuels, cement etc.) contaminating soil and the watercourse.	Low
	Dust Generation and control	Low
	Degradation of existing service infrastructure, e.g. roads, electricity.	Low
	Operation	
Terrestrial	Direct faunal impacts due to operation.	Low
Biodiversity	Alien and invasive plant species	Low
Avifauna	Bird mortalities	Medium
	Disruption of bird migratory pathways	Low
Bats	Bat mortalities	Low
	Artificial light	Very Low
	Disruption of bat migratory pathways	Low

Aquatic	Altered Hydrologic Regime	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Medium
Agriculture	Protection of soil resources	Low
Visual	Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures	High
	Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.	High
	Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures	Medium
	Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures	Low
	Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.	Moderate
	Visual impact of lighting at night on sensitive visual receptors.	Low
	Visual impact of the ancillary infrastructure.	Low
	The potential impact on the sense of place of the region.	High
	Visual impact of wind farms on the visual quality of the landscape.	High
Social	Renewable energy infrastructure and clean renewable energy	High Positive
	Creation of employment and business opportunities	High Positive
	Generation of income for landowner	High Positive
	Social Economic Development and Enterprise Development	High Positive
	Visual impacts and associated impact on sense of place	Moderate
	Impact on property values	Low
	Impact on tourism	Moderate
	Noise	Low
Traffic	Increased Traffic Volumes	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Low
	Impact on CD by Loeriesfontein WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low

Socio-Economic Wake Analysis	Impact on CD by Khobab WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Kokerboom 1 WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Kokerboom 2 WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Kokerboom 3 WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Kokerboom 4 WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Botterblom WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	High
	Cumulative impact on CD (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	High
Decommissioning		
Terrestrial Biodiversity	The ecological impacts associated with the decommissioning phase will be similar to those listed in the construction phase and the associated mitigations measures must be updated and implemented to reduce potential adverse impacts	
Agriculture	Protection of soil resources	Low
Visual	Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures	High
	Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.	High
	Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures	Medium
	Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures	Low
	Visual impact of the ancillary infrastructure.	Low
	The potential impact on the sense of place of the region.	High
Social	Deconstruction of the infrastructure and recycling	Moderate
	Loss of jobs and associated income	Moderate
Traffic	Heavy Loads during the decommissioning phase	
	Alt 1	Low

	Alt 2	Low
	Alt 3	Low

Summary of specialist opinions and recommendations

Summary of Specialist Recommendations.

Specialist	Recommendation	Opinion
Terrestrial Biodiversity	The affected area is not considered sensitive and there are no specific features of the affected area which would indicate that it is of broad-scale significance for faunal movement or landscape connectivity. Although there are two existing wind farms and several more applications in the area, the total extent of habitat loss due to wind energy is currently less than 200ha and with all applications would still be less than 1000ha and this is not considered significant in context of the affected vegetation types, which are among the more extensive in the country.	Project can proceed with the implementation of the recommended buffers and mitigation measures.
Avifauna	The occurrence of several passerine species that might potentially be affected by collision was confirmed, namely endemic and/or range-restricted larks (Red Lark and Sclater's Lark representing the highest profile and frequently observed) which are widespread species in the area. These species are considered to have a "Vulnerable and Near threatened" conservation status respectively. As habitat obligates, the potential impact on these passerines may be mitigated via avoidance. The specialist has no reason why an Environmental Authorisation (EA) should not be granted on the following conditions; • All recommended buffering be strictly adhered to. • Shutdown on demand must be implemented if 5 km nest buffers are to be breached. • All recommended mitigation measures be applied preconstruction, post construction and operations. • The EMPr be updated every three years in order to revaluate the advances in AI, radar and camera technology.	Project can proceed with the implementation of the recommended mitigation measures and associated buffers

	• Currently available Deterrent and Shutdown on demand technology is to be immediately applied to the identified turbines in the form of Artificial Intelligence Camera systems.	
Bat Assessment	Based on the available data collected, the construction of a WEF on the proposed WEF boundary will have a Low-Medium Risk of impacting the bat population in the area before mitigation measures have been applied. Currently, after mitigation measures have been implemented this risk will be reduced to Low.	Project can proceed with the implementation of the recommended mitigation measures and associated buffers
Aquatic Biodiversity	Considering the type of development proposed, a WEF, and the implementation of the recommendations and mitigation measures, the development is not likely to impact on the FEPA catchment classification associate with the study area.	Project can proceed with the implementation of the recommended mitigation measures and associated buffers
Agriculture	The proposed development will not have substantial negative impact on the agricultural production capability of the site and is therefore acceptable. This is substantiated by the facts that the land is of very low agricultural potential, the amount of agricultural land loss is within the allowable development limits, and that the proposed development poses a low risk in terms of causing soil degradation, if the recommended mitigation measures are implemented.	Project can proceed with the implementation of the recommended mitigation measures
Noise	there exists a low potential for a noise impact and that no further Scoping or other acoustical studies would be required for the proposed WEF. No specific mitigation measures regarding noise or additional noise measurements are recommended. No additional conditions regarding noise are recommended for inclusion in the EMPr. It is therefore recommended that the development of the Botterblom WEF be approved from a noise perspective.	Project can proceed with the implementation of the recommended mitigation measures
Visual	As per the result from the visual impact assessment report, the structure would be easily visible to observers due to its high visual prominence, especially within a radius of 5-10km of the proposed WEF, which will potentially result in a high visual impact.	High Impact; however this does not represent a fatal flaw for the project. The project does fit into the current sense of place

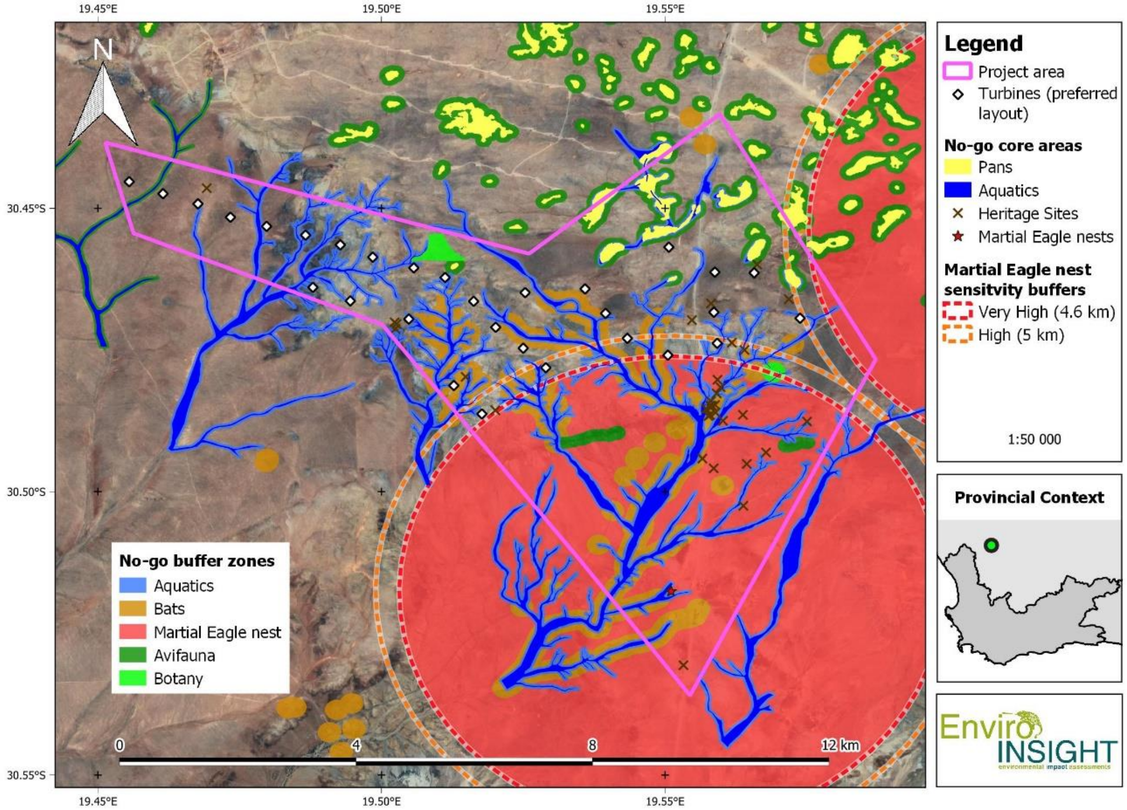
		where there are two existing wind farms, and another one commissioned for construction. The residents in the area have not complained by the visual impacts of the existing windfarms and are not opposed to the Botterblom WEF.
Heritage	The three alternatives are all considered to be acceptable since the turbines avoid significant heritage sites and the impact of the proposed project on heritage resources can be mitigated to an acceptable level. The socio-economic benefits also outweigh the possible impacts of the development if the correct mitigation measures are implemented for the project. It is recommended that the proposed project can commence on the condition that the recommendations are implemented as part of the EMPr and based on approval from SAHRA.	Project can proceed with the implementation of the recommended mitigation measures
Social	The development of the proposed WEF will create employment, training and business opportunities during both the construction and operation phases of the project. The potential negative impacts associated with the construction phase can be mitigated. The proposed WEF is an investment in clean, renewable energy infrastructure for the country which will go some way to offset the negative environmental and socio-economic impacts associated with a coal-based fossil fuel energy generation. Renewable energy, including WEF, also addresses climate change and assists the country in meeting climate change reduction goals. The development of the Botterblom WEF is supported as the project will have significant positive impacts. These positive impacts relate to the economy by providing clean energy which will reduce South Africa's carbon footprint.	Project can proceed with the implementation of the recommended mitigation measures

Traffic	The existing road network has sufficient spare capacity to accommodate the proposed Botterblom Wind Energy Facility, without any road upgrades required to the existing road infrastructure. It is recommended that the proposed Botterblom Wind Energy Facility be approved from a transport impact perspective.	Project can proceed with the implementation of the recommended mitigation measures
Socio-Economic Wake Effect Analysis	The study revealed that external turbine interactions caused by the Botterblom WEF will result in wake losses, which translates into reduced amount of electricity that potentially affected WEFs could generate. This results in the losses of annual revenues and, by extrapolation, leads to the reduced community development contributions that the WEFs can make. The negative effect on the other WEFs contributions towards community development in the area is expected to be offset by the contributions made by the Botterblom WEF itself.	Project can proceed with the implementation of the recommended mitigation measures

The combined sensitivity map was based on the findings from all specialist assessments and inputs from all stakeholders. The following relevant features were included, which are considered “no-go” areas (i.e. no development make occur in these areas):

- Avifauna: 4.6 and 5 km nest buffers, 200 m buffer around seasonally inundated watercourses.
- Watercourses: 40m buffer
- Bats: Sensitive and important habitats, including a 200m buffer
- Plants: 200m buffer around sensitive species

This report is based on a project description and site plan, provided to by the applicant, which has not been approved by DFFE at this stage of the project. The project description and site plan may undergo refinements before being regarded as final. A project description based on the final design will be concluded once all stakeholders have provided feedback on the layout provided in this report.



It was determined during the EIA that the proposed project will result in limited potential negative impacts and certain positive impacts. A preferred site layout has been identified which is less environmentally sensitive and will result in the least environmental impact.

A detailed public participation process was followed during the EIA process which conforms to the public consultation requirements as stipulated in the EIA Regulations. In addition, all issues raised by I&APs will be captured in the FEIAR and where possible, mitigation measures provided in the EMPr to address these concerns.

The 3 proposed site alternatives were assessed based on the viability and impact to the environment. Alternative 3 was considered for the maximum number of turbines for the property, but was disregarded due to sensitivities and setbacks identified early on in the process, therefore, Alternative 1 and Alternative 2 were under consideration, however taking into consideration the recommendations, buffers and no-go areas by the specialist a Preferred Layout was designed to account for the site sensitives. Kindly refer to Figure 8-1 and Figure 8-2 for the sensitivity analysis in regard to the various alternatives.

It is the opinion of the EAP that the information and data provided in this Environmental Impact Assessment report (EIR) is sufficient to enable the DFFE to consider all identified potentially significant impacts and to make an informed decision on the application. Furthermore, once the layout has considered all sensitive features by avoiding no-go areas, and based on the findings of the impact assessment, the proposed project should be granted an EA and allowed to proceed provided the conditions are adhered to and appropriate mitigation measures as suggested by each specialist are addressed.

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

BID	Background Information Document
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIR	Environmental Impact Report
EMFs	Environmental Management Framework
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GIS	Geographical Information System
GNR	Government Notice Regulation
ha	Hectare
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IUCN	International Union for Conservation of Nature
NEM: BA	National Environment Management: Biodiversity Act (Act 10 of 2004)
NEM: WMA	National Environmental Management: Waste Management Act (Act No. 59 of 2008)

NEMA	National Environmental Management Act (Act 107 of 1998) (as amended)
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA	National Water Act
PPP	Public Participation Process
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SDP	Spatial Development Plan
SCC	Species of Conservation Concern

DEFINITIONS AND TERMINOLOGY

Activity: means an activity identified in any notice published by the Minister or MEC in terms of section 24D(1)(a) of the NEMA as a listed activity or specified activity

Alternatives: in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the—

(a) property on which or location where the activity is proposed to be undertaken;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity; or

(e) operational aspects of the activity;

and includes the option of not implementing the activity;

Application: an application for an environmental authorisation in terms of Chapter 4 of the EIA Regulations (2014 as amended).

Biodiversity: Variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.

Cumulative impact: in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Development: the building, erection, construction or establishment of a facility, structure or infrastructure, including associated earthworks or borrow pits, that is necessary for the undertaking of a listed or specified activity, but excludes any modification, alteration or expansion of such a facility, structure or infrastructure, including associated earthworks or borrow pits, and excluding the redevelopment of the same facility in the same location, with the same capacity and footprint.

Development footprint: any evidence of physical alteration as a result of the undertaking of any activity.

Environmental authorisation: The Competent Authority's grant or denial of permission to undertake the proposed activity. Previously referred to as the Record of Decision (RoD).

EAP: an environmental assessment practitioner as defined in section 1 of the NEMA.

EMPr: an environmental management programme contemplated in regulation 23 of the EIA Regulations (2014 as amended).

Environmental Impact Assessment: a systematic process of identifying, assessing and reporting environmental impacts associated with an activity and includes basic assessment and S&EIR.

Mitigation: to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

Registered interested and affected party: in relation to an application, means an interested and affected party whose name is recorded in the register opened for that application in terms of regulation 42 of the EIA Regulations (2014 as amended).

Significant Impact: an impact that may have a notable effect on one or more aspects of the environment or may result in noncompliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence.

Specialist*:* a person that is generally recognised within the scientific community as having the capability of undertaking, in conformance with generally recognised scientific principles, specialist studies or preparing specialist reports, including due diligence studies and socio-economic studies. A specialist needs to be professionally registered (e.g. with the South African Council for Natural Scientific Professions).

1 INTRODUCTION

FE Botterblom (Pty) Ltd (hereafter the Applicant) is proposing the development of a wind energy facility (WEF) and associated infrastructure on a site located approximately 53 kilometers (km) north of Loeriesfontein in the Northern Cape province of South Africa. The proposed development, to be known as Botterblom WEF, will have a generation capacity of up to 240MW which will feed into the National Grid. Enviro-Insight CC (hereafter Enviro-Insight) has been appointed to undertake the requisite environmental impact assessment (EIA) process for the WEF as required in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA), as amended, on behalf of the Applicant.

The proposed study area for the WEF development is located approximately 53 km north of Loeriesfontein, 85 km west of Brandvlei and 160 km southeast of Springbok in the Northern Cape. The site can be reached via unsurfaced Granaatboskolk / Zout Dwaggas Road, which branches off the R357. The Botterblom WEF footprint is approximately 5 736 hectares (ha) and will be located on a Portion of the Remainder of the Farm Sous 226 (21-digit Surveyor General code: C01500000000022600000) The Khobab WEF is located directly north while Loeriesfontein2 WEF is located north-east of the study area.

The Botterblom WEF will consist of up to 32 wind turbines, with a generation capacity of between 4.5 and 7.5 MW per turbine, depending on the available technology at the time. Each turbine will have a hub height of up to 150m and a rotor diameter of up to 175m. The final turbine model to be utilised will only be determined closer to the time of construction, depending on the technology available at the time. Additional ancillary infrastructure to the WEF would include underground and above-ground cabling between project components, onsite substation/s, Battery Energy Storage Systems (BESS), foundations to support turbine towers, internal/ access roads (up to 10 m in width) linking the wind turbines and other infrastructure on the site, and permanent workshop area and office for control, maintenance and storage. As far as possible, existing roads will be utilised and upgraded (where needed) with the relevant stormwater infrastructure and gates constructed as required. The perimeter of the proposed WEF may be enclosed with suitable fencing. A formal laydown area for the construction period, containing a temporary maintenance and storage building along with a guard cabin will also be established.

Additionally, a power line with a capacity of up to 132kV is required. At this stage, options are still being considered for either the construction of a new line to feed into the Helios substation or connect with existing lines. This associated electrical infrastructure will require a separate Environmental Authorisation and is being conducted as a part of a separate Basic Assessment (BA) process. More details will be provided in the Final Environmental Impact Assessment Report (FEIAr).

1.1 APPLICANT DETAILS

Table 1-1: Applicant Contact Details.

Applicant	FE BOTTERBLOM PTY LTD
Contact Person	Ralf Grass
Address	60 Hennie Winterbach Street Panorama Western Cape 7500
Telephone	+27 21 013 3614
Email	ralf.grass@energyteam.co.za / millard.kotze@genesis-eco.com

1.2 THE ENVIRONMENTAL IMPACT ASSESSMENT PROJECT TEAM

1.2.1 Environmental Assessment Practitioner (EAP)

Client has appointed Enviro-Insight CC as an independent Environmental Assessment Practitioner (EAP) to undertake an environmental authorisation process for the proposed Botterblom WEF. Enviro-Insight CC has no vested interest in the proposed project and hereby declares its independence as required by the EIA Regulations (2014, as amended). For purposes of this report, the following person may be contacted at Enviro-Insight CC:

Table 1-2: Enviro-Insight contact details.

Company	Enviro-Insight CC
Contact Person	Corné Niemandt / Ronell Kuppen
Purpose	Project consultant and Environmental Consultants
Address:	Unit 8 Oppidraai Office Park, 862 Wapadrand Road, Wapadrand Security Village, Pretoria, 0081
Telephone:	012 807 0637
Email:	corne@enviro-insight.co.za / ronell@enviro-insight.co.za

1.2.1.1 Qualifications and Memberships (Appendix F)

Mr. Niemandt holds a *M.Sc*. degree in Plant Science from the University of Pretoria (2015) and is registered as a professional scientist (*Pr.Sci.Nat*.) with the South African Council for Natural Scientific Professions (SACNASP) and is a member of the International Association for Impact Assessment South Africa (IAIAsa). He has more than 7 years' experience as an environmental assessment practitioner and ecological specialist.

Ms. Kuppen has an BSc (Honours) degree in Geography, with approximately 10 years' experience in the environmental consulting field, ranging from EIA's, WULAS and Public Participation.

1.2.1.2 Summary of past experience (Appendix F)

Mr. Niemandt has over five years' experience as an environmental consultant, compiling and managing several environmental authorisation reports, including Environmental Management Programmes (EMPr), rehabilitation plans and environmental auditing. This included fieldwork, data collection, preparation of permits and licensing studies, compliance monitoring and community engagement, and project managing interdisciplinary teams and contractors. In addition, he has also compiled over 45 terrestrial biodiversity reports in South Africa. Mr. Niemandt has operated in several African countries, including South Africa, Mozambique, Tanzania and Liberia.

Ms. Kuppen has approximately 10 years' experience in the environmental consulting field, ranging from EIA's, WULAS and Public Participation and ECO's

1.2.2 Specialists

Specialist studies is being undertaken to address the key issues that require further investigation to address the impacts of the development on the receiving environment. The specialist studies involve the gathering of data relevant to identifying and assessing impacts that may occur as a result of the proposed project. The specialists will also recommend appropriate mitigation or optimisation measures to minimise potential negative impacts or enhance potential benefits, respectively.

Enviro-Insight has selected a team of highly experienced specialists in order to execute this in a professional and impartial manner. The project team, specifically the sub-consultants, is indicated in

Table 1-3: EIA Project Team.

Specialist Assessment	Company	Professional Specialist
Terrestrial Biodiversity and Sensitive Animal Species	Enviro-Insight CC	Sam Laurence Luke Verburgt
Sensitive Plant Species	Enviro-Insight CC	Corné Niemandt
Heritage Impact Assessment and Palaeontological Impact Assessment	Beyond Heritage	Jaco van der Walt Ruan van der Merwe Prof Marion Bamford

Noise Compliance Statement and Screening Noise Report	Enviro Acoustic Research (EARES)	Morné de Jager Johan Maré
Site Sensitivity verification and Agricultural Compliance Statement	Johann Lanz Soil Scientist	Johann Lanz
Aquatic Specialist Biodiversity, Wetland and Riparian Assessment	WaterMakers	Willem Lubbe Bryon Grant
Social Impact Assessment	Wat se Horak Pty Ltd Trading as HCV Africa	Stephen George Horak
Transport Impact Assessment	Innovative Transport Solutions (ITS)	Christoff Krogscheepers, Pr. Eng Pieter Arangie Tarshia Williams
Visual Assessment	LOGIS	Lourens du Plessis
Avifauna Assessment	Enviro-Insight CC	Samuel Laurence Jason Tarr Low de Vries Justin Rhys Nicolau AE van Wyk
Bat Impact Assessment	Enviro-Insight CC	Low de Vries Luke Verburgt Alex Rebelo Samuel Laurence

Neither Enviro-Insight nor any of its sub-consultants are subsidiaries of *FE Botterblom Pty Ltd,* nor is *FE Botterblom Pty Ltd* a subsidiary to Enviro-Insight. Enviro-Insight, its sub-consulting specialists, do not have any interests in secondary or downstream developments that may arise out of the authorisation of the proposed project.

1.3 ASSUMPTIONS AND LIMITATIONS

Certain assumptions, limitations, and uncertainties are associated with the EIR Phase. This report is based on information that is currently available and, as a result, the following limitations and assumptions are applicable:

- In order to obtain definitive data regarding the biodiversity, hydrology and functioning of particular wetlands, studies should ideally be conducted over a number of seasons and over a number of years. The current study relied on information gained during a single field survey conducted during a single season, desktop information for the area, as well as professional judgment and experience;

- Wetland and riparian areas within transformed landscapes, such as urban and/or agricultural settings, especially areas that have undergone several successional changes due to repeated and prolonged overgrazing practices, are often affected by disturbances that restrict the use of available wetland indicators, such as hydrophytic vegetation or soil indicators (e.g. as a result of dense stands of alien vegetation, dumping, sedimentation, infrastructure encroachment and infilling). Hence, a wide range of available indicators were considered in order to aid in determining wetland and riparian boundaries more accurately;
- Wetland and riparian assessments are based on a selection of available techniques that have been developed through the Department of Water and Sanitation (DWS). These methods are, however, largely qualitative in nature with associated limitations due to the range of interdisciplinary aspects that have to be taken into consideration. Current and historic anthropogenic disturbance within and surrounding the study area has resulted in soil profile disturbances (especially through erosional processes) as well as successional changes in species composition in relation to its original /expected benchmark condition;
- Determination of the preliminary buffer requirements for watercourse features associated with the proposed study area followed the approach of Macfarlane & Bredin (2016), this methodology was adapted to be used for riparian buffers;
- Delineations of wetland areas were largely dependent on the extrapolation of field indicator data obtained during field surveys, contour data for the study area, and from interpretation of georeferenced orthophotos and satellite imagery as well as historic aerial imagery data sets received from the National Department of Rural Development and Land Reform. As such, inherent orthorectification errors associated with data capture and transfer to electronic format are likely to decrease the accuracy of wetland boundaries in many instances.
- The author reserves the right to change impact ratings and mitigation measures as information surfaces.

2 DESCRIPTION OF THE PROPOSED PROJECT

2.1 NATURE AND EXTENT OF PROPOSED PROJECT

The proposed study area for the WEF development is located approximately 53km north of Loeriesfontein, 85 km west of Brandvlei and 160 km southeast of Springbok in the Northern Cape. The site is located within the Hantam Local Municipality which forms part of the Namakwa District of Northern Cape in South Africa.

The site can be accessed via unsurfaced Granaatboskolk / Zout Dwaggas Road, which branches off the R357 (Figure 2-1). The Botterblom WEF footprint is approximately 5 736 hectares (ha) and will be located on a Portion of the Remainder of the Farm Sous 226 (21-digit Surveyor General code: C01500000000022600000). The Khobab WEF is located directly north while Loeriesfontein2 WEF is located north-east of the study area.

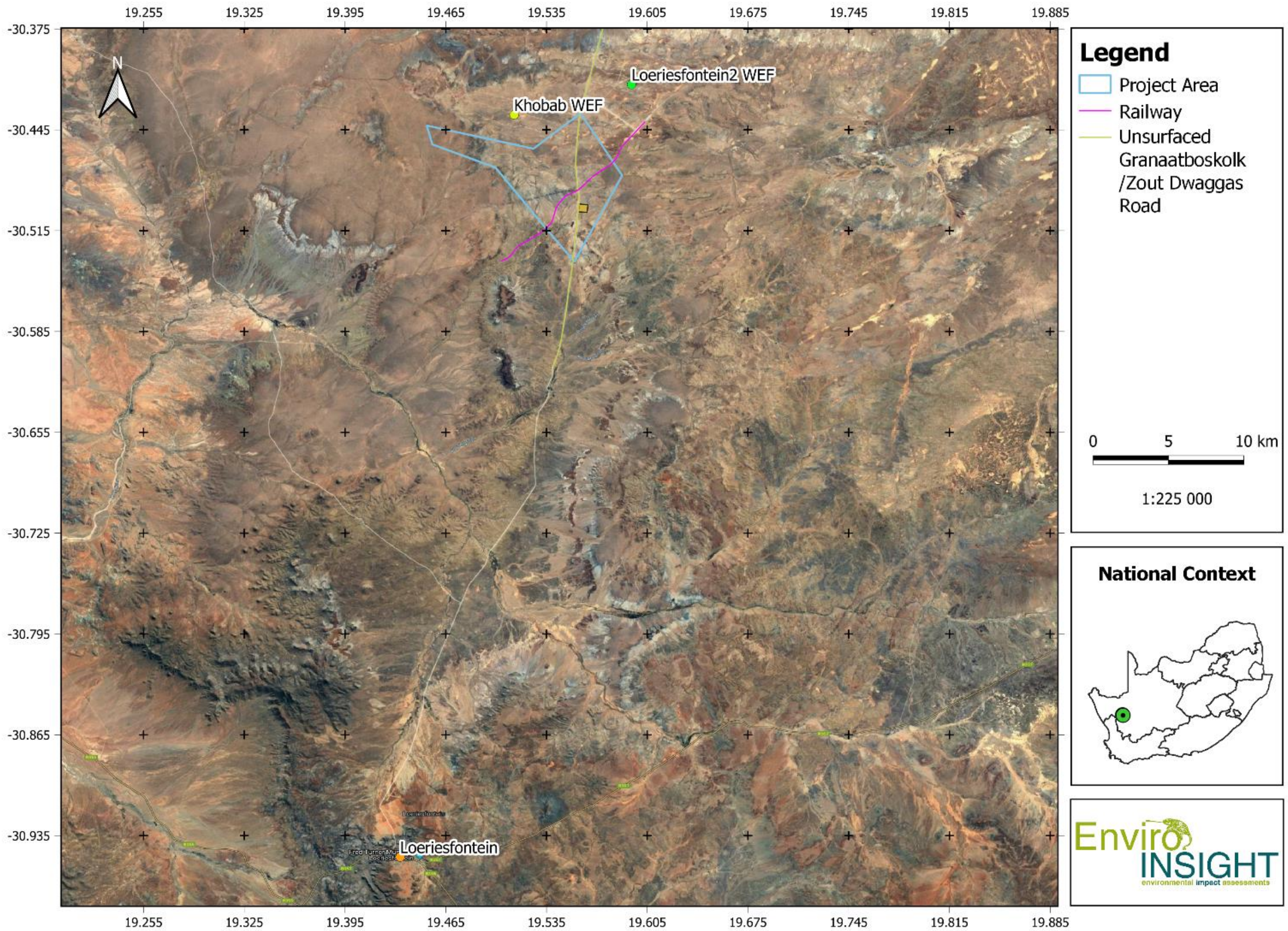


Figure 2-1: Topographical Map of the study area.

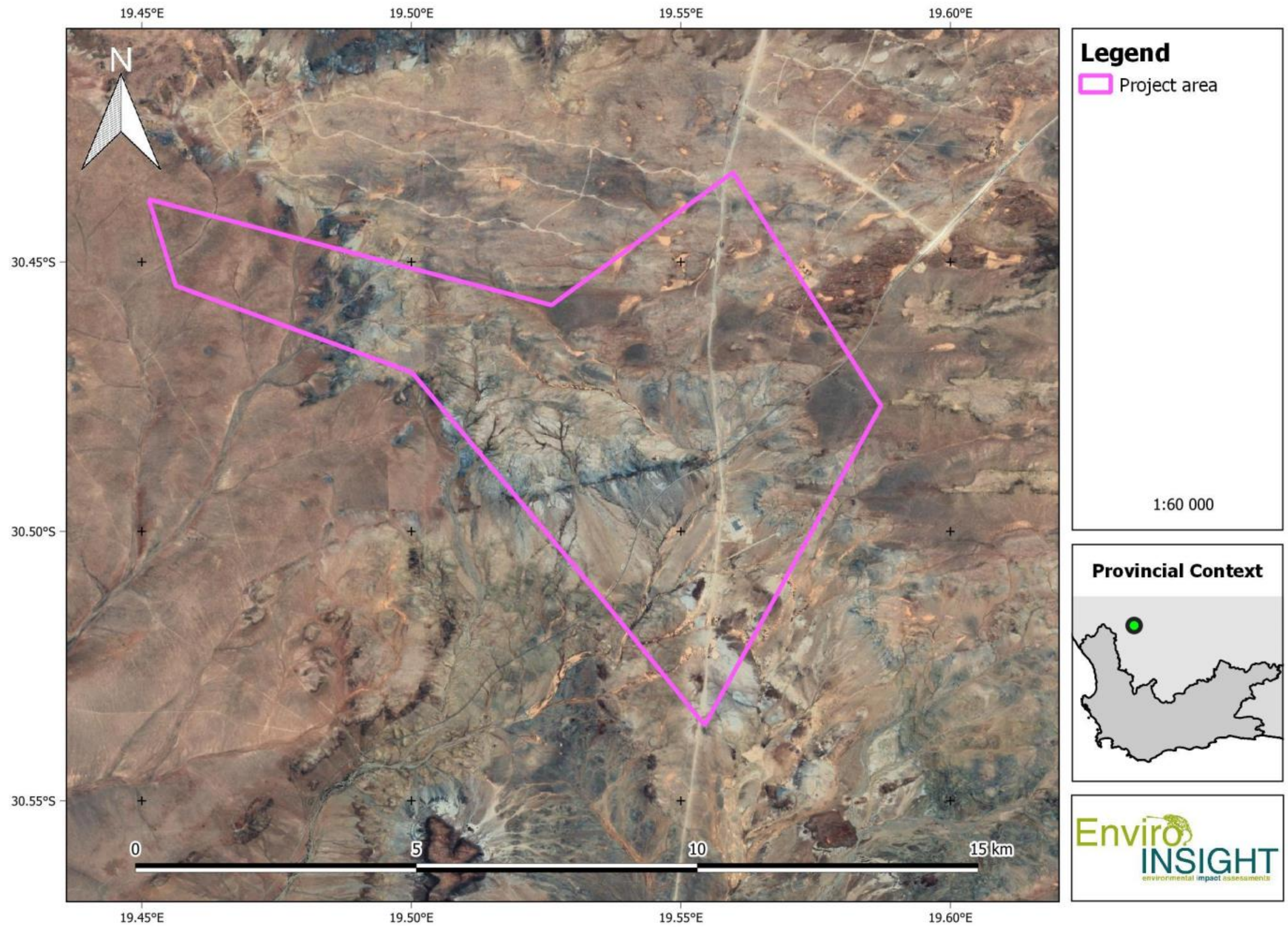


Figure 2-2: Aerial Map of the site.

Table 2-1: Project Location Details.

Development Footprint	5 736 hectares		
21-digit Surveyor General code	C01500000000022600000		
Physical address and Farm Name	Portion of the Remainder of the Farm Sous 226		
Coordinates of the boundary of the property	POINT-A	30°26’0.49”S	19°33’31.69”E
	POINT-B	30°28’36.30”S	19°35’15.49”E
	POINT-C	30°32’11.20”S	19°33’16.05”E
	POINT-D	30°28’15.98”S	19°29’58.76”E
	POINT-E	30°27’18.20”S	19°27’20.64”E
	POINT-F	30°26’31.24”S	19°27’6.35”E

	POINT-G	30°27'29.01"S	19°31'33.25"E
	POINT-A	30°26'0.49"S	19°33'31.69"E
	Middle Point	30°28'47.74"S	19°32'52.24"E
Local Municipality	Hantam Local Municipality		
District Municipality	Namakwa District Municipality		

2.2 PROJECT DESCRIPTION

The Applicant is responding to the growing electricity demand within South Africa, the current infrastructure failure which disrupts sufficient electricity supply, and the increasing pressure on countries to reduce their reliance on fossil fuels, by addressing the need for sustainable renewable energy in the country. Accordingly, the Applicant is proposing the development of a commercial WEF and associated infrastructure on the remainder of the farm Sous, located north of Loeriesfontein, to add new capacity to the national electricity grid.

The proposed study area for the WEF development is located approximately 53km north of Loeriesfontein, 85 km west of Brandvlei and 160 km southeast of Springbok in the Northern Cape. The site can be reached via unsurfaced Granaatboskolk / Zout Dwaggas Road, which branches off the R357 (Figure 1-1). The Botterblom WEF footprint is approximately 5 736 hectares (ha) and will be located on a Portion of the Remainder of the Farm Sous 226 (Figure 1-2). The Khobab WEF is located directly north while Loeriesfontein2 WEF is located north-east of the study area.

The components of the WEF and associated infrastructure are as follows:

- up to 32 wind turbines, with a generation capacity of between 4.5 and 7.5 MW per turbine (depending on the available technology at the time),
- turbines will have a hub height of up to 150m and a rotor diameter of up to 175m. The final turbine model to be utilised will only be determined closer to the time of construction (depending on the technology available at the time),
- onsite substation/s of 100mX100m (33/132kV) to facilitate the connection between the WEF and Helios substation,
- a Battery Energy Storage System (BESS),
- concrete foundations to support turbine towers,
- cabling between turbines, to be laid underground where practical,
- internal/ access roads (up to 10 m in width) linking the wind turbines and other infrastructure on the site,
- permanent workshop area and office for control, maintenance and storage, and
- temporary laydown areas during the construction phase (which will be rehabilitated).

The final turbine model to be utilised will only be determined closer to the time of construction, depending on the technology available at the time. The optimal positioning (taking into account the energy generating potential) for each turbine will be determined once all the environmental sensitivities have been determined in the EIA phase. The preferred layout design and development footprint is included in this EIA report.

The components of a typical wind turbine subsystem are depicted by Figure 2-1 and Figure 2-2, which entails:

- Rotor (consisting of hub and blades), which are the portion of the wind turbine that collect energy from the wind and convert the wind's energy into rotational shaft energy to turn the generator. The speed of rotation of the blades is controlled by the nacelle, which has the ability to turn the blades to face into the wind and change the angle of the blades to make the most use of the available wind. The maximum rotor diameter for the Albany WEF turbines is approximately 175 m, with blade lengths of 87.5m.
- Nacelle – The nacelle contains a set of gears and a generator. The generator converts the turning motion of a wind turbines blade (mechanical energy) into electricity. The nacelle is also fitted with brakes, so that the turbine can be switched off during very high winds, such as during storm events, which prevents the turbine from being damaged
- Tower – The rotor and nacelle are mounted on top of a tower. The tower (either steel or concrete) is constructed to hold the rotor blades off the ground (structural support) and also raises the hub so that its blades safely clear the ground and can reach the stronger winds at higher elevations. The tower must also be strong enough to support the wind turbine and to sustain vibration, wind loading, and the overall weather elements for the lifetime of the turbine. The maximum hub height of the Botterblom WEF turbines is approximately 150m.
- Electronic equipment such as controls, electrical cables, ground support equipment, and interconnection equipment.

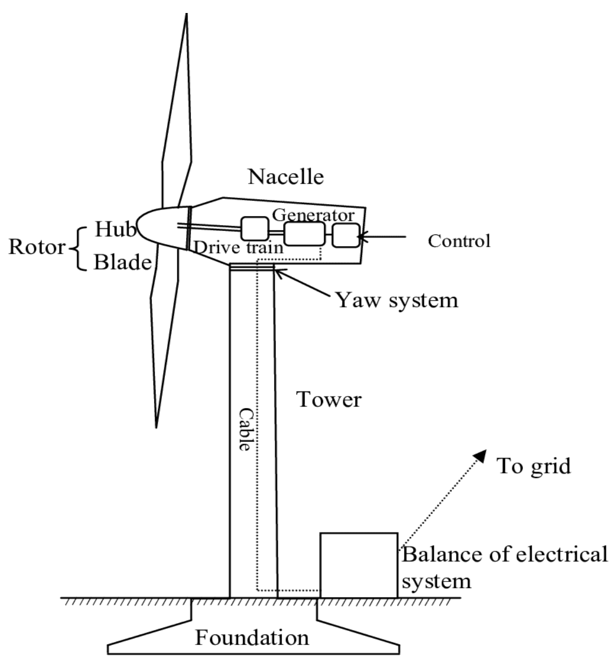


Figure 2-3: Simplified diagram of the main components of a horizontal axis wind turbine. Source: Albadi (2010).

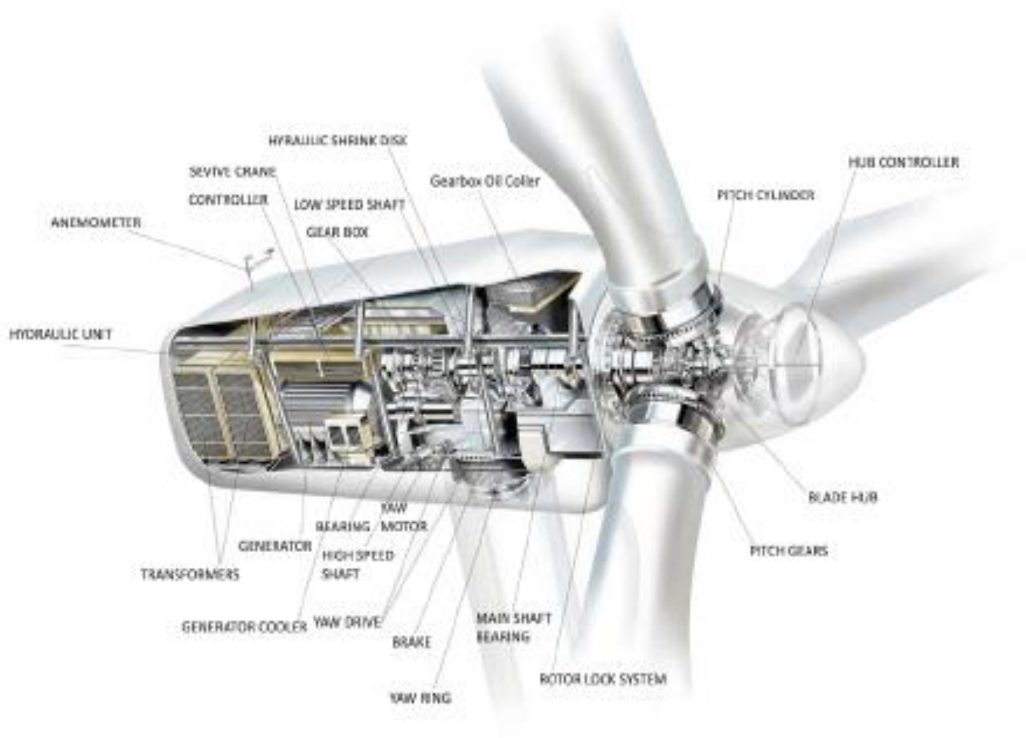


Figure 2-4:Industrial Wind turbine components diagram. Source: The Renewable energy Hub[2].

2.3 PROJECT DEVELOPMENT PHASES

The following section describes the details the different phases of the proposed Botterblom WEF:

- Pre-construction;
- Construction;
- Operation; and
- Decommission.

Pre-construction

Prior to the commencement of the main construction works, the Contractor will undertake vegetation clearance and site establishment works.

This phase ensures that all design layouts are finalised, that risks associated with the construction phase is discussed and mitigated prior to commencement, to do a final walkdown of the study area and to apply and secure the necessary permits. The 'search and rescue' procedure with regards to plants, animals and heritage features must be done, and all sensitive areas with their buffers must be demarcated prior to commencement with construction activities.

Construction

The construction phase is temporary in nature (usually between 12-18 months) with a development footprint for the construction of:

- compounds and laydown areas;
- platforms, or "crane pads", required to construct the wind turbines;
- establishment and laying of foundations for turbines;
- new or upgraded access and internal roads (some roads may be temporary during the construction phase);
- storage areas and site office;
- substation and BESS;
- underground cables to connect the turbines to the on-site substation;

Even though not a physical construction activity, the construction phase includes the transport of components and equipment to and within the site.

After the construction phase is completed, rehabilitation of temporary construction areas will commence. Any area that does not form part of the operational phase of the project (this can include internal roads and access points) must be rehabilitated as per the rehabilitation plan (to be included in the EIA report).

Operational phase

The operational phase of the WEF has an approximate lifespan of 20 years, and mainly consists of operation and maintenance. All the turbines will be operational except under circumstances of mechanical breakdown, inclement weather conditions or for maintenance purposes.

Decommissioning

Wind farm components have an expected end of life, whereby the components need to be dismantled and transported off site, or by replacing the existing infrastructure with the latest technology based on the relevant legislation at the time. Decommissioning requires a temporary laydown area and associated access to accommodate the required equipment and lifting cranes. Prior to the transportation off site, the components need to be evaluated based on reuse, recycle or permanent disposal in accordance with regulatory requirements at that time. The area needs to be rehabilitated based on the rehabilitation plan, by returning the soil, landscape features and vegetation back to its original state prior to the construction phase in order for the land to be used for agricultural purposes again, or as determined by the landowner and competent authorities.

Figure 2-5: Photographs depicting the construction phase of a wind farm similar to Botterblom WEF.

2.4 ALTERNATIVES

2.4.1 Types of Alternatives

The NEMA requires that alternatives are considered during the EIA process. An alternative can be defined as a possible course of action, in place of another, that would meet the same purpose and need (DEAT, 2004).

The 2014 EIA Regulations (as amended) provide the following definition:

> ***"alternatives"***, in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the—
>
> (a) property on which or location where the activity is proposed to be undertaken;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity; or

(e) operational aspects of the activity;

and includes the option of not implementing the activity;

The following types of alternatives are most pertinent to the proposed project and are detailed further below:

- Location alternatives;
- Layout alternatives;
- Technology alternatives; and
- The "no-go" alternative.

2.4.2 Location Alternatives

The location for the Botterblom WEF was considered based on the following:

- Good wind resource. The average wind speed measured at a height of 100m is estimated to be between 6-8 m/s;
- Close proximity to an Eskom substation (Helios substation is embedded within the property Sous) which has the potential to support the proposed WEF project generation capacity.
- Relatively flat site, which makes construction easier and less expensive than on an undulating site.
- Distance from existing towns or populated areas (anticipated lower visual, noise and dust impacts).
- Landowner support and favour for the proposed WEF.
- Other WEFs have been constructed in the area (e.g. Loeriesfontein and Khobab Wind Farms), and existing transport routes can be utilised;
- The land has a low agricultural potential, lease of the site contributes to landowner and potentially to other profitable agricultural endeavours;
- Review of six previous EIRs in the area for the Loeriesfontein and Khobab Wind Farms, Kokerboom 1, 2 and 3, and the Dwarsrug WEF indicated that a WEF development on the proposed site, was likely to be feasible from an environmental sensitivity point of view.

Based on the above, the location of the Botterblom WEF site was selected due to the favourable factors listed above.

2.4.3 Layout Alternatives

An initial site layout has been compiled based on *inter alia* the following criteria:

- Spatial orientation requirements of turbines and associated infrastructure (e.g. roads);
- Layout relative to other existing infrastructure, such as powerlines and the Helios substation;

- Wind resource profile (this could have significant technical constraints);
- Topographical constraints, including surface water and steep slopes of hills; and
- Required setbacks from property boundaries for noise, visual and flicker impacts.

Based on the findings of the EIR and specialist studies undertaken, the layout was updated to include biophysical constraints of sensitive flora, avifauna, and bats, surface water features, sensitive heritage areas, and associated buffer areas. Input from all specialists, stakeholders, and the competent authority was considered in the final layout design and selection of the preferred alternative.

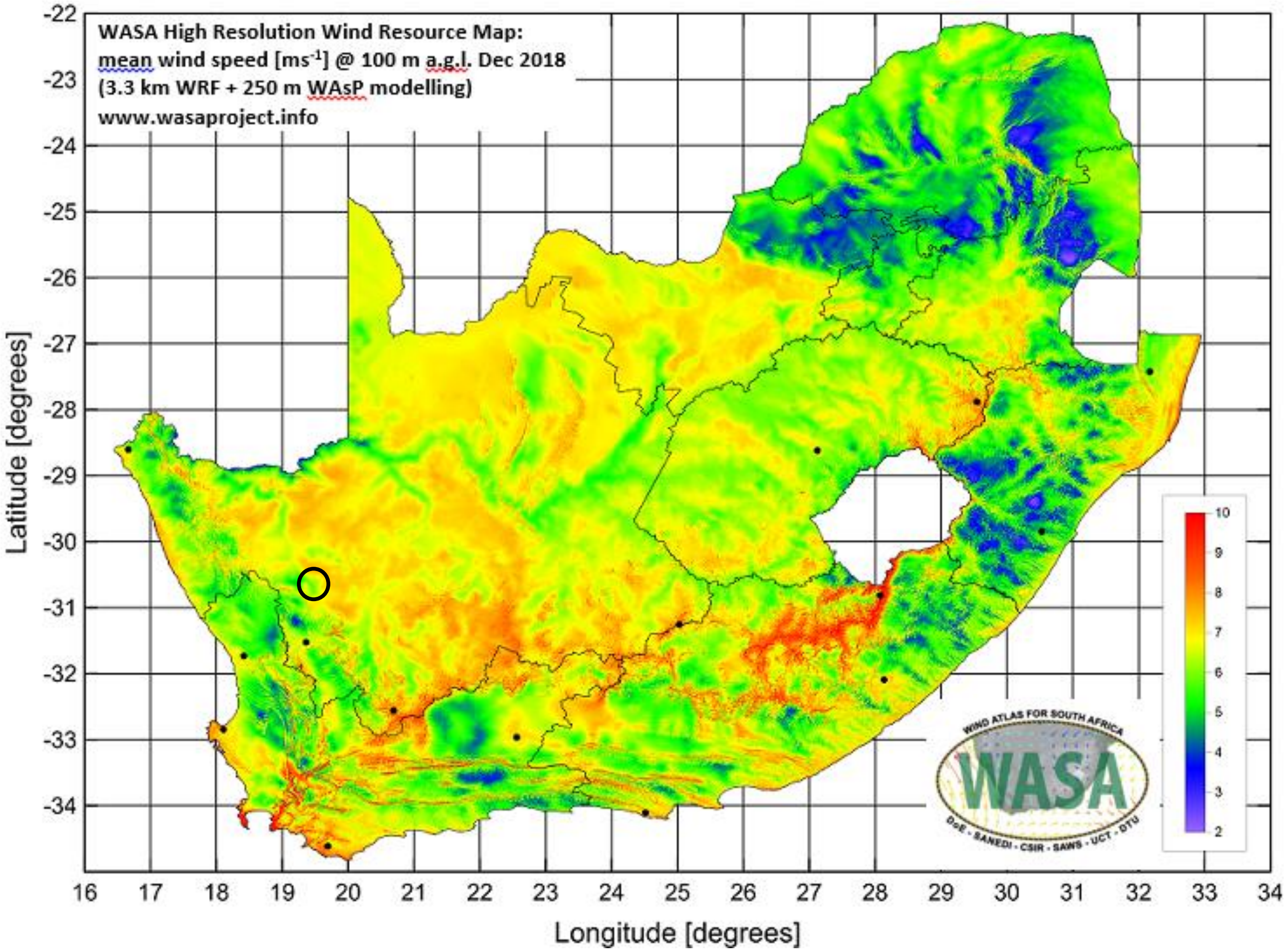


Figure 2-6: Wind resource map: average wind speed as measured at a height of 100m. The general area of the project is indicated by the black circle.

Three layout alternatives were considered for the project. Alternative 3 was disregarded from an early start of the project, due to sensitivities identified by the specialists during the scoping phase.

- Alternative 1 – 32 Turbines. The specific GPS coordinates for each turbine is shown in Table 2-2 below.

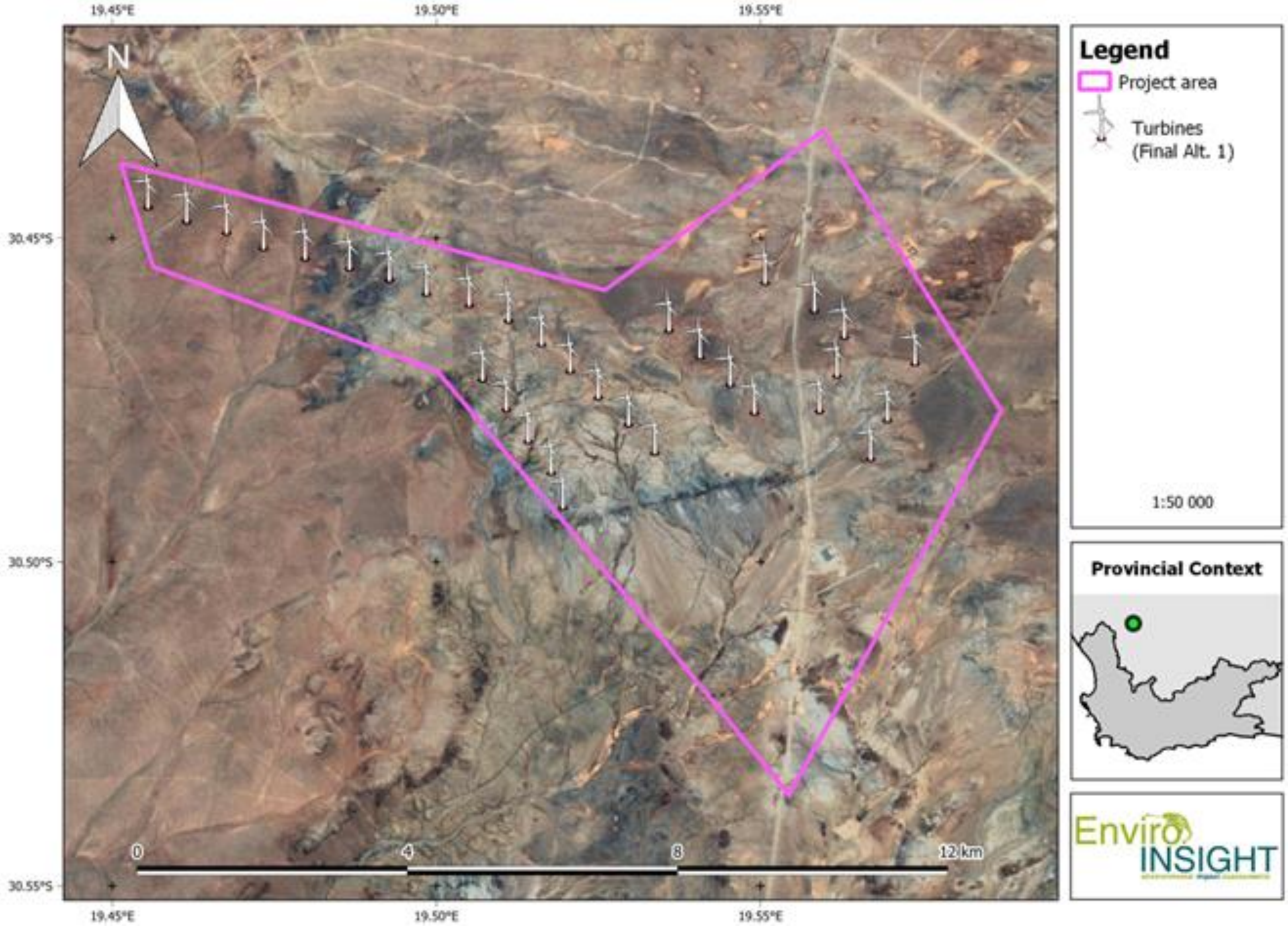


Figure 2-7: Alternative 1.

Table 2-2: Wind turbine coordinates for Layout Alternative 1 for the proposed Botterblom Wind Farm project.

Wind Turbine layout number	Latitude (S)	Longitude (E)
WT01	30°26'43.08"S	19°27'19.80"E
WT02	30°26'50.71"S	19°27'41.27"E
WT03	30°26'57.14"S	19°28'3.47"E
WT04	30°27'5.67"S	19°28'24.08"E
WT05	30°27'11.46"S	19°28'47.02"E
WT06	30°27'17.02"S	19°29'11.77"E
WT07	30°27'23.22"S	19°29'33.82"E

WT08	30°27'31.02"S	19°29'54.40"E
WT09	30°27'37.32"S	19°30'18.23"E
WT10	30°27'46.06"S	19°30'39.85"E
WT11	30°27'59.07"S	19°30'58.42"E
WT12	30°28'13.96"S	19°31'14.20"E
WT13	30°28'28.87"S	19°31'29.91"E
WT14	30°28'43.59"S	19°31'46.59"E
WT15	30°28'59.24"S	19°32'1.42"E
WT16	30°27'51.21"S	19°32'9.16"E
WT17	30°28'6.43"S	19°32'26.30"E
WT18	30°28'21.70"S	19°32'43.00"E
WT19	30°28'37.31"S	19°32'56.60"E
WT20	30°27'24.67"S	19°33'2.35"E
WT21	30°27'40.46"S	19°33'29.81"E
WT22	30°27'55.00"S	19°33'46.55"E
WT23	30°28'9.82"S	19°34'25.62"E
WT24	30°28'16.60"S	19°33'42.51"E
WT25	30°28'41.36"S	19°34'10.59"E
WT26	30°28'36.15"S	19°33'32.72"E
WT27	30°29'2.76"S	19°34'1.01"E
WT28	30°28'18.78"S	19°30'25.60"E
WT29	30°28'35.45"S	19°30'38.81"E
WT30	30°28'53.07"S	19°30'50.83"E
WT31	30°29'10.65"S	19°31'3.69"E
WT32	30°29'30.02"S	19°31'10.04"E

- Alternative 2 - 30 Turbines

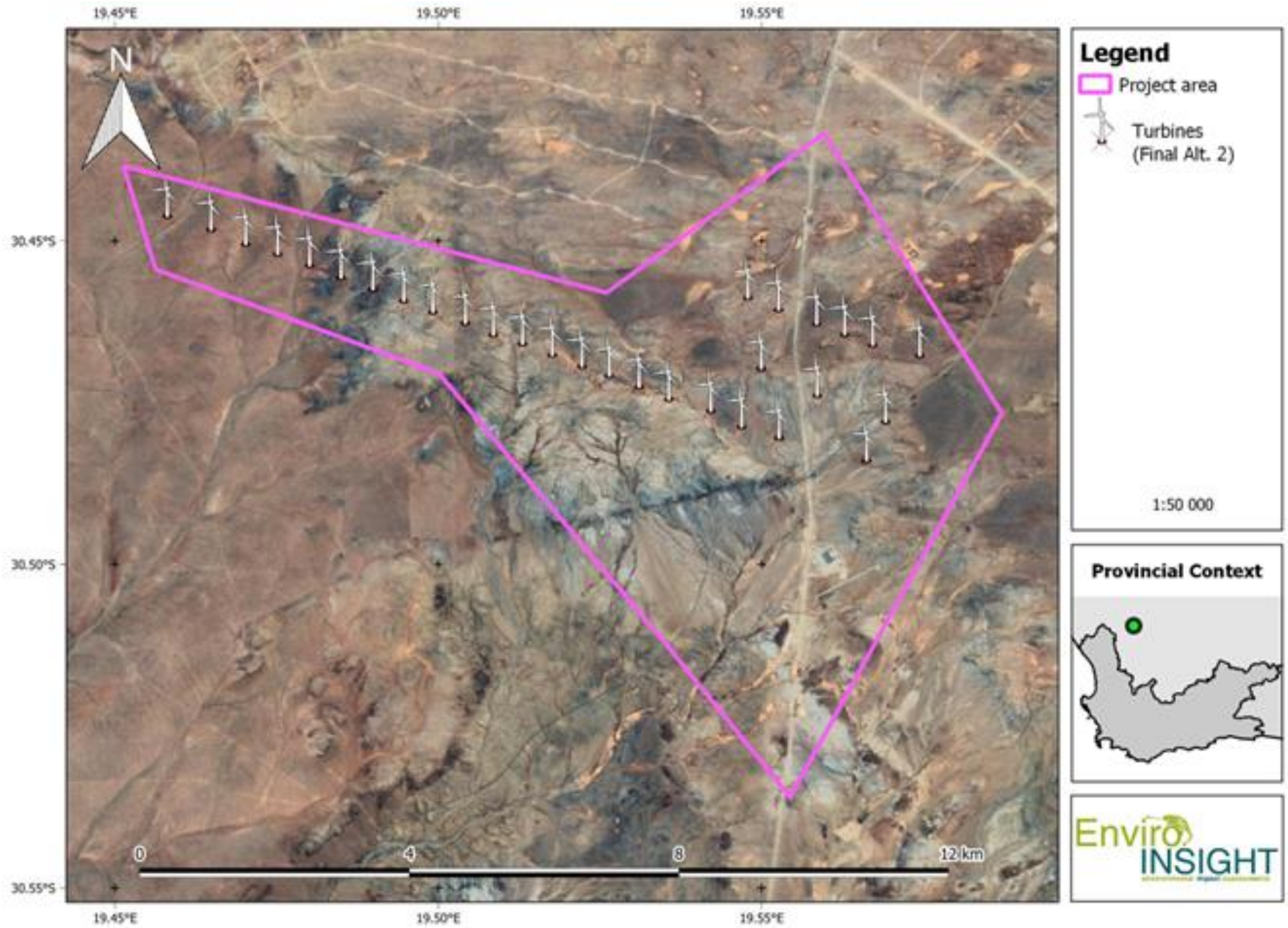


Figure 2-8: Alternative 2

Table 2-3: Wind turbine coordinates for Layout Alternative 2 for the proposed Botterblom Wind Farm project.

Wind Turbine layout number	**Latitude (S)**	**Longitude (E)**
WT01	30°26'53.65"S	19°27'53.36"E
WT02	30°27'1.70"S	19°28'12.62"E
WT03	30°27'7.50"S	19°28'30.41"E
WT04	30°27'13.65"S	19°28'48.39"E
WT05	30°27'20.44"S	19°29'5.75"E

WT06	30°27'26.89"S	19°29'23.50"E
WT07	30°27'33.29"S	19°29'40.68"E
WT08	30°27'39.36"S	19°29'56.94"E
WT09	30°27'45.73"S	19°30'14.91"E
WT10	30°27'52.18"S	19°30'30.45"E
WT11	30°27'57.27"S	19°30'46.87"E
WT12	30°28'3.34"S	19°31'3.24"E
WT13	30°28'9.67"S	19°31'19.87"E
WT14	30°28'15.13"S	19°31'35.20"E
WT15	30°28'21.26"S	19°31'51.75"E
WT16	30°28'28.04"S	19°32'8.19"E
WT17	30°28'34.67"S	19°32'31.68"E
WT18	30°28'43.34"S	19°32'48.76"E
WT19	30°28'49.55"S	19°33'9.71"E
WT20	30°29'1.98"S	19°33'58.28"E
WT21	30°28'40.75"S	19°34'9.04"E
WT22	30°28'26.00"S	19°33'30.76"E
WT23	30°28'11.12"S	19°32'59.59"E
WT24	30°28'3.94"S	19°34'28.04"E
WT25	30°27'57.73"S	19°34'1.66"E
WT26	30°27'51.94"S	19°33'46.14"E
WT27	30°27'46.18"S	19°33'30.48"E
WT28	30°27'38.25"S	19°33'9.34"E
WT29	30°27'31.69"S	19°32'52.08"E
WT30	30°26'46.15"S	19°27'28.93"E

- Alternative 3- 54 Turbines

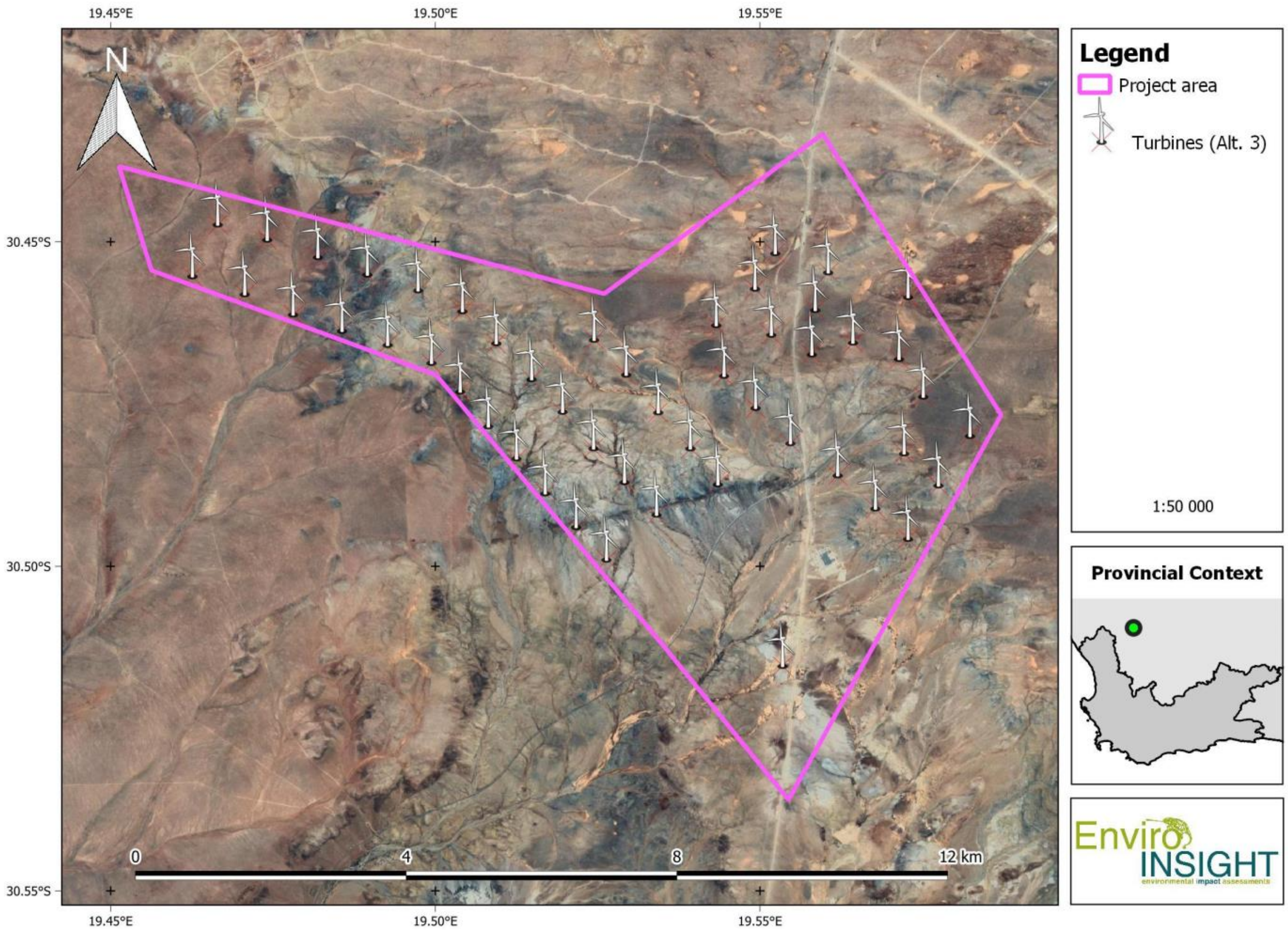


Figure 2-9: Alternative 3

Take note: Alternative 3 was considered for the maximum number of turbines for the property but was disregarded due to sensitivities and setbacks identified early in the process.

- Preferred Alternative: 30 turbines

The Preferred Layout has been designed taking into consideration recommendations and buffers determined by the specialists. Kindly refer to Figure 8-2 for the detailed sensitivity map

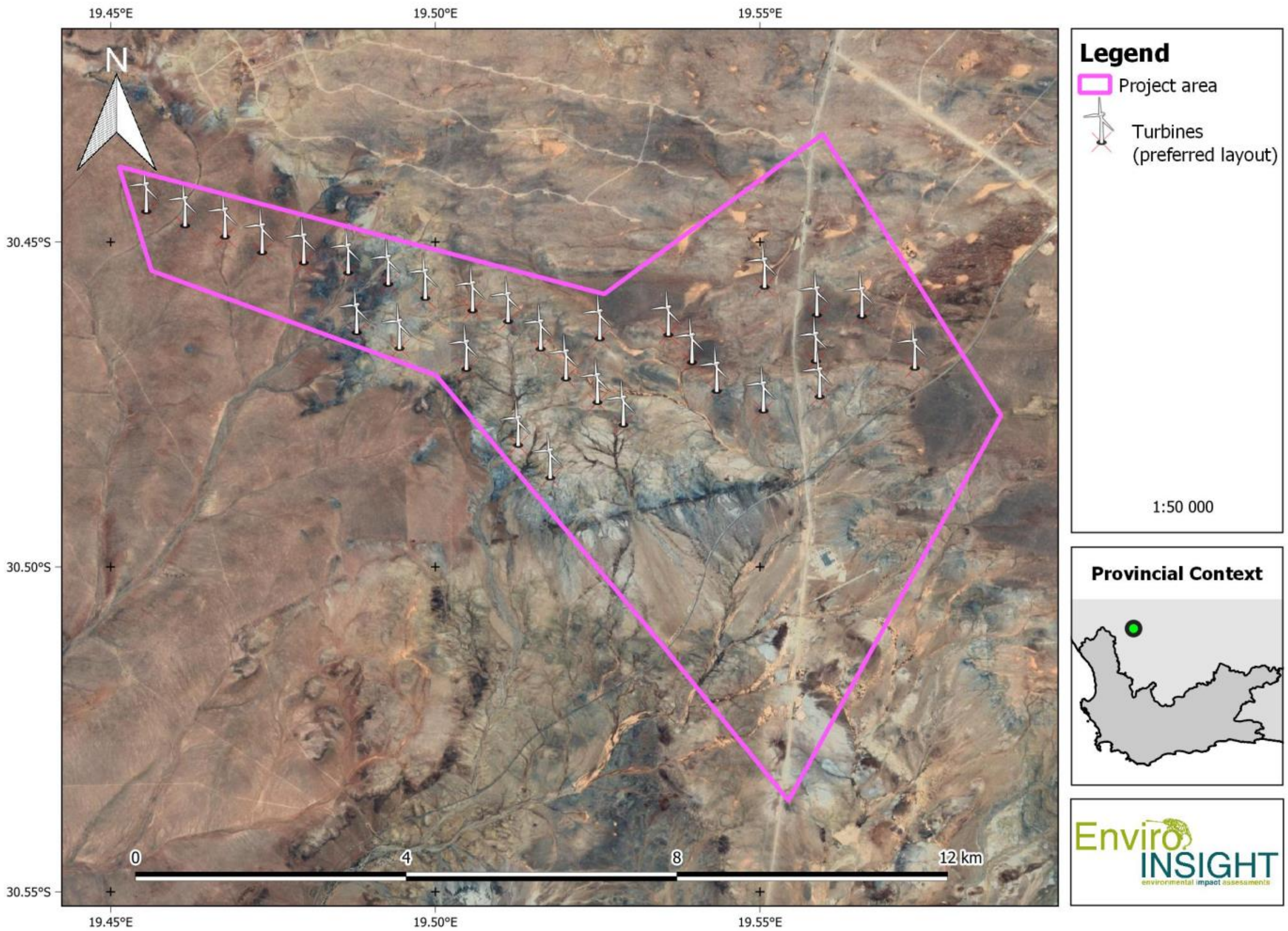


Figure 2-10: Preferred Alternative Layout

Table 2-4: Wind turbine coordinates for the Preferred Alternative for the proposed Botterblom Wind Farm project.

Wind Turbine layout number	Latitude (S)	Longitude (E)
WT01	30°26'43.08"S	19°27'19.80"E
WT02	30°26'50.71"S	19°27'41.27"E
WT03	30°26'57.14"S	19°28'3.47"E
WT04	30°27'5.67"S	19°28'24.08"E
WT05	30°27'11.46"S	19°28'47.02"E
WT06	30°27'17.02"S	19°29'11.77"E
WT07	30°27'23.22"S	19°29'33.82"E

WT08	30°27'31.02"S	19°29'54.40"E
WT09	30°27'37.82"S	19°30'20.46"E
WT10	30°27'43.95"S	19°30'40.31"E
WT11	30°27'59.07"S	19°30'58.42"E
WT12	30°28'15.57"S	19°31'12.44"E
WT13	30°28'28.87"S	19°31'29.91"E
WT14	30°28'41.26"S	19°31'44.25"E
WT15	30°27'53.56"S	19°31'31.10"E
WT16	30°27'51.21"S	19°32'9.16"E
WT17	30°28'6.76"S	19°32'22.15"E
WT18	30°28'22.61"S	19°32'35.99"E
WT19	30°28'33.31"S	19°33'1.73"E
WT20	30°27'24.67"S	19°33'2.35"E
WT21	30°27'40.56"S	19°33'31.55"E
WT22	30°27'41.00"S	19°33'56.50"E
WT23	30°28'9.82"S	19°34'25.62"E
WT24	30°28'6.02"S	19°33'30.93"E
WT25	30°28'25.72"S	19°33'33.04"E
WT26	30°27'50.21"S	19°29'16.39"E
WT27	30°27'58.83"S	19°29'40.18"E
WT28	30°28'10.35"S	19°30'17.29"E
WT29	30°28'52.59"S	19°30'45.85"E
WT30	30°29'10.65"S	19°31'3.69"E

2.4.4 Technology Alternatives

The most important factors that are considered when selecting a turbine for any site, are the annual average wind speed, reference wind speed, wind shear and turbulence, the return period for extreme wind conditions and wind direction (i.e. wind resource profile). The ongoing monitoring of the wind resource on site will be used to inform the final turbine layout.

Other determining factors when selecting the preferred turbine are efficiency, full load hours and the capacity factor. The pricing of relevant technology at the time of construction is also a key factor, as well as the exchange rate for imported components.

2.4.5 The "No-Go" Alternatives

It is required to consider the "no-go" option in the EIA process. The "no-go" alternative refers to the current status quo and the risks and impacts associated with it. Some existing activities may carry risks and may be undesirable (e.g. an existing contaminated site earmarked for a development). The no-go is the continuation of the existing land use, i.e. maintain the status quo.

The no-go option has various positive and negative impacts associated with this alternative. All baseline information provided in this report relates to the current situation on site and can be considered the no-go alternative. Impacts are limited to the status quo. Positive and negative impacts are as follows:

Positive:

- Potential livestock activities will remain undisturbed. Currently, there are no livestock on the property but it has been utilised in the past for this purpose;
- Ecological processes will continue as is;
- The potential impact on sensitive features will not occur;
- The opportunity for the proposed project to contribute significantly to greenhouse gas emission reductions and climate change mitigation, will be lost;
- All negative impacts, specifically related to the development of the wind farm, discussed in this report will not materialise.

Negative:

- The economic impact of the local community will not be achieved;
- The country will not have an opportunity to expand on renewable energy sources, which it is in dire need of achieving within the short and medium terms;
- All positive impacts, specifically related to the development of the wind farm, discussed in this report will not materialise.

2.5 NEED AND DESIRABILITY

As part of the EIA process, the need and desirability for the development of the proposed Botterblom WEF needs to be considered and discussed in order to provide context regarding the realistic economical and social benefits the proposed development will add on all spheres of government (local, provincial and national).

Reference is made to the Department of Environmental Affairs (DEA) 2017 Guideline on Need and Desirability which states that while the "concept of need and desirability relates to the type of development being proposed, essentially, the concept of need and desirability can be explained in terms of the general meaning of its two components in which need refers to time and desirability to place – i.e. is this the right time and is it the right place for locating the type of land-use/activity being proposed? Need and desirability can be equated to wise use of land – i.e. the question of what is the most sustainable use of land."

Table 2-5: Need and Desirability

<table>
<tr><th colspan="2">Question</th><th>Answer</th></tr>
<tr><td colspan="3">“securing ecological sustainable development and use of natural resources”</td></tr>
<tr><td colspan="2">1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?</td><td>The ecological specialist study states:
Impact Statement</td></tr>
<tr><td rowspan="9">1.1. How were the following ecological integrity considerations taken into account?:</td><td>1.1.1. Threatened Ecosystems</td><td></td></tr>
<tr><td>1.1.2. Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure</td><td>Various specialist studies were compiled for the proposed project. Refer to Section 6.6-Section 6.18 and Appendix D for the specialist studies undertaken. These specialists have taken inconsideration all impacts relating to the proposed development and provided the appropriate mitigation measures, which the applicant is committed to following.</td></tr>
<tr><td>1.1.3. Critical Biodiversity Areas (“CBAs”) and Ecological Support Areas (“ESAs”)</td><td>Refer to Section 6.6</td></tr>
<tr><td>1.1.4. Conservation targets</td><td>Refer to Section 6.6</td></tr>
<tr><td>1.1.5. Ecological drivers of the ecosystem</td><td>Refer to Section 6.6</td></tr>
<tr><td>1.1.6. Environmental Management Framework</td><td>Refer to Section 6.6</td></tr>
<tr><td>1.1.7. Spatial Development Framework</td><td>Refer to Section 6.6</td></tr>
<tr><td>1.1.1. Threatened Ecosystems</td><td>Refer to Section 6.6</td></tr>
<tr><td>1.1.8. Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.)</td><td>All global responsibilities to which South Africa is signatory or party to were considered, the proposed development complies with all international responsibilities.</td></tr>
<tr><td colspan="2">1.2. How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?</td><td>The proposed WEF can disturb plant and species and vegetation from clearing of the development footprint, soil erosion and alien plant invasion. Increased levels of pollution, noise, disturbance and human presence can impact negatively on faunal communities.
As part of the EIA process specialist studies were conducted to identify areas most environmentally suitable for development within the proposed development site boundary.</td></tr>
</table>

	As a result of these studies a development layout has been produced that avoids sensitive areas and identified constraints. The specialists have proposed mitigation measures to further reduce risks or enhance opportunities during construction, operation and decommissioning phases of the development. With implementation of these mitigation measures, all identified negative impacts are expected to be reduced to acceptable levels of medium or low negative significance. All mitigation measures proposed by the specialists are included in the EMPr for the project.
1.3. How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	On a national level the development will lessen the country's dependency on coal, and contribute to lowering water consumption, pollution and environmental degradation per kW of electricity produced.
1.4. What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	The generation of waste will largely be restricted to the construction phase of the project and consist of normal construction phase solid waste streams. The EMPr will detail specific mitigation measures that must be implemented for the appropriate management and minimisation of waste, during all phases of the project. Registered service providers will be utilised to transport solid waste to registered landfills.
1.5. How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	Visual buffers are applied to cultural landscapes / heritage sites. The development layout is produced by avoiding turbine placement within these visual buffers. A Heritage Impact Assessment and a Visual Impact Assessment were conducted to assess the proposed layout. Final comment from SAHRA was received during the public review period. SAHRA has no objections to the proposed development proceeding. The comment included recommendation to be included on the Final EIA report.
1.6. How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were	Wind is a renewable resource and will be the 'fuel' for the WEF to generate electricity. Therefore, the development will have a minimal impact on non-renewable resources.

explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?		
1.7. How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure	The WEF will use the renewable energy resource of wind to generate power. Construction of the WEF will require use of water, a renewable natural resource. Operation of the WEF will consume relatively small quantities of water when compared to alternative energy technologies such as coal. Impacts on the ecosystem caused by use of these renewable energy resources has been evaluated.	
	1.7.1. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)	The proposed WEF will reduce South Africa's dependency on non-renewable resources, particularly coal, as an energy source. Wind as an energy source is not dependant on water, as compared to the massive water requirements of conventional power stations, has a limited footprint and does not impact on large tracts of land, and poses limited pollution and health risks, specifically when compared to coal and nuclear energy plants.
	1.7.2. Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)	The current land use is low-intensity grazing and the land is not suitable for other agricultural uses. The proposed development will increase yield as the landowners will be paid for the use of their land. This will improve cash flow and financial sustainability of farming enterprises on site. The proposed development itself will not cause a significant change in land use, as the development site is primarily low intensity agriculture (grazing), which can still proceed once the development is constructed. Wind is a renewable resource and a wind energy facility is the best use thereof. The WEF site would also be suitable for a solar facility, however the current land use would not be able to continue.

responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	1.7.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?	The proposed WEF is predicted to reduce dependency on coal as an energy source. Wind as an energy source is not dependant on water, as compared to the massive water requirements of conventional coal fired power stations, has a limited footprint and does not impact on large tracts of land, and poses limited pollution and health risks, specifically when compared to coal and nuclear energy plants.
1.8. How were a risk-averse and cautious approach applied in terms of ecological impacts?	1.8.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	This report is based on a project description and site plan, provided to by the applicant, which has not been approved by DFFE at this stage of the project. The project description and site plan may undergo refinements before being regarded as final. A project description based on the final design will be concluded once DFFE has provided feedback on the layout provided in this report. Descriptions of the natural and social environments are based on limited fieldwork and available literature. It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without a detailed investigation being undertaken.
	1.8.2. What is the level of risk associated with the limits of current knowledge?	The risk associated with assumptions and limits of current knowledge is the potential for information being assessed to be incorrect. This would translate to erroneous impact identification and mitigation measures. However, due to the amount of site work conducted the risk associated with this is considered to be low.
	1.8.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The project description and site plan may undergo refinements before being regarded as final. A project description based on the final design will be concluded once DFFE has provided feedback on the layout provided in this report.
1.9. How will the ecological impacts resulting from this development impact on people's environmental right in terms following	1.9.1. Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance	Social impacts have been identified and assessed by the social specialist, visual specialist and noise specialist. The visual specialist identified areas most visually suitable for development. The visual specialist report found the site to be of moderate visual sensitivity. The landscape is more natural but will experience visual impacts. High visual impacts do not represent a fatal flaw.

	is not possible, to minimise, manage and remedy negative impacts?	The potential negative health risks posed by the WEF (noise, shadow flicker, electromagnetic radiation) is expected to be low. The noise impact assessment found the level of noise impacts for the proposed WEF are expected to be of low significance with mitigation. The operational impact on the sense of place is expected to be of medium negative significance with or without mitigation.
	1.9.2. Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	Renewable energy has fewer negative health effects than other forms of non-renewable energy generation and will have overall positive health benefits.
1.10. Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?		The findings of this SIA conducted for the proposed WEF indicates that during the construction and the operational phase of the proposed development project, various employment opportunities, with different levels of skills will be created. In addition this will also create local business opportunities benefitting the socioeconomic development of the local communities. The proposed WEF also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated with a coal based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole.
1.11. Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?		The ecology, avifauna, bat and aquatic specialists have all concluded that the development does not have unacceptable negative impacts that cannot be mitigated to a low or medium level of significance.
1.12. Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?		Specialist recommendations, buffers and no-go areas, influenced mapping. These identified the most suitable areas for development for which a development layout was then produced for assessment. The results of the specialist's studies further informed the development of the updated site layout.
1.13. Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?		The cumulative impacts have been assessed, kindly refer to Section 6-6 to Section 6-18 of this report.

"promoting justifiable economic and social development"		
2.1. What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	2.1.1. The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area	Namakwa District municipality Integrated Development Plan (IDP): The 2020/2021 IDP indicates that it aligns with the 17 United Nations development goals, ranging from alleviating poverty and reducing inequality through job creation and economic growth, as well as ensuring access to affordable, reliable, sustainable and modern energy for all. The IDP states that local economic development will include the construction of renewable energy projects in the area. Hantam Local Municipality Integrated Development Plan (IDP) 2020/2021: The IDP indicates that the Square Kilometre Array (SKA) megaproject and renewable energy generation are large-scale private sector driven projects which should further develop the economy of the municipality. In terms of the district Spatial Development Framework (SDF) the promotion of renewable energy projects is provided as an objective of the SDF. In summary the proposed Botterblom WEF is in congruence with national provincial and local policies and frameworks and is supported by policy.
	2.1.2. Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	Northern Cape Spatial Development Framework, 2018 The interior parts of the Province and the Namaqualand coast have been identified as having potential for renewable energy production and targets have been put in place for 25% of the provinces' energy generation capacity to be acquired from renewable energy projects such as wind, solar, thermal, biomass and hydroelectricity by the year 2020.
	2.1.3. Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.)	The current zoning of the property is agricultural. An application will be submitted to the municipality for approval. The proposed WEF will fit into the current landscape as this is evolving to accommodate WEFs in the area.
	2.1.4. Municipal Economic Development Strategy ("LED Strategy")	Hantam Local Economic Development Strategy, 2011: The strategy identifies renewable energy including wind energy as an opportunity for development of the economy of Hantam both in terms of the development of wind energy facilities and the related jobs these will create.
2.2. Considering the socio-economic	2.2.1. Will the development complement the local socio-economic initiatives	The proposed development will contribute towards local economic development and skills development programs of the two local and

context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	(such as local economic development (LED) initiatives), or skills development programs?	two district municipalities through the support and co-operation between public and private sectors, creation of employment and business opportunities, and the opportunity for skills development and on-site training during both construction and operation phases.
2.3. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities		The proposed development will contribute towards the local economic development strategies of the municipalities through the creation of employment and business opportunities, and the opportunity for skills development and on-site training during both construction and operation phases. In addition, the proposed development will also create local business opportunities benefitting the socio-economic development of the local communities.
2.4. Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term?29 Will the impact be socially and economically sustainable in the short- and long-term?		Wind energy facilities are socially and economically sustainable in the short and long term. Social economic development contributions are concentrated in the immediate vicinity of the WEF benefiting the local community.
2.5. In terms of location, describe how the placement of the proposed development will:	2.5.1. result in the creation of residential and employment opportunities in close proximity to or integrated with each other	During the construction phase of the proposed WEF employment opportunities will be created, for low-skilled workers, semi-skilled and for skilled personnel. Members from the local communities are likely to be in a position to qualify for the majority of the low skilled and a proportion of the semi-skilled positions. The typical lifespan of WEFs is 20 to 25 years. During the operational phase there will be a significant decrease in employment opportunities. It should be noted that the majority of the semi- and low skilled employment opportunities are likely to be available to the local communities, which will present a positive social benefit to these communities due to the low availability of employment opportunities in these areas. The recruitment process and the requirements for each skill level and each employment opportunity need to be clearly

		communicated to local communities to ensure that no unrealistic expectations are created.
	2.5.2. reduce the need for transport of people and goods	The need for transport of people and goods will be increased during the construction phase. Most staff employed will live within the local community or surrounding areas thereby lowering carbon footprints are predicted due to the commercial forms of transport that will be employed to move the workforce (e.g. public transport, contractor buses).
	2.5.3. result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport)	N/A
	2.5.4. compliment other uses in the area	Local communities and their service providers will benefit from the socio-economic development provided by the WEF and current land use will be able to continue.
	2.5.5. be in line with the planning for the area	The proposed WEF is in line with applicable international, national, provincial and local planning strategies.
	2.5.6. for urban related development, make use of underutilised land available with the urban edge	The proposed development occurs away from the urban edge and within rural portion of the geographical area.
	2.5.7. optimise the use of existing resources and infrastructure	Wind energy is a renewable, clean resource and reduces pollution and the reliance on non-renewable fossil fuels and water for electricity generation. Existing access roads will be utilised wherever possible. The existing Eskom substation has the capacity to support this development. It is expected that any construction water required will be delivered by tankers. Waste removal will be in accordance with best practice by qualified waste removal contractors to the nearest registered landfill. Portable sanitation facilities will be utilised during construction, so that no connection to the local sewerage system will be required. Any additional infrastructure required will be constructed by the developer.

	2.5.8. opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement)	Wind energy is a renewable, clean resource and reduces pollution and the reliance on non-renewable fossil fuels and water for electricity generation, this will contribute to the electrical bulk services for the region.
	2.5.9. discourage "urban sprawl" and contribute to compaction/densification	Not applicable as the proposed development site lies within rural areas.
	2.5.10. contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs	The existing Helios Eskom substation has capacity for additional energy generation. The proposed development will utilise this existing capacity. The project will contribute to economic and infrastructure development in the Northern Cape Province, in line with the Provincial Development and Resource Management Plan.
	2.5.11. encourage environmentally sustainable land development practices and processes	Construction of the renewable energy WEF project will assist South Africa in transitioning from a carbon-intensive resource use economy to a sustainable low carbon footprint economy. Sustainable land development is an overarching aspect of the proposed project development.
	2.5.12. take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.)	Feasibility of access for wind turbine delivery, the site is easily accessible from the main roads; Close proximity to the Eskom grid with available evacuation capacity; Viable wind resource, therefore suited to wind farm development; The proposed site is agricultural land with low agricultural potential and willingness of landowners to host a wind farm on their properties.
	2.5.13. the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential)	The proposed development will create jobs and contribute towards socio-economic development in an area that does not have high economic potential. The WEF is likely to result in significant positive socio-economic opportunities. Refer to section 6.14
	2.5.14. impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area	Impacts to the cultural landscape are unavoidable but only of a medium significance and no other aspects of heritage are expected to be impacted significantly. The area is currently being developed to accommodate various wind farms, therefore the sense of place is currently changing and the proposed WEF will fit into the change in sense of place.

	2.5.15. in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	The proposed development is predicted to support the creation of a more integrated settlement.
2.6. How were a risk-averse and cautious approach applied in terms of socio-economic impacts?	2.6.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Please refer to section 1.3 for a detailed list of Assumptions and Limitations. This report is based on a project description and site plan, provided by the applicant, which has not been approved by DFFE at the current stage of the project. The project description and site plan may undergo refinements before being regarded as final. A project description based on the final design will be concluded once DFFE has provided feedback on the layout provided in this report. Descriptions of the natural and social environments are based on fieldwork, available literature and desktop analysis. It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without a detailed investigation being undertaken.
	2.6.2. What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	The risk due to limits of current knowledge is considered to be low due to the positive socioeconomic impact expected from the proposed WEF.
	2.6.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	A risk-averse and cautious approach was utilised throughout the impact assessment process by all specialists.
2.7. How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	2.7.1. Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Negative social impacts relating to the proposed WEF has been assessed by the specialist. Appropriate mitigation measures were provided. Please refer to Section 6.14.
	2.7.2. Positive impacts. What measures were taken to enhance positive impacts?	Positive impacts were identified by the Social Specialist, refer to Section 6.14

2.8. Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?		There is a potential that the proposed WEF will place a strain on services and the ecological environment. The relevant specialist have accounted for these impacts and provided mitigation measures.
2.9. What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?		The site sensitivity map identified the most suitable areas for development for which a development layout was then produced for assessment. The results of the specialist's studies, including interviews by the Social Specialist, and Scoping phase PPP, further informed the development of the updated site layout.
2.10. What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)?34 Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?		The proposed development aligns with a variety of planning policies that consider environmental and spatial justice.
2.11. What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?		The proposed development will contribute to equitable access by supplying electricity to the national grid, and by providing local and regional socioeconomic benefits in terms of the REIPPPP Economic Development requirements, which includes a BBBEE scorecard on which wind projects are evaluated.
2.12. What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?		Construction, operation and decommissioning of the proposed development will be done according to environmental health and safety legislative requirements and applicable guidelines.
2.13. What measures were taken to:	2.13.1. ensure the participation of all interested and affected parties	Public participation is being undertaken according to NEMA: EIA Regulations (2014) as amended and DEA (2017) Public Participation Guidelines.
	2.13.2. provide all people with an opportunity to develop the understanding, skills and capacity	The PPP is being undertaken in terms of legislative requirements and best practise guidelines. All notifications are provided in English.

	necessary for achieving equitable and effective participation	
	2.13.3. ensure participation by vulnerable and disadvantaged persons,	The PPP is being undertaken according to best practise guidelines; Notification of initiation of the PPP was provided in all required channels, i.e. newspaper adverts, site notices, local posters and written notifications.
	2.13.4. promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	The proposed development fits into the various planning policies
	2.13.5. ensure openness and transparency, and access to information in terms of the process	Legislative requirements and best practise guidelines are followed throughout the process. The PPP is being undertaken in terms of legislative requirements and best practise guidelines.
	2.13.6. ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge	A PPP is being undertaken in terms of legislative requirements and best practise guidelines. A Social Impact Assessment forms part of the process.
	2.13.7. ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were be promoted	The PPP that are conducted according to legislation and guidelines ensure that women and youth are recognised and involved in the process.
2.14. Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g.. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?		The proposed WEF has a good planning fit with all applicable policies and will result in substantial local socio-economic opportunities. The key challenges facing the region are poverty and inequality and a shortage of skills. As such the proposed development will be of benefit to the local area by creating job and business opportunities, particularly for unskilled and semi-skilled local workers.
2.15. What measures have been taken to ensure that current and/or future workers will be informed of work that potentially		Future workers on the proposed development will be educated on their rights to refuse work.

might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?		
2.16. Describe how the development will impact on job creation in terms of, amongst other aspects:	2.16.1. the number of temporary versus permanent jobs that will be created,	Temporary employment opportunities will be created during the construction phase and permanent employment opportunities will be created for the operational phase of the proposed development for skilled and unskilled workers
	2.16.2. whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),	The majority of the semi- and low-skilled employment opportunities are likely to be available to the local communities, which will present a positive social benefit to these communities due to the low availability of employment opportunities in these areas.
	2.16.3. the distance from where labourers will have to travel,	It is expected that most workers will reside in the nearby towns.
	2.16.4. the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits),	The majority of employment opportunities associated with the operational phase is likely to benefit 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. The local hospitality industry is 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. Procurement during the operational phase will also create opportunities for the local economy and businesses.
	2.16.5. the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	The creation of jobs associated with the proposed WEF represents a high opportunity cost, as the employment by current agriculture operations is very low, and could continue.
2.17. What measures were taken to ensure:	2.17.1. that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment	All applicable planning policies and legislation were considered. The proposed development fits with all planning policies. Organs of State were pre-identified and registered on the I&AP database.
	2.17.2. that actual or potential conflicts of interest between organs of state were	As registered I&APs all public correspondence including notifications of reports availability are provided.

	resolved through conflict resolution procedures?	
2.18. What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?		The proposed development aims to uphold the principles of sustainable development. The project team consists of suitably qualified individuals that comply with all legal requirements.
2.19. Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?		Specialist mitigation measures were identified during the EIA process and provided in the EIAr. Refer to Section to Section 6.6-Section6.18
2.20. What measures were taken to ensure that he costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?		An EMPr is submitted with EIAr. The EMPr is a legally binding document, which when enforced during construction, operational or decommissioning phases, hold the applicant or their representative liable for any remedial actions as a result of negligence.
2.21. Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?		The alternative selection process includes the assessment of the No Development alternative, site alternatives, design layout alternatives and technology alternatives.
2.22. Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?		Specialist identified cumulative impacts during the EIA process and provided in the EIAr. Refer to Section to Section 6.6-Section6.18

3 LEGAL CONTEXT

The DFFE is Competent Authority for this project. The legislative and policy context of the Report is described in detail below.

3.1 NATIONAL ENVIRONMENTAL SCREENING TOOL AND ENVIRONMENTAL THEME PROTOCOLS

3.1.1 Screening Report

The Minister of Environment, Forestry and Fisheries, gave notice that the submission of a report generated from the national web-based environmental screening tool[1], as contemplated in Regulation 16(1)(b)(v) of the Environmental Impact Assessment Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, will be compulsory from 4 October 2019 when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the Environmental Impact Assessment Regulations, 2014.

In addition, a set of protocols that an applicant needs to adhere to in the Environmental Authorisation (EA) process were developed and on 20 March 2020 the Minister of Forestry, Fisheries and the Environment gazetted the Protocols for national implementation purposes. The gazette '*Procedures to be followed for the Assessment and Minimum Criteria for Reporting of Identified Environmental Themes in terms of Section 24(5)(a) and (h) of the National Environmental Management Act (1998) when Applying for Environmental Authorisation*', has protocols that have been developed for environmental themes which include agriculture, avifauna, biodiversity (Terrestrial and Aquatic Biodiversity), noise, defence and civil aviation.

The protocols set requirements for the assessment and reporting of environmental impacts of activities requiring EA. The higher the sensitivity rating of the features on the proposed site as identified by the screening tool report, the more rigorous the assessment and reporting requirements.

Based on the generated screening report, all environmental theme sensitivities are indicated in Table 3-1 below.

Table 3-1: Environmental themes from Screening Tool which needs to adhere to in the Environmental Authorisation process.

Theme	Very High sensitivity *	High sensitivity *	Medium sensitivity	Low sensitivity
Agriculture Theme				
Animal Species Theme				
Aquatic Biodiversity Theme				
Archaeological and Cultural Heritage Theme				
Avian (Wind) Theme				

[1] https://screening.environment.gov.za/screeningtool/#/pages/welcome

Bats (Wind) Theme				
Civil Aviation (Wind) Theme				
Defence (Wind) Theme				
Flicker Theme				
Landscape (Wind) Theme				
Noise Theme				
Paleontology Theme				
Plant Species Theme				
RFI (Wind) Theme				
Terrestrial Biodiversity Theme				

* Require full assessments.

The EAP and relevant specialists however do not agree with the outcome of the following themes:

- Avian (Wind) Theme – it is indicated as low but should be High (refer to relevant avifauna section in Chapter 5).
- Civil Aviation (Wind) Theme – indicated as high but expected to be low (comments from CAA will be sought).
- Noise Theme – indicated as high but probably low (refer to relevant noise section in Chapter 5).
- Flicker Theme – indicated as very high but probably medium or low (refer to relevant visual section in Chapter 5).

All the environmental themes followed the relevant protocols (20 March 2020; 30 October 2020) and accompanied guidelines (SANBI 2020) to assess and verify the sensitivities.

3.2 RENEWABLE ENERGY AUTHORISATION REQUIREMENTS

The legislative and policy context of this Report is detailed below.

Constitution of the Republic of South Africa, Act 108 of 1996

The Constitution of the Republic of South Africa is the supreme law of the country and underpins all environmental legislation. As such, any law or conduct that is inconsistent with the Constitution is invalid (Constitution, 1996). The Constitutional environmental right is included in section 24, which states:

"Everyone has the right—

(a) to an environment that is not harmful to their health or well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that—

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".

The constitution also gives provision in section 27(1)(b) which states that everyone has the right to have accesses to sufficient water and section 27(2) requires the state to take reasonable and other measures, within its available resources, to achieve the progressive realization of each of these rights.

The Constitution of the Republic of South Africa forms the foundation of all environmental principles and management in the country and it is enshrined in all legislation. Such legislation is discussed below with specific reference to the environment.

National Environmental Management Act (Act 107 of 1998 as amended) and EIA Regulations (2014, as amended)

The National Environmental Management Act (NEMA; No. 107 of 1998, as amended) gives effect to the Constitution of the Republic of South Africa by providing a framework for cooperative environmental governance and environmental principles that enable and facilitate decision-making on matters affecting the environment.

Chapter one of the NEMA outlines national environmental management principles that must be incorporated into all decisions regarding the environment, throughout the country by all organs of state. Central to these principles is the concept of sustainability, which entails meeting the needs of the present generation without compromising the ability of future generations to meet their own needs.

Chapters two to three of the NEMA outline government and non-government institutions and their responsibilities for ensuring co-operative governance and making decisions.

Chapter 5 of NEMA provides for integrated environmental management. The purpose of this Chapter is to promote the application of appropriate environmental management tools in order to ensure the integrated environmental management of activities. Section 24 (1) specifically states:

> *"In order to give effect to the general objectives of integrated environmental management laid down in this Chapter. the potential impact on—*
>
> *(a) the environment;*
>
> *(b) soclo-economic conditions: and*
>
> *(c) the cultural heritage,*
>
> *of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity*."

NEMA requires that an environmental authorisation be issued by a competent authority (CA) before the commencement of a listed activity in terms of the Environmental Impact Assessment Regulations Listing Notices for Basic Assessment or scoping & Environmental Impact Assessment (S&EIA).

Legal Requirements as per the EIA Regulations, 2014 (as Amended)

In South Africa, EIA became a legal requirement in 1997 with the promulgation of regulations under the Environment Conservation Act (ECA). Subsequently, NEMA was passed in 1998. Section 24(2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant environmental authorisation. On 21 April 2006 the Minister of Environmental Affairs and Tourism promulgated the first EIA regulations in terms of Section 24 of NEMA. These EIA regulations, under sections 24(5) and 44 of NEMA, were updated in June 2010 and again in December 2014. In April 2017, the 2014 EIA regulations were amended.

Environmental authorisation for an activity may only be issued by the competent authority (CA) after the developer has complied with the procedural requirements as set out in the 2014 EIA regulations of NEMA.

NEMA, as amended, establishes the principles for decision-making on matters affecting the environment. Section 2 sets out the National Environmental Management Principles which apply to the actions of organs of state that may significantly affect the environment. Accordingly, NEMA identifies activities that require authorisation prior to commencement. Such activities listed in the 2014 EIA Regulations (GN R982) are detailed in Table 3-2.

Table 3-2: Listed activities triggered by the proposed Botterblom Wind Energy Facility.

Government Notice	Activity Number	Description	Aspect of the Project
Listing Notice 1: R.327 as amended on 7 April 2017	11	The development of facilities or infrastructure for the transmission and distribution of electricity— (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or (ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;	Underground cables for the transmission of electricity generated by the turbines to the onsite switching station.
	12	The development of – (ii) infrastructure or structures with a physical footprint of 100 square meters or more; where such development occurs- (a) within a watercourse; or (c) within 32 meters of a watercourse, measured from the edge of a watercourse	The proposed turbines and associated infrastructure including access roads and laydown areas during the construction phase located within a watercourse or the 32m buffer area. The final placement of all infrastructures will be refined during the process, and avoid the watercourse and indicated buffer as far as possible.

Government Notice	Activity Number	Description	Aspect of the Project
	14	The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	Storage of fuel, oil and other chemicals on site could trigger this activity. At present the volumes are not known but once information is available on the construction and operational phases of the project can the exact quantity be provided.
	19	The infilling or depositing of any material of more than 10 m3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 m3 from a watercourse;	The infilling or depositing of any material of more than 10 m3 into a watercourse may be triggered with the construction of internal service roads or cables across drainage lines.
	24	The development of a road - (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres.	Roads are required throughout the construction and operational stages of the project. during the construction phase, roads will be approximately 12m wide for the delivery of turbine parts and other equipment, and approximately 8m wide during the operational phase for maintenance purposes.
	28	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes of afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.	The current land use of the proposed farm on which the project is proposed is agriculture.
	56	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre – (ii) where no reserve exists, where the existing road is wider than 8 metres	The widening of portions of existing roads or the lengthening of roads will be required to accommodate the logistical construction requirements to access the site and associated infrastructure.
Listing Notice 2: R.325 as amended on 7 April 2017	1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more.	The Botterblom WEF will consist of up to 30 turbines with a capacity of up to 7.5MW each, depending on the available technology at the time of construction. The overall capacity of the facility will be about 140MW.

Government Notice	Activity Number	Description	Aspect of the Project
	15	The clearance of an area of 20 hectares or more of indigenous vegetation.	The total area to be cleared is expected to be approximately 55 ha, depending on the final layout. This includes turbine placement, roads, and other permanent infrastructure. During the construction phase, some areas will be cleared for the laydown, storage and assembly areas which will be rehabilitated post construction.
Listing Notice 3: R.324 as amended on 7 April 2017	4	The development of a road wider than 4 metres with a reserve less than 13,5 metres. g. Northern Cape ii. Outside urban areas: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	A CBA runs through the study area and it is likely that roads will be constructed within this area, even if just crossings. Roads will also be rehabilitated after the construction phase, where applicable.
	10	The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic meters. g. Northern Cape ii. Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland; iii. Outside urban areas: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	A CBA runs through the study area and wetlands or watercourse is present throughout the study area. The exact location of the storage and handling of dangerous goods are not yet known, but the necessary precaution will be taken and where possible these areas will be avoided. It is possible that this activity may become redundant after the necessary steps have been taken.
	12	The clearance of an area of 300 square metres or more of indigenous vegetation. g. Northern Cape ii. Within critical biodiversity areas identified in bioregional plans;	The proposed project will clear indigenous vegetation. The extent of the clearance within the CBA is currently unknown.
	14	The development of-	The proposed turbines and associated infrastructure including access roads and laydown areas during the construction phase located within

Government Notice	Activity Number	Description	Aspect of the Project
		(ii) infrastructure or structures with a physical footprint of 10 square meters or more; where such development occurs – (a) within a watercourse; or (c) within 32 meters of a watercourse, measured form the edge of a watercourse. g. Northern Cape ii. Outside urban areas: (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	a watercourse or the 32m buffer area. The final placement of all infrastructures will be refined during the process, and avoid the watercourse and indicated buffer as far as possible within the CBA.
	18	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. g. Northern Cape ii. Outside urban areas: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ii) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland	Upgrades of existing roads are likely to take place within the CBA and a watercourse. The exact roads for upgrade are currently unknown.

National Environmental Management: Biodiversity Act (Act 10 of 2004 as amended)

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004 as amended) ("NEMBA") aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA, the protection of species and ecosystems that warrant national protection, the sustainable use of indigenous biological resources and the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources. The Act places severe restrictions on activities that could have adverse effects on threatened or protected species.

The purpose of the NEMBA includes:

- the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998;

- the protection of species and ecosystems that warrant national protection; and
- the sustainable use of indigenous biological resources and the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources.

Provision is made for protection of threatened or protected ecosystems and species as well as provisions guarding against the introduction of alien and invasive species. The Act identifies restricted activities involving listed threatened, protected or alien species. These activities include picking parts of, or cutting, chopping off, uprooting, damaging or destroying, any specimen of a listed threatened or protected species. As stipulated in Section 57 of the Act, a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7. Lists of critically endangered, endangered, vulnerable and protected species in GNR 151 of 23 February 2007 and List of threatened ecosystem 2011 have been published under NEMBA. Regulations have also been promulgated on Threatened and Protected Species in GNR 324 (29 April 2014). These lists and associated restricted activities as well as the regulations need to be taken into account during the implementation of any renewable energy development activities as well as during assessments for authorisations associated with these activities in terms of other legislation.

Application may be made for a permit to engage in restricted activities, which application may be subject to various stringent requirements as set out in Section 88 of the NEMBA. The CA responsible for administrating the NEMBA is dependent on the province in which the activity is taking place.

Environmental Conservation Act, Act No. 73 of 1989 (ECA)

In terms of section 25 of the ECA, the national Noise Control Regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCR) was promulgated. The NCRs were revised under Government Notice Number R55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Currently, no provincial or local regulations exist in the Northern Cape and no approval is required. A noise assessment forms part of this EIR and the impact assessment and identified mitigation measures are included with requirements included in the EMPr.

National Environmental Management: Air Quality Act (Act 39 of 2004 as amended)

The National Environment Management: Air Quality Act (NEMAQA) serves to repeal the Atmospheric Pollution Prevention Act (45 of 1965) and various other laws dealing with air pollution.

According to the Act, the DEA, the provincial environmental departments and local authorities are separately and jointly responsible for the implementation and enforcement of various aspects of the Air Quality Act.

Although no major air quality issues are expected, the Applicant needs to be mindful of the Act as it also relates to potential dust generation during construction.

National Environmental Management: Waste Act (Act 59 of 2008 as amended)

The National Environmental Management: Waste Act (NEMWA) came into effect on 1 July 2009. Section 19 of the NEMWA provides for listed waste management activities and states in Section 19(1) that the Minister may publish a list of waste management activities that have or are likely to have a detrimental effect on the environment. Such a list was published in GN 921 of 29 November 2013, identifying those waste management activities that require a Waste Management Licence in terms of the Act. Activities are defined within Category A (non-hazardous) and Category B (hazardous) Category C (lower threshold in terms of waste volumes) wastes.

There are no listed activities which require authorisation. The Applicant must ensure that all activities associated with the project address waste related matters in compliance with the requirements of the Act and must consult with the local municipality to ensure that all waste is disposed of at a registered landfill site.

National Water Act (Act 36 of 1998 as amended)

The National Water Act (NWA) includes provisions requiring that a water use license be issued by the Department of Water & Sanitation (DWS) before a project developer engages in any activity defined as a water use in terms of the NWA. Water use definitions considered probably or possibly relevant to Renewable Energy projects in terms of the NWA, section 21 includes:

- Taking of water from a water resource;
- Storing of water;
- Impeding or diverting the flow of water in a water course;
- Engaging in a stream flow reduction activity;
- Engaging in a controlled activity (this includes the use of water for power generation purposes);
- Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- Altering the bed, banks, course, or characteristics of a watercourse. This includes altering the course of a watercourse (previously referred to as a river diversion).

An authorisation might be required in terms of Section 21 (b), (c) and (i) in the form of a Water Use License Application (WULA). A WULA will be submitted with the DWS.

National Heritage Resources Act (No. 25 of 1999)

National Heritage Sites in South Africa are places that that are of historic or cultural importance and which are for this reason declared in terms of Section 27 of the National Heritage Resources Act (NHRA). The designation was a new one that came into effect with the introduction of the Act on 1 April 2000 when all former National Monuments declared by the former National Monuments Council and its predecessors became provincial heritage sites as provided for in Section 58 of the Act.

Both national and provincial heritage sites are protected under the terms of Section 27 of the NHRA and a permit is required to work on them. National Heritage Sites are declared and administered by the national Heritage Resources Authority, SAHRA whilst provincial heritage sites fall within the domain of the various provincial heritage resources authorities. Heritage resources are protected by the Act and may not be disturbed in any way without a permit issued by the South African Heritage Resources Agency or the relevant Provincial Heritage Resources Authority. Section 38(1) of the NHRA stipulates the triggers which would require a Heritage Impact Assessment (HIA) to become part of an EIA submitted for consideration by the relevant state department. Since the development is less than 5ha and no features have been found on site, an exclusion has been submitted to SAHRA for approval.

Conservation of Agricultural Resources Act (CARA; Act 43 of 1983)

The purpose of this Act is to ensure that natural agricultural resources of South Africa are conserved through maintaining the production potential of land, combating and preventing erosion, preventing the weakening or destruction of water sources, protecting vegetation, and combating weeds and invader plants.

As per the Screening Tool generated, the Agricultural Potential is considered low. There are currently no agricultural activities, not even grazing, taking place on the property. Where required, measures for addressing erosion, protection of vegetation and water sources and managing alien plants will be included in the EMPr.

Spatial Planning and Land Use Management Act (SPLUMA; Act 16 of 2013)

SPLUMA aims to confirm and regulate the role of municipalities in land-use planning and land-use management. Two of the most relevant objectives of the SPLUMA are to ensure that the system of spatial planning and land use management promotes social and economic inclusion and to provide for the sustainable and efficient use of land.

The Act provides that spatial planning consists of:

- Spatial development frameworks adopted at each level of government;
- Development principles, norms and standards;
- The management and facilitation of land use through land-use schemes; and
- Procedures to deal with and decide on development applications provided for in national and provincial legislation.

The national, provincial and local governments are instructed to adopt spatial development frameworks (SDFs). SDFs must ‘guide planning and development decisions across all sectors’. At different levels of government the SDFs intended to guide some of the following:

- National Spatial Development Framework (NSDF) - must indicate the desired patterns of land use in South Africa;
- Provincial Spatial Development Framework (PSDF) - must provide a spatial representation of the province’s land development policies, strategies and objectives and must indicate desired and intended patterns of land use and, importantly, delineate areas in which development would not be appropriate;

- Regional Spatial Development Framework (RSDF) – will be imposed if when a municipality fails to adopt or amend an MSDF the Minister may step in, declare a region and adopt an RSDF for that region and when it is 'necessary to give effect to national land-use policies or priorities' the Minister may do the same; and
- Municipal Spatial Development Framework (MSDF) - identify current and future significant structuring and restructuring elements of the spatial form of the municipality, including development corridors, activity spines and economic nodes where public and private investment will be prioritised and facilitated.

The proposed development needs to comply with the surrounding landscape, and must apply for a land use change with the relevant municipality since the land is classified as agricultural use.

National Roads Act (Act. 93 of 1996)

This Act provide for co-operative and co-ordinated strategic planning, regulation, facilitation and law enforcement in respect of road traffic matters by the national, provincial and local spheres of government.

The National Roads Act 93 of 1996 makes provision for regulating the transportation of dangerous goods and substances by road. Section 275 states that, no person shall operate on a public road any vehicle in or on which dangerous goods is transported, unless such dangerous goods is transported in accordance with Chapter VIII of the Act. Chapter VIII also incorporates the SABS standard specifications relating the transportation of dangerous goods and substances. Section 279 indicates the availability of an authority for classification and certification of dangerous goods should there be any doubt as to the appropriate classification of dangerous goods.

Certain vehicles and loads cannot be moved on public roads without exceeding the limitations in terms of the dimensions and/or mass as prescribed in the Regulations.

Civil Aviation Act (Act 13 of 2009)

Civil aviation in South Africa is governed by the Civil Aviation Act, 2009 (Act 13 of 2009). This Act provides for the establishment of a stand-alone authority mandated with controlling, promoting, regulating, supporting, developing, enforcing and continuously improving levels of safety and security throughout the civil aviation industry. This mandate is fulfilled by the South African Civil Aviation Authority (SA CAA) as an agency of the Department of Transport (DoT). The SA CAA achieves the objectives set out in the Act by complying with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organisation (ICAO), while considering the local context when issuing the South African Civil Aviation Regulations (SA CARs). All proposed developments or activities in South Africa that potentially could affect civil aviation must thus be assessed by SACAA in terms of the SA CARs and South African Civil Aviation Technical Standards (SA CATS) in order to ensure aviation safety.

The Obstacle Evaluation Committee (OEC) which consists of members from both the SA CAA and South African Air Force (SAAF) fulfils the role of streamlining and coordinating the assessment and approvals of proposed developments or activities that have the potential to affect civil aviation, military aviation, or military areas of interest. With both being national and international priorities, the OEC is responsible for facilitating the coexistence of aviation and renewable energy development, without compromising aviation safety.

Comments from the OEC are required to ensure the safety of aircrafts. No Comments have been received to date, follow ups will be made during the EIR comment period.

3.3 RENEWABLE ENERGY DEVELOPMENT ZONE

On 17 February 2016, Cabinet approved the Renewable Energy Development Zones (REDZs) for large scale wind and solar photovoltaic development and associated Strategic Transmission Corridors (STC) which support areas where long term electricity grid will be developed.

The procedure to be followed in applying for EA for a large-scale project in a REDZ or in a Power Corridor was formally gazetted on 16 February 2018 in GN113 and GN114. New wind or PV projects located within one of the eight REDZ areas, and new electricity grid expansion within the 5 Strategic Transmission Corridors are subject to a Basic Assessment and not a full EIA process, as well as a shortened timeframe of 147 days (90 day BA process and 57 decision-making process).

The proposed Botterblom WEF is not located in a REDZ, but is located in the Western Strategic Transmission Corridor. Accordingly, a S&EIR is required for the WEF, and a BA process is required for the grid connection.

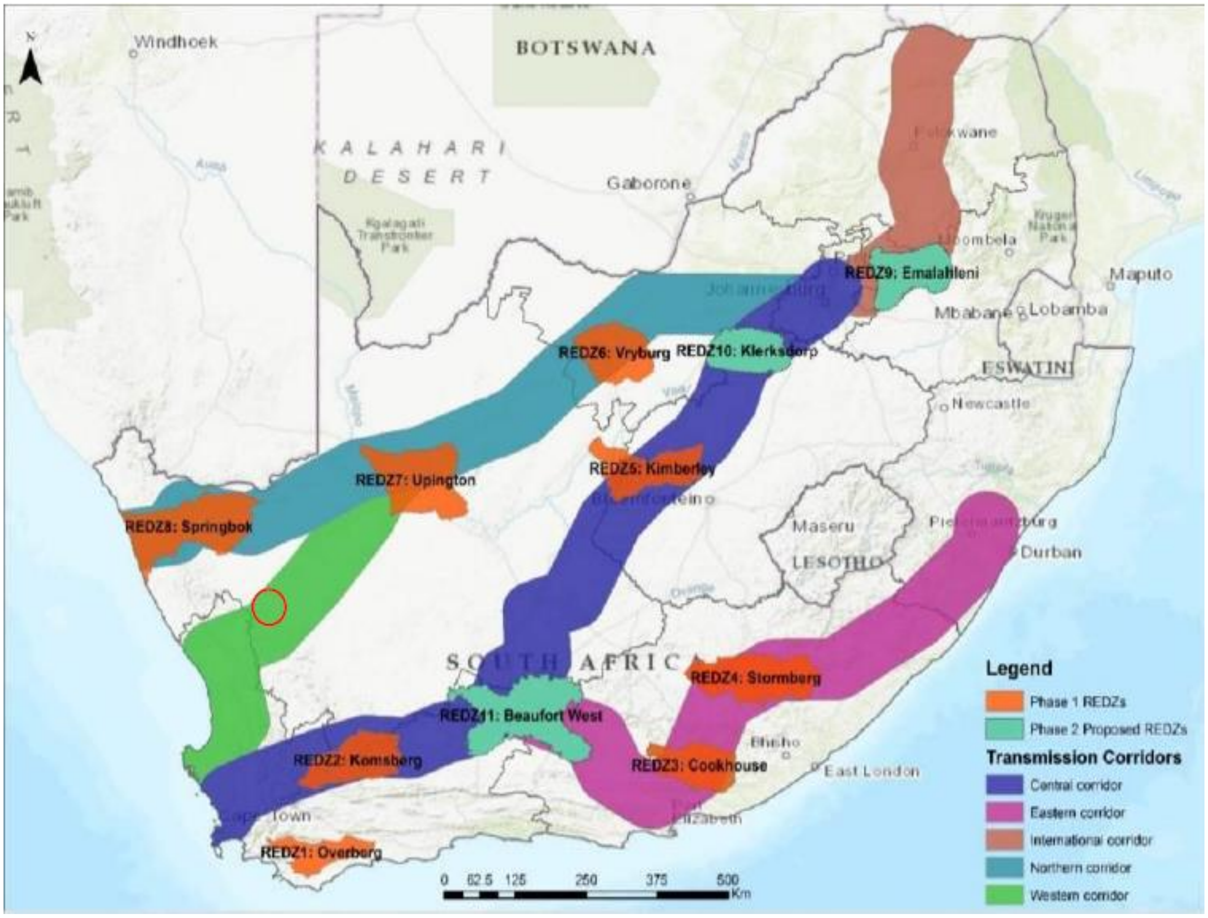


Figure 3-1: Location of eight existing Renewable Energy Development Zones (REDZs) overlayed onto the electricity grid infrastructure corridors (Source: CSIR). The proposed project area is circled in red.

4 SCOPING AND EIR PROCESS

A S&EIR is conducted in two phases. The first phase is scoping and the second phase is the EIR. The scoping phase will commence once the environmental authorisation application has been submitted with the competent authority (in this case Department of Forestry, Fisheries and the Environment - DFFE). The following tasks will be undertaken for the scoping phase: identify stakeholders and interested and affected parties (I&APs); identify relevant policies and legislation; consider the need and desirability of the project; consider alternative technologies and sites; identify the potential environmental issues; determine the level of assessment and public participation process required for the EIA phase; and identify preliminary measures to avoid, mitigate or manage potential impacts.

The requirements for the submission of the scoping report to competent authority is specifically contained in Chapter 4 Part 3 of the NEMA Reg No 326 (amended on 7 April 2017). The S&EIR process can take up to 300 days to complete (87 days for scoping phase, 106 days for EIA phase, and 107 days for competent authority to review). The applicant must, within 44 days of receipt of the application by the competent authority, submit to the competent authority a scoping report which has been subjected to a public participation process of at least 30 days and which reflects the incorporation of comments received, including any comments of the competent authority. The competent authority must, within 43 days of receipt of a scoping report, make a decision

The purpose of the scoping report is to identify and evaluate the main issues and potential impacts of the proposed development at a detailed desktop level based on existing information.

There are two distinct phases in the S&EIR process namely the Scoping Phase and the EIR Phase, as outlined in

Figure 4-1. This report deals with the scoping phase. The requirements for the S&EIA process are specifically contained in Chapter 4 Part 3 of the EIA Regulations 2014 (as amended).

The scoping phase is conducted as the precursor to the Environmental Impact Assessment (EIA) process during which:

- Project and baseline environmental information is collated. Baseline information for the scoping report is gathered through visual inspections during field visits of the proposed project area and surroundings, desktop studies which include GIS mapping, and review of existing reports, guidelines and legislation.
- Landowners, adjacent landowners, local authorities, environmental authorities, as well as other stakeholders which may be affected by the project, or that may have an interest in the environmental impacts of the project are identified.
- Interested and affected parties (I&APs) are informed about the proposed project.
- Competent authority (CA) is consulted to confirm legal and administrative requirements.
- Environmental issues and impacts are identified and described.
- Development alternatives are identified and evaluated, and non-feasible development alternatives are eliminated.
- The nature and extent for further investigations and specialist input required in the EIA phase is identified.
- The draft and final scoping reports are submitted for review by authorities, relevant organs of state and I&APs.
- Key I&AP issues and concerns are collated into an issues and response report for consideration in the EIA phase.

Issues raised in response to the Draft Scoping Report were captured in a Comments and Response Report as an appendix to the Final Scoping Report (FSR), which was submitted to the CA for decision-making. The approval of the Scoping Report was received on the 2 December 2021 but was approved/signed on the 24 November 2021.

The Environmental Impact Assessment (EIA) phase is conducted after the Scoping Phase, the EIA phase entails:

- Competent authority (CA) is consulted to confirm legal and administrative requirements. Requirements are also provided in the scoping approval;
- Development alternatives are identified and evaluated, and non-feasible development alternatives are eliminated, finalised layout, development area are analysed;
- Specialist studies are finalised;
- Environmental issues and impacts are identified and described.

- The draft and final EIA reports and environmental management programme (EMPr) submitted for review by authorities, relevant organs of state and I&APs.
- Key I&AP issues and concerns are collated into an issues and response report for consideration in the EIA phase.

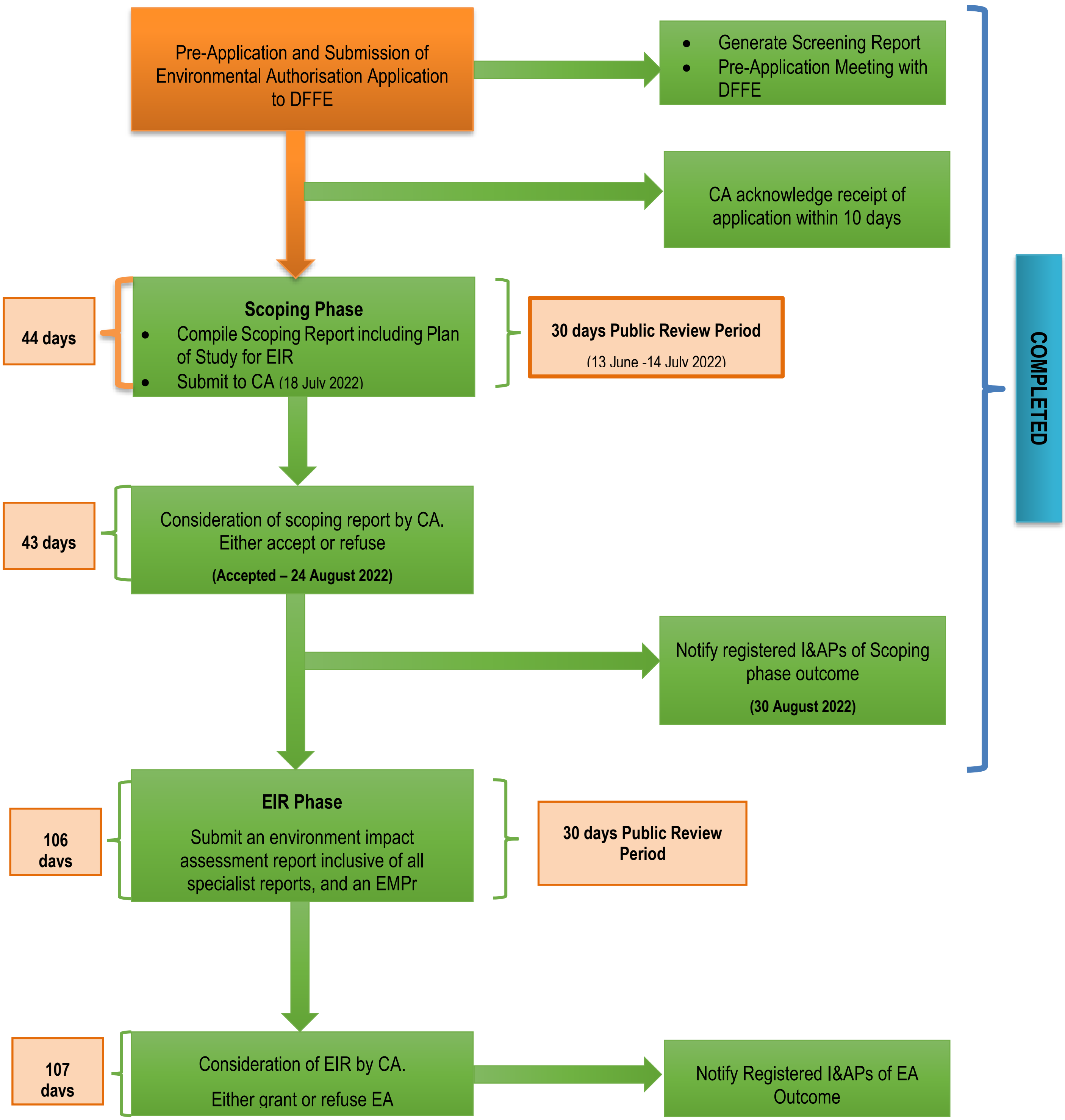


Figure 4-1: The S&EIR process in terms of the EIA Regulations (2014, as amended).

5 PUBLIC PARTICIPATION

The Public Participation Process (PPP) was developed to ensure compliance with environmental regulatory requirements and to provide I&APs with an opportunity to evaluate the proposed project. During this process stakeholders are able to provide inputs and to receive feedback from the environmental specialists, other stakeholders and the competent authority. Please refer to Appendix E for the Public Participation Report.

The current EIA process for the proposed Botterblom WEF has been subjected to a rigorous PPP both during the Scoping and EIA Phases of the project.

5.1. OBJECTIVES OF PUBLIC PARTICIPATION

- Provide Stakeholders and Interested and Affected parties (I&APs) with an opportunity to voice their support or concerns and raise questions regarding the project, application or decision made by the CA;
- Provides an opportunity for I&APs, EAP and the CA to obtain clear, accurate and understandable information about the environmental, social and economic impacts of the proposed activity or implications of a decision;
- Provide Stakeholders, I&APs, and the CA with the opportunity of suggesting ways of reducing or mitigating negative impacts of an activity and for enhancing positive impacts;
- Enable the applicant / EAP to incorporate the needs, preferences and values of affected parties into the process and submitted reports for review.

5.2. LEGISLATION

The PPP must comply with the several important sets of legislation that require public participation as part of an application for authorisation or approval, namely:

- The National Environmental Management Act (Act No. 107 of 1998 - NEMA);
- The EIA Regulations (2014, as amended);

Adherence to the requirements of the above-mentioned Acts will allow for an Integrated PPP to be conducted, and in so doing, satisfy the requirement for public participation referenced in the Acts. The details of the Integrated PPP are provided below.

Adherence to the requirements of the above-mentioned Acts and Regulations will allow for effective PPP to be conducted, and in so doing, satisfy the requirement for public participation referenced in the Acts.

5.3. IDENTIFICATION OF I&APS

An I&AP database will be compiled of key stakeholders and I&AP's identified for notification of the Environmental Authorisation Application. The I&AP database includes, amongst others; landowners, affected communities, regulatory authorities and other specialist interest groups. A list of key stakeholders was identified:

- Competent Authority: Department of Forestry, Fisheries and the Environment (DFFE)
- Northern Cape Department: Agriculture, Environmental Affairs, Rural Development and Land Reform
- Department of Water & Sanitation (DWS)
- Department of Mineral Resources and Energy (DMRE)
- Department of Agriculture, Rural Development and Land Reform (DARDLR)
- Eskom
- South African Heritage Resource Authority (SAHRA)
- Namakwa District Municipality
- Hantam Local Municipality
- Civil Aviation Authority (CAA)
- BirdLife South Africa
- South African Bat Assessment Association (SABAA)
- Square Kilometre Array (SKA)
- Endangered Wildlife Trust (EWT)

5.4. REGISTER OF I&APS

The Public Participation Process (PPP) commenced on 11 June 2022 with the site notices to notify and inform the public of the proposed project and invite I&APs to register, who has not already done so in the previous process. All individuals who register for this project will be added to the I&AP list, provided that they have given the correct and complete contact details in order to receive communications for this project. The notification procedure included (Appendix E):

- Newspaper advertisement: published in the Noordwester on 17 June 2022;
- Site Notices: erected at prominent points along the property boundaries and noticeable places on 11 June 2022; and
- Emails were composed and sent to the identified authorities, adjacent landowners, and I&APs that have registered thus far.

This draft EIR (DEIR) will be released for a 30-day commenting period from **30 September 2022 – 31 October 2022**. Comments received on the DEIR will be included in the Final EIR which will be submitted to DFFE for decision-making

5.5. BACKGROUND INFORMATION DOCUMENT

Included in the I&AP notification letters and e-mails sent out was a Background Information Document (BID). The BID includes the following information:

- Locality map and description;
- Project description and background;

- Legal framework;
- Explanation of the Scoping and EIR Process to be followed; and
- Provide opportunity to get involve and comment on the proposed project.

5.6. CONSULTATION WITH I&APS

Scoping:

A precautionary approach was taken during the scoping public participation process, where in-person meetings or open days will be limited as a precautionary measure due to the COVID-19 pandemic over the past 2 years. Accordingly alternative measures will be implemented to ensure that all relevant parties have an opportunity to take part in the PPP.

A site visit was conducted with the District ecologist Mr Peter Cloete from the Northern Cape Department: Agriculture, Environmental Affairs, Rural Development and Land Reform, with regards to sensitive flora and fauna and permit requirements for provincially protected species, on 11 October 2021.

EIR:

A precautionary approach was taken during the public participation process, where in-person meetings or open days will be limited as a precautionary measure due to the COVID-19 pandemic over the past 2 years. Accordingly alternative measures will be implemented to ensure that all relevant parties have an opportunity to take part in the PPP.

5.7. NOTIFICATION OF AVAILABILITY OF DRAFT REPORTS

Scoping: All registered I&APs and stakeholders have been notified via email of the availability of the Draft Scoping Report for review for a period of 30 days from **13 June – 14 July 2022**. The report was made available on Enviro-Insight's website at http://www.enviro-insight.co.za/download-it/project-downloads/. CD electronic copies are also available on request from Enviro-Insight.

EIR: All registered I&APs and stakeholders have been notified via email of the availability of the Draft EIR for review for a period of 30 days from **30 September 2022 – 31 October 2022**. The report was made available on Enviro-Insight's website at http://www.enviro-insight.co.za/download-it/project-downloads/. CD electronic copies are also available on request from Enviro-Insight.

5.8. FEEDBACK FROM I&APS

Limited comments were received from I&APs during the process. No comments were received from the following key stakeholders during or after the 30 day review periods: Namakwa District Municipality, Hantam Local Municipality, Department of Mineral Resources and Energy, Department of Water and Sanitation, or Eskom.

The main input received from stakeholders were from the Northern Cape Department: Agriculture, Environmental Affairs, Rural Development and Land Reform and BirdLife South Africa. These comments were incorporated into the specialist reports and EMPr.

Mainstream Renewable Power, the owners of Khobab, Loeriesfontein 2 and Dwrasrug WEFs, indicated that they request formal (separate) commitments stating that the Botterblom developers will enter into a Wind Take Agreements with the three mentioned Wind Farms. Mr Chris Billingham specifically stated that in the absence of this, these mentioned Wind Farms reserve the right to oppose the EA for Botterblom WEF. To date, no agreement is in place, but a meeting was held between the various parties on 16 February 2022. In addition, the Botterblom developer included a wake impact analysis (Appendix D11.1 & D11.2) as well as the potential social economic impact of the wake impacts (Appendix D12).

All comments received throughout the process were collated and included in the comments and response report included in Appendix E.

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

A description of the study area is outlined in the section below. The receiving environment in relation to each specialist study is also provided.

The following environmental aspects further described in the following subsections:

- Terrestrial Biodiversity;
- Sensitive Animal Species;
- Sensitive Plant Species;
- Bats (wind);
- Avifauna (wind);
- Aquatic Biodiversity;
- Cultural Heritage and Archaeology;
- Agriculture;
- Socio-economic;
- Noise;
- Visual landscape including Flicker;
- Traffic and Transportation;

- Wake effect; and
- Electromagnetic and radio frequency interference.

6.1 REGIONAL AREA

The proposed development will be located approximately 53km north of Loeriesfontein, 90 km west of Brandvlei and 105 km southeast of Springbok within the Hantam Local Municipality in the Northern Cape Province (Figure 2.2). The proposed wind farm can be accessed the via the R358 regional road towards Kliprand which lies south of the site. The centre point and corner co-ordinates for the development site are included in Table 5-1. The Project has a total footprint of approximately 5 736 ha situated on a Portion of the Remainder of the Farm Sous 226 (21 digit Surveyor General code: C01500000000022600000). The existing Khobab WEF is located directly north while Loeriesfontein2 WEF is located north-east of the study area.

6.2 TOPOGRAPHY

The area lies at a height of approximately 900 to 950 meters above sea level. The topography in the immediate vicinity of the site proposed for the wind farm is characterised by a flat to gently undulating landscape with gentle slopes (typical of much of the Karoo). North and north-east within the development footprint the presence of a number of pans signals that the topography is very flat and thus very poorly drained. In certain parts of the wider study area is characterised by the presence of localised hills / ridges / koppies which create areas of localised hilly topography. In addition, the Klein and Groot Rooiberg and Leeuwberg koppies can also be found within the wider area and form an area of localised hilly topography. The slope percentage grid was derived from the 20m SUDEM and classified into 4 categories for LandCare. The slope percentage for the majority of the development footprint is considered flat with localised steep slopes.

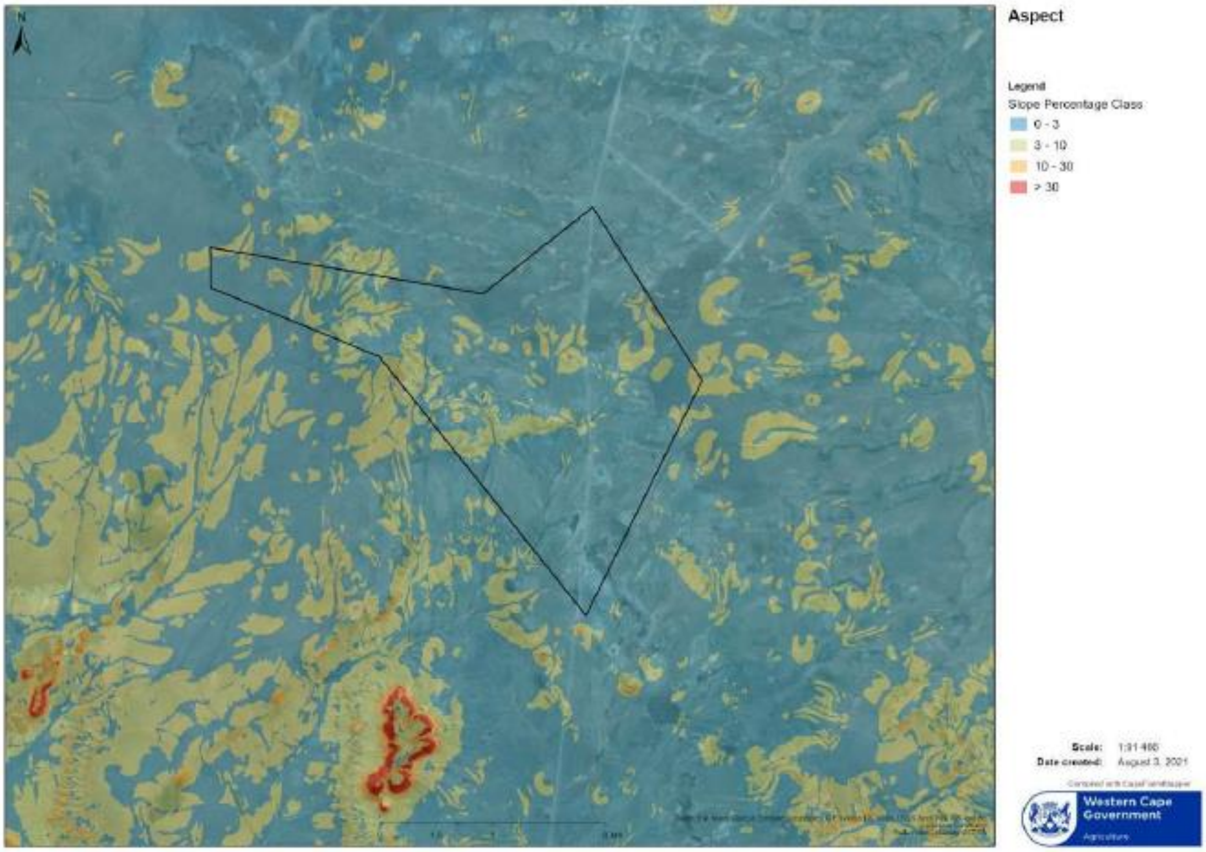


Figure 6-1: Slope Percentage Class. (Source: Stellenbosch University, WCDOA, accessed from CapeFarmMapper ver 2.6).

6.3 GEOLOGY

The underlying geology is shale of the Ecca and Dwyka Groups of the Karoo Supergroup with tillite of the Dwyka Group and dolerite intrusions. Several formations intersect with the development footprint (Figure 6-2), including grey shale with interbedded siltstones in the upper part (Tiegerberg), dolerite, minor ultrabasic rocks (Karoo Dolerite suite), grey shale, tuff, minor sandstone, chert, black (white-weathering) carbonaceous shale (Collingham and Whitehill) and dark grey-green shale (Prince Albert).

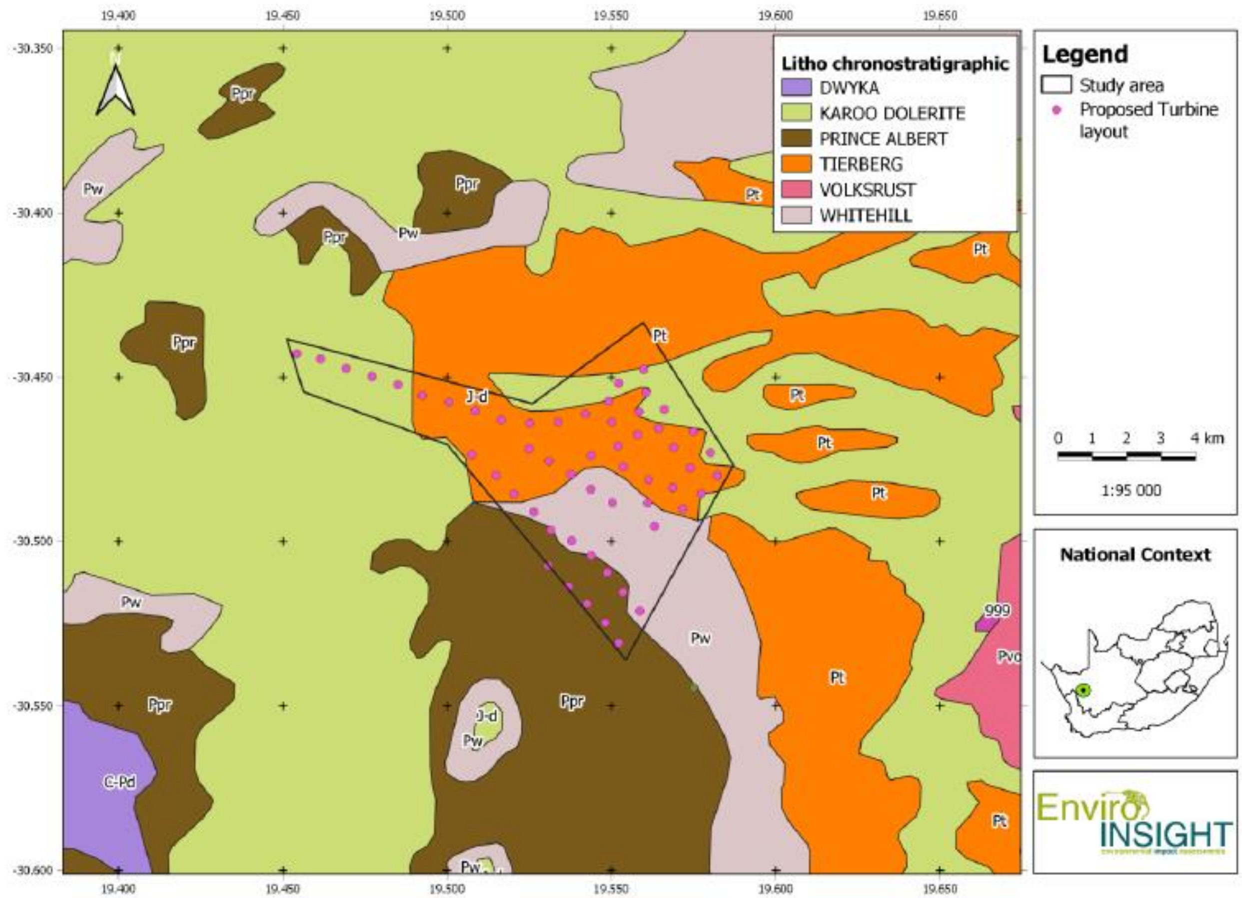


Figure 6-2: Geological Classification of the development footprint.

6.4 LAND USE

Much of the land use in the wider study area is classified as bare (Other) with bare riverbed material embedded within it and dry pans towards the north. Vegetated areas include open woodland, low shrubland (Nama Karoo), sparsely wooded grassland and natural grassland. Other land uses within the study area include industrial (Helios substation) and extraction sites for open cast mines. Major roads (road from Loeriesfontein) and railway with associated infrastructure traverse the study area (Figure 6-4). Sheep farming is the dominant activity in the area even though the arid nature of the climate restricts stocking densities which has resulted in relatively large farms across the area. There is no livestock grazing activities on the study area, and the landowner has not utilised the study area for any other purposes. Furthermore, the area is sparsely populated, and human-related infrastructure is largely restricted to isolated farmsteads and gravel access roads. There are no farmsteads that are occupied on the study area

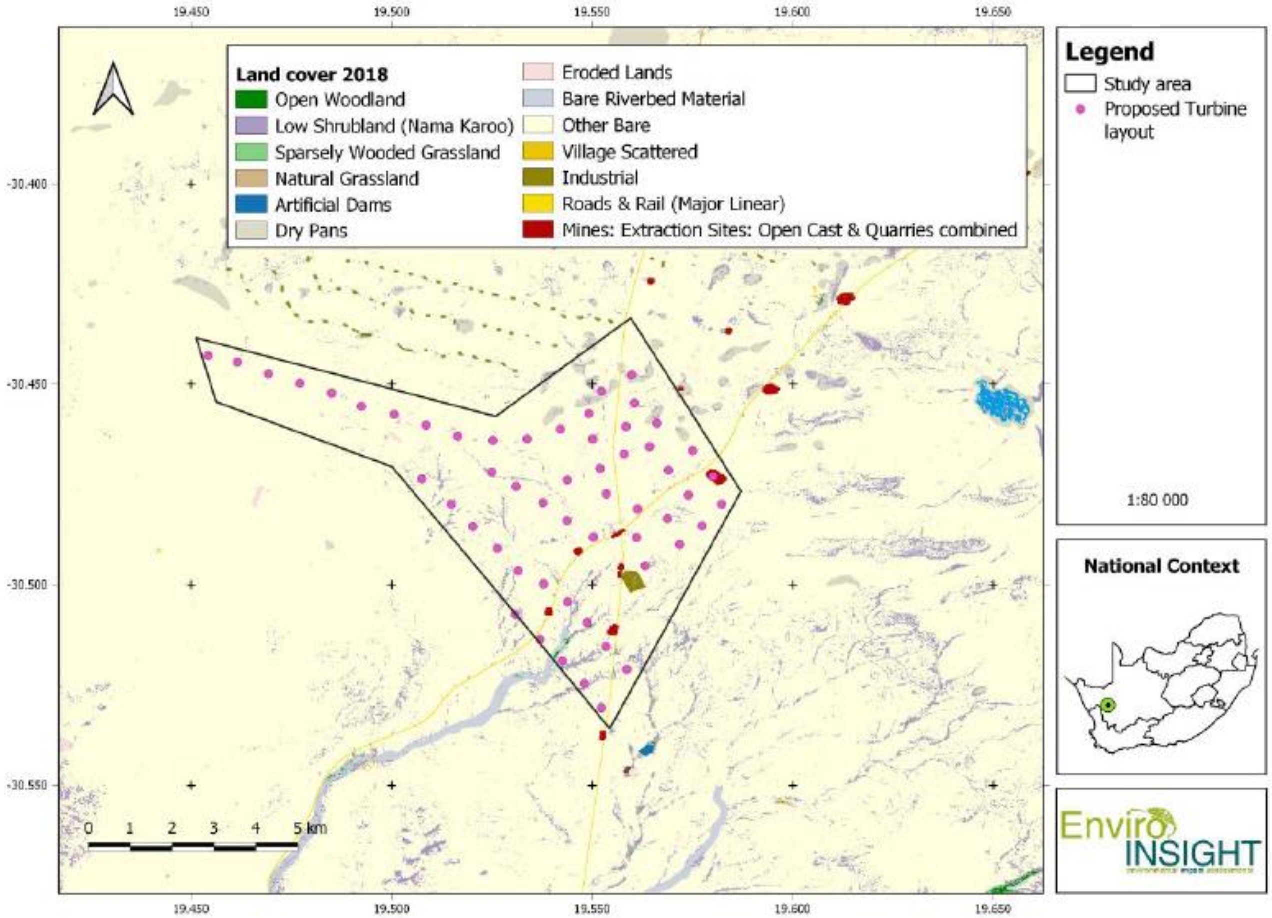


Figure 6-3: Land use in the region of the study area.

6.5 CLIMATE

The area is dominated by the Cape Winter Season (cold fronts, resulting in soft, misty showers) and is characterised by semi-arid climatic conditions, with most of the rain falling at the start of autumn and during the winter. Rainfall for the area is given as a very low 147 mm per annum (Figure 6-5), while the mean annual temperature is 17.8ºC (Figure 6-6).

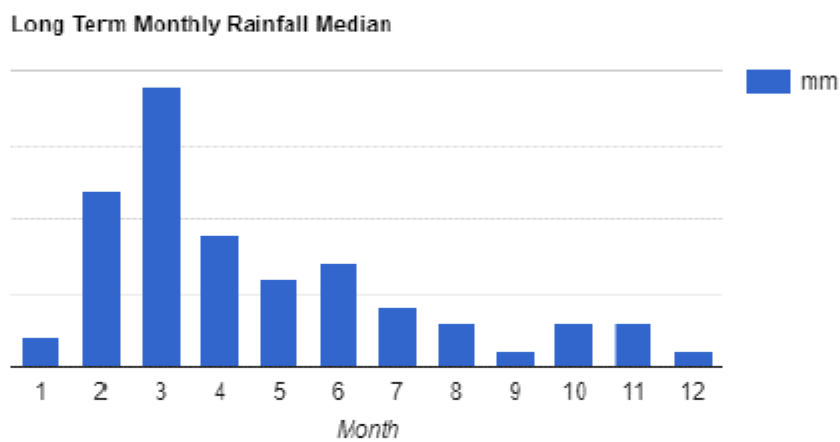


Figure 6-4: Land use in the region of the study area.

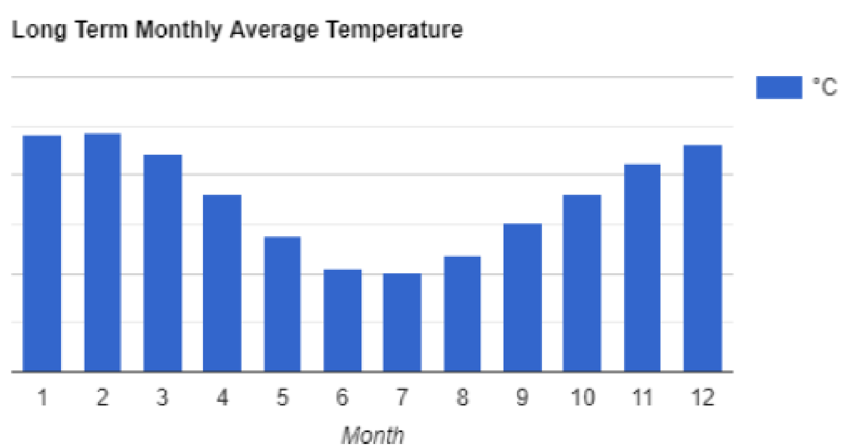


Figure 6-5: Land use in the region of the study area.

6.6 TERRESTRIAL BIODIVERSITY

The Terrestrial Biodiversity Report was undertaken by Enviro-Insight, kindly refer to Appendix D1.

The assessment and minimum reporting requirements of this protocol are associated with a level of environmental sensitivity identified by the national web based environmental screening tool (screening tool). The requirements for terrestrial biodiversity are for landscapes or sites which support various levels of biodiversity. An initial screening report was generated in October 2020, and again in February 2021 as data updates were made and confirmation was required. For this report, the February 2021 screening report will be applicable.

Based on the screening report generated on 03/02/2021, the Terrestrial Biodiversity Combined Sensitivity Theme is indicated as Very High sensitivity (Figure 6-7). The sensitive features which trigger the Very High sensitivity include:

- Freshwater ecosystem priority area quinary catchments;
- Critical Biodiversity Area 1; and
- Ecological Support Area.

Accordingly, a Terrestrial Biodiversity Specialist Assessment was conducted by Enviro-Insight based on the Protocols (published on 20 March 2020).

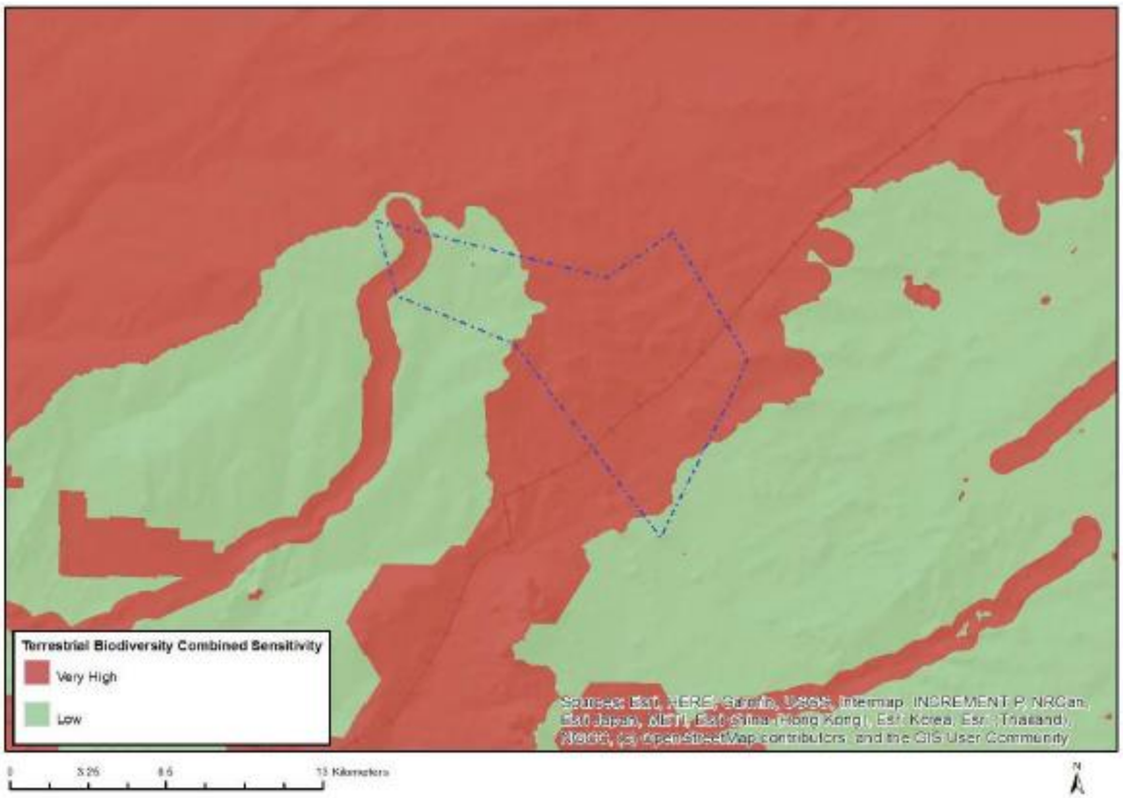


Figure 6-6: Screening Tool map of relative terrestrial biodiversity theme sensitivity.

Regional Vegetation

The study area is located in the Bushmanland Basin Shrubland vegetation type (Figure 6-7) (Table 6-1). Bushmanland Basin Shrubland occurs on the extensive basin centered on Brandvlei and Van Wyksvlei, spanning Granaatboskolk in the west to Copperton in the east, and Kenhardt in the north to around Williston in the south. The area is characterised by slightly irregular plains dominated by a dwarf shrubland, with succulent shrubs or perennial grasses in places. The geology consists largely of mudstones and shales of the Ecca group and Dwyka tillites with occasional dolerite intrusions. Soils are largely shallow to non-existent, with calcrete present in most areas. Rainfall ranges from 100-200 mm and falls mostly during the summer months as thunder storms. As a result of the arid nature of the area, very little of this vegetation type has been affected by intensive agriculture and it is classified as Least Threatened. None of the unit is conserved in statutory conservation areas. According to

Mucina and Rutherford no signs of serious transformation are present for the vegetation type, but scattered individuals of Prosopis sp. occur in some areas (e.g. in the vicinity of the Sak River drainage system), and some localised dense infestations form closed 'woodlands' along the eastern border of the unit with Northern Upper Karoo (east of Van Wyksvlei) (Mucina & Rutherford, 2006 as amended).

There are few endemic and biogeographically important species present at the site and only Tridentea dwequensis is listed by Mucina and Rutherford as biogeographically important while Cromidon minimum, Ornithogalum bicornutum and O.ovatum subsp oliverorum are listed as being endemic to the vegetation type (Mucina & Rutherford, 2006 as amended).

Table 6-1: Attributes of the Bushmanland Basin Shrubland vegetation type.

Name of vegetation type	Bushmanland Basin Shrubland
Code as used in the Book	NKb6
Conservation Target (percent of area) from NSBA	21%
Remaining (percent of area) from NSBA	99.5%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Not protected
Area (km^2) of the full extent of the Vegetation Type	34690.68
Name of the Biome	Nama-Karoo
Name of Bioregion	Bushmanland Bioregion

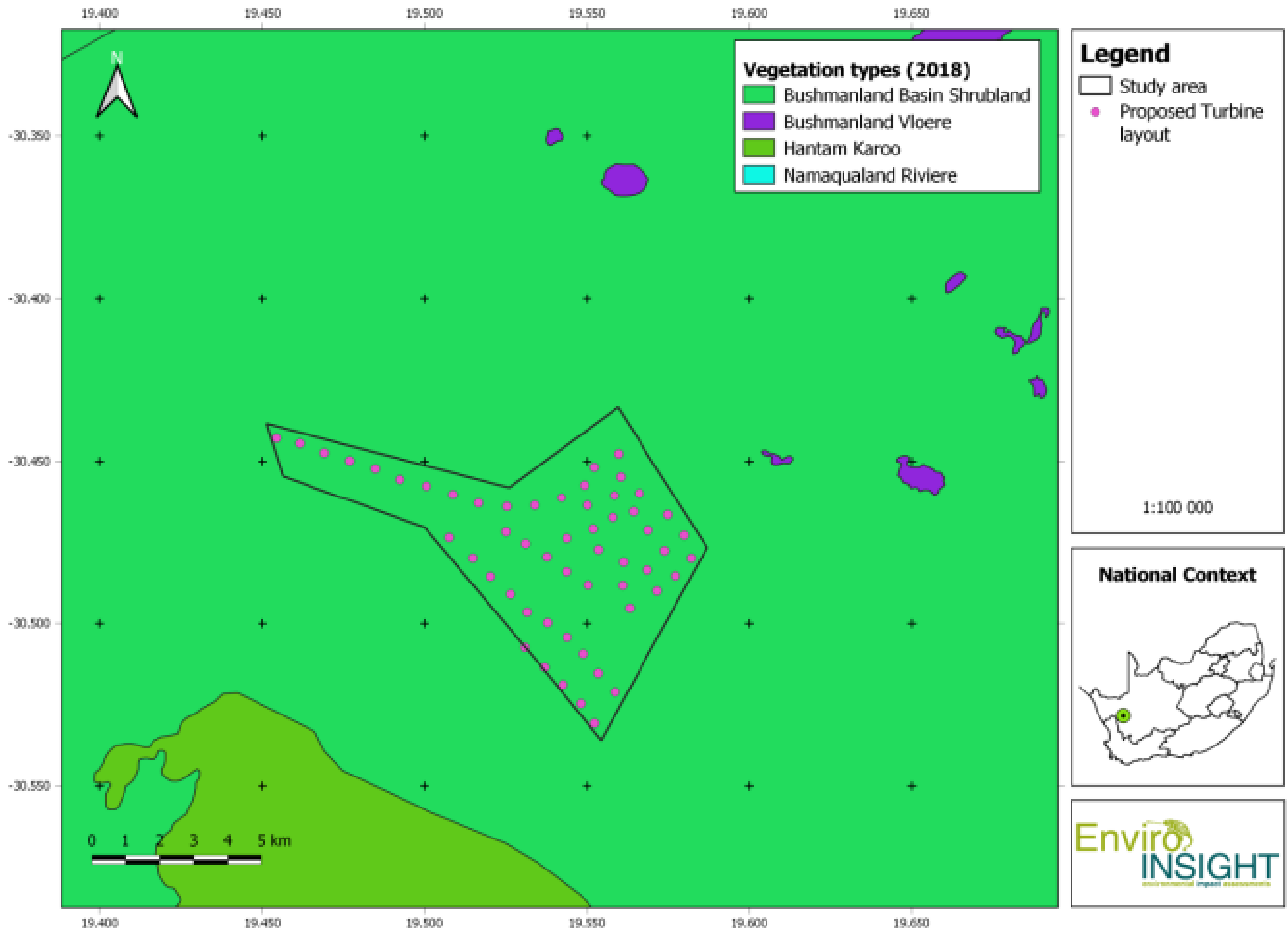


Figure 6-7: Regional vegetation types in relation to the study area (SANBI, 2018).

Other vegetation types which occur in the wider area include Hantam Karoo, some small pans in the area which fall within the Bushmanland Vloere and Namaqualand Riviere vegetation types. These are however outside of the study area and would not be affected directly by the proposed Botterblom WEF.

The study area is not located in a national threatened ecosystem.

Northern Cape Critical Biodiversity Areas

The Northern Cape CBA Map (2016) identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of e landscape as a whole (Holness & Oosthuysen, 2016). Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes.

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection of important natural habitat and landscapes. Biodiversity priority areas are described as follows:

- Critical biodiversity areas (CBA's) are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses. For CBA's the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a populations or habitat). All FEPA prioritized wetlands and rivers have a minimum category of CBA1, while all FEPA prioritised wetland clusters have a minimum category of CBA2.
- Ecological support areas (ESA's) are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas. For ESA's a change from the desired ecological state is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor results in a population going extinct elsewhere or a new plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity). All natural non-FEPA wetlands and larger rivers have a minimum category of ESA.

According to the CBA Map (Figure 6-8), the study area is mainly located in the category "Other Natural Areas" with a CBA1 running through the study area and an ESA in the western and northern sections of the study area. The CBA1 is the NFEPA River, Klein-Rooiberg running though the site. The ESA towards the western section is the Leeuwberg River, while the smaller scattered ESAs throughout the site are pans (natural non-FEPA Wetlands). From a Terrestrial Biodiversity perspective, these aquatic features represent important ecosystem functions and processes in the landscape, as they create niche habitats for both flora and fauna species. The proposed development layout must be amended to avoid all CBA1 and ESA areas.

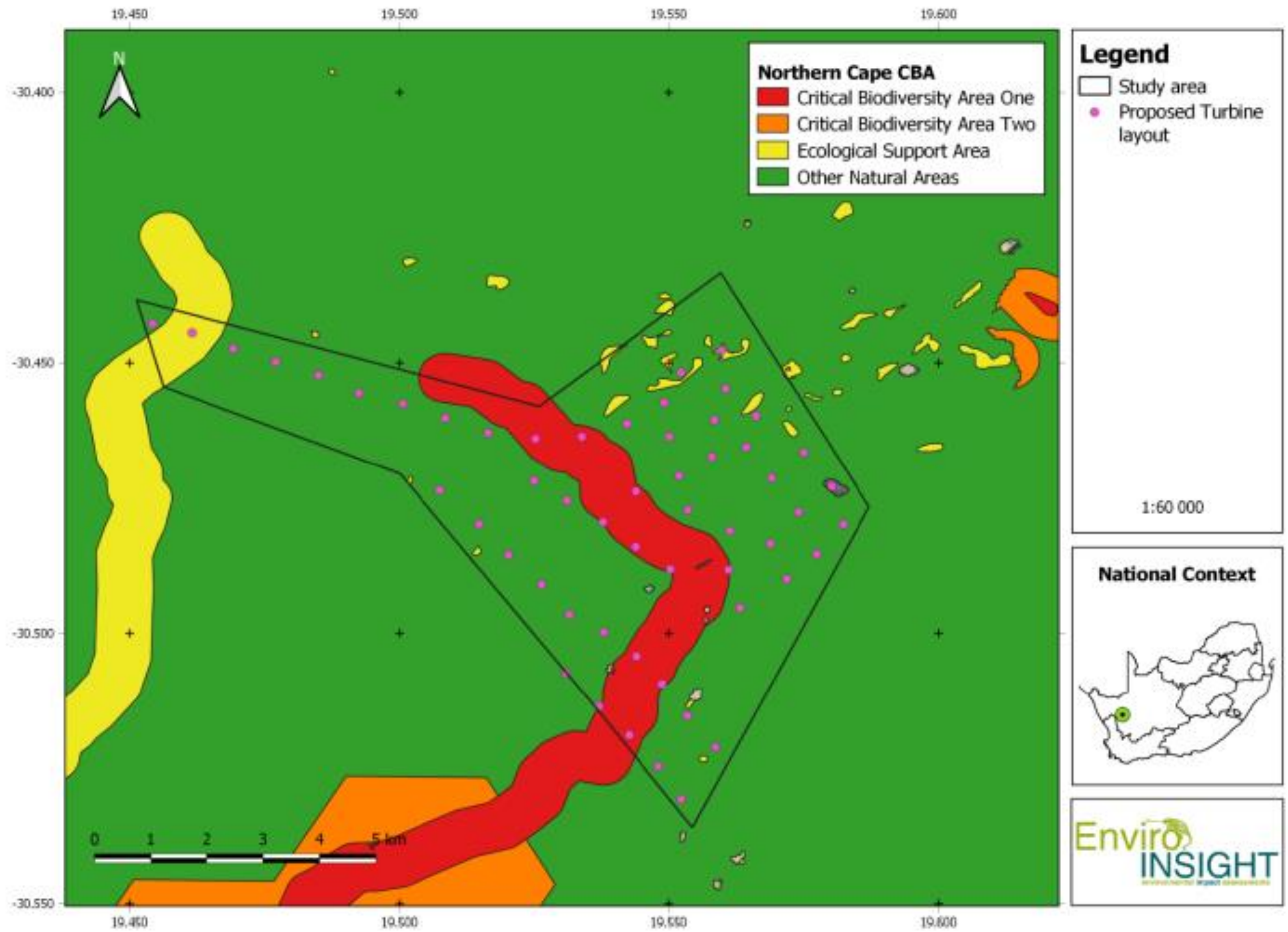


Figure 6-8: Regional vegetation types in relation to the study area (SANBI, 2018).

Ecology of the system

Ecological drivers and significant terrestrial landscape features

The study area is located in the E31C Quaternary catchment. Several important endorheic pans, wetlands clusters and rivers exist within this region which attracts several important bird species such as flamingos.

Changes in vegetation structure and composition are mainly driven by overgrazing and the introduction of alien invasive species such as *Prosopis* sp. Transformation in the Bushmanland Basin Shrubland is minimal and has increased mainly due to the construction of renewable energy facilities, both wind and solar.

National Freshwater Ecosystem Priority Areas (NFEPA), 2011

The largest section of the study area is located in a FEPA, with the Klein-Rooiberg FEPA river running through the study area, and a couple of FEPA wetlands classified as depressions, flats and seeps are located mainly in the northern section, bordering the Khobab WEF, and a few scattered throughout the site. A smaller section towards the south is classified as an Upstream

Management Area (areas in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas). The site consists of flat to gently undulating open plains dominated by low shrubs and arid tussock grasses. It is typical of southwestern Bushmanland and does contain some remarkable landscape features such as pans and large hills. Other landscape features include low ridges along the north-eastern boundary of the site, a low gravel hill in the centre of the site and some poorly developed drainage lines. The vegetation of the site is very homogenous and is dominated by shrub vegetation on gravelly soils.

Ecological functioning and processes

The watercourses in the region represent the most important ecological processes, and if not protected it could lead to reduced ecosystem services and increased negative impacts could result in a cascading effect. The vegetation unit is not considered threatened and there are limited sensitive features or important landscape features that, if disturbed or transformed, will result in a catastrophic collapse of the system.

The proposed Botterblom WEF does not represent a significant impact on the ecosystem processes and services, except for the main river courses and wetland pans located on the study area which needs to be excluded from construction activities

Ecological corridors and connectivity

An ecological corridor is a clearly defined geographical space that is governed and managed over the long-term to maintain or restore effective ecological connectivity.

The main watercourses / rivers act as corridors for the movement of fauna across the landscape. The proposed turbine layout will not impact on connectivity within the landscape, if the turbines and associated infrastructure is located outside main watercourses. Where roads and powerlines cross watercourses, the necessary mitigation measures need to be implemented to reduce fauna mortality, and not restrict movement of fauna.

Species, distribution, and important habitats

Plant diversity is generally low and the only areas with moderate levels of diversity are the ridges. Five main habitats were identified based on species composition and structure. The main driver of vegetation pattern in the area is substrate.

Gravel Shrubland / Nama Scrub

The Shrubland habitat is characterised by shrubs, forbs and succulent's characteristic of the Bushmanland Basin Shrubland, while tussock-grass-dominate areas on sandy soils. Overall diversity within this vegetation type at the site is considered medium, which can be ascribed to the aridity of the area and the poorly developed soils. Dominant species include *Aloe claviflora, Aptosimum indivisum, Drosanthemum schoenlandianum, Felicia clavipilosa, Gazania lichtensteinii, Leysera tenella, Lycium cinereum, Mesembryanthemum crystallinum, Oncosiphon grandiflorum, Oxalis furcillata, Plinthus karooicus, Pteronia incana,* *Pteronia sordida, Ruschia intricata, Salsola tuberculata, Thesium lineatum, Titanopsis calcarean, Tribulus zeyheri* and *Zygophyllum lichtensteinianum*. Protected species (for which a permit for removal will be required) include: *Aloidendron dichotomum, Hoodia gordonii, Pelargonium spp., Anacampseros spp.*

Watercourses

The drainage lines of the site are not very well developed and do not have a tall woody component. It is found along the small and narrow ephemeral drainage lines flowing in the landscape. Although the drainage lines are not well developed, which can be ascribed to aridity of the area, they are ecologically important because the higher cover and productivity of these areas is important for fauna forage and habitat availability and the also play an important hydrological role and regulate flow following occasional strong rainfall events. As such disturbance to these areas should be minimised as far as possible.

Dominant species recorded include *Augea capensis, Galenia sarcophylla, Melianthus comosus, Lessertia frutescens, Lycium pumilum, Osteospermum armatum, Parkinsonia africana, Prosopis glandulosa, Salsola aphylla, Salvia disermas, Sesamum capense, Stipagrostis namaquensis, Stipagrostis obtusa*.

Protected species (for which a permit for removal will be required) include: *Lessertia frutescens*.

Pans (Temporary)

The pans do not hold water regularly for extended periods and is only periodically filled with water after heavy rain. When filled with water it provides important ecosystem services which the fauna in the area relies on. Due to the nature of these pans and the important role they play in maintaining ecosystem services and functioning in the landscape, they are considered sensitive features which should be excluded from development. Dominant species include *Aptosimum indivisum, Gazania sp., Lycium pumilum, Prosopis glandulosa, Salsola aphylla, Salsola glabrescens, Sesamum capense, Stipagrostis namaquensis, Stipagrostis obtuse.*

Shrubby Grassland

Located imbedded in the shrubland are grassland patches which are dominated by grasses such as *Stipagrostis ciliate, S. brevifolia, S. anomala and Aristida adscenionis, shrubs including Lycium pumilum, Aptosimum spinescence, Plinthus karooicus, Salsola tuberculate, with occasional annuals such as Leysera tenella, Osteospermum pinnatum, and Limeum africanum*.

Sensitive Plant Species

Nationally Sensitive Plant Species

As per the screening reports, two sensitive species are likely to occur on the study area. Based on existing literature and surveys conducting, two more species of conservation concern were included in this assessment. One species listed as Rare, *Cephalophyllum fulleri* L.Bolus was indicated as being observed east of the proposed study area (exact location and distance unknown as limited information was provided in the specialist report; Todd 2018). This is, however, highly unlikely as this is a habitat specialist known from only three subpopulations close to Pofadder and Aggeneys, further north of the study area. Accordingly, this species was omitted for the current assessment.

Table 6-2: Expected and Observed list of Sensitive Plant Species for Botterblom WEF. Species highlighted in bold were recorded during this survey.

Species	National Status	Provincially Protected	Endemic to (1) South Africa or (2) Northern Cape	Observed or likely to occur within the study area
***Aloidendron dichotomum* (Masson) Klopper & Gideon.F.Sm.**	**Vulnerable A3ce**	**Yes**	**No**	**One individual observed within the study area, two individuals observed on neighbouring properties to the west.**
Dregeochloa calviniensis Conert	Rare		1 and 2	Low probability – was recorded approximately 52km SE of the study area
***Hoodia gordonii* (Masson) Sweet ex Decne.**	**Data Deficient - Insufficient Information**	**Yes**	**No**	**Observed within the study area and on neighbouring properties.**
Wahlenbergia divergens A.DC.	Data Deficient - Taxonomically Problematic		1 and 2	Unlikely – currently there is not enough information available for this species, but it is unlikely to be present on the study area. Based on historical records, this species was recorded approximately 19km south of the study area, within the Hantam Karoo vegetation type.

Aloidendron dichotomum (Masson) Klopper & Gideon.F.Sm. – Vulnerable A3ce

This species occurs from Nieuwoudtville east to Olifantsfontein and northwards to the Brandberg in Namibia, and is therefore not endemic to South Africa. It is known to occur on north-facing rocky slopes (particularly dolomite) in the south, and any slopes and sandy flats in the central and northern parts of its range. The main threats to this species include climate change, harvesting and trampling by livestock. Damage by baboons, scale insects and fungus has been observed, but none of these seem to cause mortality. Some social birds make large nest on the species, sometimes causing it to fall over due to the weight of the nests and its owners. Climate change models project a 36% decline in its range in 100 years, assuming dispersal into newly suitable areas. Patterns of modelled declines have been supported by field and repeat photo studies. However, no colonization of newly suitable areas has yet happened (Foden 2018). Without dispersal, the models predict a 73% decline in 100 years, qualifying the species as EN.

Only one individual was recorded within the PAOI which is not impacted on by the proposed layout. The species will be protected in situ.

Dregeochloa calviniensis Conert – Rare

This endemic species is known to occur in limestone outcrops in arid succulent karoo shrubland. It is a habitat specialist, occurring as localised subpopulations. It is a relatively unknown species from a poorly collected area. The type collection is from Handelskraal, ENE of Loeriesfontein. There are no known threats to the species. The species only flowers in October, thereby making identification out of season extremely difficult.

Hoodia gordonii (Masson) Sweet ex Decne

The species occurs in a wide variety of arid habitats from coastal to mountainous, also on gentle to steep shale ridges, found from dry, rocky places to sandy spots in riverbeds. It is a widespread species (EOO 850,000 km^2) but has undergone decline since 2001 as a result of indiscriminate harvesting for its appetite suppressant properties. International and national demand was particularly high between 2004 and 2006 and as a result of the high economic value of this species (price range between R500 and R1200 per kilogram at this time); even remote areas of its distribution range are suspected to have been harvested. Unfortunately, data do not exist to quantify the degree of decline to the population and as this species is widespread and can be locally common it is not possible to estimate overall population decline. Research on population recovery post harvesting and degree of impact of the harvesting over the past 10 years is required before this species can be accurately assessed. As a result of a decrease in demand for Hoodia internationally and the strict enforcement of new legislation to protect this species wild harvesting has declined in South Africa (Raimondo et al., 2008).

Within the study area, the species is not abundant, and less than five individuals have been recorded on site, with about another five individuals recorded in the surrounding area. Where the proposed development requires the removal or destruction of the species, the necessary permit for its relocation is required.

Provincially Protected Species

There are several provincially protected species under the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) that occur on the study area which require permits for their removal from the Provincial Department. Prior to construction activities, all individuals of these species that will be directly impacted on by the proposed development, needs to be enumerated and marked with a GPS. A permit application for their relocation needs to be submitted to the Northern Cape Department

Agriculture, Environmental Affairs, Rural Development and Land Reform and the necessary species needs to be removed or relocated prior to the commencement of construction activities.

Provincially protected species include:

Schedule 1 species:

- *Hoodia gordonii*
- *Aloidendron dichotomum*
- *Sutherlandia spp.*
- *Pelargonium spp.*

Schedule 2 species:

- All species within the Aizoaceae family, which includes *Ruschia, Mesembryanthemum crystallinum, Drosanthemum spp., Stomatium mustelinum*,
- All species within the Amaryllidaceae family, including *Boophone haemanthoides*
- All species within the Anacampserotaceae family, including *Anacampseros spp., Avonia spp*.
- All species within the Oxalidaceae family, including *Oxalis spp*.,
- All species within the Apocynaceae family, including *Larryleachia cactiformis, Microloma sagittatum, Tridentea jucunda*,
- All species within the Asphodelaceae family, including all *Aloe spp.* (except those listed in Schedule 1), *Gonialoe variegata.*

Impacts

Construction

- Habitat Loss and Fragmentation during construction phase.
- Loss of species of conservation concern.
- Alien and invasive plant species.
- Increased risk of erosion and flash floods.
- Disturbances or displacement impacts on fauna including traffic, noise and dust.

Operational

- Direct faunal impacts due to operation.
- Alien and invasive plant species

Decommissioning

When the wind farm reaches the end of its lifespan, all machinery and related installations must be dismantled and removed, and the site should, as far as is reasonably possible, be restored to its original condition. It is only if the developer decides to extend the life of the wind farm and repowering the site, that only the top section of the turbines (mainly the blades and operating mechanism) must be replaced. As decommissioning of large-scale wind farms in South Africa are new, the regulatory framework and impacts associated with this phase are based on assumptions. Perhaps the most important assumption is that decommissioning a wind farm is straight forward and simple, compared to the problems associated with decommissioning a nuclear power station, or a coal or gas fired plant. The major issue is not the physical removal but rather the disposal of the used parts. Where possible, all recyclable materials must be repurposed in an environmentally friendly way.

It is expected that the dismantling of turbines and associated infrastructure can lead to disturbance of fauna community, in all ways similar to that resulting from the construction phase. The dismantling of the project will eventually contribute to the removal of all the implemented structures; accordingly, this may be considered a positive impact.

Cumulative

- Vegetation and habitat loss,
- Increased habitat fragmentation,
- Loss of critical habitat for flora SCC as well as endemic species,
- Loss of provincially protected species which require a permit,
- Surface water impacts and associated ecological processes,
- Increased erosion due to flooding (not a yearly event but longer term),
- Increased alien flora and fauna species.

Mitigation

Construction

- Placement of turbines within the High Sensitivity areas and drainage lines should be avoided.
- Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.
- Minimise the development footprint as far as possible.
- Rehabilitate disturbed areas that are no longer required by the operational phase of the development. Inadequate rehabilitation could result in limited revegetation and/or an invasion of alien vegetation which will result in long term ecological degradation and damage.
- A Rehabilitation Management Plan must be developed and implemented during the construction phase as construction is complete at each site.
- 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. Where possible, existing roads must be used to avoid additional habitat loss and fragmentation.

- Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However, caution should be exercised to avoid using material that might entangle fauna.
- An Environmental Control Officer (ECO) must be employed to monitor the clearing of vegetation for the construction of roads and hardstands.
- A comprehensive Plant Search and Rescue must be undertaken by a suitably qualified botanical specialist prior to vegetation clearance.
- All relevant plant permits must be obtained from the provincial authority prior to the removal or relocation of SCC, including provincially protected species.
- Plant SCC (excluding A. *dichotomum* which must be protected in situ) found within the proposed site must either be housed in an onsite nursery for use during rehabilitation or be relocated to suitable areas where vegetation clearance will not occur.
- Demarcate sensitive species with the appropriate buffers which must be excluded from development activities. A 200m buffer must be applied to *A. dichotomum*.
- A site-specific Alien Invasive Species (AIS) Management Plan must be implemented during the construction phase and continued monitoring and eradication needs to take place throughout the life of the project.
- Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site.
- The development footprints and immediate surroundings should be monitored for the growth/regrowth of alien vegetation throughout the construction and operation phases of the project.
- Soil erosion and Rehabilitation Plan to be part of the EMPr.
- The clearance of vegetation, at any given time, must be kept to a minimum to reduce the possibility of soil erosion.
- Rehabilitation of eroded areas on a regular basis during the construction period.
- 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.
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.
- Ground clearing and the digging of trenches should ideally take place at the end of the dry season, prior to the first rains in order to minimise the impacts of dust.
- Newly cleared and exposed areas must be managed for dust and landscaped with indigenous vegetation to avoid soil erosion. Where necessary, temporary stabilisation measures must be used until vegetation establishes.
- Speed restrictions (40 km per hour is recommended) should be in place to reduce the amount of dust caused by vehicle movement along the roads, and to reduce possible fauna fatalities with vehicle collisions.

- Driving around in the area as well as noise levels at night should be limited, as should the use of harsh lights which could cause light pollution for nocturnal species.
- Where appropriate, sound dampeners must be used.
- Avoid the presence of people and vehicles in highly sensitive areas as far as possible.
- Fences should be constructed in such a way so that burrowing animals can still gain access.
- Strict measures should be put into place to prevent workers from poaching and hunting naturally occurring fauna.

Operational

- Reduce the presence of human activity on the project area as far as possible by only focusing on the areas where operational tasks are required,
- Avoid the presence of people and vehicles in highly sensitive areas as far as possible,
- No unauthorised persons should be allowed onto the site,
- Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location,
- Lower the levels of noise whenever possible and avoid the destruction or disturbance of identified important features,
- The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except by individuals with the appropriate permits,
- 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 the nature of the spill,
- Fences should be constructed in such a way so that burrowing animals can still gain access, which will allow other animals to also utilise the holes dug under fences to increase connectivity in the area.
- The site-specific AIS Management Plan must be implemented for the first year of the operational phase. Thereafter, alien vegetation must continue to be monitored and eradicated annually throughout the life of the project.
- 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 and are likely to increase rapidly if not controlled.
- 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.
- Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site.

Decommissioning

The ecological impacts associated with the decommissioning phase will be similar to those listed in the construction phase and the associated mitigations measures must be updated and implemented to reduce potential adverse impacts.

Conclusion

The study area is located within Bushmanland Basin Shrubland vegetation type, listed as Least Threatened, and intersects a CBA2 and ESA according to the Northern Cape CBA Map. This is mainly due to Freshwater ecosystem priority area quinary catchments, main rivers and FEPA Rivers and wetlands. These habitats should be avoided as far as possible and the appropriate mitigation measures should be in place to reduce impacts to acceptable levels.

The majority of the Botterblom WEF consist of shrubland with grassland patches on flat plains and gently sloping hills that are not considered sensitive. The watercourses and pans are considered sensitive and should be avoided during the construction period for placement of turbines, laydown areas and associated infrastructure. Roads and cables will cross watercourses, and the impacts can be mitigated by reducing it to acceptable levels since avoidance is not possible.

Large sections of the affected area are not considered sensitive and there are no specific features of the affected area which would indicate that it is of broad-scale significance for faunal movement or landscape connectivity. One individual of a sensitive species was recorded on site which should be protected in situ as it can be avoided by the proposed development. A 200m buffer has been placed around its location. For other provincially listed species which are affected by the proposed development, a permit application for their removal must be applied for with the provincial authority prior to the commencement of construction activities.

Several wind energy developments has and are being developed around the Helios Substation, the intensity of development in the wider area is still low. The affected area is not considered sensitive and there are no specific features of the affected area which would indicate that it is of broad-scale significance for faunal movement or landscape connectivity. Although there are two existing wind farms and several more applications in the area, the total extent of habitat loss due to wind energy is currently less than 200ha and with all applications would still be less than 1000ha and this is not considered significant in context of the affected vegetation types, which are among the more extensive in the country.

6.7 AVIFAUNA

An Avifaunal Preconstruction Monitoring Assessment was conducted by Enviro-Insight. Please refer to Appendix D2 for the report.

- **Preconstruction Bird monitoring Survey**

The field surveys were arranged so that the study area and control sites were surveyed for a total of 12 months and completed in September 2021. This complies with the requirements of the Best Practice Guidelines available at the time (Jenkins et al. 2015). The preconstruction monitoring programme has included a total of four visits to the site, covering the study area through a twelve-month period that included the spring, summer, autumn and winter seasons of the (non-calendar) year. The first survey conducted in September 2020 (Spring) was part of the scoping phase and limited methods were applied, i.e., only walk transect (WT) and drive transects (DT) were conducted to establish these sites, in addition to two vantage point (VP) were conducted for a limited time to capture initial data for planning purposes. All subsequent survey dates are summarised in the table below:

Table 6-3: Avifauna monitoring sampling period for Botterblom WEF and Control Site.

Date	Season	Methodology applied*
2-5 September 2020	Spring	VP, WT, DT – scoping phase
8-10 December 2020	Summer	VP, WT, DT
13 - 17 May 2021	Autumn	VP, WT, DT, NE, WB
9 - 14 July 2021	Winter	VP, WT, DT, NE, WB
31 August - 4 September 2021	Spring	VP, WT, DT, NE, WB

*** VP – Vantage points; WT – Walked transects; DT – Drive transects; NE – Nest searches, inspection and monitoring; WB – Water body inspections.**

Vantage Points

Four vantage points (VPs) within the project study area were identified based on the preliminary desktop and scoping survey in the Botterblom WEF, and one identified at the control area, to record the flight altitude and patterns of priority species (totaling five VPs). Each location was surveyed for a minimum of 12 hours of observation per season divided through the early morning, midday and late afternoon times of day (Jenkins et al. 2015).

Walked Transects

Four linear transects ranging from 1.4 km to 3.3 km in length, three located in the Botterblom WEF and one within the control area, were walked in order to characterize the passerine and small bird communities. Birds were only recorded (seen or heard) within a fixed maximum width of between 150 to 200 m on either side if the transect line. The same transects were repeated in every season. Surveys started after sunrise and were performed throughout the day to account for temporal variation in bird activity.

Driven Transects

Three drive transects were identified in the Botterblom WEF and one drive transect in the control area with a combined total length of 22 km. One observer travelling slowly in a vehicle recorded all species on both sides of the drive transect. The observer stopped at regular intervals (every 100 to 300 m) to scan the environment with binoculars.

Wetlands

Prior to the initiation of the preconstruction monitoring campaign, the main water bodies (including wetlands) present within the study area were identified using 1:50 000 topographic maps and aerial photos. Several significant water bodies were identified on and surrounding the study area. These identified and mapped water bodies were surveyed to determine their level of utilisation by water birds. Due to seasonality, the birds were only be surveyed during periods with some prevailing inundation or rainfall. Some drainage lines within the greater PAOI were inundated during the 2020 spring surveys and were observed accordingly.

Specialist Nest Survey

Any habitats within the PAOI of the proposed WEF, or equivalent habitats around the study area, deemed likely to support nest sites of key raptor and other species of conservation concern, including power lines, stands of large trees, marshes and drainage lines, were surveyed. All potential breeding sites, once identified fully, were mapped, and checked during each survey to confirm occupancy, and all evidence of breeding and the outcomes of such activity, where possible, recorded.

Incidental Observations of Priority Species

All other sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) on the WEF and control site as well as within the broader study area were recorded, along with additional relevant information such as habitat type, abundance, habits and weather data. These observations were used as complementary data to characterise the bird community and its utilisation of the site, as recommended by the Best Practice Guidelines.

Species Collision Risk and Bird Passage Rate

For pre-construction surveys of this nature, Collision Risks are usually calculated, however, and for the survey area, this was not possible due to the extreme variations in undulations at the vantage points, not allowing for standardised measurements of duration. Therefore, collision risk was calculated based on a measurement of the three assumed variations of crude passage rates as described by Smallie and Strugnell (2020), primarily focusing on passage rate, flight height and total surface area of turbines.

- **Results**

The Botterblom WEF is not located in or directly adjacent to an Important Bird Area (IBA) or protected area. The closest IBA to the Botterblom WEF is Bitterputs Conservation Area which is approximately 72 km north-west of the study area.

Description of Major Bird Habitats

The primary avifaunal habitats are described below. It is apparent throughout the study area that most of the habitats are generic in their ability to support general avifaunal species and Red-Listed / SCC with little differentiation. However, unique geological (such as red dunes) geographical or topographical features exist which may cause the areas these areas to be buffered from proposed development. Due to the high diversity and density of the above mentioned Red-Listed species recorded during the survey, (including regionally and globally listed Endangered and Vulnerable birds), the PAOI as a whole is considered to be an area of avifaunal importance and the EIA will be strongly associated with Guidelines at a policy level, prioritising avoidance mitigation and the monitoring of avifaunal SCC.

Watercourses and Drainage Lines

Avifaunal assemblages differed depending on the classification of the drainage line system as well as the season. Most of the drainage line systems are seasonally ephemeral or dry. Thus, most of the bird associations are linked to the prevailing vegetation and soil types within the delineated drainage line habitats. In summary, drainage lines with taller shrub and tree layers showed a much higher diversity of passerine species as well as sand-associates and ground-dwelling birds such as coursers and thick-knees. Species of conservation concern such as Red Lark and Sclater's lark were observed in varying densities.

The seasonal drainage lines and accompanying riparian trees are linear dispersal corridors for terrestrial bird species. Much higher species diversity (as well as a unique composition) was observed in this habitat and therefore, these systems are classified to be of high avifaunal importance. The drainage lines act as important flight corridors for passerines and raptors between foraging and roosting sites.

Nama Grassland

The open grassed karoo habitats show a reduced structural complexity and vegetation which provides for a more generic species diversity albeit often higher densities of avifauna. The habitat contains features similar to the Nama Scrub, namely open karoo habitats (including old, cultivated lands and some grassland areas) that provide suitable foraging habitat for Ludwig's Bustard (Neotis ludwigii), Kori Bustard (Ardeotis kori) and Secretary bird (Sagittarius serpentarius). However, the habitat is characterised by a much-reduced rocky substrate and a higher prevalence of grassed red sand infusions which provides optimal habitat for Red Larks.

Nama Scrub/ Succulent Scrub

The stony and rocky ridges (ridges found more within the PAOI and not prevalent on the study area) act as prominent landmarks and foraging habitat for diurnal birds of prey. It also provides potential hunting habitat for all SCC eagles which hunts rock hyrax (common in these habitats) and rock rabbits as a staple of their dietary requirements. The localised high population densities of small mammals such as rock rabbits within the PAOI as well as the regional linkage to the koppie habitats, elevates the importance of this habitat for avifauna. The rocky habitats provide structural complexity not available in the open karoo vegetation which provides for an increase in species diversity and often higher densities of avifauna due to the prey species that are found in this habitats;. Boulder and/ or rocky habitats intersperse much of the Nama Scrub and provide suitable foraging habitat for the Ludwig's Bustard (Neotis ludwigii), Kori Bustard (Ardeotis kori) and Secretary bird (Sagittarius serpentarius).

Transformed areas

Low density permanent structures, including bridges, railway tracks, gravel roads, homesteads consisting of houses, and kraals are present. These locations may be important for several bird species which use them for roosting and/or nesting, such as owls and swallows as well as valuable roosting and nesting habits for a wide spectrum of species ranging from the synanthropic (Pied Crows) to the Red-Listed (Martial Eagles).

Observations confirmed that a high density of birds, mainly raptors, can frequently be found associated with road infrastructure, possibly due to the prevalence of perching locations, such as electric or telephone lines running alongside available roads, or due to road kills (attracting scavenging species). However, species such as Ludwig's bustard would fly directly above large linear structures such as train tracks, presumably for the purpose of navigation. Finally, homestead and livestock related transformed areas act as attractants for both synanthropic and some Red-Listed species that seek water or food.

Observed and Expected Avifauna

The study area supports a relatively low diversity and abundance of avifauna, which is to be expected in an arid area like Loeriesfontein. A total of 92 species have been observed to date. This low diversity is predominantly due to a number of factors including:

- High regional aridity which reduces the overall species diversity;
- Somewhat generic habitat types (albeit with some highly sensitive habitat such as red sands and temporary pans within the PAOI).
- Climate change which is characterised by lower rainfall and increased temperatures.
- A lack of standing water.
- An incomplete survey period (one year, still to be completed) which omits migrant species and seasonal water associates.
- Sub-optimal climate conditions experienced during the survey.

It must be noted that stochastic high rainfall events and other atypical prevailing influences (persistent cold) may influence the local avifaunal assemblages.

Priority species list

A total of 24 priority species are expected to occur on and surrounding the study area, of which 14 have been recorded within the study area to date during this study. Lappet-faced Vulture is included given the sighting of two individuals within the greater PAOI although the species is supposedly a highly uncommon vagrant within the region. However, evidence is growing that the species is undergoing a significant range expansion as a result of climate change.

The recorded mortality incidence due to priority species colliding with turbines from the adjacent Khobab WEF over 2 years is considered to be of low concern due to a very small number (four) of threatened and identified priority species being killed (Chris van Rooyen Consulting, 2020). The four priority species mortalities were one incidence each of the Near Threatened Karoo Korhaan and priority species Spotted Eagle Owl with two Greater Kestrel mortalities. This was deemed not to be ecologically significant. However, and as with all proposed WEF developments, it is vital to consider the context within which these species are observed in the current study, as congregatory behaviour, nesting behaviour and foraging behaviour may differ from that at the adjacent existing WEF facility. Indeed, Van Rooyen (2020) suggests that displacement effects of the WEF are more significant than direct mortality which can greatly affect habitat specific species such as Red Lark and Ludwig's Bustard.

According to the literature, 15 Red-Listed species are known to occur in the region with nine species confirmed during the completed surveys, representing a very high success rate given the short study period (and considering the absence of migrants). Of the expected species and according to Taylor et al. (2015), two of the species are Endangered, seven of the species are Vulnerable species and four are Near-Threatened. For the current study, it was deemed unnecessary that all SCC should be discussed in greater detail until all the four monitoring seasons have been completed. Specifically excluded from initial discussions was Lappet-faced Vulture (rare vagrant). Therefore, the selected relevant species that are possibly susceptible to the proposed development will be discussed in greater detail during the EIA phase, which will include specific (Guideline-based) recommendations for monitoring and mitigation.

Preconstruction Monitoring main results

- *Walked and Driven Transects*

During the walked transects, the total number of individual birds (per species) were recorded regardless of if they are listed as priority or not. Notable Priority Species recorded during walked transects included Ludwig's Bustards that were often flushed from foraging positions as well as Northern Black Korhaans and Karoo Korhaans. The main focus of drive transects were the recording of large birds and raptors. Raptors and korhaans and Red Lark were the most frequently recorded priority species. On some sample days, the observers returned at night and priority species were recorded (such as owls, coursers and thick knees). For walked transects, a total of 685 individual bird contacts were recorded of which 54 contacts and seven species are priority. For driven transects, a total of 573 individual bird contacts were recorded of which 44 contacts and seven species are priority.

The overall (priority and non-priority) IKA is 41,9 which is a significantly higher risk value. However, a wholly insignificant fraction of all observations occurred at rotor sweep height which thus shows a strong data set (based on s=density of observations) interpreted as a low risk of significant collision mortality

- *Vantage Points*

The Vantage Point data collection appeared to provide the richest avifaunal observations. Priority species recorded during VP surveys were divided into three flight height categories (Low 0 to 50 m, Medium 50 to 150 m and High with all observations of birds flying more than 150 m). A total of 180 hours of bird flight observation were completed at the 5 Vantage Points on site during the year. Eleven (11) priority species were recorded during VP watches in the WEF.

Due to its abundance and conservation status, the Ludwig's Bustard is a priority species of concern since it may be prone to collision at certain times (e.g. when commuting between roosting and feeding sites, following rainfall events, invertebrate outbreaks (locusts) or commuting after farming activities which increase food availability). The species has been observed flying at rotor height multiple times during very brief survey periods. In the remaining observations, Ludwig's Bustards were mostly observed close to drainage lines, adjacent to roadsides, in adjacent livestock fields and flying above linear structures such as the large railway line that bisects the PAOI. On multiple occasions, the observers' presence flushed some birds (presumably breeding pairs and/ or breeding pairs with a juvenile). Flights were most often generally very low (less than 50 m height) and short distanced although twice, individuals would take flight and leave the vicinity (+/- 2 km).

- *Focal Sites*

The drainage line system outside the western boundary of the project study area contained a relatively high density (and higher diversity) of passerines, including Sclater's Lark. However, this species was not directly associated with the project development footprint but was associated with the PAOI and a static bat recorder point. The existing power lines were also surveyed, and the only noticeable species of concern are the two recorded Martial Eagle pairs, chicks and nests

- *Nest Survey*

Nest sites were searched for during the surveys which included windmills, trees, pylons, bridges and masts, representing most potential roost and nesting sites for raptors. Water bodies were potential roost and nesting sites for multiple species but the high degree of seasonality and highly arid conditions was prohibitive to being representative of optimal breeding habitat for water associates. The most significant breeding habitat recorded during the survey were the two active Martial Eagle nests, where breeding and foraging activity has been noted and strongly drive both the site development plan layout and the recommended mitigation measures. Ludwig's Bustard is considered a resident and to be breeding on site although no nests have been located.

- *Site Sensitivity*

Each demarcated sensitive feature was evaluated for the degree of sensitivity based on the complete 12-month data set. There is an important presence of a number of SCC in the study area, recorded regularly and widespread through the proposed WEF area. In addition, there are several raptors utilising the PAOI, some of them priority species and/or of conservation concern, such as the Martial Eagle, Lanner Falcon, Pale-chanting Goshawk and Black-winged Kite. Areas of drainage lines and natural vegetation which are vital to maintaining populations of habitat obligate sensitive species (such as Sclaters' Lark and Red Lark) are deemed to have some probability of collision consistently throughout the year. Furthermore, natural drainage line vegetation represents an important habitat to maintain natural geohydrological processes of the PAOI. A 50 m buffer around these areas must be considered NO-GO where no turbines and associated infrastructure may be located. A 200 m buffer is also applied around seasonally inundated watercourses in the PAOI, as these features attract birds under certain conditions and could be the only locations were certain sensitive species such as the ducks, herons, storks and water birds are likely to occur. These areas must be avoided by the developer where no turbines and associated infrastructure may be located. Several of the proposed turbine positions and associated infrastructure coincide with areas currently demarcated as sensitive features within the prescribed buffers and consequently were subjected to the mitigation hierarchy, including mitigation measures and avoidance. The layout needs to be carefully re-evaluated in order to mitigate against negative interaction with priority species such as Red Lark and Martial Eagle.

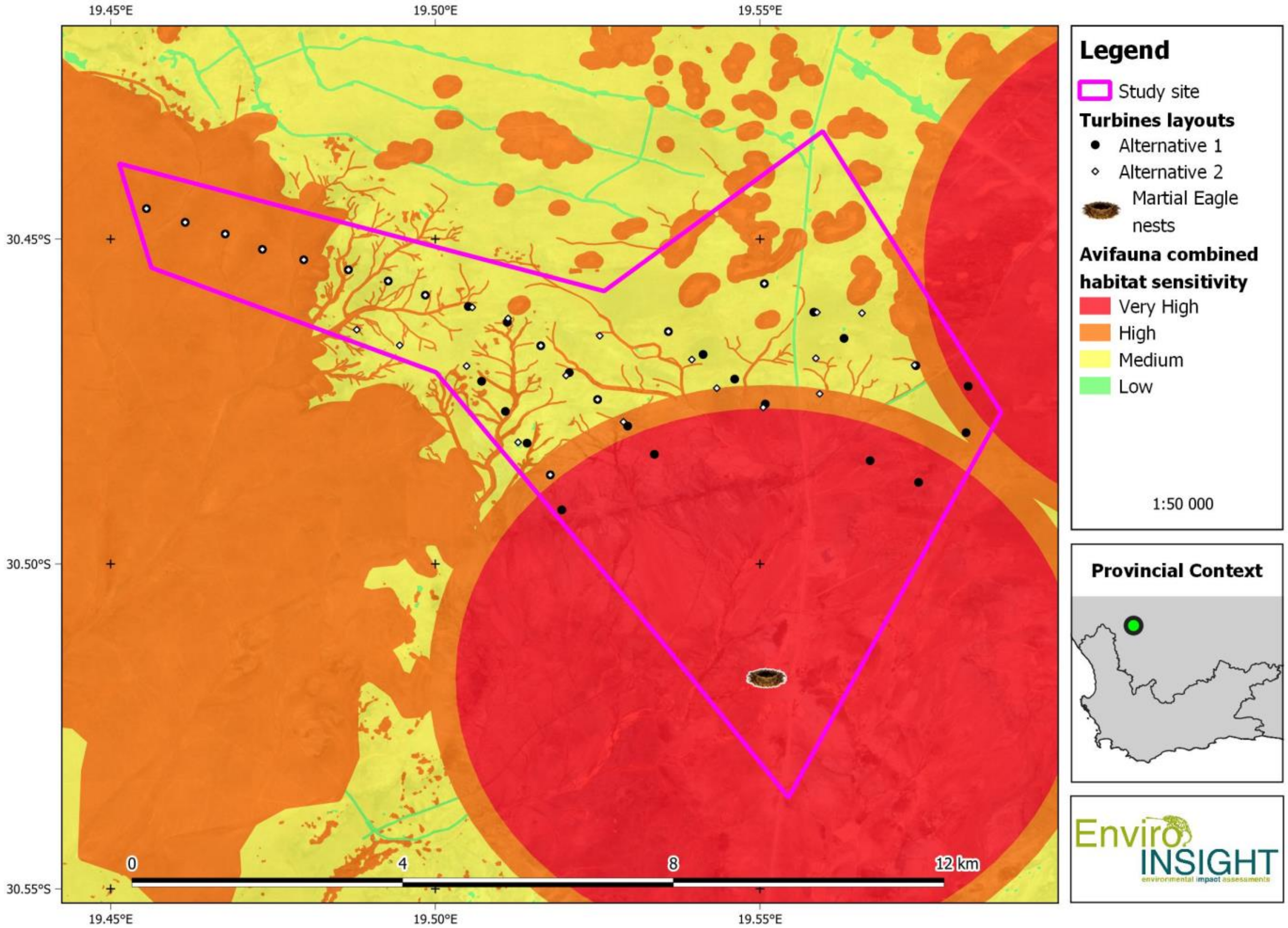


Figure 6-9: Overall avifauna sensitivity and associated buffers.

Martial Eagle Nest Site

Utilising the interpretations stipulated above and in the absence of any mitigation measures, a preliminary buffer of 5 km is recommended as an exclusion area around the two active Martial Eagle nests, which were confirmed after the completion of the 12-month pre-construction monitoring. The only published recommended buffer to implement around raptor nests in South Africa is for the Verreauxs' Eagle (Ralston-Paton, 2017), which dictates that a precautionary buffer of 3 km is recommended and may be reduced or increased based on the results of rigorous avifaunal surveys, but nest buffers should never be less than 1.5 km. This buffer is deemed inadequate for Martial Eagles, therefore a 5km buffer is recommended.

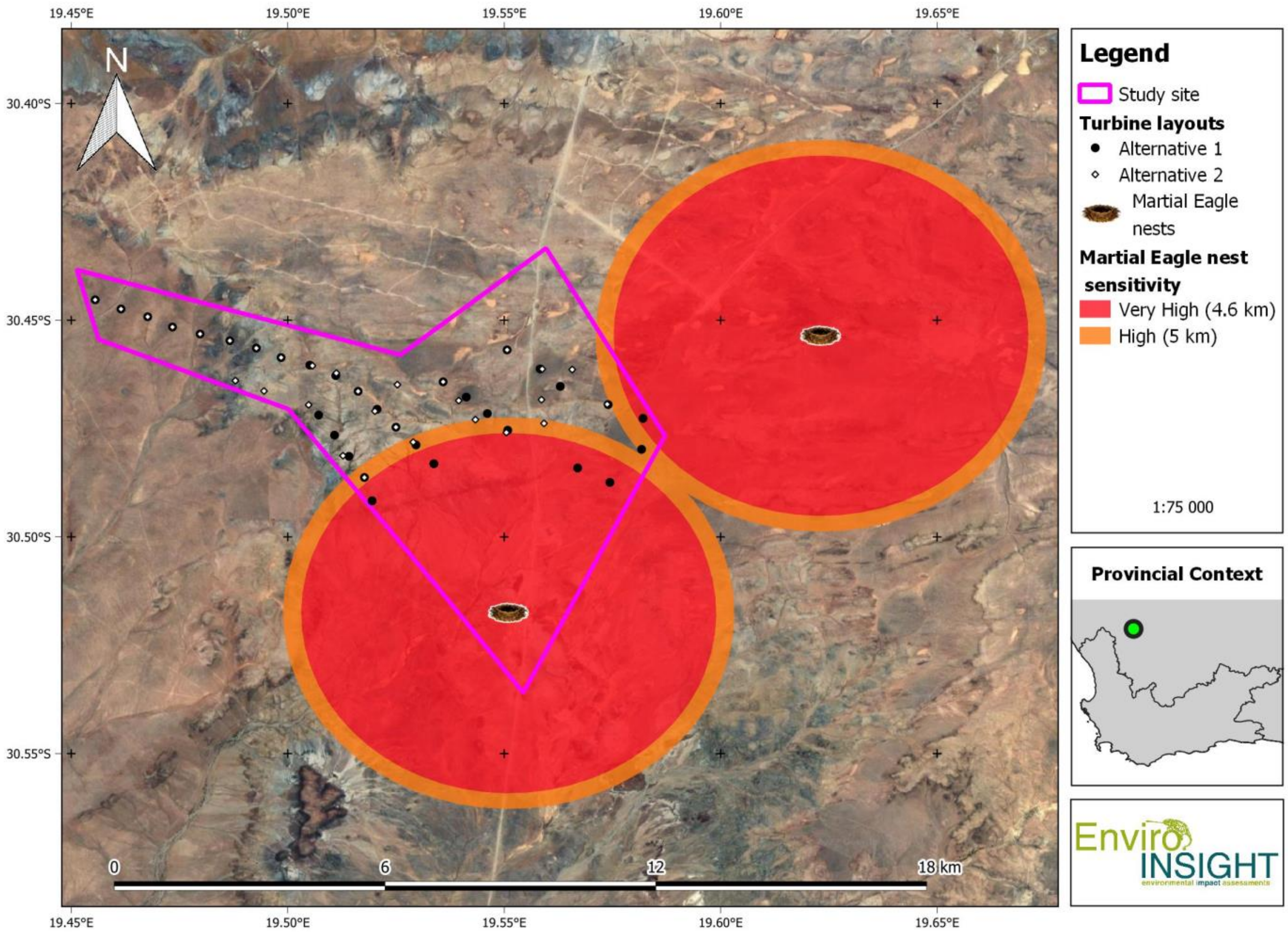


Figure 6-10: Martial Eagle Nest Buffers

- **<u>Impacts</u>**

Construction:

- Habitat destruction
- The destruction or disturbance of bird roosts

Operation:

- Bird mortalities
- Disruption of bird migratory pathways

Cumulative:

- Habitat loss: The destruction of highly sensitive habitat (for example sandy substrates for Red Lark) will greatly increase.
- Road-kills: Many birds are commonly killed on roads, especially nocturnal species such as Spotted Eagle-Owl.

- Regional saturation of turbines: This has implications for several priority species, both in terms of collision mortality for some species, especially Bustards and Raptors, and displacement due to transformation of habitats
- Powerlines: Numerous existing and new power lines are significant threats to large terrestrial priority species in the region as powerlines may kill significant numbers of all large terrestrial bird species.

- **Mitigation**

Construction

- Habitat destruction: access roads and turbine or infrastructure construction may necessitate the removal of foraging habitat, breeding habitat, roosting habitat and sensitive avifauna features, such as migratory routes. Apply necessary buffers for roost sites and other sensitive bird habitat features, avoiding the construction of turbines and access roads in these areas. Roads must utilise or upgrade existing farm roads as far as possible.

Operation

- Avifaunal mortality: physical bird collisions by spinning blades of the turbines during the operational phase. Avoid placement of turbines near sensitive bird breeding and roosting habitats. The application of adaptive mitigation measures (e.g., shutdown on demand retrofitting), according to post-construction monitoring results (counted strikes of threatened species) must be informed by environmental correlates of avifaunal activity and/or strikes.
- Flight/migratory paths: Turbines placed along flight pathways used for migration can cause a large number of mortalities on birds moving through the area during times of seasonal migration to winter / summer roosts as well as short-term daily migrations between preferred habitats.

General

- Formal post construction monitoring must be resumed once the turbines have been activated, as per the most recent edition of the best practice guidelines (Jenkins et al. 2015). The exact scope and nature of the post-construction monitoring will be informed on an ongoing basis by the result of the monitoring through a process of an establishment of available new technology and adaptive management. The purpose of this would be to establish if and to what extent displacement of priority species has occurred through the altering of flight patterns post-construction, and to search for and identify carcasses at turbines (mortality).
- High value target species such as Martial Eagle should be tracked using telemetry systems in order to more accurately monitor movement patterns, especially in conjunction with turbines. These programs should be implemented during and post construction.
- Post-construction monitoring should be undertaken annually. The exact scope, nature and frequency of the post-construction monitoring will be informed on an ongoing basis by the results of the monitoring through a process of adaptive management.

- If turbines are to be lit at night, lighting should be kept to a minimum and should preferably not be white light. Flashing strobe lights should be used where possible (provided this complies with Civil Aviation Authority regulations).
- Lighting of the wind farm (for example security lights) should be kept to a minimum. Lights should be directed downwards (provided this complies with Civil Aviation Authority regulations).

Species Specific Mitigations

Martial Eagle and other Raptors

- Human Monitors: General raptor monitors should be employed to monitor general movements and behaviours of target species, which may serve to both ensure local job creation as well as supplement the radar-based, shutdown on demand mitigation measures. Permanent observers can be assigned to both the nest sites as well as the affected WEF areas.
- Nest Buffering and Potential Removal: Removal of nest are not recommended however a 5km buffer is preferred
- Shutdown on Demand: Implementation of automated radar monitoring be implemented during the operation phase of the project is recommended.

Ludwig's Bustard (*Neotis ludwigii*)

- Buffering: as per the avifaunal sensitivity delineation
- Shutdown on Demand: Implementation of automated radar monitoring be implemented during the operation phase of the project is recommended.

Red Lark (*Calendulauda burra*): Avoidance based mitigation is the primary mitigation measure and must be based upon the aforementioned delineated sensitivity.

- **Conclusion**

The study area is located in a region dominated by natural karoo vegetation types with some transformed/ agricultural. Several drainage lines and small dams can be found scattered across the study area with most being mostly dry with some seasonal flow. Fourteen priority species were recorded during the initial surveys, including Martial Eagle, Ludwig's Bustard, Lanner Falcon, Red Lark and Black-winged Kite. Of these, the Ludwig's Bustard was the most concerning large bird species and was observed flying within the rotor sweep area. The high densities of other Bustard species (occasionally flying at rotor height) also represent a concern.

One current concern regarding the bird community observed is the presence of potential collision sensitive raptors species, of which one of them is considered a species of conservation concern, namely the Martial Eagle. Currently, this species has been observed at heights of >50 m, and therefore in the absence of additional data, the exact significance cannot be established with 100% certainty. In addition, it is perhaps noteworthy that in four years of monitoring no observed mortalities of this species was recorded at the adjacent Khobab WEF. However, the presence of two active nests within the PAI and proposed Botterblom WEF is of concern and requires intensive attention to mitigation measures and development footprint placement (avoidance).

The occurrence of several passerine species that might potentially be affected by collision was confirmed, namely endemic and/or range-restricted larks (Red Lark and Sclater's Lark representing the highest profile and frequently observed) which are widespread species in the area. These species are considered to have a "Vulnerable and Near threatened" conservation status respectively. As habitat obligates, the potential impact on these passerines may be mitigated via avoidance. The specialist has no reason why an Environmental Authorisation (EA) should not be granted on the following conditions;

- All recommended buffering be strictly adhered to.
- Shutdown on demand must be implemented if 5 km nest buffers are to be breached.
- All recommended mitigation measures be applied preconstruction, post construction and operations.
- The EMPr be updated every three years in order to revaluate the advances in AI, radar and camera technology.
- Currently available Deterrent and Shutdown on demand technology is to be immediately applied to the identified turbines in the form of Artificial Intelligence Camera systems.

6.8 BATS

A Pre-construction Bat Monitoring Assessment was complied for the site by Enviro-Insight. Please refer to Appendix D3

- **Affected Environment**

The project area is located in the Nama Karoo Biome and is characterized by Bushmanland Basin shrubland. Based on the ecoregions delineated by Dinerstein et al. (2017), the entire project area is located in the Gariep Karoo ecoregion, analogous to the Nama Karoo Shrublands ecoregion discussed in MacEwan et al. (2020). Despite the more recent and updated nature of the ecoregions delineation provided by Dinerstein et al. (2017), the South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities (SABPG) (MacEwan et al., 2020) preferentially use the ecoregions delineation of Olson et al. (2001), which indicates that a small portion in the southern part of the project area falls within the Succulent Karoo ecoregion. Given that there is no obvious difference in the recently delineated regional vegetation map and observations in the field also failed to detect any obvious vegetation differences in this southern portion. It was decided to preferentially apply the more recent and updated ecoregion delineation from Dinerstein et al. (2017) for this project area and therefore assess bat fatality risk for the whole project area according to the Nama Karoo ecoregion thresholds.

- **Field surveys**

Field surveys were conducted using the following methods: Site visits, Walkover survey, Passive song meters, Active transects and evaluation of Bat roosts

<u>Site visits</u>

Several site visits have been completed to date spanning a full year encompassing all seasons. The data from the autumn and winter surveys will be included in the EIA report after the full12 month pre-construction monitoring has taken place.

Table 6-4: Summary of site visits and work conducted

Season and Dates	Methods	Weather and veld conditions	Comments
Spring: 1-5 September 2020	Scoping Phase	End of winter rain – vegetation sparse and plants starting to wilt.	The static bat detectors were deployed.
Early summer: 10-14 November 2020	Walk, Drive	Dry and hot conditions. Vegetation minimal, bare landscape.	Transect were walked and driven
Summer: 9-11 December 2020	Bat roosts	Dry and hot conditions. Vegetation minimal, bare landscape.	Roost inspections
Late summer: 15-17 March 2021	Bat roosts	After good rains. Green vegetation with grass cover. Pans filled with water.	Roost inspections
Autumn: 24-28 April 2021	Bat roosts, drive transects	Green vegetation still present in places. Pans dry.	Roost inspections and drive transects
Winter: 14-22 July 2021	Bat roosts, drive transects	Cold, windy and rainy conditions, vegetation present and flowers beginning to bloom	Roost inspections and drive transects
Spring: 6-11 September 2021	Bat roosts, drive transects	Mild temperatures, vegetation sparse and plants starting to wilt	Roost inspections and drive transects

<u>Walkover survey</u>

A survey was performed by walking and driving across the project area as a ground truthing exercise to identify suitable areas for placement of bat detectors, identify potential roosting sites and sensitive areas and evaluate the level of monitoring that is required. This was performed prior to the deployment of the bat detectors.

<u>Passive song meters</u>

Twelve months of pre-Construction Monitoring are required for > 20 MW WEFs both inside and outside of REDZ. As Botterblom WEF exceeds 20 MW, bat detectors were deployed for the full 12 months. Nightly recordings of bats from dusk to dawn were captured using the Wildlife Acoustics Song Meter SM4BAT FS Ultrasonic Recorders (hereafter referred to as "bat detectors"). A total of five bat detectors were deployed throughout the project area, spatially arranged to cover all major habitat types and/or important bat habitat features. As per the SABPG (MacEwan et al., 2020), one bat detector must be deployed at a height of 7 - 10 m per 5 000 ha or for every significant biotope on the project area of influence (AOI) and one detector must be deployed at a height of 50 – 80 m per 10 000 ha for mast that are 80 m tall. Four bat detectors were deployed at 7 m above ground level, whereas one was deployed at 50 m. An additional recorder was placed at 100 m, but only started recording in March 2021. All devices were scheduled to record from 30 min before sunset to 30 min after sunrise at the location of the bat detector. During this time, the device is 'armed' and will begin a recording if a 'trigger' is detected. A trigger is defined as a sound within the set frequency range (Default: >16 kHz) amplitude (Default: 12 dB) for a minimum duration (Default: 1.5 ms). The recording then continues for the duration of the Trigger Window (Default: 3 second) after the last Trigger, and then saves the recorded data. If there are constant Triggers, the recording will save and close after the maximum length of a recording file (Default: 00m:15s). The batteries for the bat detectors were exchanged approximately every month and at this time all data were copied from the SD cards and backed up.

Active transects

Transects were driven for a minimum of two nights per season across the project AOI and some additional transects were walked to assess habitats away from the road. The transect duration each night did not always consist of a 2.5 hour period but the total transect duration exceeded the minimum requirement of 5 h total survey duration over 2 nights. Transects were only conducted under fair weather conditions (nights with rain or strong winds were avoided). Bats were recorded using a bat detector with the microphone held outside the vehicle while driving at a maximum of 35 km/h along the same transect routes between survey periods. All transects were tracked using a handheld GPS.

Bat roosts

Potential bat roosts, including buildings and other infrastructure, were visited and visually inspected during the day for signs of bats. No caves were found on the site, and none are expected within 20 km of the area due to the topography, but the railway cutting across the AOI can create potential artificial roosts. These were inspected for any signs of roosting bats, which included looking for faecal material and acoustic monitoring with a handheld bat detector.

Results

Literature review

The ACR (2020) indicated that no bat species have previously been found within 100 km of the proposed site and as such no museum records have been collected for the area. The closest records are *Rhinolophus clivosus* (104 km from site) and *Laephotis capensis* (107 km from site). Based on Monadjem et al. (2020), the ACR (2020) and previous surveys conducted for WEFs in the area (Animalia 2011, Animalia 2017), 11 species could potentially occur in the AOI, all of which are considered to be of Least Concern by the IUCN. Two of these, *Laephotis capensis* and *Tadarida aegyptiaca*, were confirmed on the Khobab WEF site (Animalia, 2011) that was constructed to the north of the Botterblom WEF project AOI, and as such it can be expected that these two species will be found during the current survey. During the survey for the proposed Kokerboom WEF (Animalia, 2017), L. capensis, *Miniopterus natalensis* and *T. aegyptiaca* were commonly found in the area. In addition, *Myotis tricolor* and *Eptesicus hottentotus* were detected, but in low numbers. Finally, no nationally recognized protected areas are found within 100 km of the Botterblom WEF project area.

Acoustic Monitoring

Passive Monitoring

Six static bat detectors were deployed for the survey, four with the microphone at 7 m, one at 50 m and one at 100 m. The bat detectors were active for a total of 19 822 hours and captured a total of 14 670 bat passes with a median of 0.14 bp/h (see details for each bat detector in Table 3-2). It must be noted that LSM1 did not record from the 11 November to 12 December

2020, LSM2 from 13 to 21 January 2021 and LSM3 from 8 October to 11 November 2020. LSM6 was only deployed in March 2021, but as stipulated above, it will remain deployed and collecting data. Even with the downtime on the bat detectors, data were recorded for more than 75% of the monitoring year and as such comply with the minimum requirements regarding duration recorded (MacEwan et al., 2020b).

Bat activity increased steadily after sunset and was highest between 20:00 and 1:00. The average and median recordings of hourly bat passes per microphone were 0.73 (range: 0.18-1.32) and 0.14 (range: 0.00-0.50) respectively. There is a distinct peak in bat activity during November and April, and this is especially pronounced for LSM1 and 2.

Seasonal activity was highest between autumn and spring, suggesting that bats move out of the area, or forage elsewhere, during the dry summer and cold winter months, and that there are no breeding colonies present on the project AOI. Activity was relatively high during summer at LSM5. This is the only area on the AOI with more complex vegetation and is located in a large drainage line, and it is thus possible that bats prefer the area around LSM5 as foraging grounds during these months. Average bat activity was highest at LSM5, as well as LSM1 and 2 around the met mast, indicating that these areas are preferred foraging zones for bats.

Passes by species

Three bat species were recorded by the bat detectors during the Sep 2020 – Sept 2021 survey period, all of which are listed as Least Concern on the IUCN Red Data List, are not regarded as ToPS species, are not CITES listed or endemic to South Africa (IUCN, 2021). Due to uncertainty in the identification of calls between call *T. aegyptiaca* and *S. petrophilus* these two species were grouped together for all analyses. These two species were the most detected species in the area with a total of 14 480 passes and a median of 0.10 bp/h, followed by *L. capensis* with a total of 190 passes and a median of 0 bp/h. *Tadarida aegyptiaca* and *S. petrophilus* are open-air foragers, and this habitat structure thus provides excellent foraging opportunities for these species. *Laephotis capensis* is a clutter-edge forager, and the lack of a more complex vegetation structure does not suite their foraging requirements. As such it is expected that their presence in the project area will be limited. Seasonal activity of all three species is higher during autumn and spring than summer and winter when considering average bp/h.

Passes by height

Bat activity was higher at the microphone deployed at 50 m than the 100 m microphone and all microphones deployed at 7 m combined, but similar between the 50 m (LSM2) and 7 m (LSM1) bat detector pair. The bat detector placed at 50 m recorded a median of 0.24 bp/h, while in comparison, the median for all the combined 7 m bat detectors only recorded 0.10 bp/h, and the 7 m microphone at the same geographic location as the 50 m recorded a median of 0.23 bp/h. This suggests that the location of the bat detector has a greater influence on bat activity recorded than height, and that at this location bats, specifically T. aegyptiaca and S. petrophilus divide their foraging time equally between ground level and at height. The lower activity observed for all bat detectors at ground level (7 m) is most likely due to the lower levels of activity observed in the western section of the project area. Laephotis capensis was more commonly recorded at the 7 m microphone (average of 0.66 bp/h) than the 50 m microphone (average of 0.0015 bp/h), due to their clutter-edge foraging behaviour, flying close to the ground and not flying at height as much as either T. aegyptiaca or S. petrophilus.

Environmental variables and bat activity

Unfortunately, rainfall data was not available for the monitoring period and only wind speed, temperature, relative humidity and barometric pressure were measured and could be used as environmental variables. While it has been shown for certain bat populations that bat activity increases during low wind speeds and high temperatures (Amorim et al., 2012), no such effect was observed during the pre-construction monitoring period and changes in bat activity observed could be more easily ascribed to seasonal dependence.

Active Monitoring

Because roads were limited within the project AOI and portions thereof were driven/walked on multiple nights, transect effort was calculated as the number of times a particular area was traverse. In total, 115 echolocation calls were recorded during all seasons with most bats recorded during spring. No pattern of activity for *T. aegyptiaca* could be detected and this species was detected across the entire AOI. *Sauromys petrophilus* were detected on only ten occasions and these were spread out across the project AOI. *Laephotis capensis* was only detected on four occasions, and all these records were on the road next to the railway line. This might indicate that *L. capensis* forages mostly in the area around the railway, potentially because there are more structures associated with the railway line, including culverts and pylons. During summer, too few calls were recorded to make any inferences, but during autumn activity was higher in the western section of the project AOI and mostly outside of the boundary of the proposed WEF. Winter transects indicated that activity was fairly spread out across the project AOI. During spring most of the calls were recorded within the boundary of the project AOI.

Roosting sites

The surrounding topography does not lend itself to cave structures and no mention was made of large roosts or caves in any previous surveys. Ten potential roost sites were investigated for the presence of bats, and at four of these signs of bats were present.

Table 6-5: The details of bat roost inspections.

Roost id	Habitat feature	Latitude (°)	Longitude (°)	Bat presence
LR1	Railway road underpass	-30.486504	19.557184	None
LR2	Railway road overpass	-30.541286	19.490915	TADAEG or SAUPET recorded
LR3	Railway water underpass	-30.503408	19.540763	None
LR4	Railway in-cut banks	-30.540895	19.491753	None
LR5	Abandoned farmhouse	-30.47576	19.564543	Bat droppings observed
LR6	Natural rock outcrop	-30.489887	19.537563	None
LR7	Existing homestead	-30.544862	19.492741	None
LR8	Existing homestead	-30.59227348	19.69595265	*Nycteris thebaica*
LR9	Existing homestead	-30.59227348	19.67191502	Dead bat found next to house
LR10	Existing homestead	-30,5449	19,49274	None

<u>Railway Roosts</u>

The railway bisects the project area from north-east to south-west and is used for the transport of ore to the coast. Various infrastructure is associated with the railway that includes water underpasses, road underpasses, road overpasses and in-cut banks into the bedrock.

Water underpasses are common along the length of the railway and usually consist of multiple sections of round concrete pipes. The seams of the connections between the pipes have a gap that may be suitable for bats to roost, and occasionally open into the foundational rubble under the railway track. A number of these pipes were investigated during the day for bats, but none were observed.

There is a single road underpass and overpass within and adjacent to the project area which are constructed from concrete and has various seams and cavities that could be used as bat roosts. No bats were observed within the seams, but the structures could not be comprehensively searched from the ground.

In-cut banks that were incised to make the railway level have exposed a shale-like bedrock adjacent to the project area. These rock faces are characterised by long, and in some cases, deep cracks and crevices that could be used by bats as roosting sites.

<u>Abandoned / unused farmhouses</u>

Only one abandoned farmhouse is present on the project area in a dilapidated state with little structure. However, there are ceilings in two of the rooms with some gaps that might allow bats to roost. The ceilings could not be extensively investigated during the day without destructively sampling the building. Bat droppings were found inside the house, but it is unlikely to act as a roost for a large colony.

<u>Existing / used farmhouses</u>

A large homestead approximately 14.9 km west of the project area was identified during the scoping phase. It may provide suitable features for roosting bats

Bat sensitive features

During the 12 month monitoring period the median number of bat passes per hour across the site was 0.14, which classifies the current project area as a Low Risk for bat collision based on the SABPG (MacEwan et al., 2020b) for the Nama Karoo Shrublands ecoregion. The bat detector placed at 100 m in the rotor sweep zone had a median of 0.00 and average of 0.38 bp/h, which again (according to the median) classifies this as Low Risk for bat collisions. It must, however, be stated that this detector has only been active for eight months and a more informed conclusion will be drawn after a full 12 months of monitoring, although it is unlikely that a full 12 month period will result in a different bat collision risk classification, given the data collected from the other two bat detectors on the same met mast with microphones at different heights. All considered, the proposed WEF is likely to have an overall low impact on bats in the area. Nevertheless, based on static bat detectors, driven transects and roost inspections, sensitive areas have been identified that should be buffered and excluded from development. Certain habitats are expected to have a higher abundance of bats due to their potential for roosting, foraging and migration routes and should be viewed as sensitive. As per the SABPG (McEwan et al., 2020) no turbines or any other structure, including infrastructure and major roads, may be constructed within 200 m of bat sensitive areas.

The bat detector (LSM5) placed in the largest water course had a median of 0.50 bp/h, which was the highest for any bat detector deployed in the project area. These water courses, although mostly dry and episodic, nevertheless provide a seemingly greater density of vegetation that remains green for longer than the vegetation of the surrounding plains and therefore, are likely of importance for bats as a foraging resource because vegetation is required for their insect prey to feed on. While these water courses are only classified as a Medium Risk, it is recommended that a 200 m buffer be placed around all the large water courses. Smaller water courses do not seem to support habitat that provides adequate foraging opportunities. This is evident from the low number of bp/h detected at LSM3 which is situated next to one of these smaller water courses. The area around the met mast (LSM1/2/6) also had a comparatively high number of bp/h. The median bp/h for the LSM 1 (7 m) and LSM 2 (50 m) were above 0.18, indicating relatively high levels of activity that could potentially warrant application of buffers. However, as discussed above, the elevated activity detected for LSM1, LSM2 & LSM5 is hypothesised to be due in part to the proximity to the main road and consequently, it is recommended that a 200 m buffer be placed around the main road as described in 3.2.1.1 Passes by Bat Recorder. The driven/walked transects indicated that the railway line might offer foraging areas for clutter-edge foragers. In addition, while no roosting bats were detected, the buildings and culverts associated with the railway could act as roosts for bats. As such it is recommended that a 200 m buffer be implemented around the railway line. Evidence of bats was found only at the abandoned farmhouse (LR5) and inhabited houses (LR9). Although no roosting bats were observed at these sites they are used at times by bats, either as a roosting site or a night roost and possibly for foraging too. A 200 m buffer is thus recommended for the abandoned farmhouse within the project area (LR5). Despite no evidence of bats detected at other infrastructure on the project AOI, a precautionary 200 m buffer was implemented around each of these as bats may have been overlooked and could potentially use such infrastructure as night-time roosts. LR9 falls outside of the project area and therefore the buffers are not applicable to the project.

The sensitive features for bats (with the appropriate 200 m buffer) within the project AOI, that the presence of sensitive bat features within the WEF boundary must be taken into account for the placement of the turbines and auxiliary infrastructure.

Impacts

Construction

- Habitat destruction: access roads and turbine or infrastructure construction may necessitate the removal of foraging habitat and sensitive bat features, such as migratory routes
- Destruction or disturbance of bat roosts: access roads and turbine or infrastructure construction may necessitate the removal or disturbance of bat roosts.

Operational

- Bat mortality: physical bat strikes and barometric trauma causes by spinning blades of the turbines during the operational phase.
- Artificial lighting: Artificial lights can have a negative effect on bat behaviour by affecting flight paths used. On the other hand, bats could be attracted to lights due to higher insect abundance and be at higher risk of collision mortality.
- Flight/migratory paths: Turbines placed on pathways used for migration can have severe effects on bats moving through the area during times when bats move to winter/summer roosts.

Table 6-6: Summary of potential negative impacts evaluated pre-mitigation and post-mitigation.

Impact	Pre-mitigation Significance	Post-mitigation Significance	Specialist Confidence	Residual impacts	Potential Fatal Flaw
Loss or destruction of foraging habitat	Medium	Low	High	No	No
Loss or destruction of bat roosts	Low - Medium	Very Low	High	No	No
Bat mortality	High	Low	Medium	Potentially	Unlikely
Artificial lighting	Low - Medium	Very Low	Low	No	No
Flight/migratory paths	Low - Medium	Low	Low	Potentially	Unlikely

Cumulative

Several renewable energy development applications have been submitted and/or authorised within the immediate area of the proposed Botterblom WEF which will likely already have a negative impact on bats in the region. Considering that there is already two WEFs to the north and north-east of the current site the proposed WEF will add to the impacts currently experienced in the greater area (magnitude currently unknown due to absence of mortality data. Furthermore, several additional WEFs are being planned for this area based on approved environmental.

A major cumulative impact is expected by the creation of a long continuous front of turbines that seem to be orientated in rows along a NW to SE axis and that may block migratory pathways and result in mortalities of bats moving or migrating on the north to south axis (specifically SW to NE).

Mitigation

- Habitat destruction: Apply the 200 m buffer to all potential bat roosts, avoiding the construction of turbines and access roads in these areas. Roads must follow existing farm roads as far as possible. The buffered sensitive areas must be excluded from all activities related to the WEF. Access roads may cross these however if required
- Baat Roosts: All potential bat roosts must be avoided by applying a 200 m buffer
- Bat mortality: Cut-in speeds of turbines should be increased at strategic times based on bat mortalities observed during post-construction monitoring. An annual threshold for bat mortality in Nama Karoo is estimated at 0.0106 bats/hectare (MacEwan et al., 2020a) per annum. Therefore, the total annual bat mortality threshold for the Botterblom WEF is estimated at 61.4 bats. Corrected mortality estimates and appropriate adaptive mitigation thresholds and strategies will need to be determined during the post-construction monitoring.
- Bat collisions: Increase turbine cut in speed as this has been shown to reduce collisions.
- Avoidance: It is recommended that NO development (including the full rotor swept zone of wind turbines) takes place in BOTH Very High and High bat sensitivity areas. Take note that these areas still need to be defined and will be shown in the final EIA report. Avoid impacts to natural and artificial wetlands and water bodies by implementing the appropriate buffer areas where no development may take place.
- Artificial lighting: All artificial lights should be kept at a minimum with only civil aviation lights being used if possible. In cases where lighting is needed close to buildings the use of these lights must be limited and directed only where needed. Non-UV emitting lights must be used.
- Flight/migratory paths: Increasing the cut-in speed of turbines is especially relevant for periods of migration and/or increased feeding activity during frontal activity as seen in April and possible migration during November when higher than normal number of bats are expected in the area and curtailment of turbines may be required if mortalities during monitoring indicate immediate mitigation action. This will necessitate increased monitoring activities during these times with rapid dissemination of number of carcasses detected so that on-the-fly mitigation can occur.
- Cumulative: Provision for a flyway that excludes turbines should be considered for the region, especially if future WEFs are proposed on the east to west axis.

- Cumulative: It is recommended that SABAA obtain bat mortality data from post-construction monitoring surveys of all the WEFs to evaluate this impact, consolidate evidence to gain better insight into seasonal migrations in the region and propose necessary mitigation measures, since no single WEF is likely to be able/willing to do this.

Discussion and Conclusion

A total of three species were detected on the project AOI namely: *T. aegyptiaca*, *S. petrophilus*, and *L. capensis*, all listed as Least Concern by the IUCN (2021). Based on the SABPG (MacEwan et al., 2020b) a median of under 0.18 bp/h for the bat detectors placed at ground level is regarded as a Low Fatality Risk and between 0.18 and 1.01 is Medium Risk for the Nama Karoo Shrublands ecoregion. The median bp/h recorded at ground level for LSM3 and 4 during the current survey was below 0.18, qualifying as a Low Risk for bat mortalities, whereas the median bp/h recorded at ground level for LSM1 and LSM5 was above 0.18 qualifying as a Medium Risk. The median bp/h recorded at 50 m (LSM2) was 0.24, and this indicates a Medium Risk. The detector deployed at 100 m (LSM6) recorded a median bp/h of 0.00 indicating a Low Risk, and while it has only been active for eight months and was not recording during the November peak, it was shown to record less bat activity than LSM1 & LSM2 during the time that it was active (including the April peak).

Bat activity peaks during November and April, a possible indication of bats feeding during insect eruptions or migrating through the area. It is highly recommended that additional mitigation measures are incorporated during these times, particularly when the first major frontal activity of autumn/winter occurs, including higher cut in speeds, in order to minimise bat mortalities. Additionally, it is recommended that mortality search effort is increased throughout the post-construction during the months of April and November in an attempt to obtain a more reliable estimate of bat mortalities during these periods of higher activity. In addition, sensitive bat areas have been defined and buffered with the appropriate distance and these areas must be avoided. This includes all potential bat roosts and the major water courses with appropriate vegetation across the AOI.

From the available data collected, the construction of a WEF on the proposed WEF boundary will have a Low-Medium Risk of impacting the bat population in the area before mitigation measures have been applied. Currently, after mitigation measures have been implemented this risk will be reduced to Low.

It is advised that bat mortality mitigation measures be implemented during the spring and autumn months considering the peak bat activity levels during this period. These mitigation measures would include a higher cut-in speed as this has been shown to significantly reduce bat mortalities (Arnett et al., 2009) or curtailment during peak activity periods.

6.9 AQUATIC BIODIVERSITY

The Aquatic Biodiversity, Wetland and Riparian Assessment was undertaken by WaterMaker, dated December 2021, refer to Appendix D4.

A total of five riparian networks were delineated within the study area and within 500m from the study area as well as sections further downstream of the study area. All five riparian networks feed into the Leeuberg and Klein-Rooiberg Rivers which joins the Krom River downstream. In addition, there were several non-FEPA wetlands indicated on the NFEPA database that was investigated. Only the terrain unit indicator was confirmed for the indicated NFEPA database depression wetlands. None of the other three wetland indicators were present. However, these depressions do hold water for a few days a year and could act as potential temporary habitat for various faunal species, however, water is likely not retained for a long enough period for redox morphology to develop, thus they are not likely wetlands. Following a cautionary approach, these features are termed 'riparian/ephemeral depressions', with some of the depressions being isolated while a cluster of depressions are linked via riparian channels. Further infield research is necessary to establish whether these features should indeed be classified as watercourses and thus have regulatory standing. For now, a cautionary approach stands in order to facilitate an environmentally friendly and sustainable planning process. The same cautionary and conservative approach was taken where there were doubt between differentiating between A section and B section channels, with A section channels likely included in the current delineation, especially on the highest lying areas where channels often do not carry base flow. The proposed preliminary lay-out of wind turbines along with the watercourses and associated 40m freshwater ecosystem buffer is displayed in Figure 6-11.

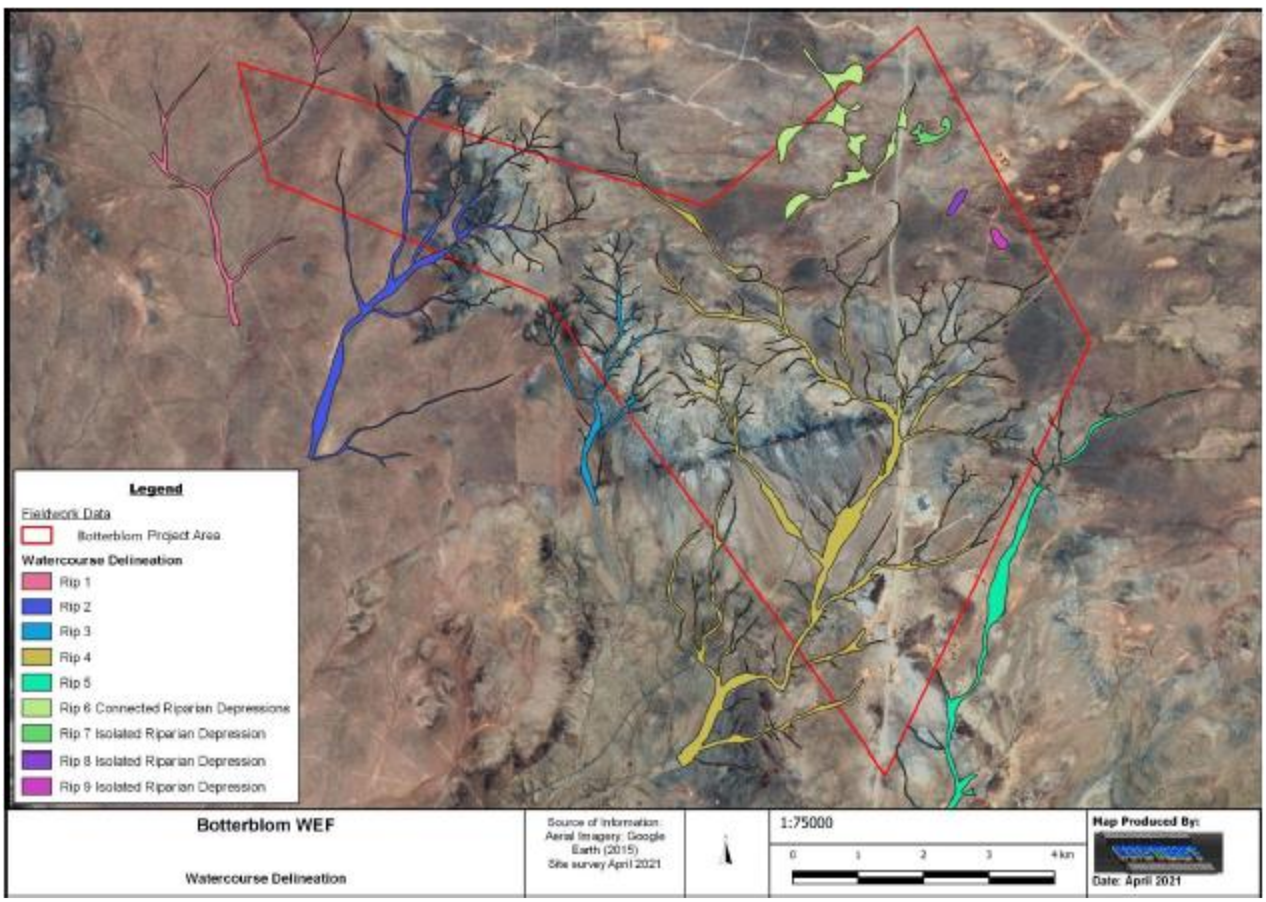


Figure 6-11: Watercourse delineation for the study area

Functional and Present Ecological State Assessment

The Present Ecological State of the riparian zone was assessed using the Riparian Vegetation Response Assessment Index (VEGRAI) Level 3 approach (Kleynhans et al., 2007). Findings of the VEGRAI vegetation assessment conducted on riparian units identified within the study area indicated that riparian habitat associated with the study area were regarded as being in a largely natural state (i.e. Ecological Category B). There are a few small areas that has been highly impacted through grazing practices (e.g. artificial waterholes, overnight camps etc), but collectively these heavily impacted zones form a very small percentage of the total riparian habitat.

Table 6-7: VEGRAI score for the riparian vegetation calculated for riparian habitat associated with the various riparian areas associated with the present study area

Riparian Unit	VEGRAI Score	Ecological Category
Riparian 1	81.8	B
Riparian 2	83.1	B
Riparian 3	82.9	B
Riparian 4	81.2	B
Riparian 5	83.3	B
Riparian 6	80.4	B
Riparian 7	82.2	B
Riparian 8	84.0	B
Riparian 9	84.5	B

Ecological Importance and Sensitivity

Ecological importance refers to biophysical aspects in the sub-quaternary reach that relates to its capacity to function sustainably. Essentially, the ecological importance and the ecological sensitivity of the relevant reaches are assessed to obtain an indication of its vulnerability to environmental modification within the context of the PES. The Ecological Importance and Sensitivity of the riparian habitat in the study area were determined using the River Ecological Importance & Sensitivity (EIS) DWAF riverine EIS tool (Kleynhans, 1999).

In terms of ecological importance and sensitivity, riparian habitat (Riparian 1 to Riparian 9) within the study area was designated as sensitive as a result of the ecological and functional values attributed to riparian areas in general, legal regulations and requirements as well as the supporting ecological services afforded to the downstream ecosystems. The Klein-Rooiberg River is also considered a FEPA River.

Table 6-8: Ecological Importance and Sensitivity scores for Riparian habitat within the study area

Riparian Unit	EIS Score (0 – 5)	Class
Riparian 1	2.7	**Moderate**
Riparian 2	2.6	**Moderate**
Riparian 3	2.2	**Moderate**
Riparian 4	DWS (2014)	**High**
Riparian 5	2.3	**Moderate**
Riparian 6	2.1	**Moderate**
Riparian 7	2.1	**Moderate**
Riparian 8	2.4	**Moderate**
Riparian 9	2.6	**Moderate**

Despite the current Ecological condition associated with the vegetation of the riparian habitat, all riparian habitat within and surrounding the study area was designated as sensitive as a result of the high ecological and functional values attributed to riparian areas in general, legal regulations and requirements.

Freshwater Ecosystem buffers

Buffer zones associated with water resources have been shown to perform a wide range of functions, and have been proposed as a standard measure to protect water resources and associated biodiversity on this basis. These functions can include (Macfarlane & Bredin, 2016):

- Maintaining basic aquatic processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses;
- Providing habitat for aquatic and semi-aquatic species;
- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits.

Determination of the preliminary buffer requirements for riparian features associated with the proposed study area followed the approach of Macfarlane & Bredin (2016), whereby the preliminary required buffers were developed based on various factors, including assumed agricultural impacts, slope, annual precipitation, rainfall intensity, channel width, catchment to wetland ratio, etc. Accordingly, preliminary buffer requirements for the identified watercourse were determined to be 40m from the edge of the delineated riparian areas.

Impacts and Mitigation Measures

The impact assessment identified destruction of water courses, sedimentation, erosion, invasive vegetation, surface water pollution as well as an altered hydrological regime as the major potential impacts during the construction and operational phase. Impacts have been separated into Construction and Operational Phases.

Construction Phase Impacts:

- Sedimentation of watercourse: The clearing of natural vegetation and the stripping of topsoil will result in increased runoff of sediment from the site into watercourses transporting sediments downstream, particularly during times of high rainfall. Water flowing down trenches and access roads, as well as movement of construction vehicles and personnel, could cause additional sediment to accumulate within downstream areas. Alternative 2 was considered to have a lower impact on the watercourses due to the reduced number of water crossings and length of the associated linear infrastructure. It is recommended that Turbine 16 (Alternative 2) be moved approximately 150m north across the main riparian tributary in order to reduce impacts, refer to Figure 6-12.

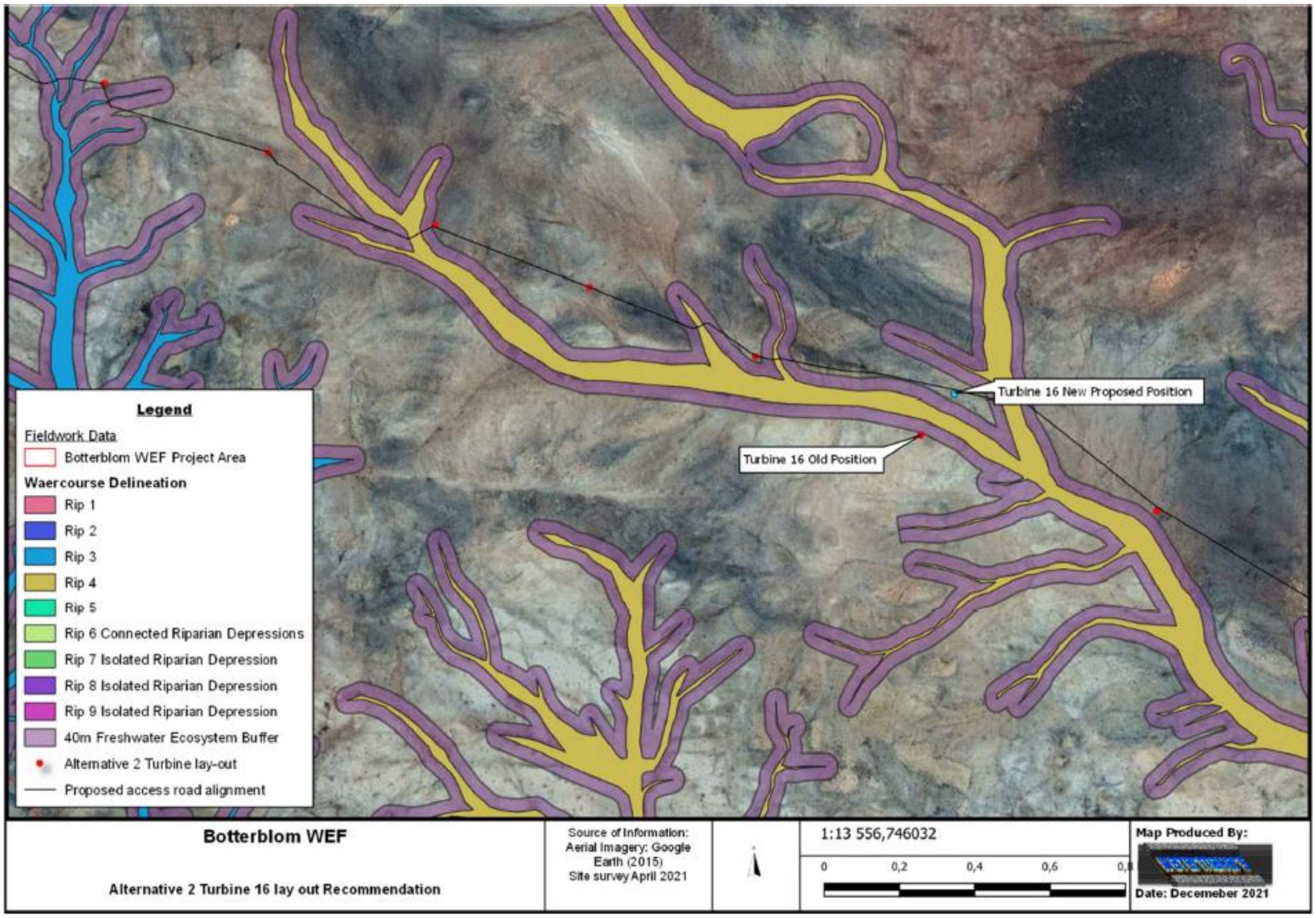


Figure 6-12: Old position and new recommended position for Turbine 16 with Alternative 2.

- Exposure to erosion: The removal of surface vegetation will cause exposed soil conditions where rainfall and high winds can cause mechanical erosion. Rainfall and inadequate drainage systems would lead to sediments washing down into riparian habitat and rivers, causing sedimentation. In addition, hardened surfaces and bare areas are likely to increase surface run off velocities and peak flows received by riparian habitat. Poorly designed roads and or water crossings will likely cause concentrated flows with easily initiate erosional processes within the arid environment with low inherent basal cover.
- Potential increase in invasive vegetation: During construction, vegetation will be removed and soil disturbed. The seed of alien invasive species that occur on and in the vicinity of the construction area could spread into the disturbed and stockpiled soil. In addition, the construction vehicles and equipment were likely used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the construction site. Alien vegetation could easily disperse into the watercourses through stormwater infrastructure located on site. In

addition to the potential of alien invasive species, the spread of pioneer and rudimentary species will also likely be exacerbate.

- Pollution of water resources: Hydrocarbon-based fuels or lubricants spilled from construction vehicles, construction materials that are not properly stockpiled, and litter deposited by construction workers may be washed into the surface water bodies. Should appropriate toilet facilities not be provided for construction workers at the construction crew camps, the potential exists for surface water resources and surroundings to be contaminated by raw sewage. The utilisation of stormwater infrastructure for disposal of water used for washing could decrease the abundance and diversity of aquatic macro-invertebrates inhabiting the section of the wetland and riparian areas further downstream. Contaminated runoff from concrete mixing and sediment release including hydrocarbon spillages may lead to the infiltration of toxicants into the groundwater.

Operation Phase Impacts

- Altered Hydrologic Regime: The presence of hard impermeable surfaces such as roads, foundations, parking areas and roofs, will result in an increase in stormwater runoff volume and velocity. The size of the turbine foundation footprints could be considerable. The foundations in combination with construction of roads with altered surface run-off regimes could have an impact if not well managed. Erosional process should not be allowed to develop and current process haltered and rehabilitated. In terms of hydropedology, from a preliminary perspective, the hydropedology of the landscape seems to be dominated by surface run-off (although some recharge is expected and there is likely some slow to stagnant interflow as suggested by yellow soils). The cumulative impacts of developments within the catchments could cause concentrations of surface water runoff and the decrease of infiltration which will potentially result in an increase in erosion potential and sedimentation to the riparian habitat.

Mitigation Measures:

Construction:

- It is essential that the road and other linear networks (cables) follow contour and lowest gradients as far as possible. Appropriate stormwater design for the road network is essential to prevent roads from serving as concentrated conduits for water run-off, significantly increasing erosion potential and sediment transport capacity. Water diversions along the road should be placed at regular intervals in order to divert water back into the natural veld on the downstream side of the road. This diverted water should be released in a diffuse manner on contour, e.g. appropriately designed swale which is appropriately vegetated to achieve high basal cover.
- Water crossing must be exactly perpendicular to the natural flow of water as not to create water flow to concentrate more to one side. A potential road access network with perpendicular crossing.
- It is essential to choose appropriate water crossing for the road network in order to reduce potential negative impacts. Crossing points should preferably utilise watercourse sections which already contain exposed bedrock and has a low

gradient in that particular section of the watercourse. All crossing to be in the form of low water bridges in order for water to follow historic flow paths as much as possible. Concentration of water flow must be avoided. Where water is concentrated it needs to be diffusely released through appropriate diffuse release infrastructure placed on contour.

- It is recommended that all final positions of watercourse crossings be appropriately “fine tuned” through field verification in order to minimise potential impacts and reduce road construction cost.
- Topsoil preparation and bush clearing must be done in a phased approach, only strip what is needed immediately prior to construction / field preparation.
- The construction of surface stormwater drainage systems during the construction phase must be done in a manner that would protect the quality and quantity of the downstream system. Where applicable, the use of swales, which could then be grassed for the operational phase, is recommended as the swales would attenuate run-off water and facilitate the settling of sediment within the swale rather than within watercourses. For example, on the downslope edge of the infrastructure camp before vegetation clearing commences.
- An effective 40m Buffer Zone which include all riparian habitat must be established prior to any construction activities taking place. No person or vehicle will be allowed within the Buffer Zone, except for officially marked crossings. Management should be vigilant in preventing personnel taking short-cuts across the Buffer Zones between construction sites.
- All livestock should be removed from the site prior to the initiation of rehabilitation or construction activities. This would increase veld condition and thereby afford the study area higher basal coverages with associated higher sediment and erosion control properties. Further, no veld fires should be allowed for the next 5 years in order to aid veld restoration processes.
- All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimized, and be surrounded by bunds. It should also only be stored for the minimum amount of time necessary.
- Erosion control of all banks must take place so as to reduce erosion and sedimentation processes.
- Topsoil, leaf and plant litter as well as subsoil must be stockpiled separately in low heaps.
- Do not strip topsoil when it is wet.
- In the absence of a recognizable topsoil layer, strip the upper most 500mm of soil.
- Management has a responsibility to inform staff of the need to be vigilant against any practice that will have a harmful effect on riparian habitat and associated watercourses.
- If possible, re-position the topsoil stockpile upslope of any infrastructure within the surface infrastructure footprint so as to prevent contaminated surface water coming into contact with topsoil.
- Ensure that all topsoil is stored and protected in such a way and in such a place that it will not cause the damming up of water, erosion gullies, or wash away itself;

- The ECO must be vigilant to detect any negative impacts on watercourses and consult with a wetland/riparian specialist if erosion or other negative impacts within watercourses or their buffers are noticed.
- An ecologically-sound stormwater management plan must be implemented at the onset of the construction phase. This must include sustainable and sensitive stormwater design for the new road network and base infrastructure. Stormwater run-off must reach the A and B Section channels and or buffer zones in a diffuse manner;
- The above guidelines can be achieved through diffuse release of stormwater flows utilising the natural topography and associated contours, vegetated channels, riparian buffers and veld restoration techniques, gabion baskets, eco-logs etc;
- Erosion must not be allowed to develop on a large scale before effecting repairs;
- A riparian monitoring program should be initiated prior to the start of the construction phase.
- Make use of existing roads and tracks where feasible, rather than creating new routes through vegetated areas;
- Vegetation and soil must be retained in position for as long as possible, and removed immediately ahead of construction / earthworks in that area (DWAF, 2005);
- Veld restoration must be actively pursued within the study area. As a start, it is recommended that all livestock must be removed from the property for at least a period of 5 years. Active reseeding must take place on the periphery of all disturbances .e.g roads and foundation platforms.
- Runoff from roads must be managed to avoid erosion and pollution problems;
- During the construction and operational phases, measures must be put in place to control the flow of surface water so that it does not impact on the vegetation, i.e., energy dissipaters and canal flow designs must be used to prevent scouring and erosion;
- All areas susceptible to erosion must be protected and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas;
- Indigenous shrubbery and grass species must be retained wherever possible;
- Areas exposed to erosion due to construction should be vegetated with species naturally occurring in the area; and
- Surface water or storm water must not be allowed to concentrate, or flow down cut or fill slopes without erosion protection measures being in place.
- During construction, the construction area and immediate surroundings should be monitored regularly for emergent invasive vegetation;
- Surrounding natural vegetation should not be disturbed to minimize chances of invasion by alien vegetation;
- All alien seedlings and saplings must be removed as they become evident for the duration of construction and operational phase;
- Manual / mechanical removal is preferred to chemical control;

- All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction site. This should be verified by the ECO;
- An alien invasive eradication and monitoring plan must be compiled and implemented whereby all emergent invasive species are removed during construction. The monitoring plan must also ensure that the re-emergence of invasive species is monitored continuously during the operational and decommissioning phases and that monitoring and eradication continues post decommissioning.
- Construction vehicles are to be maintained in good working order so as to reduce the probability of leakage of fuels and lubricants;
- A walled concrete platform, dedicated store with adequate flooring or bermed area should be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well ventilated areas;
- Storage of potentially hazardous materials should take place far away from preferential flow paths and or stormwater infrastructure. These materials include fuel, oil, cement, bitumen etc.;
- Surface water draining off contaminated areas containing oil and petrol would need to be channelled towards a sump which will separate these chemicals and oils;
- Concrete is to be mixed on mixing trays only, not on exposed soil;
- Concrete and tar shall be mixed only in areas which have been specially demarcated for this purpose;
- After all the concrete / tar mixing is complete all waste concrete / tar shall be removed from the batching area and disposed of at an approved dumpsite;
- Stormwater shall not be allowed to flow through the batching area. Cement sediment shall be removed from time to time and disposed of in a manner as instructed by the Consulting Engineer;
- All construction materials liable to spillage are to be stored in appropriate structures with impermeable flooring;
- Portable septic toilets are to be provided and maintained for construction crews. Maintenance must include their removal without sewage spillage;
- No uncontrolled discharges from the construction crew camps to any surface water resources shall be permitted. Any discharge points need to be approved by the relevant authority;
- In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs must be informed immediately;
- Store all litter carefully so it cannot be washed or blown into any of the water courses within the study area;
- Provide bins for construction workers and staff at appropriate locations, particularly where food is consumed;
- The construction site should be cleaned daily and litter removed;
- Conduct ongoing staff awareness programs so as to reinforce the need to avoid littering; and

- Backfill must be compacted to form a stabilised and durable blanket and the current load above the sewer lines must at no time be exceeded.

Operation:

- It is essential that the road and other linear networks (cables) follow contour and lowest gradients as far as possible. Appropriate stormwater design for the road network is essential to prevent roads from serving as concentrated conduits for water run-off, significantly increasing erosion potential and sediment transport capacity. Water diversions along the road (and other linear infrastructure) should be placed at regular intervals in order to divert water back into the natural veld on the downstream side of the road. This diverted water should be released in a diffuse manner on contour, e.g. appropriately designed swale which is appropriately vegetated with high basal cover).
- It is essential to choose appropriate water crossing for the road network in order to reduce potential negative impacts. Crossing points should preferably utilise watercourse sections which already contain exposed bedrock and has a low gradient in that particular section of the watercourse. All crossing to be in the form of low water bridges in order for water to follow historic flow paths as much as possible. Concentration of water flow must be avoided. Where water is concentrated it needs to be diffusely released through appropriate diffuse release infrastructure placed on contour. The water crossing themselves should be designed and placed exactly on contour and be perpendicular to the flow of the watercourse)
- It is recommended that all final positions of watercourse crossings be appropriately “fine tuned” through field verification in order to minimise potential impacts and reduce road construction cost.

Conclusion and Recommendations

A total of five riparian networks were delineated within the study area and within 500m from the study area as well as sections further downstream of the study area. All five riparian networks feed into the Leeuberg and Klein-Rooiberg Rivers which joins the Krom River downstream.

There were several non-FEPA wetlands indicated on the NFEPA database that was investigated. Only the terrain unit indicator was confirmed for the indicated NFEPA database depression wetlands. None of the other three wetland indicators were present. These depressions however do hold water for a few days a year and could act as potential temporary habitat for various faunal species, however, water is likely not retained for a long enough period for redox morphology to develop, thus they are not likely wetlands. A cautionary approach was therefore adopted and these features are termed ‘riparian/ephemeral depressions’, with some of the depressions being isolated while a cluster of depressions are linked via riparian channels. Further infield research is necessary to establish whether these features should indeed be classified as watercourses and thus have regulatory standing. For the purpose of this study, a cautionary approach stands in order to facilitate an environmentally friendly and sustainable planning process. The same cautionary and conservative approach was taken where there were doubt between differentiating between A section and B section channels, with A section channels likely included in the current delineation, especially on the highest lying areas where channels often do not carry baseflow.

The VEGRAI vegetation assessment conducted on riparian units identified within the study area indicated that riparian habitat associated with the study area were regarded as being in a largely natural state (i.e. Ecological Category B). There are a few small areas that has been highly impacted through grazing practices (e.g. artificial waterholes, overnight camps etc), but collectively these heavily impacted zones form a very small percentage of the total riparian habitat.

In terms of ecological importance and sensitivity, riparian habitat (Riparian 1 to Riparian 9) within the study area was designated as sensitive as a result of the ecological and functional values attributed to riparian areas in general, legal regulations and requirements as well as the supporting ecological services afforded to the downstream ecosystems.

A preliminary buffer requirement for the identified watercourses were determined to be 40m from the edge of the delineated riparian areas.

Considering the type of development proposed, a WEF, and the implementation of the recommendations and mitigation measures, the development is not likely to impact on the FEPA catchment classification associate with the study area.

6.10 AGRICULTURAL POTENTIAL

The Agricultural Compliance Statement was conducted by Johann Lanz (the Compliance Statement is included in Appendix D5).

Agricultural Potential

The agricultural potential for the proposed project area is low. This is not only due to the predominantly rainfall constraints, but also due to the soil constraints. The terrain is unsuitable for cultivation and the opportunity for grazing is very limited for livestock. Currently, the land is not being utilised for livestock grazing.

Agricultural Sensitivity

In terms of sensitivity, the land is regarded as low and medium. During the site assessment there were three agricultural impacts identified that might have a potential negative impact. However, none of the impacts are of high significance. These include loss of agricultural land use, land degradation and dust generation impact. The one positive impact that was identified is the increase of financial security. Figure 6-13 indicates the proposed development sight overlaid by the agricultural potential as per the Screening Tool, green = Low and yellow = Medium.

Impacts

- Loss of agricultural potential by occupation of land: Agricultural land directly occupied by the development infrastructure will become unavailable for agricultural use, with consequent potential loss of agricultural productivity and employment. This impact is relevant only in the construction phase. No further loss of agricultural land use occurs in subsequent phases.
- Loss of agricultural potential by soil degradation: This impact is only relevant once the land is returned to agricultural land use after decommissioning. Soil can be degraded by impacts in three different ways: erosion; topsoil loss; and contamination. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations. Hydrocarbon spillages from construction activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth. This impact is relevant only during the construction and decommissioning phases. Due to the very low slope of the land, the site has a low susceptibility to soil degradation.
- Dust impact: The disturbance of the soil surface, particularly during construction, will generate dust that can negatively impact surrounding veld and farm animals.
- Enhanced agricultural potential through increased financial security for farming operations: Reliable income will be generated by the farming enterprises through the lease of the land to the energy facility. This is likely to increase their cash flow and financial security and could improve farming operations and productivity through increased investment into farming.
- Regional Loss of Agricultural Land: This cumulative impact has been assessed using DFFE’s criteria. The loss of land was quantified, and this was calculated to approximately 0.14% of surface area that will be lost, taking into consideration the multiple renewable energy developments within a 35 km radius. This loss is justified in the sense that in order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. The limits of acceptable agricultural land loss are far higher in this region than in regions with higher agricultural potential. The cumulative impact of loss of agricultural land use will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it is approved.

Due to the low agricultural sensitivity of the site, and the effectively uniform agricultural conditions across the site, there will be absolutely no material difference between the agricultural impacts of any alternative layouts that may be proposed, and there are therefore no preferred alternatives from an agricultural impact perspective. All alternatives are considered acceptable.

Mitigation Measures

The following mitigation measures are recommended for the proposed WEF:

- Implementation and maintenance of an effective stormwater system is recommended to protect the study area.
- Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion
- Topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation
- Facilitate re-vegetation of denuded areas throughout the site

Conclusion

The proposed development will not have substantial negative impact on the agricultural production capability of the site and is therefore acceptable. This is substantiated by the facts that the land is of very low agricultural potential, the amount of agricultural land loss is within the allowable development limits, and that the proposed development poses a low risk in terms of causing soil degradation, if the recommended mitigation measures are implemented.

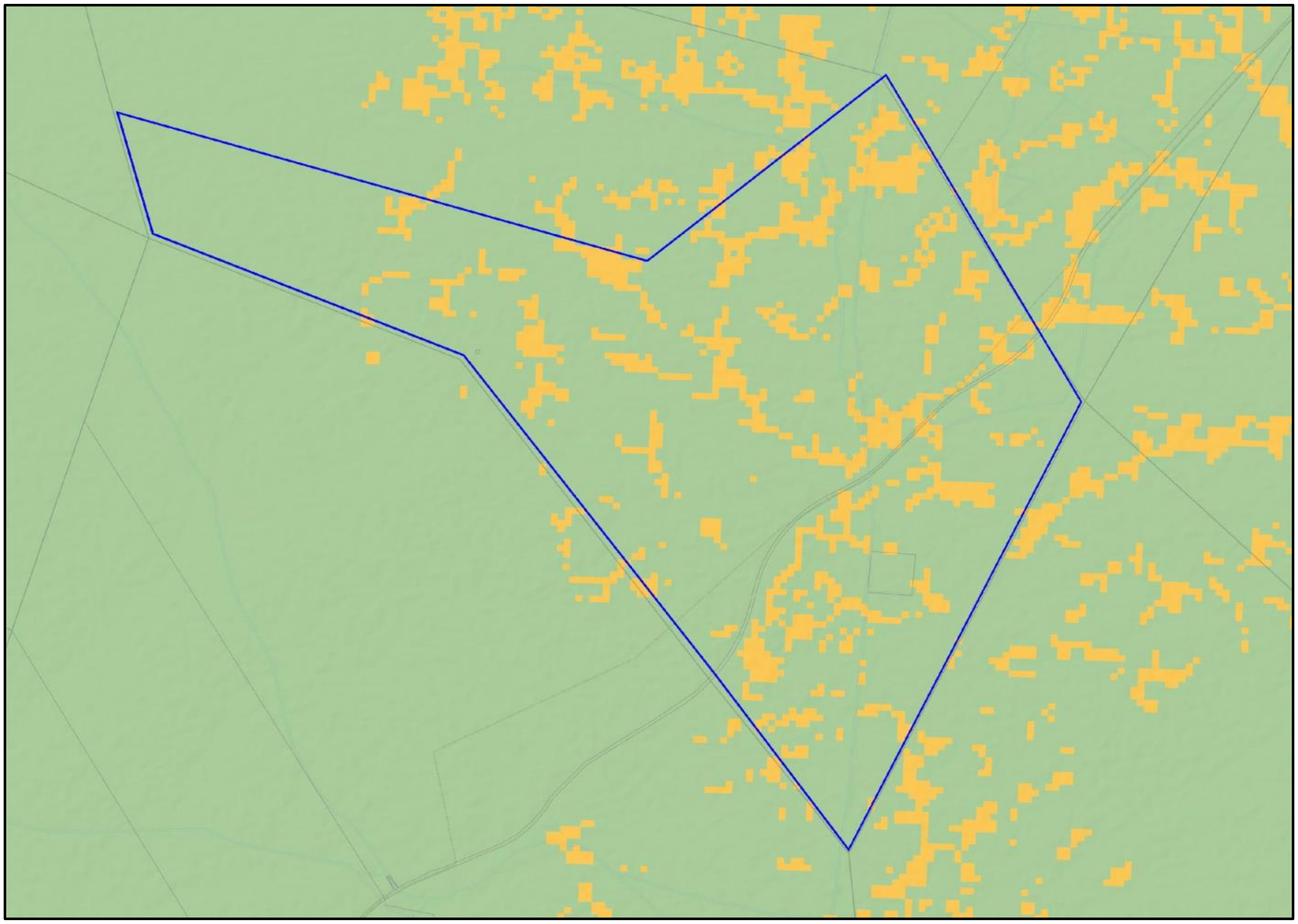


Figure 6-13: Agricultural Potential sensitivity (green = Low and yellow = Medium) as per the Screening Tool.

6.11 NOISE

The Noise Compliance Statement was conducted by Enviro Acoustic Research (EARES) (the Compliance Statement is included in Appendix D6). Using the questionnaire as per the South African National Standards (SANS) 10328:2008, the conclusion of whether the proposed development could have noise implications and sensitivities, could be determined. All question as per the questionnaire were negative (not applicable) and therefore it is unlikely that the proposed development will have any noise disturbance. As per the recommendations of SANS 10328:2008, a scoping investigation and noise impact assessment will therefore not be required.

Noise Sensitivity

As indicated in the figure below (Figure 6-14), the closest wind turbines would be over 2 km away from any Noise-Sensitive Development (NSD). No further Scoping or other acoustical studies is therefore required due to the proposed WEF having a low potential for noise impact.

Mitigation measures

In terms of the noise impact or any additional noise measurements, there are no specific mitigation measures recommended and no additional conditions needed for including in the EMPr.

Conclusion

In conclusion, there exists a low potential for a noise impact and that no further Scoping or other acoustical studies would be required for the proposed WEF. No specific mitigation measures regarding noise or additional noise measurements are recommended. No additional conditions regarding noise are recommended for inclusion in the EMPr. It is therefore recommended that the development of the Botterblom WEF be approved from a noise perspective.

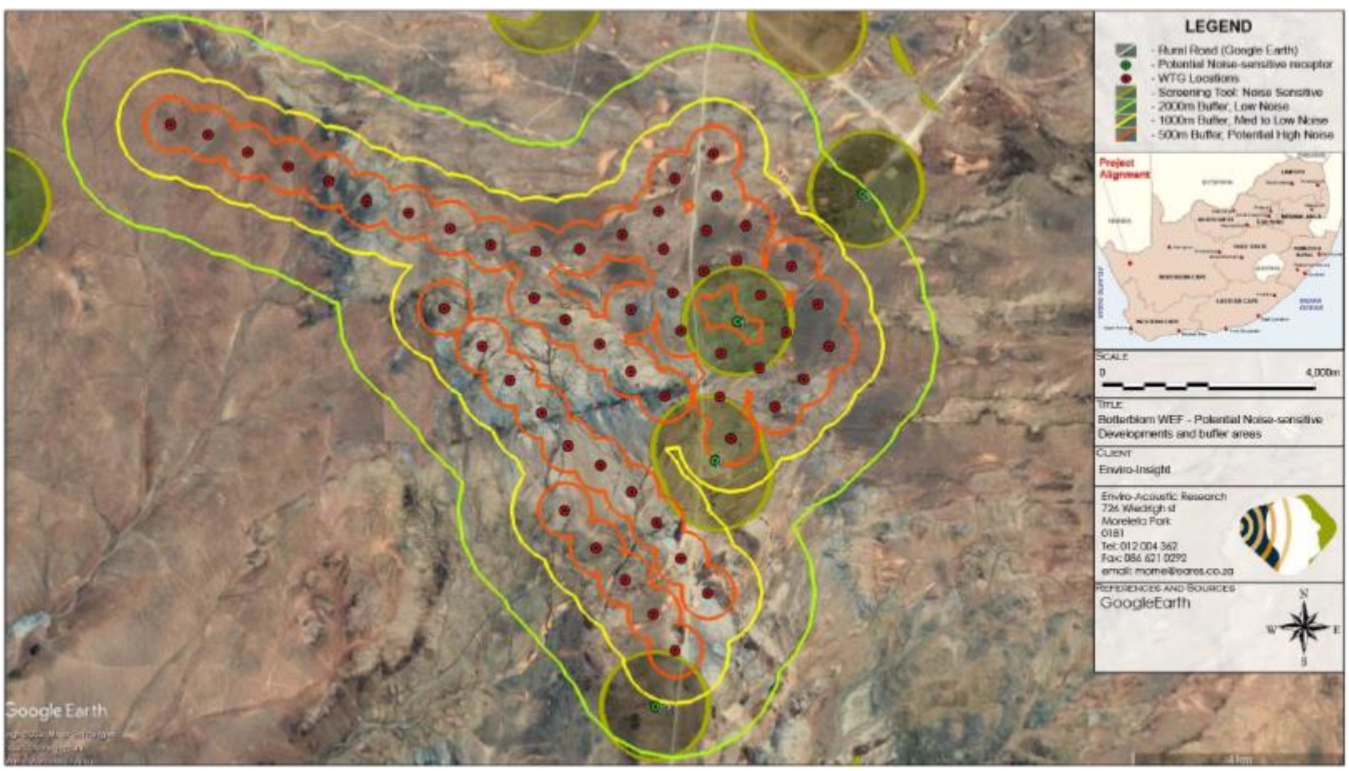


Figure 6-14: Agricultural Potential sensitivity (green = Low and yellow = Medium) as per the Screening Tool.

6.12 VISUAL, LANDSCAPE AND FLICKER

The Visual Impact Assessment was conducted by Lourens du Plessis from LOGIS (the report is included in Appendix D7). The visibility analysis was undertaken from each of the wind turbine positions at an offset of 150m (approximate hub-height) above ground level. All three layout alternatives were calculated individually and compared. There was a negligible difference in the visual exposure of the alternatives due to the tall turbine dimensions, the close proximity of the layouts to each other and the generally flat topography within the study area (i.e. they will all be similarly exposed).

Visual Viewshed Analysis

As per the visual assessment the following is noticeable as per the indicated distances below:

0 - 5km

The potential visual exposure will have a large central area within a radius of 5km of the proposed development. This is due to the wind turbines being a very tall structure and of the type of topography. The central area includes the following, the Khobab WEF, the largest part of the Loeriesfontein WEF and a 21.5km section of the Loeriesfontein secondary road.

The residents situated within 5km of the proposed WEF that might be exposed to the proposed wind turbine structures include the following:

- Kareedoornpan (Loeriesfontein WEF)
- Sous se Plaat (Khobab WEF)
- Sous (proposed Botterblom WEF)
- Narosies

5 – 10km

The exposure in terms of visual will remain high within this distance due to the type of topography found in the area. The residents situated within 5 - 10km of the proposed WEF that might be exposed to the proposed wind turbine structures include Bloupan, Brakpan, Klein Rooiberg and Raskraal.

10 – 20km

The visual exposure will be somewhat reduced within the radius distance, especially towards the west of the proposed project area. A number of settlements and residents, as well as secondary road sections are found within the distance which includes the following:

- Soutkonnes
- Bitterputs
- Goedom
- Struiskom
- SpringboktandTweelingpompe
- Bitter Kamas

- Hefnaar
- Soutpansfontein
- Stinkputs Noord
- Kluitjieskraal
- Stinkputs Suid

> *20km*

Visual exposure in a radius of 20km and above is reduced significantly, especially southwest of the proposed development area, along the Krom River valley. It is expected that the turbine structures may be visible from the following residents and sections of secondary road, Konnes, Stootvleipan, Loerkop and Nelswerwe.

Cumulative Viewshed Impacts:

The viewshed analyses were undertaken from all existing, proposed and authorised WEFs within a 30km radius of the proposed Botterblom WEF. The general close proximity of the WEFs adjacent to each other has as an effect that the viewshed patterns are very similar. This is also attributed to the homogenous topography of the study area. It is preferable to concentrate future wind energy infrastructure within this hub, this will largely help to prevent the scattered proliferation of WEF structures throughout the greater region. The remote location of the proposed WEF, and the generally limited number of affected sensitive visual receptors, further mitigates the potential cumulative visual exposure of the WEFs. The potential cumulative visual impact is therefore considered to be within acceptable limits.

Impacts

<u>Construction:</u>

- Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF. During construction, there may be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and landowners in the area.

<u>Operation</u>

- Visual impact on observers (residents at homesteads and visitors/tourists) in close proximity (i.e. within 5km) to the wind turbine structures
- Visual impact on observers travelling along the roads in within 5km to 20km to the wind turbine structures
- Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF. There are no places of residence within the 800m buffer. The significance of shadow flicker is therefore anticipated to be low to negligible.
- Visual impact of lighting at night on sensitive visual receptors. This anticipated lighting impact is likely to be of high significance within a 5 to 10km radius of the wind turbine structures

- Visual impact of the ancillary infrastructure on observers in close proximity to the structures. The anticipated visual impact resulting from this infrastructure is likely to be of low.
- The potential impact on the sense of place of the region. The significance of the visual impacts on the sense of place within the region is expected to be of low significance.

Cumulative

- The potential cumulative visual impact of wind farms on the visual quality of the landscape. The cumulative visual impact (should all the authorised wind and solar projects be constructed) is expected to be high, depending on the observer's sensitivity to renewable energy generation infrastructure. In spite of this, the cumulative visual impact is still considered to be within acceptable limits due to the generally remote location of the infrastructure and the limited number of affected sensitive visual receptors.

Mitigation:

Planning

- Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site.

Construction

- Ensure that vegetation is not unnecessarily removed during the construction period.
- Reduce the construction period through careful logistical planning and productive implementation of resources
- Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) where possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed of regularly at licensed waste facilities.
- Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
- Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts.
- Rehabilitate all disturbed areas immediately after the completion of construction works.
- Existing roads should be utilised wherever possible. New roads should be planned taking due cognisance of the topography to limit cut and fill requirements. Construction/upgrade of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

Operation

- Maintain the general appearance of the facility as a whole.

- Implement needs-based night lighting if considered acceptable by the CAA.
- Limit aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact.
- Shield the sources of light by physical barriers (walls, vegetation, or the structure itself).
- Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights.
- Make use of minimum lumen or wattage in fixtures.
- Make use of down-lighters, or shielded fixtures.
- Make use of Low Pressure Sodium lighting or other types of low impact lighting.
- Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.
- The maintenance of the turbines and ancillary structures and infrastructure must be undertaken to ensure that the facility does not degrade, therefore aggravating the visual impact
- Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.

Decommissioning

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.

Conclusion

As per the result from the visual impact assessment report, the structure would be easily visible to observers due to its high visual prominence, especially within a radius of 5-10km of the proposed WEF, which will potentially result in a high visual impact. This however does not pose a fatal flaw to the project.

6.13 HERITAGE

The Heritage Impact Assessment was conducted by Jaco van der Walt from HCAC (the report is included in Appendix D8).

Findings

Heritage

A site survey was conducted from the 11-14 September 2021. It is important to note that the survey focussed on the turbine locations of the original layout. After the survey was conducted other alternatives was proposed, covering other areas much of which was previously covered (Van der Walt 2012, Morris 2013, Van der Walt 2015, Orton 2017). The various assessments culminated in a total of 32 locations where heritage observations were made. Stone Age artefacts were recorded mostly as isolated scatters of very little heritage significance except for denser concentrations of artefacts. No grave sites, historical material or built heritage was recorded during the current survey. The only other observation made was a sandstone memorial for Jan G du Toit who passed away here on 18 March 1953.

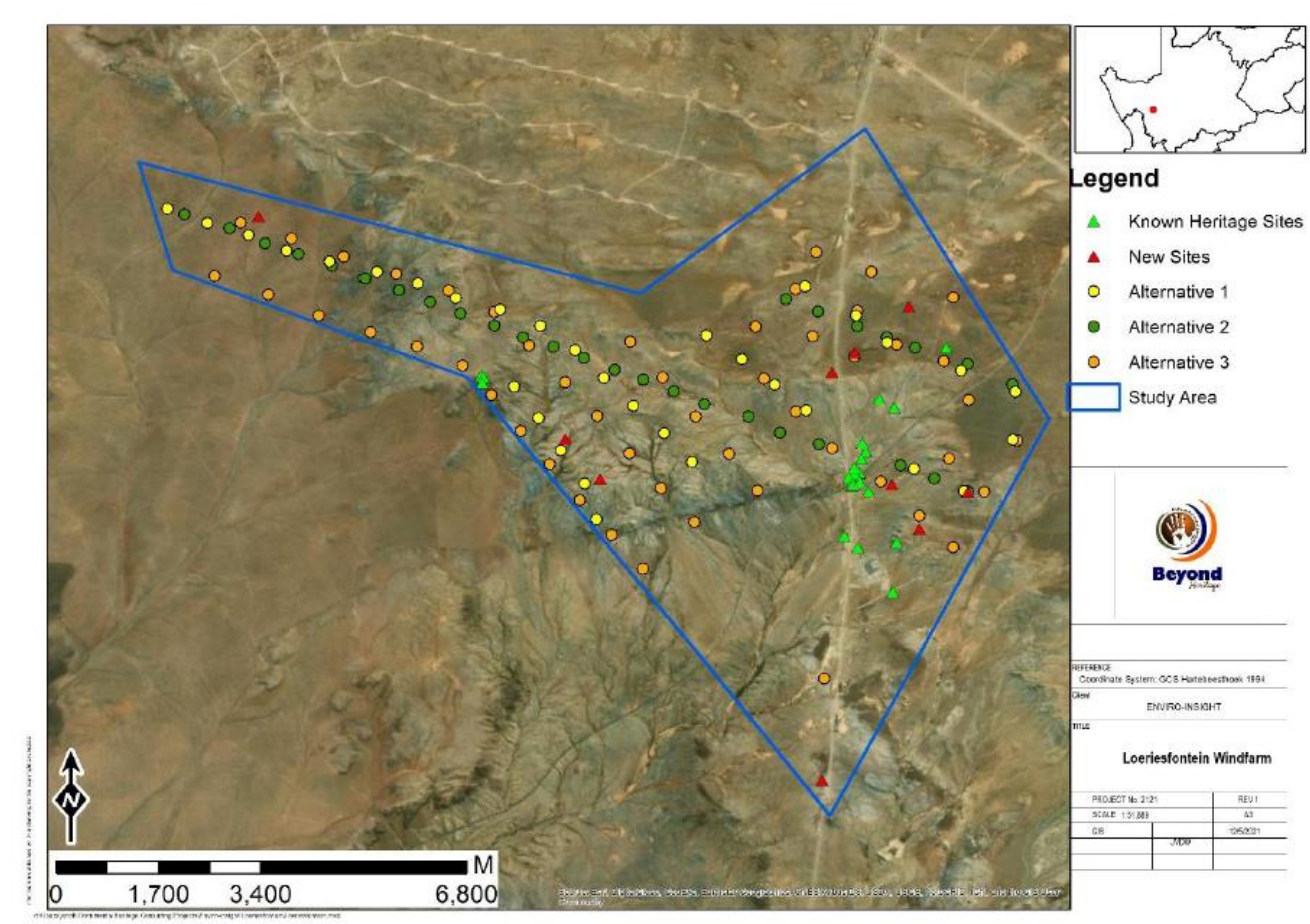


Figure 6-15: Heritage site distribution map in relation to the proposed layouts.

Paleontological Heritage

An independent study was conducted by Prof Marion Bamford. It was concluded that it is extremely unlikely that any fossils would be preserved in the alluvium of the Quaternary.

Impacts

Impacts to archaeological resources would mostly occur during the construction phase and will be of low magnitude since none of the turbines is placed on or near known sites. A few recorded resources of higher significance that will potentially be impacted on by the project, specifically by roads and ancillary infrastructure, are the sites clustered around Waypoint 20 and 22 and if so, mitigation will be required.

Construction

- Potential Impact on Waypoint 20 and 22. During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.
- Impact of the proposed project on the other recorded heritage resources. During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.

The proposed project will have a low cumulative impact as no significant heritage resources will be adversely affected. Cumulative impacts are deemed to be of low significance in this case because the broader landscape is extensive and is likely to hold many similar archaeological resources.

Mitigation

Construction

- Avoidance of known heritage sites, if this cannot be achieved mitigation will be required subject to Section 35 SAHRA permits;
- Implementation of a chance find procedure for the project.
- Avoidance of known heritage sites, if this cannot be achieved mitigation will be required subject to Section 35 SAHRA permits;
- Final infrastructure must be subjected to a pre-construction survey

Recommendations

- Implementation of a chance find procedure for the project;
- Avoidance of known heritage sites, if this cannot be achieved mitigation will be required subject to Section 35 SAHRA permits;
- Final infrastructure must be subjected to a pre-construction survey;
- Turbines associated with alternative 3 located in the southern portion of the farm Sous (Turbine 23, 29 3, 24, 25, 14, 17 and 48) and infrastructure on the section indicated in bright blue on the geology map or red on the SAHRIS map will require a paleontological site visit prior to construction to look for any possible fossils. The palaeontologist must obtain a relevant SAHRA permit in order to collect the fossils.

Conclusion

The three alternatives are all considered to be acceptable since the turbines avoid significant heritage sites and the impact of the proposed project on heritage resources can be mitigated to an acceptable level. The socio-economic benefits also outweigh the possible impacts of the development if the correct mitigation measures are implemented for the project. It is recommended that the proposed project can commence on the condition that the recommendations are implemented as part of the EMPr and based on approval from SAHRA.

6.14 SOCIO-ECONOMIC

The Social Impact Assessment was conducted by Steve Horak of HCV Africa and the full report is included in Appendix D9.

Literature review

History of Loeriesfontein

Loeriesfontein is a small rural service centre town that lies within a basin surrounded by the Hantam mountains and is situated to the north-west of the town of Calvinia. The town grew around a general store established in 1894 by a travelling Bible salesman, named Fredrick Turner, the son of the sister of the theologian Charles Spurgeon. Fredrick Turner came from Norwich, England. The general store still exists. It is currently owned by Victor Haupt, the grandson of Fredrick Turner. The shop is currently called Turner & Haupt SPAR and has been in the family for 113 years (Wikipedia , 2021).

Census and community survey information at glace

Table 5-9 presents information for Loeriesfontein, the HLM and the NDM over the period of the 2011 census and the 2016 community survey. As indicated in limitations the 2016 community survey does not collect data at the local level so the information for Loeriesfontein is only presented for the period 2011. The information presented here is discussed in more detail in the sections to follow.

Demographics

- Population

Based on census data 2011 the population of Loeriesfontein is estimated at 2 744 people distributed over 34.5 km² which translates to a population density 80 persons/km2. This is considerably denser than the population density of the Northern Cape at 3 persons/km².

The population of Loeriesfontein is young - 26% are between 0-14 years, 64.2% are of working age and 9.7% are elderly giving a dependency ratio of 55.7. Dependency ratio indicates the proportion of the population not in the workforce who are 'dependent' on those of working-age, it is a calculation which groups those aged under 15 with those over 65 years as the dependants and classifying those aged 15-64 years as the working-age population. A ratio of 55.7 is significantly higher than the district ratio of 47.1 indicating that there is high dependency on those of working age in Loeriesfontein.

- Ethnicity and Language

Of the 2,744 households in Loeriesfontein 86% are Coloured followed by White (11%) Black African (2.0%) and Indian/Asian (0.1%). 98 % of the people living in Loeriesfontein speak Afrikaans as a first language.

- Culture

As reflected in the demographical profile above, 86% of the people living in Loeriesfontein are identified as Coloured people. The term Coloured (also known as Bruinmense, Kleurlinge or Bruin Afrikaners) refers to the ethnic group of mixed race people in South Africa who possess some sub-Saharan African ancestry, but not enough to be considered Black African. Apart from ancestry in sub-Saharan Africa, coloureds also have substantial ancestry from Europe, Indonesia, Madagascar, Malaya, Mozambique, Mauritius, St Helena and Southern Africa. Genetic history studies suggest that this group has the highest levels of mixed ancestry in the world.

Coloured people generally observe two main religions, namely Christianity and Islam, however in the Northern Cape most coloured people follow the Christian religion as reported in the 2016 Stats SA community survey. Only 0.7% of people in the Northern Cape follow the Muslim faith and 95% of Coloured people self-reported as being Christian. In the Western Cape 5.6% of people follow the Muslim faith. These faiths usually result in a conservative outlook on life, people are generally family orientated and community is important.

- Vulnerable Households

According to the Hantam IDP there are 2 978 indigent households in the local municipality, this refers to households earning a combined income of less than R3 200 per month. Another measure of vulnerability is female-headed households in the HLM, 57.7% of households are headed by woman, this is considerably higher than in the NDM of 37.6%. The sex ratio is also higher for woman in Loeriesfontein at 102 women per 100 men, but this is not significant. Reported persons living with disabilities in the community survey 2016 is 9.8% which is lower than the provincial average of 10.7%.

Loeriesfontein also has a Soup Kitchen project which was establish in 2007. This project is funded by the Department of Social Development. The project currently provides soup to 80 people daily with a nutritional meal and 130 households are supported monthly. The presence of soup kitchens is an indication of poverty in communities.

- Housing

96.3% of people living in Loeriesfontein live in formal housing and a high percentage of people own their homes (69.5%) indicating a stable population. This is also higher than the district with 53.8% of people owning their houses in 2011. The average household size is 3,2 which is similar for the HLM and the NDM.

- Crime

Overall, the crime rates have increased between 2017 and 2018 and drug related crimes are particularly high for the district.

- Education

Loeriesfontein has a high percentage of people aged 20+ who have no schooling (16.8%) which is much higher than the NDM at 4.4%. Only 7.1% of people have a higher education aged 20+ and 17.1% have Matric at aged 20+. In terms of school facilities there is both a primary school and a high school.

- Waste management

96. 9 % of households in Loeriesfontein have weekly waste collection, the highest in the district and the town also has its own landfill site.

- Electricity

92.3% of households in Loeriesfontein have electricity for lighting, this is higher than for the district of 76.3 % of households in 2011.

- Health

Loeriesfontein has a clinic and hospital, the nearest large hospital is situated at Calvinia.

- Safety and security

Loeriesfontein has its own police station.

- Transport infrastructure

Using the R55 gravel road, the distance between Calvinia and Loeriesfontein is 86km, whilst travelling from Calvinia to Brandvlei requires the utilisation of the R27 tar surface road for a journey of approximately 2.5 hours. There is also a train station in Loeriesfontein.

- Social and Recreational Infrastructure

The Hantam LM has the following social and recreational infrastructure available:

- Three libraries in Calvinia, Loeriesfontein and Nieuwoudtville
- Seven sport facilities in Calvinia and Loeriesfontein
- Nine religious centres in Loeriesfontein

- Nature reserves

The Akkerendam Nature Reserve is situated next to Calvinia and is a popular recreation facility for residents. The reserve has hiking trails in the Hantam Mountains with routes of varying difficulty. The municipality and the Department of Environmental Affairs are in talks regarding the management and further development of this nature reserve. The project is currently unfunded in the NDM IDP. Nieuwoudtville has a flower bulb reserve managed by the Municipality that is very popular during the peak flower season. There is also a waterfall on the road between Nieuwoudtville and Loeriesfontein which can be considered a tourist attraction (NDM IDP, 2020/2021).

- Provincial economy

According to StatsSA (March 2019) the provincial economy grew at 2.84% (2017), an improvement from -1.24% experienced in 2016. Noteworthy, is the fact that the provincial growth of 2.8% in 2017, was above South African GDP growth average of 1.4% for the same period. The GDP of the Province is R 96 billion, of which the mining sector contributes an estimated R19 billion, agriculture contributes R6.8 billion while construction provides R2.6 billion. (NDM IDP, 2020-2021). It is of interest that power generation is not reported despite several largescale renewable energy projects in the Northern Cape.

- Hantam Local Municipality Economy

The Hantam Municipality is a relatively small economy, making up about 13% of 2017 Gross Value Added (GVA) in the Namakwa district – up from 12% in 2016. These contributions in growth are negligible proportions (for both years at 1.6%) of the provincial economy and are like the respective contributions in 2011.

The percentage share contribution by the tertiary sector in 2017 to the total GVA generated in the Hantam municipal area is about 69% or R1012 million compared to 70% or R928 million in 2016. The primary sector contributed 23.5% or R344 million and the secondary sector 7.5% or R111 million in 2017 – increased contributions from the year before.

Between 2000 and 2015, every economic sector in the municipal area grew positively in terms of GVA contribution but manufacturing showed negative growth in recent years. Note that the subsectors do not have high levels of volatility that are typical for, specifically the primary sector.

Electricity, gas and Water secondary sector of the local economy grew by 937% between 2000 and 2015 and at 0.4 % during 2015 and 2016 making this the largest growing sector in the municipality and showing the most growth. However, the Agricultural Primary sector showed the most growth between 2015 and 2016 at 19. 2 % (Hantam IDP, 2020/2021).

The significant increase in the subsector contribution of 'electricity, gas and water' since 2010, is due to the establishment of renewable energy generation facilities in the municipal area. Note that the contribution in this subsector as well as the 'transport' subsector, more than doubled between 2010 and 2015 while the contribution in the 'construction' subsector increased substantially between 2015 and 2017, i.e. as an economic activity with strong linkages to the establishment of the renewable energy generation facilities and the Square Kilometre Array (SKA) megaproject. It is reported that SKA has created more than 1000 jobs through infrastructure upgrades and construction on and around the SKA SA site 8. Between 2015 and 2017 the 'general government' sector has also shown high growth. The municipality also recognises that the renewable energy sector will continue to make a positive contribution to the economy going forward (Hantam IDP, 2020/2021).

- Loeriesfontein economy

The Loeriesfontein economy is still dominated by the Agriculture sector and general trade, the hospitality sector has also benefited from accommodating workers during the construction of the two existing WEFs in the area. Although the mining industry currently has a low contribution to the economy, 80% of the worlds' gypsum reserves lie just outside Loeriesfontein town, thus an opportunity exists for salt and gypsum mining in the region.

- Tourism in Loeriesfontein

The most significant tourist attraction is the floral display which happens August to September when wildflowers bloom in the veld surrounding the town. The town also boasts a windmill museum which is reported to be the second largest in the world. Quiver Tree Forest located on Gannabos outside of Loeriesfontein is the largest and southernmost colony for this member of the aloe family. Gannabos also offers a B&B, cottage and farmhouse for those wanting to stay a little longer. This is a coveted location for photographers and botanists, and a favourite stop-off for visitors from all over the world who annually visit this region to experience its legendary spring flower extravaganza.

- Wind Energy Facilities in the area

The Northern Cape has the highest volume of renewable energy utility power plants in the country. Loeriesfontein WEF and the Khobab WEF commenced their 20-year commercial operations in December 2017. With a generation capacity of 140 megawatts each, these two neighbouring WEF combined make up the largest single expanse of wind turbines in the country. Together they comprise a total of 122 wind turbine generators, spanning 6 653 hectares. Collectively the wind farms will power approximately 240 000 South African households, positively impacting the country's economy and its people. The WEFs have a combined value of approximately ZAR 7 Billion and are owned by a consortium led by Lekela Power. The majority of the 99m turbine towers were locally manufactured at the Gestamp Wind Turbine Tower Factory in the Western Cape (Khobabwind, 2021).

- The projects contribution to the local economy

The project will contribute to sustainable community growth through financial and non-financial community development initiatives. This will be done by giving back a percentage of total revenue earned to the community; through Socio-Economic Development (SED) and Enterprise Development (ED). This is a requirement for all wind farms.

- Local farm economy

As the project has not been announced it is difficult to develop a baseline for local farm economy where the project will be established. However, the area is mostly suitable for sheep farming and the farms do not offer many jobs since sheep farming is not labour intensive. At the same time agriculture makes a significant contribution to the economy and Loeriesfontein is classified as a rural service centre serving the surrounding farms. A more detailed assessment will be undertaken when the SIA is conducted as part of the EIA specialist studies.

- Employment

Employment and unemployment rates are important as these give an indicator of socio-economic well-being, as employment is how most households generate income to supply their basic needs. Hantam and Loeriesfontein have the lowest unemployment rates as shown in the table below. The data is for 2011 and this situation may look vastly different after the construction of the WEFs have taken place since 2017 in the area, the rates may be even lower.

In the Hantam municipal area, 5 165 (or 38.2%) of the working age population was formally employed in 2017, compared to 5224 (or 39.3%) in 2016 and 5 614 (or 37.4%) in 2001, i.e. a relative improvement in overall formal employment since 2001 but worsening in recent years. These figures also represent a worsening trend if measured in number of persons employed. The number of unemployed persons (802) in the municipal area in 2017 was more or less the same as in 2016 (746) and in 2001

(779). These trends must be seen in the light of the general depopulation of the municipality, i.e. a smaller working age population and the high percentage of persons not economically active. (Hantam, IDP).

Impacts

Interviews were undertaken for those affected by the proposed project to develop a social profile, these include Hantam Local Municipality, Farm owner, Neighbouring farmers, The Loeriesfontein farmers union and Ward 5 (Loeriesfontein) ward councillor.

Construction

- Creation of Employment, business opportunities and skills development (Positive Impact)
- Impacts associated with the presence of construction workers on site and in the local area. The presence of construction workers can have a negative impact on local populations, these mostly relate to unacceptably behaviours which are different from what the local population might be used to or have been exposed to such as An increase in crime levels; the loss of wives and girlfriends to construction workers who have higher disposable income than locals, an increase in alcohol and drug abuse, increase in teenage and unwanted pregnancies, an increase in prostitution; and an increase in Sexually Transmitted Diseases (STDs), including HIV.
- Influx of job seekers to the area;
- Impacts on farms, farmers and their workers;
- Impact of construction vehicles, including traffic damage to the dirt road safety and dust;
- Impact on farming activities;
- Additional pressure on services offered by the local municipality;
- Loss of sense of place; and
- Noise, dust and visual impacts.

Operation

- The establishment of renewable energy infrastructure and generation of clean, renewable energy (Positive);
- Creation of employment and business opportunities (Positive);;
- Generation of income for landowner (Positive); and
- The prescribed investment into socio-economic and enterprise development initiatives by IPPs (Positive);.
- Visual impacts and an associated impact on sense of place;
- Impact on property values;
- Potential impact on tourism; and
- Noise impacts.

Cumulative

- Increased pressure on services in the local area

- Loss of sense of place
- Improvement to the local economy
- Increased Employment opportunities

Mitigation

Construction

- As far as possible local labour should be used particularly for the low skilled and semi-skilled job opportunities. The majority of the skilled jobs will be filled by people from outside the local area due to a lack of skilled people in the local area.
- The HLM should be engaged to establish if they know of skilled local contractors which could be appoint for the construction phase of the project
- HLM and local ward councillor should be informed when jobs will become available, and these should be well advertised locally including the employment criteria and that a transparent process for employment will be followed including employment equity.
- A number of local workers will have been used in the construction of the existing WEF and Solar Plant, these workers will have developed skills during the construction of these facilities and they should also be considered for further employment, existing contractors could be engaged for references for good workers.
- Once local workers have been employed, they should receive on-the-job training and skills development. Where high potential workers are identified, these should be considered for further training and formal qualification.
- The project developer should engage with the HLM to establish a database of local businesses, especially BBBEE compliant businesses, which could qualify as service providers such as construction companies, catering, waste collection, security companies and cleaning services before the construction starts and tenders are issued. Botterblom WEF is at an advantage as the existing WEF and the Solar Plant will have already developed some of these businesses.
- Where feasible prospective service providers should be assisted with the completion of tender forms and submitting bids for work which will be within their ability to complete, but they might not have the skill in terms of these administrative competencies.
- As far as practically possible local business should be given preference over businesses outside of the local area, which in this instance is defined as the HLM, then the district, then the province and then South Africa.
- It is recognised that preference should be given to local companies, tender processes still need to be fair and transparent and quality of services cannot be compromised as this can have undesired consequences such as lapses in health and safety standards.

- As discussed above the developer and or the appointed contractors should implement a local employment policy giving preference to people from Loeriesfontein, as this would mean that the construction workers will stay at their own homes with their partners reducing the risky behaviours as discussed.
- A code of conduct should be developed for all construction workers including all levels of skill. The code of conduct should include not practicing risky behaviours. Workers should sign that they agree to this code and if the code is broken, they could be dismissed. All actions taken against workers will need to be within the requirements of South African labour legislation.
- A community liaison officer should be appointed before construction is started, this person should be responsible for accepting grievances from the local population, these grievances can include misconduct of workers. These grievances can then be investigated and the appropriate action taken.
- Prostitutes should not be permitted to sleep at the construction workers' accommodation in Loeriesfontein.
- Workers should be educated with regards to risky behaviour and the risks of contracting an STD, including HIV, and the consequences of contracting these diseases. Workers should be advised to regularly have HIV testing.
- All workers should be transported to and from the construction site and their accommodation in Loeriesfontein, no accommodation should be permitted on site.
- There are no farm workers living close to the site and the nearest permanent residents are 5km away, the site is isolated being 53km from Loeriesfontein. Controlling access of workers will protect the permanent residents from workers who might want to engage in crime, including stock theft, which might be an issue.
- Workers should not be permitted to stay on neighbouring farms.
- Workers should be regularly tested for the presence of alcohol and drugs when they enter the work place as required by health and safety regulations.
- The developer and/or the appointed contractors should look to employ locals first before looking outside of the local area, this is especially important with unskilled and low skilled opportunities as it is likely that jobseekers will come to the area looking for these types of jobs.
- No job opportunities should be provided at the gate of the construction site, all opportunities should be secured in Loeriesfontein, this will prevent jobseekers looking for jobs at the construction site which would have its own set of impacts such as on health and safety and security of the site.
- The site should also be secured to ensure that unwanted jobseekers do not access the construction site or commit crimes in the area around the construction site
- It is recommended that a community liaison officer be employed by the developer. The purpose of this position is to receive grievances should they arise, these could relate to damage to farm infrastructure, theft and fires. Should these occur, an investigation would need to be undertaken and if it is proven that these were as a result of the construction activities then fair compensation would need to be made for these damages.

- The developer and/or the appointed contractors should ensure that they have the necessary firefighting equipment as required by the health and safety regulations so that if a fire starts on the site, it can be put out quickly before it spreads to neighbouring farms.
- Workers may not trespass on the neighbouring farms, they should be transported to and from site to prevent this from happening. ‘No trespassing’ should be included in the code of conduct. Should workers trespass or be caught stealing, they should be dismissed in line with South African labour legislation.
- No employment opportunities should be provided at the construction site gate.
- Should a contractor be appointed to develop the WEF, they would need to be held liable for any loss to farmers which may result from construction activities including damage to infrastructure, fires and stock theft. This should be included in contracts with contractors appointed to build the WEF.
- Contractors will also need to sign the code of conduct.
- All waste generated during the construction phase should be managed in line with the Environmental Management Plan (EMP) which will be developed for the project. No waste should be allowed to impact surrounding farms.
- During induction of workers, they should be trained on the code of conduct and the consequences of trespassing should be stressed. These topics should also be covered during the daily tool box talks which are held as part of the Health Safety and Environment (HSE) requirements for any construction site.
- Other than security personnel, no workers should be allowed on site outside of work hours.
- The road will need to be maintained which is a function of the district and local government, however they may need assistance in increasing the frequency of the grading of the dirt road. It may be worth investigating whether it would be worth entering into agreements with all the road users to fund the tarring of the road.
- Dust suppression will be necessary on the dirt road to site to lessen the dust impacts. Construction vehicles carrying materials which can become airborne, such as construction sand, will need to be tied down with tarpaulins or other suitable covers.
- All construction vehicles will need to be roadworthy, and drivers must have the correct code and valid driver’s licenses. They should also be instructed on road safety and the need to stay within the speed limits. It may be necessary to fit GPS systems to ensure that drivers stick to the speed limits.
- In order to mitigate the traffic impacts, the transportation of equipment not manufactured on site needs to be planned for outside the peak periods such as weekends, school holidays and during the peak flower season when there is additional tourist traffic between August and September.
- Farmers need to be given ample warning of construction activities and when the road will be in heavy use so that the sheep who may be affected by these activities can be moved away from the road.
- Drivers and passengers need to be informed that they may not dispose of waste next to the road by throwing rubbish out the window. This will also need to be included in the code of conduct.

- The road reserve should be cleared regularly by the developer and or contractors appointed to construct the WEF and this should be included in the EMP.
- All waste should be removed from site to a registered landfill and transported in a closed vehicle or secured by a tarpaulin or other suitable cover. This requirement should also be included in the EMP.
- During the construction of the wind turbines access roads should be limited as far as possible and only the necessary roads constructed
- The footprint of the construction related activities and areas, such as offices and workshops, should be minimized.
- Grazing areas should not be unnecessarily lost to laydown areas and offices.
- Ensuring that disturbed areas are rehabilitated on completion of the construction phase will lessen the impact of the loss of grazing and should be included in the EMP.
- Rehabilitation requirements should also be included in the contracts with contractors.
- It will need to be ensured that infrastructure on the property and neighbouring properties such as kraals and water infrastructure are not damaged during construction as this would negatively impact these farms.
- The local municipality needs to be informed of the timing of the project so that they can prepare for the addition pressure on social services.
- An opportunity exists to work together with the HLM in assisting the municipality to provide services to the project's construction employees and the greater municipality.
- There is also an opportunity for the WEF to work together to assist the HLM in providing services, this is supported in that at a meeting with the HLM they had a list of projects with which the WEFs can assist. This included water provision, youth development, SMME development, and the development of conservation areas.
- Identify projects in the IDP to support the municipality.
- The loss of the sense of place cannot be mitigated but the impact is lessened by the fact that the entire area is changing with regards to its sense of place from rural agriculture to an area where renewable energy is generated.
- The area is still remote and rural, the main receptors of this change in sense of place are the farmers who use the road to travel to their farms.
- The only social impact which cannot be mitigated is the loss of sense of place, this can be reversed during the deconstruction of the WEF and is therefore rated as High reversibility.
- The other potential impacts of noise and visual impacts do not need to be mitigated as the closest human receptors will not experience these impacts. Should they experience these impacts, they will be low impacts and insignificant.

<u>Operation</u>

- Ensure that the WEF contributes to the power grid by providing clean energy.
- Make sure that as much local content in terms of materials used to build the WEF and in supplying the personnel to construct the WEF

- As discussed, it should be a recruitment policy to look for skills locally first, including in the HLM, district, province and nationally before looking for skills internationally.
- On the job training and development programmes implemented by the developer and or contractors will further enhance this positive impact.
- The developer should look to establish a mechanism to administer funds which are set aside for socio-economic and enterprise development initiatives by IPPs, with input from the HLM and the community.
- Local businesses should be developed to provide services to the WEF.
- The lease agreement will need to be in place before the development of the WEF commences.
- The SED and ED should be aligned with what the HLM has in mind for the development of the local municipality.
- Stakeholders such as the HLM Municipal Manager and IDP manager, ward councillors and community representatives should be engaged, to ensure that the initiatives align with their expectations and are practical to the Loeriesfontein social- economic environment.
- The percentage income to be assigned to SED and ED will need to be determined and agreed before the WEF becomes operational.
- The suggestion was made by the ward councillor during engagement with him that a community trust with independent trustees should be established to administer the money allocated to SED and ED for the benefit of the community of Loeriesfontein.

<u>Decommissioning</u>

- Local workers and contractors should be given preference for work when the decommissioning of infrastructure is undertaken
- Once the site is decommissioned it should be well rehabilitated and funds should be allocated to rehabilitation whilst the WEF is still in operation. This will also assist in restoring a sense of place to a condition similar to before the Botterblom WEF was built.
- During the engagement with the HLM it was mentioned that Calvinia would be a good place to recycle the materials from the WEF, this could be investigated at the time of decommissioning.
- Workers should be notified of their pending retrenchment at least 6 months before the event so that they are given time to search for alternative employment whilst still being employed.
- Workers should be retrenched in line with the South African labour law requirements.
- Retrenchment packages should be fair and enable workers to support themselves for a period of at least three months.
- Workers should be assisted in claiming from the Unemployment Insurance Fund (UIF).
- The HLM will need to be notified of the pending decommission of the WEF so that social services are prepared for the potential additional dependents.

<u>Cumulative</u>

- Assisting the municipality in providing services
- Assistance in financing projects identified in the HLM IDP
- Inform the HLM of the timing of the project
- The impact of the change in the sense of place cannot be mitigated.
- Local businesses should be used to provide services as much as possible.
- There is also an opportunity to develop local businesses to provide materials for the construction and maintained of the WEF.
- Locals should be employed as far as possible.

Conclusion

The development of the proposed WEF will create employment, training and business opportunities during both the construction and operation phases of the project. The potential negative impacts associated with the construction phase can be mitigated. The proposed WEF is an investment in clean, renewable energy infrastructure for the country which will go some way to offset the negative environmental and socio-economic impacts associated with a coal-based fossil fuel energy generation. Renewable energy, including WEF, also addresses climate change and assists the country in meeting climate change reduction goals.

The development of the Botterblom WEF is supported as the project will have significant positive impacts. These positive impacts relate to the economy by providing clean energy which will reduce South Africa's carbon footprint.

6.15 TRANSPORTATION IMPACT ASSESSMENT

A Transportation Impact Assessment Report was compiled by Innovative Transport Solutions (refer to Appendix D10).

Roads considered and assessed within the vicinity of the project area include the N1 (Paved/Tar), R27 (Paved/Tar), R354/R356 (Paved/Tar), R355 (Paved/Tar), R357 (Paved/Tar) and Granaatboskolk / Zout Dwaggas Road (Gravel).

The existing traffic volumes along the public roads in the site vicinity are low and well within the capacity of the surrounding road network. The existing traffic volumes will not be any reason for concern in terms of network and intersection capacity.

Access to the wind turbine locations will be via existing accesses off the Granaatboskolk / Zout Dwaggas Road. The available shoulder sight distances (SSD) along the Granaatboskolk / Zout Dwaggas Road from the different access positions is sufficient.The proposed WEF will require the transportation of abnormal loads. Three routes are considered for the transportation of these loads, these are:

- The Coega route is approximately 1 033 km in length, it follows the R334 to Uitenhage and then following the R75 to Kleinpoort, then via the R329 past Mount Stewart, then via R61 to Beaufort West , then south along the N1 pass Laingsburg to the R354, then north via the R354 via Sutherland to Calvinia, then via the R355 passing Calvina to Loeriesfontein and via the grave road, Granaatboskolk / Zout Dwaggas, to the site.

- The Saldanha route is approximately 724 km in length, it follows the R45 and then the R311 to Moorreesburg, then the R311 to Riebeeck Kasteel and the R46 via Hermon and Wolseley to the N1 at Worcester, then via the N1 to the R354 at Matjiesfontein and then north via the R354 via Sutherland to Calvinia, then via the R355 passing Calvina to Loeriesfontein and via the grave road, Granaatboskolk / Zout Dwaggas, to the site.
- The Cape Town route is approximately 751 km in length, it follows the R27 to Melkbosstrand and then the via the Melkbosstrand Road to the N1, then via the to Moorreesburg, then the R311 to Riebeeck Kasteel and the R46 via Hermon and Wolseley to the N1 at Worcester, then via the N1 to the R354 at Matjiesfontein and then north via the R354 via Sutherland to Calvinia, then via the R355 passing Calvina to Loeriesfontein and via the grave road Granaatboskolk / Zout Dwaggas, to the site.

The final route will have to be checked for compliance during the final design stages of the project. Permits will need to be obtained from the relevant road authorities for all abnormal loads and the specific route will be specified based on the characteristics of each load type.

Traffic Analysis

- Year 2025 Background Traffic Conditions: Due to the low traffic volumes along the surrounding road network, it is expected that the road network will continue to operate at acceptable levels-of-service during the background conditions. The roads in the site vicinity are in a fair condition and no major maintenance will be required in the near future
- Construction Phase: A large amount of traffic will be generated during the construction phase. If any internal access roads to the turbines will be constructed mainly of local materials sourced on site if the material is suitable, otherwise material will be imported from commercial sites. These roads will be retained and used for inspection and maintenance of the wind turbines.

Trip Generation:

- Alternative 1&2: Approximately 176 motor vehicle and truck trips during the average weekday
- Alternative 3: It is expected that approximately 2 908 trucks loads will be required during the 18-month construction period. This means that on average approximately 7 trucks will visit the site per day which equates to approximately 14 truck trips spread over an eight-hour day.

Impacts

Construction

- Increase in traffic volumes on the surrounding road network because of construction traffic. During the construction phase there will be an increase in traffic volumes on the surrounding road network that will impact on the general road users.
- Gravel loss and possible damage to the road layer works. because of additional truck traffic and heavy load truck traffic during the construction phase. During the construction phase there will be gravel loss and possible damage to the road

layer works along Granaatboskolk / Zout Dwaggas Road as a result of additional truck traffic and heavy load truck traffic delivering equipment to the site.

Operation

- Increase in traffic volumes on the surrounding road network. During the operational phase there will be a slight increase in traffic volumes on the surrounding road network that might impact on the general road users and result in gravel loss along Granaatboskolk / Zout Dwaggas Road.

Decommissioning

- Gravel loss and possible damage to the road layer works. as a result of additional truck traffic and heavy load truck traffic during the decommissioning phase. During the decommissioning phase there will be gravel loss and possible damage to the road layer works along Granaatboskolk / Zout Dwaggas Road as a result of additional truck traffic and heavy load truck traffic removing equipment from the site.

Cumulative

Cumulative impacts are considered low in all impacts identified.

Mitigation

Construction

- Abnormal and heavy load vehicles should not be allowed on the public road network during the typical weekday a.m. and p.m. peak hours.
- Abnormal load vehicles should be escorted by traffic officials to control traffic and limit possible conflicts at intersections.
- These measures will be included in the Transport Management Plan
- Resurfacing of sections along Granaatboskolk / Zout Dwaggas, where required and regular road maintenance i.e. grading of the road once every two weeks during the construction phase.
- The road can also be sprayed with water (grey water if available) once a day to limit dust pollution and gravel loss.

Operation

- Routine road maintenance by the relevant Roads Authority.

Decommissioning

- Resurfacing of sections along Granaatboskolk / Zout Dwaggas Road, where required and regular road maintenance i.e. grading of the road once every two weeks during the decommissioning phase.
- The road can also be sprayed with water (grey water if available) once a day to limit dust pollution and gravel loss.

Cumulative

Cumulative impacts were considered to be low, therefore no mitigation measures were provided.

Traffic Management and Transportation Plan

- During the construction phase there will be an increase in truck traffic along the roads in the site vicinity, compared to the current truck traffic along these roads. However, the expected total traffic volumes along these roads will still be well within the function of the roads and no operational or safety issues are expected.
- It is recommended that construction and abnormal load traffic should be limited to outside the typical traffic peaks in build-up areas and through towns.
- Most of the equipment and construction material will be delivered to the site with heavy vehicles. The turbine components will be transported by abnormal load vehicles. It is expected that the delivery of the equipment can occur over a 18-month period and the impact of the delivery vehicles on the existing traffic along the road network in the site vicinity will be acceptable. All deliveries with abnormal loads will operate under an approved transportation plan with the necessary traffic routes and traffic accommodation plans in place.

Conclusion

The existing road network has sufficient spare capacity to accommodate the proposed Botterblom Wind Energy Facility, without any road upgrades required to the existing road infrastructure. It is recommended that the proposed Botterblom Wind Energy Facility be approved from a transport impact perspective.

6.16 ELECTROMAGNETIC AND RADIO FREQUENCY INTERFERENCE

The South African Radio Astronomy Observatory (SARAO) is a National Facility managed by the National Research Foundation and incorporates all national radio astronomy telescopes and programmes.

The Square Kilometre Array (SKA) project is an international effort (co-hosted between South Africa and Australia) to build the world's largest radio telescope, with a square kilometre (one million square metres) of collecting area. It will have an unprecedented scope in observations, exceeding the image resolution quality of the Hubble Space Telescope by a factor of 50 times, whilst also having the ability to image huge areas of sky in parallel.9 The South African MeerKAT radio telescope, situated 90 km outside the small Northern Cape town of Carnarvon, is a precursor to the SKA telescope and will be integrated into the mid-frequency component of SKA Phase 1. The SKA is located in the Nama Karoo of South Africa, providing the perfect radio quiet backdrop for the high and medium frequency arrays that will form a critical part of the SKA's ground-breaking continent wide telescope. In an effort to protect this unique landscape in the country, the Minister of Science and Technology declared three Astronomy Advantage Areas in the Karoo in terms of the Astronomy Geographic Advantage Act (Act 21 of 2007).

A comment was received by SARAO on 17 June 2021 (Appendix, which indicated that the project represents a low risk of interference to the SKA radio telescope with a required mitigation measure of -5.10 dBm/Hz to reduce interference at the telescope. As such, SARAO do not have any objection to the development. They did, however, recommend that the Applicant should take all precautionary measures to limit the electromagnetic emissions (EMI) in all your electrical cable installations and equipment.

The sensitivity with regards to telecommunications is considered low. Nevertheless, it was attempted to receive feedback from the major telecommunication networks in the area. So far, only Vodacom has responded on 26 May 2021 indicating no objection to the proposed Botterblom WEF as it will have no impact on surrounding Vodacom towers or its existing / future transmission routes (Microwave) in this area.

6.17 WAKE IMPACT ASSESSMENT

6.17.1. A Wake Impact Assessment Report was compiled by DNV, refer to Appendix D11.1.

Wake effect and turbine turbulence occur when wind energy facilities are located in close proximity to one another. Both wake effect and turbine turbulence can occur when a new wind energy facility is established upwind of an existing wind energy facility. Wake effect is the phenomenon that can occur when the new upwind wind energy facility is first in line in receiving and capturing the available wind resource, thereby possibly reducing the quantity of wind available to the downwind facility and, concomitantly, the energy production capabilities of such a facility.

Wind turbines extract energy from the wind, and downstream there is a wake from the wind turbine where the wind speed is reduced. As the flow proceeds downstream, there is a spreading of the wake, and the wake recovers towards free stream conditions. The wake effect loss is the aggregated influence on the energy production of the wind farm which results from the changes in wind speed caused by the impact of the turbines on each other. These effects are calculated using the WindFarmer computational model.

The new upwind facility may also have an impact on the quality of the remaining wind available to the downwind facility to the extent that, as the wind passes through the turbine rotors of the upwind facility, the flow of the remaining wind becomes more turbulent. The more turbulent wind may result in mechanical wear and tear and, therefore, increased maintenance on the turbines of the downwind facility. The result may be possible additional downtime and may even result in a decrease in the expected longevity of the turbines.

While the impacts of wake effects and turbine turbulence have not yet been the subject matter of judicial consideration in the country, and despite the relatively limited number of wind energy facilities in the country, they are now being raised by the owners of downwind energy facilities in their legal opposition to the granting of environmental authorisations for the development of proposed new nearby and upwind facilities.

The site is proposed within a region of high wind farm development activity and the following wind farms exist or are proposed in the vicinity of the site, namely, Kokerboom 1 Wind Farm (proposed), Kokerboom 2 Wind Farm (proposed), Kokerboom 3 Wind Farm (proposed), Kokerboom 4 Wind Farm (proposed), Khobab Wind Farm (operational) and Loeriesfontein Wind Farm (operational).

Long term Wind Regime Onsite

The ERA5 dataset was identified as the most suitable source of long-term reference data for the analysis.

- Derivation of long-term wind speed at the mast

The slope and intercept of the correlation were applied to the 10-daily mean wind speeds recorded at the reference source to synthesise historical 10-daily mean wind speeds at the mast at the primary anemometer. The measured and synthesised 10-daily means were then combined, with priority given to measured data, to derive the long-term annual wind speed at the mast

Device	Height [m]	Measurement period [years]	Period defining the long-term wind speed [years]	Measured wind speed [m/s]	Long-term wind speed [m/s]	Long-term wind speed adjustment [%]
Mast M1	124.0	1.3	19.8	8.0	8.0	-0.1

Figure 6-16: Long Term wind speed at site.

- Hub-height wind regime

The measured variation in wind speed with height at the site mast has been defined using the power law shear exponent and has been used to predict the wind resource at the proposed hub heights

Device	Heights [m]	Long-term wind speed at Measurement height [m/s]	Measured wind shear exponent	Long-term wind speed at 99 m [m/s]	Long-term wind speed at 118 m [m/s]	Long-term wind speed at 120 m [m/s]
Mast M1	40, 60, 80, 100	8.0	0.12	7.8	7.9	7.9

Figure 6-17: Measured wind shear exponents at the site.

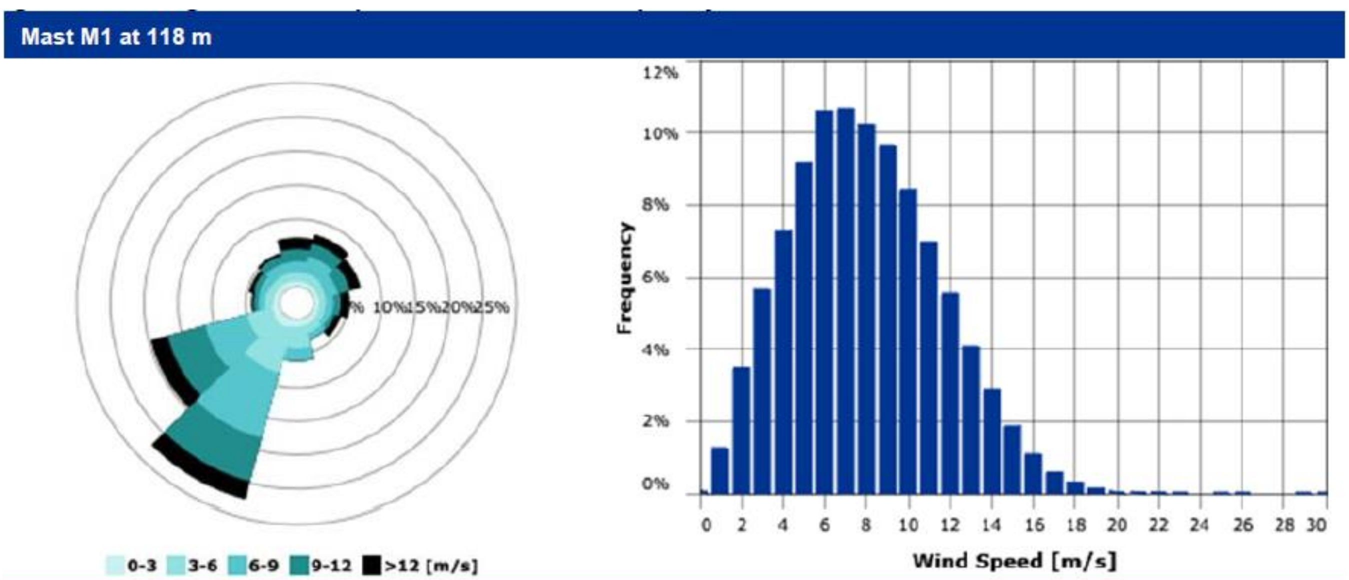


Figure 6-18: Long term wind speed and direction frequency distribution

Wake Analysis

The eddy viscosity model within WindFarmer is employed using a site-specific definition of the turbulence intensity as an input, combined with a Large Wind Farm Wake Model developed by DNV /11/, /12/, /13/. In addition, turbine interaction also includes lateral as well as upstream effects, which together contribute to a resistance, or blockage, on the wind flow, deflecting some of the flow above and around the wind farm. The parameter used in the model are:

- Turbine layout and inter-turbine spacing;
- Adjusted wind speed from site wind flow calculations;
- Ambient turbulence profile;
- Wind turbine thrust characteristic;
- Wind turbine power characteristic; and
- Rotor speed characteristic.

Table 6-9: External turbine interaction effect.

Neighbouring wind farm	External turbine interaction effect caused by Botterblom Layout 1	External turbine interaction effect caused by Botterblom Layout 2
Loeriesfontein	98.2%	98.3%
Khobab	98.4%	98.4%
Kokerboom 1	99.2%	99.2%
Kokerboom 2	99.7%	99.7%
Kokerboom 3	99.7%	99.7%
Kokerboom 4	99.2%	99.2%

6.17.2. Additional Wake Impact Assessment Appendix 11.2.

An updated Wake Impact Assessment was undertaken by EnergieTEAM and Genesis, refer to Appendix 11.2. This study should be read together in conjunction with the Wake Analysis undertaken by DNV. The updated report was conducted to account for the further seven surrounding WEFs, namely Khobab (operational), Loeriesfontein (operational), Kokerboom 1 (proposed), Kokerboom 2 (proposed), Kokerboom 3 (proposed), Kokerboom 4 (proposed), Kokerboom 5 (proposed) and Dwarsrug (proposed).

The Eddy Viscosity model with WindPro was used which, taking each wind speed and direction and in turn calculates the wake loss and power production of a project. The important parameters used in the analysis are:

- Turbine layout and inter-turbine spacing;
- Adjusted wind speed rom site wind flow calculations;
- Ambien turbulence profile;

- Wind turbine thrust characteristic;
- Wind turbine power characteristic; and
- Rotor speed characteristic.

It was concluded that Khobab wind farm will be affected by Botterblom in terms of wake effect as it has a 1,70% wake loss. Loeriesfontein, Kokerboom 1 and Kokerboom 5 are all likely to have a 0.6%. Kokerboom 2, Kokerboom 3, Kokerboom 4 and Dwarsrug WEFs influence would be negligible.

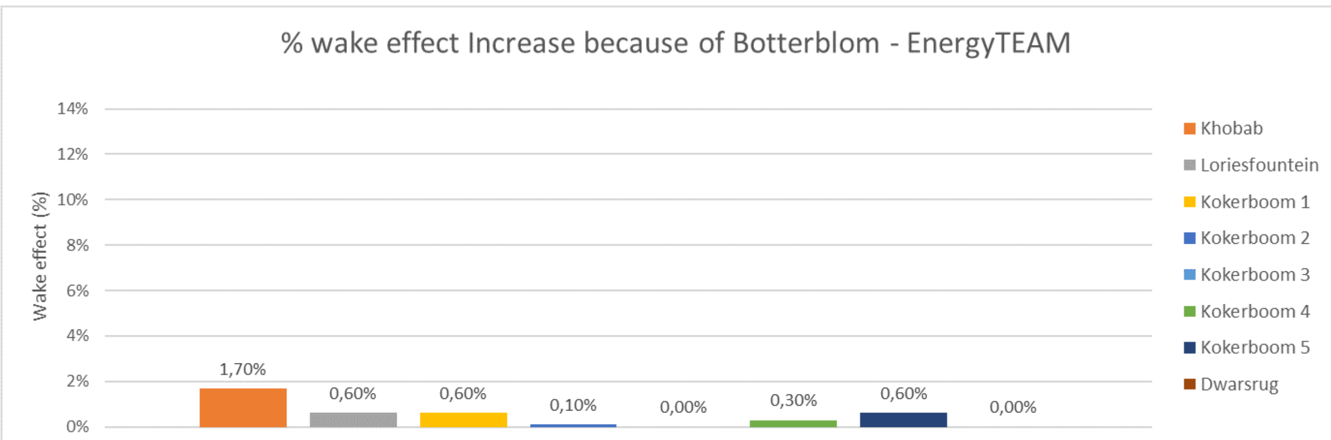


Figure 6-19: Summary predicted external wake loss of Botterblom on neighbouring wind farms

6.18 SOCIO-ECONOMIC ASSESSMENT OF THE POTENTIAL WAKE EFFECTS

The Socio-Economic Assessment of the potential wake effects was compiled by Urban-Econ Development Economists and Urban-Econ:NIKELA (refer to Appendix D12).

The report was compiled to socio-economic implications of the potential wake losses that could be caused by the Botterblom WEF on six WEFs. Community development contributions made by WEFs, which are selected as preferred bidders though the REIPPPP, are linked to the revenue derived by the same facilities. With community development contributions set as a percent of annual revenue, this means that any changes in the revenue of a WEF would result in the changes of the contribution made by the same facility for the development of the community.

The results of the study show that the Botterblom WEF could cause between R4.9 million (2021 prices) and R4.8 million (2021 prices) of losses for the community during the PPA periods of six WEFs, depending on the layout option chosen. The majority of these losses will ensue from the impact of the Botterblom WEF on the already operating Loeriesfontein WEF (R1.8 million for

Botterblom L1 WEF to R1.7 million for Botterblom L2 WEF over outstanding PPA period) and Khobab WEF (R1.6 million over outstanding PPA period, irrespective of the layout option). Among the Kokerboom WEFs, the largest negative impact on CD contributions made by these facilities will fall onto the Kokerboom 1 WEF (R0.8 million over 20-year PPA period, irrespective of the layout option), while the smallest negative impact will be on the Kokerboom 4 WEF (R0.2 million over 20-year PPA period, irrespective of the layout option).

The above-mentioned negative effect on the other WEFs contributions towards community development in the area is expected to be offset by the contributions made by the Botterblom WEF itself. With the proposed WEF having the potential to contribution R51.6 million to R55.0 million (2021 prices) towards community development of its 20-year PPA period, the net effect on the community will be positive. Overall, depending on the layout option chosen, the development of the Botterblom WEF will increase the community development contributions by R46.7 million to R50.2 million (2021 prices) over the PPA periods of considered WEFs.

Impacts

- Negative change in the contribution towards CD due to the wake losses caused by the Botterblom WEF to Loeriesfontein WEF, Khobab WEF, Kokerboom 1 WEF, Kokerboom 2 WEF, Kokerboom 3 WEF, Kokerboom 3 WEF
- Positive change in the contribution towards CD due to contributions made by the Botterblom WEF
- Cumulative positive change in the contribution towards CD due to the wake losses caused by the Botterblom WEF and contributions made by the Botterblom WEF

Mitigation

- Sign a compensation agreement with Loeriesfontein WEF, Khobab WEF, Kokerboom 1 WEF, Kokerboom 2 WEF, Kokerboom 3 WEF, Kokerboom 3 WEF

Conclusion

The study revealed that external turbine interactions caused by the Botterblom WEF will result in wake losses, which translates into reduced amount of electricity that potentially affected WEFs could generate. This results in the losses of annual revenues and, by extrapolation, leads to the reduced community development contributions that the WEFs can make. The negative effect on the other WEFs contributions towards community development in the area is expected to be offset by the contributions made by the Botterblom WEF itself.

7 IMPACT ASSESSMENT

7.1 METHODOLOGY

Direct, indirect and cumulative impacts of the issues that will be identified during the specialist investigations will assessed in terms of these standard rating scales to determine their significance. The rating system used for assessing impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on six criteria, namely:

- **Status** of impacts – determines whether the potential impact is positive (positive gain to the environment), negative (negative impact on the environment), or neutral (i.e. no perceived cost or benefit to the environment). Take note that a positive impact will have a low score value as the impact is considered favourable to the environment;
- **Spatial extent** of impacts – determines the spatial scale of the impact on a scale of localised to global effect. Many impacts are significant only within the immediate vicinity of the site or within the surrounding community, whilst others may be significant at a local or regional level. Potential impact is expressed numerically on a scale of 1 (site-specific) to 5 (global);
- **Duration** of impacts – refers to the length of time that the aspect may cause a change either positively or negatively on the environment. Potential impact is expressed numerically on a scale of 1 (project duration) to 5 (permanent);
- **Frequency of the activity**– The frequency of the activity refers to how regularly the activity takes place. The more frequent an activity, the more potential there is for a related impact to occur.
- **Severity** of impacts – quantifies the impact in terms of the magnitude of the effect on the baseline environment, and includes consideration of the following factors:
  - The reversibility of the impact;
  - The sensitivity of the receptor to the stressor;
  - The impact duration, its permanency and whether it increases or decreases with time;
  - Whether the aspect is controversial or would set a precedent;
  - The threat to environmental and health standards and objectives;
- **Probability** of impacts –quantifies the impact in terms of the likelihood of the impact occurring on a percentage scale of <5% (improbable) to >95% (definite).

Determination of Impact Significance

The information presented above in terms of identifying and describing the aspects and impacts is summarised in below in and significance is assigned with supporting rational.

Table 7-1: Consolidated Table of Aspects and Impacts Scoring

Spatial Scale	Rating	Duration	Rating	Severity	Rating
Activity specific	1	One day to one month	1	Insignificant/non-harmful	1
Area specific	2	One month to one year	2	Small/potentially harmful	2
Whole site/plant/mine	3	One year to ten years	3	Significant/slightly harmful	3
Regional/neighbouring areas	4	Life of operation	4	Great/harmful	4
National	5	Post closure	5	Disastrous/extremely harmful	5

Frequency of Activity	Rating	Probability of Impact	Rating
Annually / Once-off	1	Almost never/almost impossible	1
6 monthly	2	Very seldom/highly unlikely	2
Monthly	3	Infrequent/unlikely/seldom	3
Weekly	4	Often/regularly/likely/possible	4
Daily / Regularly	5	Daily/highly likely/definitely	5

Significance Rating of Impacts	Timing
Very Low (1-25)	
Low (26-50)	Pre-construction
Low – Medium (51-75)	Construction
Medium – High (76-100)	Operation
High (101-125)	Decommissioning
Very High (126-150)	
Adjusted Significance Rating	

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- Low;
- Medium; or
- High.

In addition, each impact needs to be assessed in terms of reversibility and irreplaceability as indicated below:

- **Reversibility** of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):

- High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);
- Moderate reversibility of impacts;
- Low reversibility of impacts; or
- Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).

The environmental significance rating is an attempt to evaluate the importance of a particular impact, the consequence and likelihood of which is assessed by the relevant specialist. The description and assessment of the aspects and impacts is presented in a consolidated table with the significance of the impact assigned using the process and matrix detailed below.
The sum of the first three criteria (spatial scope, duration and severity) provides a collective score for the consequence of each impact. The sum of the last two criteria (frequency of activity and frequency of impact) determines the likelihood of the impact occurring. The product of consequence and likelihood leads to the assessment of the significance of the impact (Significance = Consequence X Likelihood), shown in the significance matrix below in Table 7-2

Table 7-2: Significance Assessment Matrix

	Consequence (Severity + Spatial Scope + Duration)														
Likelihood (Frequency of Activity + Probability of Impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	08	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 7-3: Positive and Negative Impact Mitigation Ratings.

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very High	126-150	Avoidance – consider alternatives	Optimal contribution from Project
	High	101-125	Avoidance as far as possible; implement strict mitigation measures to account for residual impacts	Positive contribution from Project with scope to improve
	Medium-High	76-100	Where avoidance is not possible, consider strict mitigation measures	Moderate contribution from Project with scope to improve
	Low-Medium	51-75	Mitigation measures to lower impacts and manage the project impacts appropriately	Improve on mitigation measures
	Low	26-50	Appropriate mitigation measures to manage the project impacts	Improve on mitigation measures; consider alternatives to improve on
	Very Low	1-25	Ensure impacts remain very low	Consider alternatives to improve on

7.2 IDENTIFICATION OF IMPACTS

Potential impacts resulting from the proposed Botterblom WEF were identified during the EIR phase using input from the following sectors:

- Existing information based on literature reviews and desktop assessments (EAP and specialist inputs);
- Site visit with the project team;
- Guidelines;
- Legislation; and
- Views of interested and affected parties (thus far).

The following potential impacts were identified:

- Socio-economic impacts;
- Sensitive Flora and Fauna;
- Terrestrial Biodiversity / Ecosystem services;
- Aquatic Impact;
- Agricultural;
- Heritage;
- Traffic;
- Dust;

- Noise;
- Transportation;
- Wake Impact Analysis;
- Visual; and
- Safety.

7.3 MITIGATION MEASURES

The Impact Mitigation Hierarchy (DEA 2013) will be followed to achieve no overall or limited negative impact on the receiving environment. The Impact Mitigation Hierarchy is a tool which is used reiteratively throughout the project lifecycle to limit negative impacts on the environment. There are four steps/tiers within the hierarchy, and include: Avoid/Prevent, Minimise, Rehabilitate and Offset (Figure 7-1).

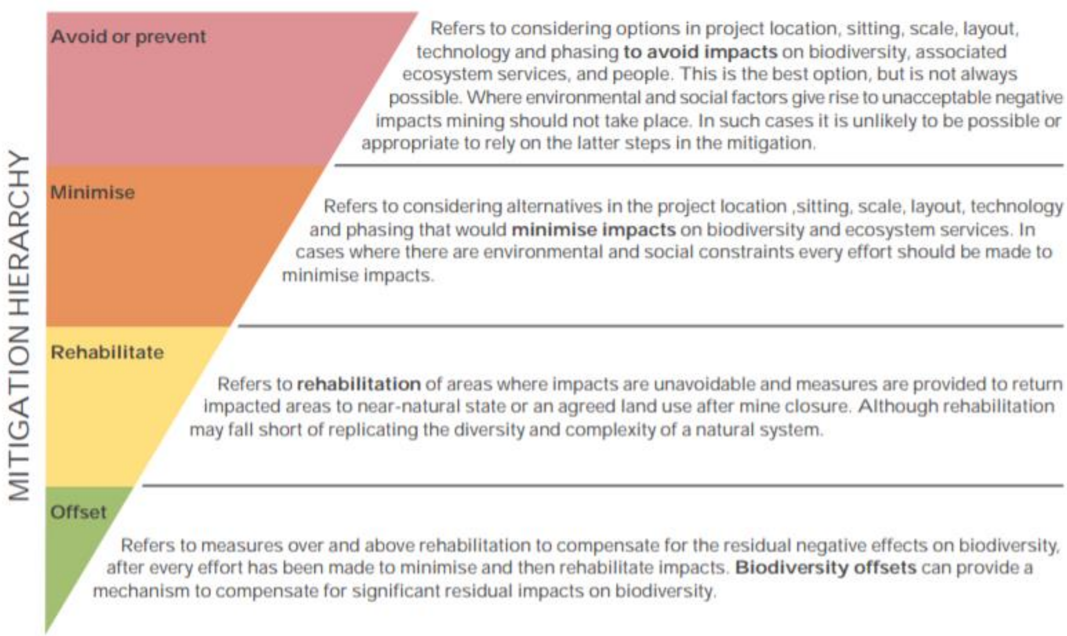


Figure 7-1: The Impact Mitigation Hierarchy (DEA et al., 2013).

Very High impacts should be avoided through alternative layout designs, technology alternatives etc. Where avoidance is not possible, the impacts that are generated by the development should be minimised if measures are implemented in order to reduce the impacts. The proposed mitigation measures should ensure that the development considers the environment and the predicted impacts in order to minimise impacts and achieve sustainable development. Where avoidance and/or minimisation are not possible, rehabilitation and possible offset will be considered. These last two options are rarely considered, and should only be done if the first two options could not be met.

7.4 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

Table 7-4: Potential Impacts prior to mitigation measures.

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
PLANNING & CONSTRUCTION										
Terrestrial Biodiversity										
Habitat Loss and Fragmentation.	Direct	Whole Site	• Life of operation (WoM) • One month to one year (WM)	• Partial (WoM) • Partial (WM)	Possible	Daily/highly likely/definitely	Partial	• Placement of turbines within the High Sensitivity areas and drainage lines should be avoided. • Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.	Often/regularly/likely/possible	Low – Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								• Minimise the development footprint as far as possible. • Rehabilitate disturbed areas that are no longer required by the operational phase of the development. Inadequate rehabilitation could result in limited revegetation and/or an invasion of alien vegetation which will result in long term ecological degradation and damage. • A Rehabilitation Management Plan must be developed and implemented		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								during the construction phase as construction is complete at each site. • 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. Where possible, existing roads must be used to avoid additional habitat loss and fragmentation. • Demarcate all areas to be cleared with construction tape or other appropriate		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								and effective means. However, caution should be exercised to avoid using material that might entangle fauna. • An Environmental Control Officer (ECO) must be employed to monitor the clearing of vegetation for the construction of roads and hardstands.		
Loss of species of conservation concern.	Direct	Whole Site	Life of operation (WoM &WM)	No (WoM) Yes (WM)	Yes (WoM) No (WM)	Daily/highly likely/definitely	Yes	• A comprehensive Plant Search and Rescue must be undertaken by a suitably qualified botanical specialist	Infrequent/unlikely/seldom	Low - Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								prior to vegetation clearance. • All relevant plant permits must be obtained from the provincial authority prior to the removal or relocation of SCC, including provincially protected species. • Plant SCC (excluding A. dichotomum which must be protected in situ) found within the proposed site must either be housed in an onsite nursery for use during rehabilitation or be relocated to suitable areas where		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								vegetation clearance will not occur. • Demarcate sensitive species with the appropriate buffers which must be excluded from development activities. A 200m buffer is applied to *A. dichotomum*.		
Alien and invasive plant species	Direct	Whole Site	Life of operation (WoM &WM)	No (WoM) Yes (WM)	Possible (WoM) Unlikely (WM)	Often/regularly/likely/possible	Yes	• A site-specific Alien Invasive Species (AIS) Management Plan must be implemented during the construction phase and continued monitoring and eradication needs to take	Infrequent/unlikely/seldom	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								place throughout the life of the project. • Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site. • The development footprints and immediate surroundings should be monitored for the growth/regrowth of alien vegetation throughout the construction and operation phases of the project.		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
Increased risk of erosion and flash floods.	Direct and Indirect	Whole Site	• One year to ten years (WoM) • One month to one year (WoM)	Partially (WoM &WM)	Possible (WoM) No (WM)	Often/regularly/likely/possible	Yes	• Soil erosion and Rehabilitation Plan to be part of the EMPr. • The clearance of vegetation, at any given time, must be kept to a minimum to reduce the possibility of soil erosion. • Rehabilitation of eroded areas on a regular basis during the construction period. • All roads and other hardened surfaces should have runoff control features which redirect water flow	Infrequent/unlikely/seldom	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.		
Disturbances or displacement impacts on fauna including traffic, noise and dust.	Direct	Whole Site	Life of operation (WoM) One year to ten years(WM)	Yes (WoM&WM)	Possible (WoM) No (WM)	Daily/highly likely/definitely	Yes	• Ground clearing and the digging of trenches should ideally take place at the end of the dry season, prior to the first rains in order to minimise the impacts of dust.	Infrequent/unlikely/seldom	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								• Newly cleared and exposed areas must be managed for dust and landscaped with indigenous vegetation to avoid soil erosion. Where necessary, temporary stabilisation measures must be used until vegetation establishes. • Speed restrictions (40 km per hour is recommended) should be in place to reduce the amount of dust caused by vehicle movement along the roads, and to reduce		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								possible fauna fatalities with vehicle collisions. • Driving around in the area as well as noise levels at night should be limited, as should the use of harsh lights which could cause light pollution for nocturnal species. • Where appropriate, sound dampeners must be used. • Avoid the presence of people and vehicles in highly sensitive areas as far as possible.		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								• Fences should be constructed in such a way so that burrowing animals can still gain access. • Strict measures should be put into place to prevent workers from poaching and hunting naturally occurring fauna.		
Avifauna										
Habitat destruction	Direct	Area specific	Life of operation (WoM) One year to ten years (WM)	Medium (WoM) Low (WM)	No	Daily/highly likely/definitely	Yes	Apply necessary buffers for roost sites and other sensitive bird habitat features, avoiding the construction of turbines and access roads in these	Often/regularly/likely/possible	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								areas. Roads must utilise or upgrade existing farm roads as far as possible.		
Destruction or disturbance of bird roosts	Direct	Area specific	One month to one year (WoM&WM)	No (WoM) Yes (WM)	Yes (WoM) No (WM)	Daily/highly likely/definitely	Yes	Apply necessary buffers for roost sites and other sensitive bird habitat features, avoiding the construction of turbines and access roads in these areas. Roads must utilise or upgrade existing farm roads as far as possible.	Infrequent/unlikely/seldom	Low
Bat										
Habitat destruction	Direct	Whole Site	One year to ten years (WoM&WM)	-	-	Definite	Yes	Apply the 200 m buffer to all potential bat roosts, avoiding the construction of	Definite	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								turbines and access roads in these areas. Roads must follow existing farm roads as far as possible. The buffered sensitive areas must be excluded from all activities related to the WEF. Access roads may cross these however if required		
The destruction or disturbance of bat roosts	Direct	Area Specific	One year to ten years (WoM) One month to one year (WM)	-	-	Possible	Yes	All potential bat roosts must be avoided by applying a 200 m buffer	Almost impossible	Very Low
Aquatic										

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
Sedimentation of watercourse										
Alt 1	Direct	Regional	Medium term (WoM) Short Term (WM)	-	-	Medium	Yes	• It is essential that the road and other linear networks (cables) follow contour and lowest gradients as far as possible. Appropriate stormwater design for the road network is essential to prevent roads from serving as concentrated conduits for water run-off, significantly increasing erosion potential and sediment transport capacity. Water	Low	Low
Alt 2	Direct	Regional	Medium term (WoM) Short Term (WM)	-	-	Medium	Yes		Low	Low
Alt 3	Direct	Regional	Medium term (WoM) Short Term (WM)	-	-	High	Yes		Medium	Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								diversions along the road should be placed at regular intervals in order to divert water back into the natural veld on the downstream side of the road. This diverted water should be released in a diffuse manner on contour, e.g. appropriately designed swale which is appropriately vegetated to achieve high basal cover (taking cognisance		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								of natural local herbaceous conditions). • Water crossing must be exactly perpendicular to the natural flow of water as not to create water flow to concentrate more to one side. • It is essential to choose appropriate water crossing for the road network in order to reduce potential negative impacts. Crossing points should preferably utilise watercourse sections		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								which already contain exposed bedrock and has a low gradient in that particular section of the watercourse. All crossing to be in the form of low water bridges in order for water to follow historic flow paths as much as possible. Concentration of water flow must be avoided. Where water is concentrated it needs to be diffusely released through appropriate diffuse release		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								infrastructure placed on contour. • It is recommended that all final positions of watercourse crossings be appropriately "fine tuned" through field verification in order to minimise potential impacts and reduce road construction cost. • Topsoil preparation and bush clearing must be done in a phased approach, only strip what is needed immediately		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM**-Without Mitigation **WM**- With Mitigation	Can impact be prevented/ reversed or managed? **WoM**-Without Mitigation **WM**- With Mitigation	Will irreplaceable resources be lost? **WoM**-Without Mitigation **WM**- With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								prior to construction / field preparation. • The construction of surface stormwater drainage systems during the construction phase must be done in a manner that would protect the quality and quantity of the downstream system. Where applicable, the use of swales, which could then be grassed for the operational phase, is recommended as the swales would attenuate		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								run-off water and facilitate the settling of sediment within the swale rather than within watercourses. For example, on the downslope edge of the infrastructure camp before vegetation clearing commences. • An effective 40m Buffer Zone which include all riparian habitat must be established prior to any construction activities taking place. No person or vehicle will be allowed		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								within the Buffer Zone, except for officially marked crossings. Management should be vigilant in preventing personnel taking short-cuts across the Buffer Zones between construction sites. • All livestock should be removed from the site prior to the initiation of rehabilitation or construction activities. This would increase veld condition and thereby		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								afford the study area higher basal coverages with associated higher sediment and erosion control properties. Further, no veld fires should be allowed for the next 5 years in order to aid veld restoration processes. • All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimized, and be surrounded by bunds. It should also only		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								be stored for the minimum amount of time necessary. • Erosion control of all banks must take place so as to reduce erosion and sedimentation processes. • Topsoil, leaf and plant litter as well as subsoil must be stockpiled separately in low heaps. • Do not strip topsoil when it is wet. • In the absence of a recognizable topsoil		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								layer, strip the upper most 500mm of soil. • Management has a responsibility to inform staff of the need to be vigilant against any practice that will have a harmful effect on riparian habitat and associated watercourses. • If possible, re-position topsoil stockpiles upslope of any infrastructure within the surface infrastructure footprint so as to prevent		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								contaminated surface water coming into contact with topsoil. • Ensure that all topsoil is stored and protected in such a way and in such a place that it will not cause the damming up of water, erosion gullies, or wash away itself; • The ECO must be vigilant to detect any negative impacts on watercourses and consult with a wetland/riparian specialist if erosion or other		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								negative impacts within watercourses or their buffers are noticed.		
Exposure to erosion										
Alt 1	Direct	Regional	Medium term (WoM) Short Term (WM)	-	-	Medium	Yes	• An ecologically-sound stormwater management plan must be implemented at the onset of the construction phase. This must include sustainable and sensitive stormwater design for the new road network and base infrastructure. Stormwater run-off must reach the A and B Section	Low	Low
Atl 2	Direct	Local	Medium term (WoM) Short Term (WM)	-	-	Medium	Yes		Low	Low
Alt 3	Direct	Regional	Medium term	-	-	High	Yes		Medium	Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
			(WoM) Short Term (WM)					channels and or buffer zones in a diffuse manner; • The above guidelines can be achieved through diffuse release of stormwater flows utilising the natural topography and associated contours, vegetated channels, riparian buffers and veld restoration techniques, gabion baskets, eco-logs etc; • Erosion must not be allowed to develop on a		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								large scale before effecting repairs; • A riparian monitoring program should be initiated prior to the start of the construction phase. • Make use of existing roads and tracks where feasible, rather than creating new routes through vegetated areas; • Vegetation and soil must be retained in position for as long as possible, and removed immediately ahead of construction /		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								earthworks in that area (DWAF, 2005); • Veld restoration must be actively pursued within the study area. As a start, it is recommended that all livestock must be removed from the property for at least a period of 5 years. Active reseeding must take place on the periphery of all disturbances .e.g roads and foundation platforms.		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								• Runoff from roads must be managed to avoid erosion and pollution problems; • During the construction and operational phases, measures must be put in place to control the flow of surface water so that it does not impact on the vegetation, i.e., energy dissipaters and canal flow designs must be used to prevent scouring and erosion;		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								• All areas susceptible to erosion must be protected and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas; • Indigenous shrubbery and grass species must be retained wherever possible; • Areas exposed to erosion due to construction should be vegetated with		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								species naturally occurring in the area; and • Surface water or storm water must not be allowed to concentrate, or flow down cut or fill slopes without erosion protection measures being in place.		
Potential increase in invasive vegetation										
Alt 1	Direct	Regional	Medium term (WoM) Short Term (WM)	-	-	Medium	Yes	• During construction, the construction area and immediate surroundings should be monitored regularly for emergent invasive vegetation;	Low	Low
Alt 2	Direct	Regional	Medium term	-	-	Medium	Yes		Low	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
			(WoM) Short Term (WM)					• Surrounding natural vegetation should not be disturbed to minimize chances of invasion by alien vegetation; • All alien seedlings and saplings must be removed as they become evident for the duration of construction and operational phase; • Manual / mechanical removal is preferred to chemical control; • All construction vehicles and equipment, as well as		
Alt 3	Direct	Regional	Medium term (WoM) Short Term (WM)	-	-	High	Yes		Medium	Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction site. This should be verified by the ECO; • An alien invasive eradication and monitoring plan must be compiled and implemented whereby all emergent invasive species are removed		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM**-Without Mitigation **WM**- With Mitigation	Can impact be prevented/ reversed or managed? **WoM**-Without Mitigation **WM**- With Mitigation	Will irreplaceable resources be lost? **WoM**-Without Mitigation **WM**- With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								during construction. The monitoring plan must also ensure that the re-emergence of invasive species is monitored continuously during the operational and decommissioning phases and that monitoring and eradication continues post decommissioning.		
Pollution of water resources										
Alt 1	Direct	Regional	Medium term (WoM)	-	-	Medium	Yes	• Construction vehicles are to be maintained in good working order so as to	Low	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
			Short Term (WM)					reduce the probability of leakage of fuels and lubricants; • A walled concrete platform, dedicated store with adequate flooring or bermed area should be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well ventilated areas; • Storage of potentially hazardous materials should take place far		
Alt 2	Direct	Regional	Long term (WoM) Short Term (WM)	-	-	Medium	Yes		Low	Low
Alt 3	Direct	Regional	Medium term (WoM) Short Term (WM)	-	-	High	Yes		Medium	Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								away from preferential flow paths and or stormwater infrastructure. These materials include fuel, oil, cement, bitumen etc.; • Surface water draining off contaminated areas containing oil and petrol would need to be channelled towards a sump which will separate these chemicals and oils; • Concrete is to be mixed on mixing trays only, not on exposed soil;		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								• Concrete and tar shall be mixed only in areas which have been specially demarcated for this purpose; • After all the concrete / tar mixing is complete all waste concrete / tar shall be removed from the batching area and disposed of at an approved dumpsite; • Stormwater shall not be allowed to flow through the batching area. Cement sediment shall be		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								removed from time to time and disposed of in a manner as instructed by the Consulting Engineer; • All construction materials liable to spillage are to be stored in appropriate structures with impermeable flooring; • Portable septic toilets are to be provided and maintained for construction crews. Maintenance must include their removal without sewage spillage;		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								• No uncontrolled discharges from the construction crew camps to any surface water resources shall be permitted. Any discharge points need to be approved by the relevant authority; • In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs must be informed immediately;		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								• Store all litter carefully so it cannot be washed or blown into any of the water courses within the study area; • Provide bins for construction workers and staff at appropriate locations, particularly where food is consumed; • The construction site should be cleaned daily and litter removed; • Conduct ongoing staff awareness programs so		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								as to reinforce the need to avoid littering; and • Backfill must be compacted to form a stabilised and durable blanket and the current load above the sewer lines must at no time be exceeded.		
Agricultural										
Loss of agricultural potential by occupation of land	Direct	Local	Long term (WoM)	-	-	High	Yes	Increased financial security for farming operations by the leasing of the property	Medium	Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
Loss of agricultural potential by soil degradation	Direct	Local	Medium term (WoM) Short Term (WM)	-	-	Medium	Yes	• Design an effective system of storm water runoff control, where it is required that is at any points where runoff water might accumulate. The system must effectively collect and safely disseminate any runoff water from all accumulation points and it must prevent any potential down slope erosion. • Maintain where possible all vegetation cover and	Low	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								facilitate revegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion. • If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for respreading during rehabilitation. During rehabilitation, the		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								stockpiled topsoil must be evenly spread over the entire disturbed surface.		
Dust impact	Direct	Local	Medium term (WoM) Short Term (WM)	-	-	Medium	Yes	Implement dust control measure	Low	Low
Enhanced agricultural potential through increased financial security for farming	Positive Impact									

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact WoM-Without Mitigation WM- With Mitigation	Can impact be prevented/ reversed or managed? WoM-Without Mitigation WM- With Mitigation	Will irreplaceable resources be lost? WoM-Without Mitigation WM- With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
operations										
Visual										
Visual impact of construction on sensitive visual receptors in close proximity to the proposed WEF	Direct	Local	Short term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly Probable	Yes	• Retain and maintain natural vegetation in all areas outside of the development footprint, but within the project site. • Ensure that vegetation is not unnecessarily removed during the construction period. • Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation	Improbable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								clearing (i.e. in already disturbed areas) where possible. • Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. • Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed of regularly at licensed waste facilities.		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								• Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). • Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. • Rehabilitate all disturbed areas immediately after the completion of construction works.		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly probable	Only best practice management measures can be implemented.	Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site.	Highly probable	High
Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly probable	Only best practice management measures can be implemented.	Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site.	Highly probable	High

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures	Direct	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly probable	Only best practice management measures can be implemented.	Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site.	Highly probable	High
Visual impact on observers travelling along the roads and residents at homesteads	Direct	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Probable	No, only best practice management measures can be implemented.	Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site.	Probable	Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
within a 10 – 20km radius of the wind turbine structures										
Visual impact of lighting at night on sensitive visual receptors.	Direct	Local / Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Highly probable	Yes	• Implement needs-based night lighting if considered acceptable by the CAA. • Limit aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact. • Shield the sources of light by physical barriers	Probable	Moderate

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								(walls, vegetation, or the structure itself). • Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. • Make use of minimum lumen or wattage in fixtures. • Make use of down-lighters, or shielded fixtures. • Make use of Low Pressure Sodium lighting		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								or other types of low impact lighting. Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.		
Visual impact of the ancillary infrastructure.	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Improbable	No, only best practise measures can be implemented	Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site.	Improbable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
The potential impact on the sense of place of the region.	Direct	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Improbable	No, only best practise measures can be implemented	Maintain the general appearance of the facility as a whole.	Improbable	Low
Heritage										
Impact on Waypoint 20 and 22	Direct	Local	Permanent (WoM&WM)	Not reversible	Yes	Probable	N/A	Avoidance of known heritage sites, if this cannot be achieved mitigation will be required subject to Section 35 SAHRA permits	Improbable	Low
Impact on other recorded heritage resources	Direct	Local	Permanent (WoM&WM)	Not reversible	Yes	Probable	N/A	• Implementation of a chance find procedure for the project. • Avoidance of known heritage sites, if this cannot	Improbable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM**-Without Mitigation **WM**- With Mitigation	Can impact be prevented/ reversed or managed? **WoM**-Without Mitigation **WM**- With Mitigation	Will irreplaceable resources be lost? **WoM**-Without Mitigation **WM**- With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								be achieved mitigation will be required subject to Section 35 SAHRA permits; • Final infrastructure must be subjected to a pre-construction survey		
Social										
Employment, business opportunities and skills development impact rating	Direct and Cumulative	Whole site/plant/mine (WoM&WM)	One month to one year (WoM) Life of operation (WM)	-	-	Often/regularly/likely/possible	Yes	• Use local labour as far as possible • Local contractors and businesses • On the job skills development and training	Daily/highly likely/definitely	High Positive
Construction workers on site	Direct	Whole site/plant/mi	One month to one year (WoM)	-	-	Often/regularly/likely/possible	Yes	• Use local labour and contractor as far as possible	Infrequent/unlikely/seldom	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
and in local area impact rating		ne (WoM&WM)	One day to one month (WM)					• Have code of conduct • Community liaison officer		
Influx of job seekers to the area	Direct	Area specific (WoM&WM)	One month to one year (WoM&WM)	-	-	Often/regularly/likely/possible	Yes	• Do not employ at gate • Employ locally first • Secure construction site	Infrequent/unlikely/seldom	Low
Impacts on farms, farmers and their workers	Direct	Area specific (WoM&WM)	One month to one year (WoM&WM)	-	-	Infrequent/unlikely/seldom	Yes	• Employ community Liaison Officer • Employ locally • Secure site	Infrequent/unlikely/seldom	Low
Impact of construction vehicles	Direct	Area specific (WoM&WM)	One month to one year (WoM&WM)	-	-	Daily/highly likely/definitely	Yes	• Dust suppression • Road maintained • Roadworthy vehicles and licenced drivers	Often/regularly/likely/possible	Moderate

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Impact on farming activities	Direct	Area specific (WoM&WM)	One month to one year (WoM&WM)	-	-	Often/regularly/likely/possible	Yes	• Access roads should be limited • Grazing areas should not be unnecessarily lost • Ensuring that disturbed areas are rehabilitated	Often/regularly/likely/possible	Moderate
Additional pressure on services	Direct and Cumulative	Area specific (WoM&WM)	One month to one year (WoM&WM)	-	-	Often/regularly/likely/possible	Yes	• Assist the municipality • HLM informed of the timing of the project • Identify projects in IDP	Infrequent/unlikely/seldom	Low
Loss of sense of place	Direct and Cumulative	Activity specific (WoM&WM)	Post closure (WoM&WM)	-	-	Daily/highly likely/definitely	No	• The area is changing the sense of place • No mitigation possible • Not many local permanent human receptors	Daily/highly likely/definitely	High

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
Noise, dust and visual impacts	Direct	Area specific (WoM&WM)	One month to one year	-	-	Often/regularly/likely/possible	Yes	• Dust mitigated from road • Few human receptors	Infrequent/unlikely/seldom	Low
Traffic										
Increased Traffic Volumes										
Alt 1	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes	• Abnormal and heavy load vehicles should not be allowed on the public road network during the typical weekday a.m. and p.m. peak hours. • Abnormal load vehicles should be escorted by traffic officials to control traffic and limit possible conflicts at intersections.	Probable	Low
Alt 2	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes		Probable	Low
Alt 3	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes		Probable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								• These measures will be included in the Transport Management Plan		
Heavy Loads during the construction phase										
Alt 1	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes	• Resurfacing of sections along Granaatboskolk / Zout Dwaggas, where required and regular road maintenance i.e. grading of the road once every two weeks during the construction phase. • The road can also be sprayed with water (grey water if available) once a	Probable	Low
Alt 2	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes		Probable	Low
Alt 3	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes		Probable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								day to limit dust pollution and gravel loss.		
General										
Stormwater Management	Indirect	Local	Construction	Yes – can be prevented/ managed	No	Medium	High	Vegetation maintenance: regular watering, weed control, replacement of dead plants, pest monitoring and control and dirt removal. Vegetation maintenance should occur bi-weekly. Maintenance of infrastructure such as concrete pipe and channels as well as grids and kerb inlets should occur monthly.	Low	Low

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Hunting / Fishing by construction workers.	Direct	Local	Construction phase (short-term)	Yes – can be prevented	No	Medium - Low	High	Hunting / poaching and fishing are prohibited. During construction, guidelines set out by the ECO will be followed to ensure no potential impacts occur and workers will be instructed that hunting and fishing is a non-compliance of the authorized activity.	Low	Low
Degradation and contamination of the surrounding environment by	Direct	Local/ regional	Construction phase (short-term)	Yes – can be managed/ prevented	No	High	High	Site workers will be trained in avoiding impacts in areas of potential concern. Designated concrete mixing areas and storage areas for	Low	Low

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construction activities, cement, hydrocarbons and other hazardous materials.								any hazardous materials must be assigned; cement mixing is not permitted in any area where runoff can contaminate the surrounding environment. This must be strictly controlled through the site specific EMPr.		
Potential disturbance or unearthing of graves or disturbance to other heritage resources	Direct	Local/ regional	Construction phase (short-term)	Yes – can be managed/ prevented	No	Low	Low	There is no evidence of any heritage resources. If any resources are discovered during construction, the ECO must be notified immediately and construction around the	Low	Low

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			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
during the construction phase.								resource must cease immediately. This must be strictly monitored by the ECO and controlled through the EMPr.		
Improper storage and disposal of solid waste.	Direct	Local/ regional	Construction phase (short-term)	Yes – can be managed/ prevented	No	High	High	Due to the nature of the activity, waste is anticipated to be minimal. All solid waste generated during the construction process must be placed in a designated waste collection area within the construction camp and must not be allowed to blow around the site, be accessible by animals, or be	Low	Low

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								placed in piles adjacent to the skips / bins. All solid waste must then be disposed of at the nearest licensed landfill and safe disposal certificates must be obtained and kept on site at all times during construction. Separate skips/ bins for the different waste streams must be available on site. The waste containers must be appropriate to the waste type contained therein and		

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								where necessary should be lined and covered.		
Littering around the site.	Direct	Local	Construction & Operation phase (short-term)	Yes – can be prevented	No	Medium - Low	High	Littering is not permitted on the site and general housekeeping must be enforced. General waste bins must be readily available for litter disposal and general housekeeping.	Low	Low
Improper disposal of rubble i.e.: burying or neglecting building rubble resulting in	Direct	Local (within construction site)	Construction phase (short-term)	Yes impact can be managed	No	Medium	High	All excess material and rubble must be removed from the site so not to restrict the rehabilitation process. All excess material and rubble must go to an approved designated landfill	Low	Low

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direct mechanical damage to surrounding vegetation and untidiness of the site.								and a safe disposal certificate must be obtained. Site workers will be trained in avoiding such impacts during induction training and regular toolbox talks.		
Lack of toilet facilities resulting in unsanitary conditions.	Direct	Local	Construction & Operation phase (short-term)	Yes – can be prevented	No	High	High	Adequate toilet facilities must be provided for all staff members as standard construction practice as well as during operational activities. Chemical toilets, if used, must be secured to the ground and kept away from any sensitive areas. It	Low	Low

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								should be regularly cleaned by a reputable company and maintained in a clean state. During operation toilet facilities provided by the venue must be used by staff and guests. This must be monitored in an EMPr.		
Improper disposal of toilet waste from chemical toilets resulting in contamination of the	Indirect	Local	Construction phase (short-term)	Yes – can be prevented	No	High	High	Chemical toilets must be placed onsite and not in close proximity to any sensitive areas. The chemical toilets must be provided by a registered company and all effluent must be regularly disposed	Low	Low

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surrounding environment								of at a licenses facility. Safe disposal certificates must be obtained and kept on site.		
Increase waste to landfill site.	Indirect	Local	Construction & Operation phase (short-term)	Yes – can be managed	No	High	Medium	Due to the nature of the activity during construction and operational phases, waste is anticipated to be minimal. Where possible, waste streams will be separated and recycled to limit the amount of waste being added to the landfill site.	Medium	Low
Risk of spills from construction	Direct	Local (within construction site)	Construction phase (short-term)	Yes impact can be managed	No	Medium	High	Any hazardous or dangerous goods utilised during the construction	Low	Low

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equipment (oils, fuels, cement etc.) contaminating soil and the watercourse.								phase must be stored on an impermeable surface that is bunded, fenced, locked and covered. A spill kit must be clearly marked and visible when utilizing hazardous or dangerous materials to ensure that all spills are immediately cleaned. Spill kits must be regularly checked and maintained.		
Dust Generation and control	Direct	Local	Construction & Operation phase	Yes impact can be managed	No	Medium	High	• The Developer and construction contractors must take all reasonable measures to minimise the generation of dust as a	Low	Low

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								result of construction activities to the satisfaction of the ECO and the relevant regulatory authorities; • Removal of vegetation must be avoided until such time as soil stripping is required, and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible; • Appropriate dust suppression measures must be used when dust		

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								generation is unavoidable, e.g. damping down of all exposed soil surfaces with a water bowser or hosepipe when necessary; • To reduce dust dampening with water, particularly during prolonged periods of dry weather appropriate chemical binders may be used. Such measures must also include the use of temporary stabilising		

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								measures (e.g. chemical soil binders, straw, brush packs, chipping etc.); • During high wind conditions, the Contractor during construction and the developer during operation, must evaluate the situation and make recommendations as to whether dust-damping measures are adequate, or whether working will cease altogether until the wind speed drops to an acceptable level;		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								• Excavations and other clearing activities must only be done during agreed working times and permitting weather conditions to avoid sand and dust drifting into neighbouring areas; • The dust monitoring programme as per the National Dust Control Regulations, will be implemented and the necessary steps taken to ensure compliance with		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								the relevant quality requirements; and • A complaints register will be implemented and any complaints related to dust will be investigated and appropriate measures taken to resolve the issue.		
Degradation of existing service infrastructure, e.g. roads, electricity.	Direct	Local	Construction phase (short-term).	Yes impact can be managed	No	High	High	Any damage to existing infrastructure will result in the reinstating of that infrastructure to an acceptable state. The cost of which will be that of the applicant. The site currently	Low	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								is not dependent on municipal services.		
OPERATION										
Terrestrial Biodiversity										
Direct faunal impacts due to operation.	Direct	Area specific	Life of operation (WoM&WM)	The impact will persist for the lifespan of the facility (WoM&WM)	Possible (WoM) No (WM)	Often/regularly/likely/possible	Yes	• reduce the presence of human activity on the project area as far as possible by only focusing on the areas where operational tasks are required, • avoid the presence of people and vehicles in highly sensitive areas as far as possible,	Very seldom/highly unlikely	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								• no unauthorised persons should be allowed onto the site, • any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location, • lower the levels of noise whenever possible and avoid the destruction or disturbance of identified important features,		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								• The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except by individuals with the appropriate permits, • 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		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								related to the nature of the spill, • fences should be constructed in such a way so that burrowing animals can still gain access, which will allow other animals to also utilise the holes dug under fences to increase connectivity in the area.		
Alien and invasive plant species	Direct	Whole Site	Life of operation (WoM&WM)	With appropriate mitigation the impact can be	Possible (WoM) Unlikely (WM)	Often/regularly/likely/possible	Yes	• The site-specific AIS Management Plan must be implemented for the first year of the operational phase. Thereafter, alien vegetation must continue to	Very seldom/highly unlikely	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
				ameliorated (WoM&WM)				be monitored and eradicated annually throughout the life of the project. • 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 and are		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								likely to increase rapidly if not controlled. • 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. • Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site.		
Avifauna										

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Bird mortalities	Direct	Whole site/plant/mine	Life of operation (WoM&WM)	No	Yes (WoM) Potentially (WM)	Daily/highly likely/definitely	Yes	Avoid placement of turbines near sensitive bird breeding and roosting habitats. The application of adaptive mitigation measures (e.g., shutdown on demand retrofitting), according to post-construction monitoring results (counted strikes of threatened species) must be informed by environmental correlates of avifaunal activity and/or strikes.	Infrequent/unlikely/seldom	Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Disruption of bird migratory pathways	Indirect	Whole site/plant/mine	Life of operation (WoM) One year to ten years (WM)	No (WoM) Yes (WM)	Yes (WoM) No (WM)	Daily/highly likely/definitely	Yes	Increase turbine cut in speed as this has been shown to reduce collisions. The risk is not considered to be high, and the annual collision risk is estimated at less than 5 birds per year. This is confirmed by the post-construction monitoring at Khobab WEF. The fatality rates post-construction will provide additional data and the risk model can be adjusted accordingly. Advanced Radar-based shutdown on	Very seldom/highly unlikely	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								demand must be applied where turbines transcend recommended buffers for nesting Martial Eagles.		
Bats										
Bat mortalities	Direct	Regional	Life of operation (WoM&WM)	-	-	Almost certain	Yes	• Cut-in speeds of turbines should be increased at strategic times based on bat mortalities observed during post-construction monitoring. An annual threshold for bat mortality in Nama Karoo is estimated at 0.0106 bats/hectare (MacEwan et al., 2020a) per annum. Therefore, the	Almost impossible	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								total annual bat mortality threshold for the Botterblom WEF is estimated at 61.4 bats. Corrected mortality estimates and appropriate adaptive mitigation thresholds and strategies will need to be determined during the post-construction monitoring • Increase turbine cut in speed as this has been shown to reduce collisions		
Artificial light	Direct	Whole Site	Life of operation (WoM&WM)	-	-	Infrequent		All artificial lights should be kept at a minimum with only civil aviation lights being	Almost impossible	Very Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								used if possible. In cases where lighting is needed close to buildings the use of these lights must be limited and directed only where needed. Non-UV emitting lights must be used.		
Disruption of bat migratory pathways	Direct and Indirect	Regional	Life of operation	-	-	Infrequent	Yes	Increasing the cut-in speed of turbines is especially relevant for periods of migration and/or increased feeding activity during frontal activity as seen in April and possible migration during November when higher than normal number	Almost impossible	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								of bats are expected in the area and curtailment of turbines may be required if mortalities during monitoring indicate immediate mitigation action. This will necessitate increased monitoring activities during these times with rapid dissemination of number of carcasses detected so that on-the-fly mitigation can occur		
Aquatic										
Altered Hydrologic Regime										

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Alt 1	Direct	Regional	Long Term (WoM) Short Term (WM)	-	-	High	Yes	• It is essential that the road and other linear networks (cables) follow contour and lowest gradients as far as possible. Appropriate stormwater design for the road network is essential to prevent roads from serving as concentrated conduits for water run-off, significantly increasing erosion potential and sediment transport capacity. Water diversions along the road	Low	Low
Alt 2	Direct	Regional	Long Term (WoM) Long Term (WM)	-	-	High	Yes		Low	Low
Alt 3	Direct	Regional	Long Term (WoM) Short Term (WM)	-	-	High	Yes		Medium	Medium

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								(and other linear infrastructure) should be placed at regular intervals in order to divert water back into the natural veld on the downstream side of the road. This diverted water should be released in a diffuse manner on contour, e.g. appropriately designed swale which is appropriately vegetated with high basal cover). • It is essential to choose appropriate water		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								crossing for the road network in order to reduce potential negative impacts. Crossing points should preferably utilise watercourse sections which already contain exposed bedrock and has a low gradient in that particular section of the watercourse. All crossing to be in the form of low water bridges in order for water to follow historic flow paths as much as possible. Concentration		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								of water flow must be avoided. Where water is concentrated it needs to be diffusely released through appropriate diffuse release infrastructure placed on contour. • The water crossing themselves should be designed and placed exactly on contour and be perpendicular to the flow of the watercourse) • It is recommended that all final positions of		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM**-Without Mitigation **WM**- With Mitigation	Can impact be prevented/ reversed or managed? **WoM**-Without Mitigation **WM**- With Mitigation	Will irreplaceable resources be lost? **WoM**-Without Mitigation **WM**- With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								watercourse crossings be appropriately "fine tuned" through field verification in order to minimise potential impacts and reduce road construction cost.		
Agriculture										
Protection of soil resources	Direct	Local	Long Term (WoM) Short Term (WM)	-	-	Medium	Yes	• Maintain the storm water runoff control system. Monitor • erosion and remedy the storm water control system • in the event of any erosion • occurring.	Low	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								• Facilitate revegetation of • denuded areas throughout the site		
Visual										
Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly probable	No, only best practice management measures can be implemented.	• Maintain the general appearance of the facility as a whole.	Highly probable	High
Visual impact on observers travelling along roads in close	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly probable	No, only best practice management measures can	Maintain the general appearance of the facility as a whole.	Highly probable	High

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
proximity to the proposed wind turbine structures.							be implemented.			
Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures	Direct	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly probable	No, only best practice management measures can be implemented.	Maintain the general appearance of the facility as a whole.	Highly probable	High

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures	Direct	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Probable	No, only best practice management measures can be implemented.	Maintain the general appearance of the facility as a whole.	Probable	Medium
Visual impact of shadow flicker on sensitive visual receptors in close	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Improbable	N.A. due to the low probability of occurrence	N/A	Improbable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
proximity to the proposed WEF.										
Visual impact of lighting at night on sensitive visual receptors.	Direct	Local / Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Highly probable	Yes	• Implement needs-based night lighting if considered acceptable by the CAA. • Limit aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact. • Shield the sources of light by physical barriers (walls, vegetation, or the structure itself).	Probable	Moderate

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation	**WoM-**Without Mitigation **WM-** With Mitigation					
								• Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. • Make use of minimum lumen or wattage in fixtures. • Make use of down-lighters, or shielded fixtures. • Make use of Low Pressure Sodium lighting or other types of low impact lighting.		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								• Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.		
Visual impact of the ancillary infrastructure.	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Improbable	No, only best practise measures can be implemented	Maintain the general appearance of the infrastructure.	Improbable	Low
The potential impact on the sense of place of the region.	Direct	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Improbable	No, only best practise measures can	Maintain the general appearance of the facility as a whole.	Improbable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM**-Without Mitigation **WM**- With Mitigation	Can impact be prevented/ reversed or managed? **WoM**-Without Mitigation **WM**- With Mitigation	Will irreplaceable resources be lost? **WoM**-Without Mitigation **WM**- With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
							be implemented			
Visual impact of wind farms on the visual quality of the landscape.	Cumulative	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Highly probable	No	N/A	Highly probable	High
Social										
Renewable energy infrastructure and clean renewable energy	Direct and Cumulative	Regional/neighbouring areas (WoM&WM)	Life of operation (WoM&WM)	-	-	Often/regularly/likely/possible	N/A	• Ensure project goes ahead • Ensure local content	Daily/highly likely/definitely	High Positive

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
Creation of employment and business opportunities	Direct and Cumulative	Whole site/plant/mine (WoM) Regional/neighbouring areas(WM)	One year to ten years (WoM) Life of operation (WM)	-	-	Infrequent /unlikely/seldom	N/A	• Local employment • On the job training and development • Local business development	Daily/highly likely/definitely	High Positive
Generation of income for landowner	Direct	Activity specific (WoM&WM)	Life of operation (WoM&WM)	-	-	Often/regularly/likely/possible	N/A	Agreements should be in place before WEF becomes operational	Daily/highly likely/definitely	High Positive
Social Economic Development and Enterprise Development	Direct and Cumulative	Whole site/plant/mine (WoM&WM)	Life of operation (WoM&WM)	-	-	Often/regularly/likely/possible	N/A	Align with the HLM IDP SED and ED spend will need to be determined and agreed	Often/regularly/likely/possible	High Positive

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
								Community trust with independent trustees should be established		
Visual impacts and associated impact on sense of place	Direct	Area specific (WoM&WM)	Life of operation (WoM&WM)	-	-	Often/regularly/likely/possible	No	The visual impact cannot be effectively mitigated	Often/regularly/likely/possible	Moderate
Impact on property values	Indirect	Area specific (WoM&WM)	Life of operation (WoM&WM)	-	-	Almost never/almost impossible	N/A	Due to the limited prospect of this occurring no mitigation measures are suggested	Almost never/almost impossible	Low
Impact on tourism	Direct	Area specific (WoM)	Life of operation (WoM&WM)	-	-	Almost never/almost	Yes	• The possible impact is low no mitigation is required • Marketing area as a tourist attraction	Often/regularly/likely/possible	Moderate

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM**-Without Mitigation **WM**- With Mitigation	Can impact be prevented/ reversed or managed? **WoM**-Without Mitigation **WM**- With Mitigation	Will irreplaceable resources be lost? **WoM**-Without Mitigation **WM**- With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
		Whole site/plant/mine (WM)				impossible				
Noise	Direct	Activity specific (WoM&WM)	Life of operation (WoM&WM)	-	-	Almost never/almost impossible	N/A	There is no impact on human receptors no mitigation measures are required	Almost never/almost impossible	Low
Traffic										
Increased Traffic Volumes										
Alt 1	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes	Routine road maintenance by the relevant Roads Authority.	Probable	Low
Alt 2	Direct	Local	Short Term (WoM&WM)			Highly Probable	Yes		Probable	Low
Alt 3	Direct	Local	Short Term (WoM&WM)			Highly Probable	Yes		Probable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
Socio-Economic Wake Analysis										
Impact on CD by Loeriesfontein WEF (L1 and L2)										
Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Direct	Regional	Life of operation (WoM&WM)	-	-	Probable	Yes	Sign a compensation agreement	Highly improbable	Low
Impact on CD by Khobab WEF (L1 and L2)										
Change in the contribution towards CD due to the wake losses caused	Direct	Regional	Life of operation (WoM&WM)	-	-	Probable	Yes	Sign a compensation agreement	Highly improbable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
by the Botterblom WEF										
Impact on CD by Kokerboom 1 WEF (L1 and L2)										
Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Direct	Regional	Life of operation (WoM&WM)	-	-	Probable	Yes	Sign a compensation agreement	Highly improbable	Low
Impact on CD by Kokerboom 2 WEF (L1 and L2)										
Change in the contribution towards CD due	Direct	Regional	Life of operation (WoM&WM)	-	-	Probable	Yes	Sign a compensation agreement	Highly improbable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
to the wake losses caused by the Botterblom WEF										
Impact on CD by Kokerboom 3 WEF (L1 and L2)										
Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Direct	Regional	Life of operation (WoM&WM)	-	-	Probable	Yes	Sign a compensation agreement	Highly improbable	Low
Impact on CD by Kokerboom 4 WEF (L1 and L2)										

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Direct	Regional	Life of operation (WoM&WM)	-	-	Probable	Yes	Sign a compensation agreement	Highly improbable	Low
Impact on CD by Botterblom WEF (L1 and L2)										
Change in the contribution towards CD due to the wake losses caused by the	Direct	Regional	Life of operation (WoM&WM)	-	-	Highly Probable	N/A	N/A	Highly Probable	High

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Botterblom WEF										
Cumulative impact on CD (L1 and L2)										
Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF and contributions made by the Botterblom WEF	Cumulative	Regional	Life of operation (WoM&WM)	-	-	Highly Probable	Yes	Sign compensation agreements with affected WEFs	Highly Probable	High
DECOMMISSIONING										

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Terrestrial Biodiversity										
The ecological impacts associated with the decommissioning phase will be similar to those listed in the construction phase and the associated mitigations measures must be updated and implemented to reduce potential adverse impacts.										
Agriculture										
Protection of soil resources	Direct	Local	Long Term (WoM) Short Term (WM)	-	-	Medium	Yes	• Implement an effective system of storm water runoff control, where it is required that is at any points where run off water might accumulate. The system must effectively collect and safely disseminate any runoff water from all accumulation points and it must prevent any	Low	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								potential down slope erosion. • Maintain where possible all vegetation cover and facilitate revegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion. • If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed		

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
								and stockpiled for respreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.		
Visual										
Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly probable	Only best practice management measures can be implemented.	• Remove infrastructure not required for the post-decommissioning use. • Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.	Highly probable	High

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly probable	Only best practice management measures can be implemented.	• Remove infrastructure not required for the post-decommissioning use. • Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.	Highly probable	High
Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of	Direct	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Highly probable	Only best practice management measures can be implemented.	• Remove infrastructure not required for the post-decommissioning use. • Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.	Highly probable	High

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
the wind turbine structures										
Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures	Direct	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No (WoM&WM)	Probable	Only best practice management measures can be implemented.	• Remove infrastructure not required for the post-decommissioning use. • Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.	Probable	Medium
Visual impact of the ancillary infrastructure.	Direct	Local	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Improbable	No, only best practise measures can	• Remove infrastructure not required for the post-decommissioning use.	Improbable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
							be implemented	• Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
The potential impact on the sense of place of the region.	Direct	Regional	Long Term (WoM&WM)	Reversible (WoM&WM)	No	Improbable	No, only best practise measures can be implemented	• Remove infrastructure not required for the post-decommissioning use. • Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.	Improbable	Low
Social										
Deconstruction of the infrastructure and recycling	Direct	Whole site/plant/mine (WoM&WM)	One month to one year (WoM&WM)	-	-	Often/regularly/likely/possible	Yes	• Local contractors • Local employment • Rehabilitation	Daily/highly likely/definitely	Moderate

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact **WoM-**Without Mitigation **WM-** With Mitigation	Can impact be prevented/ reversed or managed? **WoM-**Without Mitigation **WM-** With Mitigation	Will irreplaceable resources be lost? **WoM-**Without Mitigation **WM-** With Mitigation	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
Loss of jobs and associated income	Direct	Area specific (WoM&WM)	Life of operation (WoM&WM)	-	-	Daily/highly likely/definitely	Yes	• Workers should be notified of their pending retrenchment • Workers should be assisted in calming form the UIF • Social services are prepared for the potential additional dependents	Often/regularly/likely/possible	Moderate
Traffic										
Heavy Loads during the decommissioning phase										
Alt 1	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes	• Resurfacing of sections along Granaatboskolk / Zout Dwaggas Road, where required and	Probable	Low
Alt 2	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes		Probable	Low

Nature of impact (potential)	Direct or indirect or cumulative	Extent of impact	Duration of impact	Can impact be prevented/ reversed or managed?	Will irreplaceable resources be lost?	Probability before mitigation	Mitigatory potential	Mitigation measure	Probability after mitigation	Significance after mitigation
			WoM-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation	**WoM**-Without Mitigation **WM**- With Mitigation					
Alt 3	Direct	Local	Short Term (WoM&WM)	-	-	Highly Probable	Yes	regular road maintenance i.e. grading of the road once every two weeks during the decommissioning phase. • The road can also be sprayed with water (grey water if available) once a day to limit • dust pollution and gravel loss.	Probable	Low

8 ENVIRONMENTAL IMPACT STATEMENT

8.1 IMPACT ANALYSIS

The potential impacts associated with the proposed Botterblom WEF and associated infrastructure are summarised below in Table 8-1. Should the mitigation provided in the tables in Section 7, and detailed in the EMPr be implemented, post-migration impacts are anticipated to range between very low to medium negative significance, and up to highly positive.

Table 8-1: Summary of Impact Assessment

Aspect	Impact	Post Mitigation
	Planning and Construction	
Terrestrial Biodiversity	Habitat Loss and Fragmentation	Low – Medium
	Loss of species of conservation concern	Low - Medium
	Alien and invasive plant species	Low
	Increased risk of erosion and flash floods.	Low
	Disturbances or displacement impacts on fauna including traffic, noise and dust.	Low
Avifauna	Habitat destruction	Low
	Destruction or disturbance of bird roosts	Low
Bats	Habitat destruction	Low
	The destruction or disturbance of bat roosts	Very Low
Aquatic	Sedimentation of watercourse	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Medium
	Exposure to erosion	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Medium
	Potential increase in invasive vegetation	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Medium
	Pollution of water resources	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Medium
Agricultural	Loss of agricultural potential by occupation of land	Medium

	Loss of agricultural potential by soil degradation	Low
	Dust impact	Low
	Enhanced agricultural potential through increased financial security for farming operations	High Positive
Visual	Visual impact of construction on sensitive visual receptors in close proximity to the proposed WEF	Low
	Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures	High
	Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.	High
	Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures	High
	Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures	Medium
	Visual impact of lighting at night on sensitive visual receptors.	Moderate
	Visual impact of the ancillary infrastructure.	Low
	The potential impact on the sense of place of the region.	Low
Heritage	Impact on Waypoint 20 and 22	Low
	Impact on other recorded heritage resources	Low
Social	Employment, business opportunities and skills development impact rating	High Positive
	Construction workers on site and in local area impact rating	Low
	Influx of job seekers to the area	Low
	Impacts on farms, farmers and their workers	Low
	Impact of construction vehicles	Moderate
	Impact on farming activities	Moderate
	Additional pressure on services	Low
	Loss of sense of place	High
	Noise, dust and visual impacts	Low
Traffic	Increased Traffic Volumes	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Low
	Heavy Loads during the construction phase	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Low
General	Stormwater Management	Low

	Hunting / Fishing by construction workers.	Low
	Degradation and contamination of the surrounding environment by construction activities, cement, hydrocarbons and other hazardous materials.	Low
	Potential disturbance or unearthing of graves or disturbance to other heritage resources during the construction phase.	Low
	Improper storage and disposal of solid waste.	Low
	Littering around the site.	Low
	Improper disposal of rubble i.e.: burying or neglecting building rubble resulting in direct mechanical damage to surrounding vegetation and untidiness of the site.	Low
	Lack of toilet facilities resulting in unsanitary conditions.	Low
	Improper disposal of toilet waste from chemical toilets resulting in contamination of the surrounding environment	Low
	Increase waste to landfill site.	Low
	Risk of spills from construction equipment (oils, fuels, cement etc.) contaminating soil and the watercourse.	Low
	Dust Generation and control	Low
	Degradation of existing service infrastructure, e.g. roads, electricity.	Low
	Operation	
Terrestrial Biodiversity	Direct faunal impacts due to operation.	Low
	Alien and invasive plant species	Low
Avifauna	Bird mortalities	Medium
	Disruption of bird migratory pathways	Low
Bats	Bat mortalities	Low
	Artificial light	Very Low
	Disruption of bat migratory pathways	Low
Aquatic	Altered Hydrologic Regime	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Medium
Agriculture	Protection of soil resources	Low
Visual	Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures	High
	Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.	High
	Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures	Medium

	Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures	Low
	Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.	Moderate
	Visual impact of lighting at night on sensitive visual receptors.	Low
	Visual impact of the ancillary infrastructure.	Low
	The potential impact on the sense of place of the region.	High
	Visual impact of wind farms on the visual quality of the landscape.	High
Social	Renewable energy infrastructure and clean renewable energy	High Positive
	Creation of employment and business opportunities	High Positive
	Generation of income for landowner	High Positive
	Social Economic Development and Enterprise Development	High Positive
	Visual impacts and associated impact on sense of place	Moderate
	Impact on property values	Low
	Impact on tourism	Moderate
	Noise	Low
Traffic	Increased Traffic Volumes	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Low
Socio-Economic Wake Analysis	Impact on CD by Loeriesfontein WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Khobab WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Kokerboom 1 WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Kokerboom 2 WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Kokerboom 3 WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Kokerboom 4 WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	Low
	Impact on CD by Botterblom WEF (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	High
	Cumulative impact on CD (L1 and L2): Change in the contribution towards CD due to the wake losses caused by the Botterblom WEF	High

Decommissioning		
Terrestrial Biodiversity	The ecological impacts associated with the decommissioning phase will be similar to those listed in the construction phase and the associated mitigations measures must be updated and implemented to reduce potential adverse impacts	
Agriculture	Protection of soil resources	Low
Visual	Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures	High
	Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.	High
	Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures	Medium
	Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures	Low
	Visual impact of the ancillary infrastructure.	Low
	The potential impact on the sense of place of the region.	High
Social	Deconstruction of the infrastructure and recycling	Moderate
	Loss of jobs and associated income	Moderate
Traffic	Heavy Loads during the decommissioning phase	
	Alt 1	Low
	Alt 2	Low
	Alt 3	Low

8.2 VISUAL REPRESENTATION OF ALTERNATIVE AND SITE SENSITIVITY

The combined sensitivity map was based on the findings from all specialist assessments and inputs from all stakeholders. The following relevant features were included, which are considered “no-go” areas (i.e. no development make occur in these areas):

- Avifauna: 4.6 and 5 km nest buffers, 200 m buffer around seasonally inundated watercourses
- Watercourses: 40m buffer
- Bats: Sensitive and important habitats, including a 200m buffer
- Plants: 200m buffer around sensitive species.

This report is based on a project description and site plan, provided to by the applicant, which has not been approved by DFFE at this stage of the project. The project description and site plan may undergo refinements before being regarded as final. Since only a few stakeholders participated in the process, the buffers could not be finalised.

The Preferred Alternative is considered the most suitable alternative, however micro-siting might be necessary to move some turbines during the construction phase.

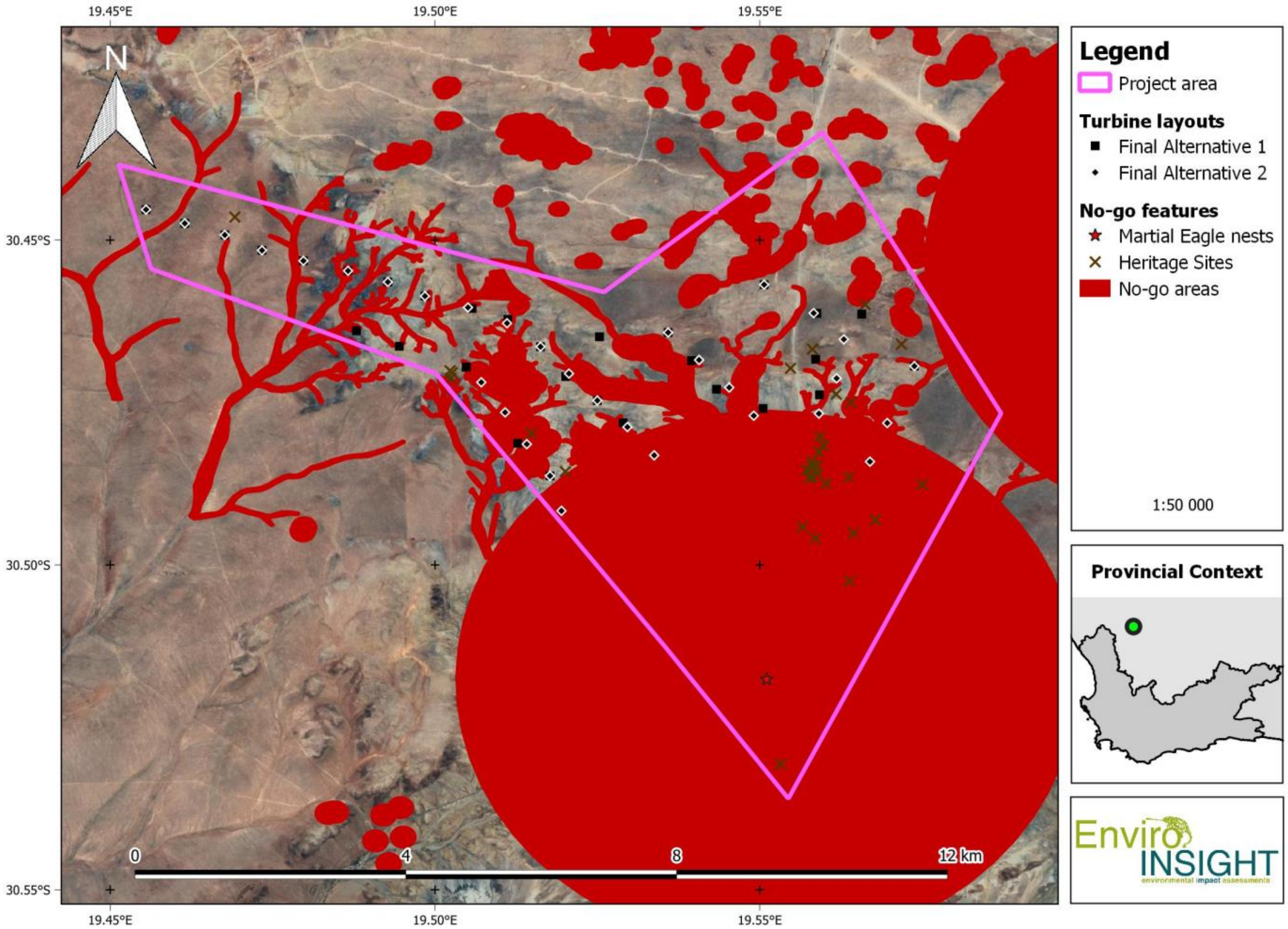

Figure 8-1: Sensitivity analysis indicating no-go areas for alternative 1 and alternative 2 layouts considered

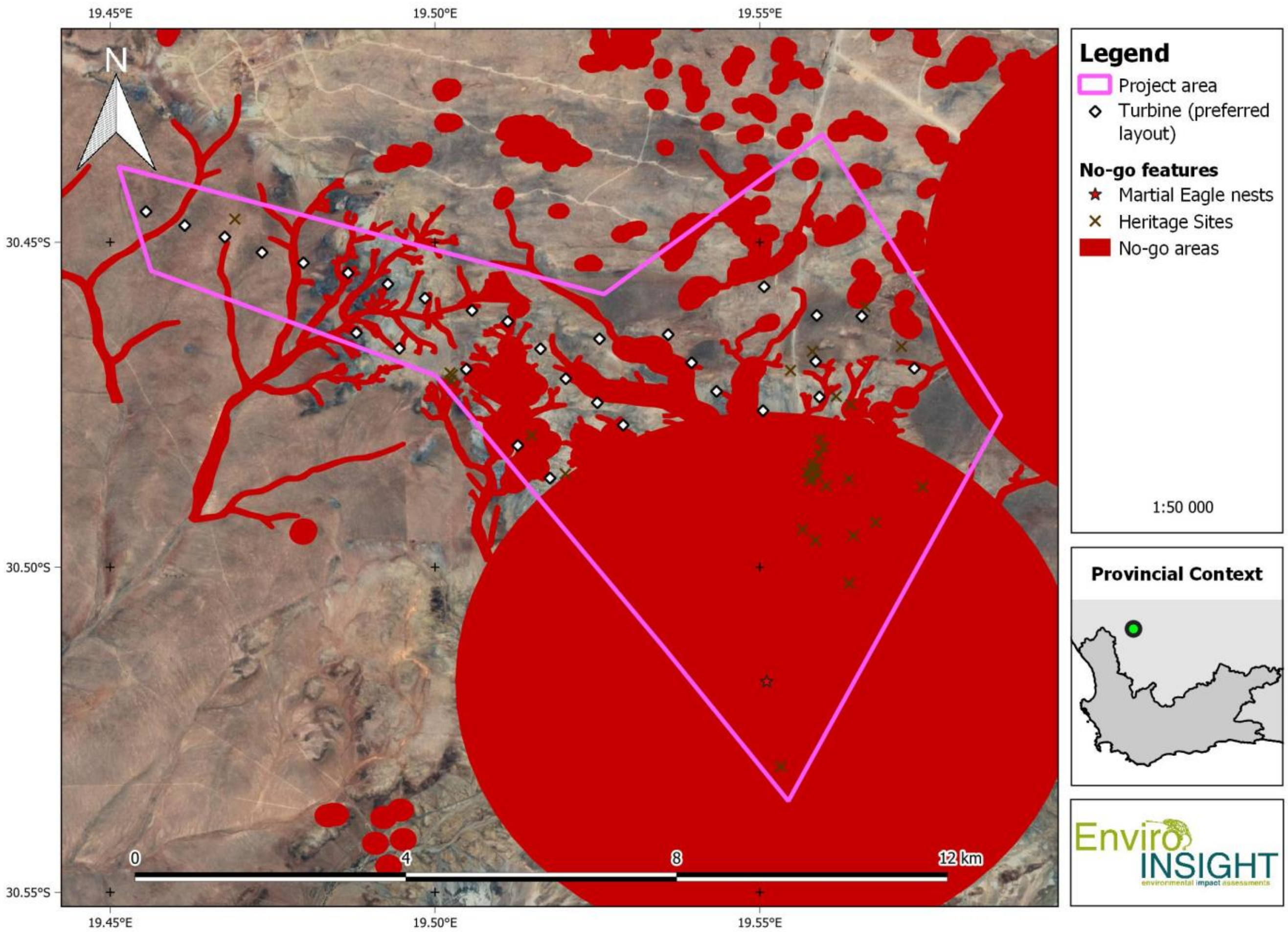

Figure 8-2: Sensitivity analysis indicating no-go areas for the preferred layout considered

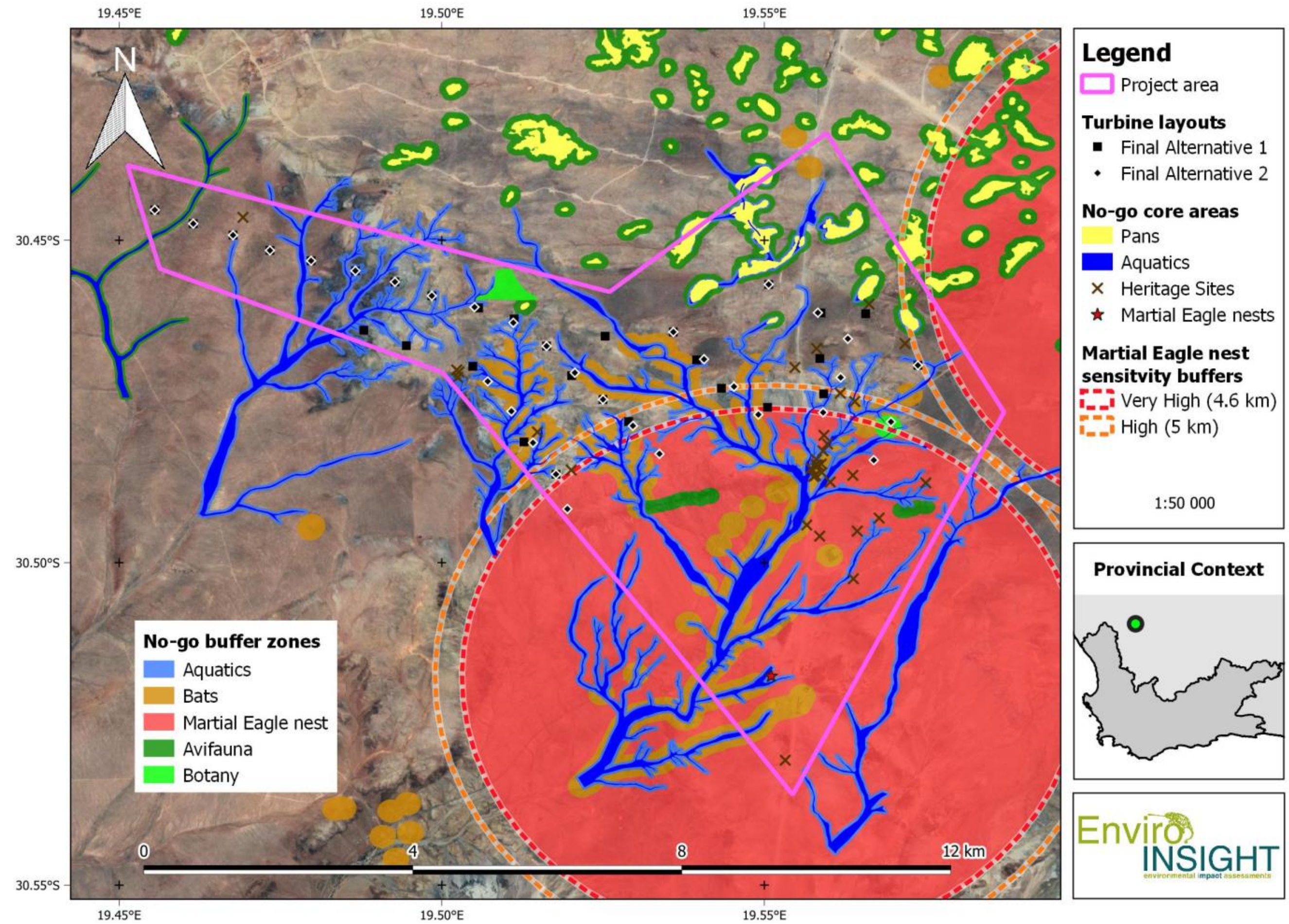

Figure 8-3: Sensitivity analysis indicating high sensitivity areas for alternative 1 and alternative 2 layouts considered.

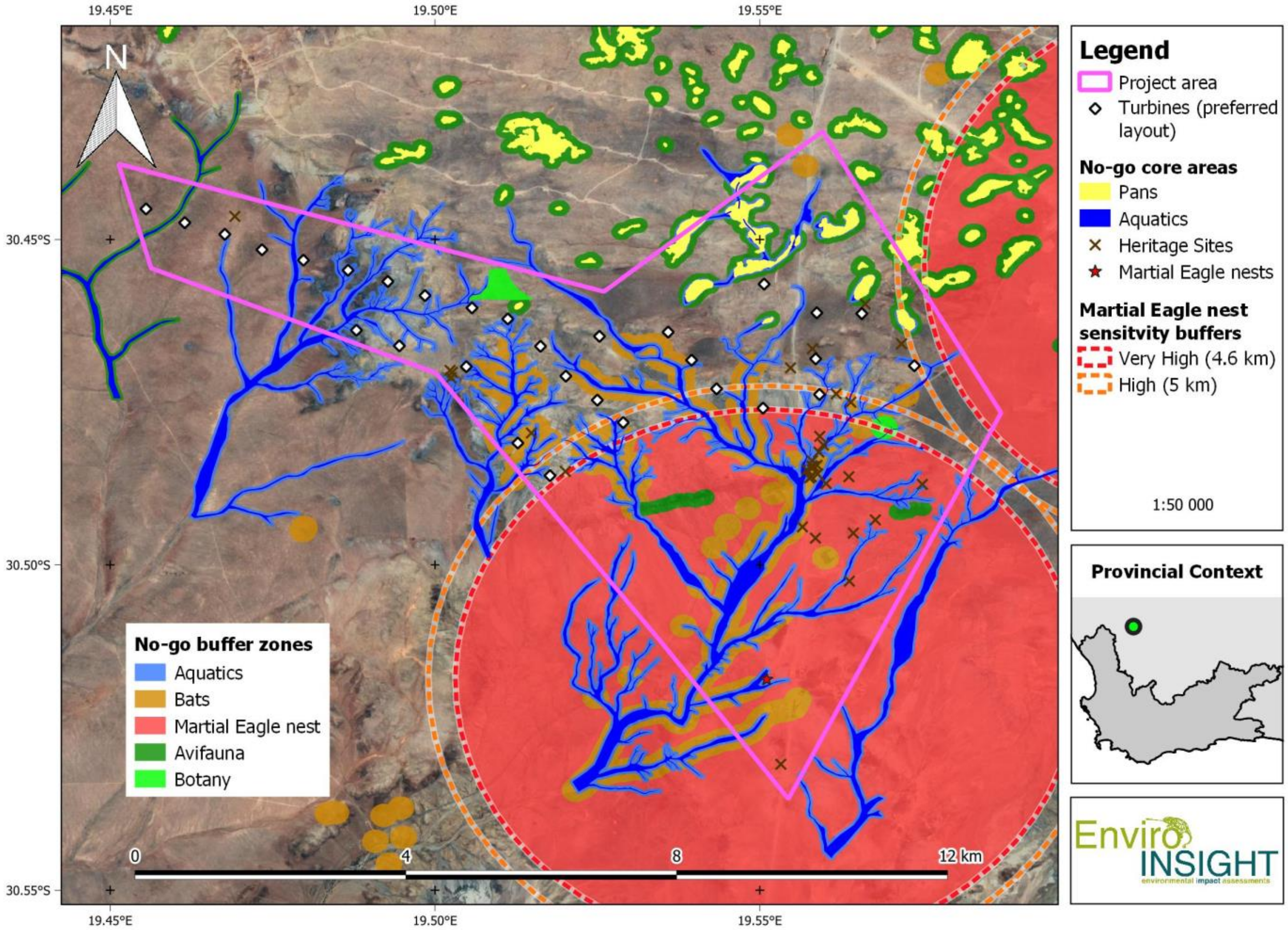

Figure 8-4: Sensitivity analysis indicating high sensitivity areas for the preferred layout.

8.3 SPECIALIST RECOMENDATIONS

Summary of specialist opinions and recommendations

Table 8-2: Summary of Specialist Recommendations.

Specialist	Recommendation	Opinion
Terrestrial Biodiversity	The affected area is not considered sensitive and there are no specific features of the affected area which would indicate that it is of broad-scale significance for faunal movement or landscape connectivity. Although there are two existing wind farms and several more applications in the area, the total extent of habitat loss due to wind energy is currently less than 200ha and with all applications would still be less than 1000ha and this is not considered significant in context of the affected vegetation types, which are among the more extensive in the country.	Project can proceed with the implementation of the recommended mitigation measures

Avifauna	The occurrence of several passerine species that might potentially be affected by collision was confirmed, namely endemic and/or range-restricted larks (Red Lark and Sclater's Lark representing the highest profile and frequently observed) which are widespread species in the area. These species are considered to have a "Vulnerable and Near threatened" conservation status respectively. As habitat obligates, the potential impact on these passerines may be mitigated via avoidance. The specialist has no reason why an Environmental Authorisation (EA) should not be granted on the following conditions; • All recommended buffering be strictly adhered to. • Shutdown on demand must be implemented if 5 km nest buffers are to be breached. • All recommended mitigation measures be applied preconstruction, post construction and operations. • The EMPr be updated every three years in order to revaluate the advances in AI, radar and camera technology. • Currently available Deterrent and Shutdown on demand technology is to be immediately applied to the identified turbines in the form of Artificial Intelligence Camera systems.	Project can proceed with the implementation of the recommended mitigation measures
Bat Assessment	Based on the available data collected, the construction of a WEF on the proposed WEF boundary will have a Low-Medium Risk of impacting the bat population in the area before mitigation measures have been applied. Currently, after mitigation measures have been implemented this risk will be reduced to Low.	Project can proceed with the implementation of the recommended mitigation measures
Aquatic Biodiversity	Considering the type of development proposed, a WEF, and the implementation of the recommendations and mitigation measures, the development is not likely to impact on the FEPA catchment classification associate with the study area.	Project can proceed with the implementation of the recommended mitigation measures
Agriculture	The proposed development will not have substantial negative impact on the agricultural production capability of the site and is therefore acceptable. This is substantiated by the facts that the land is of very low agricultural potential, the amount of agricultural land loss is within the allowable development limits, and that the proposed development poses a low risk in terms of causing soil degradation, if the recommended mitigation measures are implemented.	Project can proceed with the implementation of the recommended mitigation measures
Noise	there exists a low potential for a noise impact and that no further Scoping or other acoustical studies would be required for the proposed WEF. No specific mitigation measures regarding noise or additional noise measurements are recommended. No additional conditions regarding noise are recommended for inclusion in the EMPr. It	Project can proceed with the implementation of the recommended mitigation measures

	is therefore recommended that the development of the Botterblom WEF be approved from a noise perspective.	
Visual	As per the result from the visual impact assessment report, the structure would be easily visible to observers due to its high visual prominence, especially within a radius of 5-10km of the proposed WEF, which will potentially result in a high visual impact.	High Impact; however this does not represent a fatal flaw for the project. The project does fit into the current sense of place where there are two existing wind farms, and another one commissioned for construction. The residents in the area have not complained by the visual impacts of the existing windfarms and are not opposed to the Botterblom WEF.
Heritage	The three alternatives are all considered to be acceptable since the turbines avoid significant heritage sites and the impact of the proposed project on heritage resources can be mitigated to an acceptable level. The socio-economic benefits also outweigh the possible impacts of the development if the correct mitigation measures are implemented for the project. It is recommended that the proposed project can commence on the condition that the recommendations are implemented as part of the EMPr and based on approval from SAHRA.	Project can proceed with the implementation of the recommended mitigation measures
Social	The development of the proposed WEF will create employment, training and business opportunities during both the construction and operation phases of the project. The potential negative impacts associated with the construction phase can be mitigated. The proposed WEF is an investment in clean, renewable energy infrastructure for the country which will go some way to offset the negative environmental and socio-economic impacts associated with a coal-based fossil fuel energy generation. Renewable energy, including WEF, also addresses climate change and assists the country in meeting climate change reduction goals. The development of the Botterblom WEF is supported as the project will have significant positive impacts. These positive impacts relate to the economy by providing clean energy which will reduce South Africa's carbon footprint.	Project can proceed with the implementation of the recommended mitigation measures

Traffic	The existing road network has sufficient spare capacity to accommodate the proposed Botterblom Wind Energy Facility, without any road upgrades required to the existing road infrastructure. It is recommended that the proposed Botterblom Wind Energy Facility be approved from a transport impact perspective.	Project can proceed with the implementation of the recommended mitigation measures
Socio-Economic Wake Effect Analysis	The study revealed that external turbine interactions caused by the Botterblom WEF will result in wake losses, which translates into reduced amount of electricity that potentially affected WEFs could generate. This results in the losses of annual revenues and, by extrapolation, leads to the reduced community development contributions that the WEFs can make. The negative effect on the other WEFs contributions towards community development in the area is expected to be offset by the contributions made by the Botterblom WEF itself.	Project can proceed with the implementation of the recommended mitigation measures

9 CONCLUSION AND RECOMMENDATIONS

FE Botterblom (Pty) Ltd (hereafter the Applicant) is proposing the development of a wind energy facility (WEF) and associated infrastructure on a site located approximately 53 km north of Loeriesfontein in the Northern Cape province of South Africa. The proposed development, to be known as Botterblom WEF, will have a generation capacity of up to 240MW which will feed into the National Grid.

The proposed study area for the WEF development is located approximately 53km north of Loeriesfontein, 85 km west of Brandvlei and 160 km southeast of Springbok in the Northern Cape. The site can be reached via unsurfaced Granaatboskolk / Zout Dwaggas Road, which branches off the R357. The Botterblom WEF footprint is approximately 5 736 hectares (ha) and will be located on a Portion of the Remainder of the Farm Sous 226 (21-digit Surveyor General code: C01500000000022600000) The Khobab WEF is located directly north while Loeriesfontein2 WEF is located north-east of the study area.

The Botterblom WEF will consist of up to 30 wind turbines, with a generation capacity of between 4.5 and 7.5 MW per turbine, depending on the available technology at the time. Each turbine will have a hub height of up to 150 m and a rotor diameter of up to 175 m. The final turbine model to be utilised will only be determined closer to the time of construction, depending on the technology available at the time. Additional ancillary infrastructure to the WEF would include underground and above-ground cabling between project components, onsite substation/s, Battery Energy Storage Systems (BESS), foundations to support turbine towers, internal/ access roads (up to 10 m in width) linking the wind turbines and other infrastructure on the site, and permanent workshop area and office for control, maintenance and storage. As far as possible, existing roads will be utilised and upgraded (where needed) with the relevant stormwater infrastructure and gates constructed as required. The perimeter of the proposed WEF may be enclosed with suitable fencing. A formal laydown area for the construction period, containing a temporary maintenance and storage building along with a guard cabin will also be established.

The findings of the specialist studies undertaken within this EIA provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed wind farm project. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding. Areas of special concern have however been identified which will require site specific mitigation measures.

It was determined during the EIA that the proposed project will result in limited potential negative impacts and certain positive impacts. A preferred site layout has been identified which is less environmentally sensitive and will result in the least environmental impact.

A detailed public participation process was followed during the EIA process which conforms to the public consultation requirements as stipulated in the EIA Regulations. In addition, all issues raised by I&APs will be captured in the FEIAR and where possible, mitigation measures provided in the EMPr to address these concerns.

The three proposed site alternatives were assessed based on the viability and impact to the environment. Alternative 3 was considered for the maximum number of turbines for the property but was disregarded due to sensitivities and setbacks identified early on in the process, therefore, Alternative 1 and Alternative 2 were under consideration, however taking into consideration the recommendations, buffers and no-go areas by the specialist a Preferred Layout was designed to account for the site sensitives. Kindly refer to Figure 8-1 for the sensitivity analysis in regard to the various alternatives. This report is based on a project description and site plan, provided to by the applicant, which has not been approved by DFFE at this stage of the project. The project description and site plan may undergo refinements before being regarded as final. A project description based on the final design will be concluded once all stakeholders have provided feedback on the layout provided in this report.

It is the opinion of the EAP that the information and data provided in this EIAR is sufficient to enable the DFFE to consider all identified potentially significant impacts and to make an informed decision on the application. Further, it is the opinion of the EAP that based on the findings of the EIA that the proposed project should be granted an EA and allowed to proceed provided that the conditions as stipulated in this report are adhered to.

When deciding whether the activity should or should not be authorised in terms of NEMA, the EAP has evaluated and considered all identified impacts (positive and negative) as listed in Table 7-8. Where impacts cannot be avoided, the significance of these impacts was measured. The EAP has included specialist recommendations and prescribed mitigation measures into the EMPr.

9.1. CONDITIONS FOR THE ENVIRONMENTAL AUTHORISATION

Considering all the information presented in this EIR, a number of conditions for environmental authorisation can be prescribed. These conditions include:

- The applicant must ensure that the construction and post-construction mitigation measures and controls specified in the EMPr are adhered to. An independent ECO must be appointed to assess compliance with these measures and to enforce the EMPr.

- Environmental audits during the construction phase should be conducted on a monthly basis by an independent ECO in addition to a post-construction audit (PCA), Avifauna and Bat Monitoring.
- The post-construction avifauna monitoring reports must be submitted to BirdLife South Africa as per the guidelines and as per recommendations by the Avifauna Specialists
- The post-construction bat monitoring reports must be submitted to SABAA as per the guidelines.
- Mitigation measures provided by all specialists are to be adhered to.
- Inclusions, additions and adaptations of the EMPr, as well as all final plan drawings and maps must be submitted to DFFE for final approval.
- The high cumulative risk on regional bat and bird fatalities, it is recommended that if the post-construction bat and bird monitoring programmes determine that allowable fatality thresholds are exceeded, then Botterblom Wind Farm should be required to engage with DFFE, BirdLife South Africa and SABAA, and a curtailment plan developed and implemented if deemed the appropriate response.
- The final layout must exclude all no-go areas as per Figure 8-2.

This report is based on a project description and site plan, provided to by the applicant, which has not been approved by DFFE at this stage of the project. The project description and site plan may undergo refinements before being regarded as final. Since only a few stakeholders participated in the process, the buffers could not be finalised. Further discussions might be warranted with all stakeholders, and depending on the final buffer areas agreed upon, the layout will be adapted accordingly.

Layout Alternative 2 remains the preferred alternative, but micro-siting might be necessary to move some turbines out of sensitive buffer areas. Again, this is dependent on the final agreed upon buffer areas.

The following mitigation measures must be implemented as part of the planning and design, and pre-construction phases:

- All structures must be located outside no-go areas as per Figure 8-2.
- Project planning must include a plan for traffic control that will be implemented, especially during the construction phase of the development. Consultation with the local Road Traffic Unit in this regard must be done early in the planning phase. The necessary road traffic permits must be obtained for transporting parts, containers, materials and construction equipment to the site.
- Careful planning of the routes taken by heavy vehicles must highlight areas of road that may need to be upgraded in order to accommodate these vehicles. Once identified, these areas must be upgraded if necessary.
- The construction of surface stormwater drainage systems during the construction phase must be done in a manner that would protect the quality and quantity of the downstream system.
- A Stormwater Management Plan must be designed and implemented for the road network to prevent roads from serving as concentrated conduits for water run-off, significantly increasing erosion potential and sediment transport capacity. Water diversions along the road should be placed at regular intervals in order to divert water back into the natural veld on the downstream side of the road.

- It is recommended that all final positions of watercourse crossings be appropriately "fine-tuned" through field verification in order to minimise potential impacts and reduce road construction cost.
- An effective 40m watercourse Buffer Zone which include all riparian habitat must be established prior to any construction activities taking place. No person or vehicle will be allowed within the Buffer Zone, except for officially marked crossings. Management should be vigilant in preventing personnel taking short-cuts across the Buffer Zones between construction sites.
- A Waste Management Plan must be developed for handling onsite waste. This plan must designate an appropriate area where waste can be stored before disposal. All general waste must be disposed of at a registered landfill site.
- A plant search and rescue programme must be followed by a suitably qualified SACNASP registered botanist to identify all nationally and provincially protected species. The species already identified in the Terrestrial Biodiversity Assessment (Appendix D1) require a flora permit from the provincial authority for relocation prior to the commencement of construction activities.
- All sensitive areas must be clearly demarcated prior to construction activities.
- The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except by individuals with the appropriate permits
- Where sensitive features occur close to laydown areas or permanent structures, these sensitive features need to be fenced off (or a similar method used) to protect it from construction activities. This includes *A. dichotomum*, watercourses, and avifauna nests.

The following mitigation measures must be implemented during the construction phase:

- Sensitive Terrestrial Biodiversity features must be avoided. In order to minimise the loss of vegetation and faunal habitat, several mitigation measures are proposed.
- A Rehabilitation Management Plan must be developed and implemented during the construction phase as construction is complete at each site.
- Rehabilitate disturbed areas that are no longer required by the operational phase of the development. Inadequate rehabilitation could result in limited revegetation and/or an invasion of alien vegetation which will result in long term ecological degradation and damage.
- The clearance of vegetation, at any given time, must be kept to a minimum to reduce the possibility of soil erosion.
- A site-specific Alien Invasive Species (AIS) Management Plan must be implemented during the construction phase and continued monitoring and eradication needs to take place throughout the life of the project.
- Newly cleared and exposed areas must be managed for dust and landscaped with indigenous vegetation to avoid soil erosion. Where necessary, temporary stabilisation measures must be used until vegetation establishes.

- Apply necessary buffers for roost sites and other sensitive bird habitat features, avoiding the construction of turbines and access roads in these areas. Roads must utilise or upgrade existing farm roads as far as possible.
- Avoid placement of turbines near sensitive bird breeding and roosting habitats.
- Increase turbine cut in speed as this has been shown to reduce collisions. The risk is not considered to be high, and the annual collision risk is estimated at less than 5 birds per year.
- High value target species such as Martial Eagle should be tracked using telemetry systems in order to more accurately monitor movement patterns, especially in conjunction with turbines. These programs should be implemented during and post construction.
- A 5km buffer must be implemented for the Martial Eagle nest in the absence of mitigation measures. Avoidance measures in adherence to the 5 km recommended buffers is the most preferred option of mitigation.
- Based on the current preferred layout, 5 turbines lie between 4.6 and 5 km away from one of the two martial eagle nests. Without moving the turbine positions, this immediately triggers the requirement for the application of radar-based shutdown on demand technology. AI-based technology such as cameras may be implemented on higher risk turbines (determined through the monitoring programs and telemetry-based tracking of local eagles) as the preferred hybridised solution.
- Apply 200m buffer for bat roost sites and sensitive bat features, avoiding the construction of turbines, other infrastructure, clearing or laydown areas and access roads in these areas.
- Increase turbine cut in speed as this has been shown to reduce bat collisions. This is especially relevant in the eastern section of the site which has higher bat activity.
- Measures must be put in place to control the flow of surface water so that it does not impact on the vegetation, i.e., energy dissipaters and canal flow designs must be used to prevent scouring and erosion.

The following conditions are recommended for post-construction/operation phase:

- The post-construction and operational requires of the EMPr must be adhered to and an Independent ECO appointed to ensure compliance.
- All construction materials and waste must be removed from the site at the end of construction.
- Waybills must be produced showing the removal of waste / spoil / rubble to a registered waste site.
- A separate Post Construction audit must be carried out for the activities on completion to ensure compliance with the authorisation, if awarded, and this must be submitted to DFFE for review.
- A Complaints Register should be maintained onsite. All complaints should be recorded and addressed accordingly.
- The development must be in compliance with the following legislation: National Health Act, 2003 (Act 61 of 2003), the National Environmental Management Act, 1998 (Act 107 of 1998), the National Water Act, 1998 (Act 36 of 1998), the Occupational Health and Safety Act, 1993 (Act 85 of 1993), SABS 0400-1990, Hazardous Chemical Substances

Regulations of 1995, The Environment Conservation Act of 1989, The National Forests Act of 1998, The National Heritage Resources Act of 1999 and the Environmental Regulations for Workplaces of 1987.

- Rehabilitation of areas disturbed by construction activities or earthworks must commence immediately after the completion of construction activities, utilising indigenous species.
- Hazardous materials that require disposal (paints, solvents, old fuel / oil etc.) must be disposed of to a registered hazardous landfill site. These materials may be removed by an appropriate hazardous waste contractor. Proof of appropriate disposal must be available to the ECO for scrutiny and kept on record.
- Measures must be put in place to control the flow of surface water so that it does not impact on the vegetation, i.e., energy dissipaters and canal flow designs must be used to prevent scouring and erosion.
- Formal post-construction avifauna monitoring must be resumed once the turbines have been activated, as per the most recent edition of the best practice guidelines (Jenkins et al. 2015). The exact scope and nature of the post-construction monitoring will be informed on an ongoing basis by the result of the monitoring through a process of an establishment of available new technology and adaptive management. The purpose of this would be to establish if and to what extent displacement of priority species has occurred through the altering of flight patterns post-construction, and to search for and identify carcasses at turbines (mortality). The Avifauna Specialist has recommended post-construction monitoring for the site, which has been included in the EMPr, these recommendations will have to revaluated once the turbines have been activated.
- Formal post-construction bat monitoring must be resumed once the turbines have been activated, as per the most recent edition of the best practice guidelines (MacEwan et al., 2020). The exact scope and nature of the post-construction monitoring will be informed on an ongoing basis by the result of the monitoring through a process of an establishment of available new technology and adaptive management. It is recommended that mortality search effort is increased throughout the post-construction during the months of April and November in an attempt to obtain a more reliable estimate of bat mortalities during these periods of higher activity. In addition, apply adaptive mitigation measures according to post-construction monitoring results (counted strikes) informed by environmental correlates of bat activity, such as slowing or curtailment of strategic turbines during certain times or conditions.

Decommissioning Phase:

- All recyclable materials must be repurposed in an environmentally friendly way

10. REFERENCES

African Chiroptera Report. (2020). AfricanBats NPC, Pretoria. i-xv + 8297 pp. doi: 10.13140/RG.2.2.27442.76482

Albadi. M.H.H. (2010). On Techno-economic Evaluation of Wind-based DG. PhD Thesis in Electrical and Computer Engineering, Waterloo, Ontario, Canada.

Animalia. (2011). Environmental Constraints Analysis with regards to bat (Chiroptera) sensitivity - For the proposed Loeriesfontein Wind Energy Facility near Loeriesfontein, Northern Cape.

Animalia. (2017). Findings of a 12-month Long-Term Pre-Construction Bat Monitoring Study and Impact Assessment for the proposed Kokerboom 1 Wind Farm, Northern Cape. Ref: R-1701-02.

Cape Farm Mapper. Available at: https://gis.elsenburg.com/apps/cfm/.

Census 2011: Statistics South Africa (2011) South African Population Census 2011.

Council for Scientific and Industrial Research (CSIR). (2011). NFEPA rivers [vector geospatial dataset] 2011. Available from the Biodiversity GIS website.

Council for Scientific and Industrial Research (CSIR). (2011). NFEPA wetlands [vector geospatial dataset] 2011. Available from the Biodiversity GIS website.

Department of Agriculture, Forestry and Fisheries (DAFF). (2017). National land capability evaluation raster data layer, 2017. Pretoria.

Department of Environmental Affairs (DEA). 2013. Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria. 100 pages.

Department of Environmental Affairs (DEA). (2015). EIA Guideline for Renewable Energy Projects. Department of Environmental Affairs, Pretoria, South Africa.

Department of Environmental Affairs (DEA). (2017). Guideline on Need and Desirability. Department of Environmental Affairs (DEA), Pretoria, South Africa, ISBN: 978-0-9802694-4-4.

Department of Water Affairs and Forestry. (2005). A practical field procedure for identification and delineation of wetlands and riparian areas. Department of Water Affairs and Forestry, Pretoria, South Africa.

Driver, A., Nel, J.L., Snaddon, K., Murray, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J. & Funke, N. (2011). Implementation manual for Freshwater Ecosystem Priority Areas. WRC Report No. 1801/1/11. Water Research Commission, Pretoria, South Africa.

Gartman, V., Bulling, L., Dahmen, M., Geißler, G., & Köppel, J. (2016a). Mitigation measures for wildlife in wind energy development, consolidating the state of knowledge—part 1: planning and siting, construction. *Journal of Environmental Assessment Policy and Management*, 18(03), 1650013.

Gartman, V., Bulling, L., Dahmen, M., Geißler, G., & Köppel, J. (2016b). Mitigation measures for wildlife in wind energy development, consolidating the state of knowledge—Part 2: Operation, decommissioning. *Journal of Environmental Assessment Policy and Management*, 18(03), 1650014.

Hantam Local Municipality. 2020. Integrated Development Plan (IDP) 2020/2021. REVIEW 3 OF THE 4TH GENERATION IDP (MAY 2020).

Holness, S., & Oosthuysen, E. (2016). Critical Biodiversity Areas of the Northern Cape: Technical Report.

IUCN. (2021) The IUCN Red List of Threatened Species. [Online] Available at: http://www.iucnredlist.org.

Jenkins, A.R., van Rooyen, C.S., Smallie, J.J., Harrison, J.A., Diamond, M., Smit-Robinson, H.A. & Ralston, S. (2015) *Best-Practice Guidelines for Assessing and Monitoring the Impact of Wind-Energy Facilities on Birds in Southern Africa.*

MacEwan, K., Sowler, S., Aronson, J., and Lötter, C. (2020) South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities - ed 5. South African Bat Assessment Association.

Macey, P.H., Siegfried, H.P., Minnaar, H., Almond, J., & Botha, P.M.W. (2011). Loeriesfontein 3018 Geological Map.

Macfarlane, D.M. & Bredin, I.P. (2016). Buffer zone guidelines for rivers, wetlands and estuaries. Part 1: Technical Manual. WRC Report No. TT 715/1/17. Water Research Commission, Pretoria, South Africa.

May, R., Nygård, T., Falkdalen, U., Åström, J., Hamre, Ø., & Stokke, B. G. (2020). Paint it black: Efficacy of increased wind turbine rotor blade visibility to reduce avian fatalities. Ecology and evolution, 10(16), 8927-8935.

McClure, C. J., Rolek, B. W., Dunn, L., McCabe, J. D., Martinson, L., & Katzner, T. (2021). Eagle fatalities are reduced by automated curtailment of wind turbines. *Journal of Applied Ecology*, 58(3), 446-452

Monadjem, A., Shapiro, J.T., Mtsetfwa, F., Reside, A.E., McCleery, R.A. (2017) Acoustic Call Library and Detection Distances for Bats of Swaziland. *Acta Chiropterologica*, 19(1):175-187.

Monadjem, A., Taylor, P., Cotterill, F., Schoeman, M. (2020) *Bats of Southern and Central Africa: A biogeographic and taxonomic synthesis, second edition*. Johannesburg: Wits University Press. doi:10.18772/22020085829.

Morris, D. 2013. Khobab Wind Energy Facility: Power Line Route Options, Access Road And Substation Positions Specialist Input For The Environmental Basic Assessment And Environmental Management Programme For Proposed Power Line Options For The Loeriesfontein 1 Wind & Loeriesfontein 3 Solar Energy Facility At Sous And Aan De Karee Doorn Pan, North of Loeriesfontein, Northern Cape Province.

Mucina, L. & Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria.

Murgatroyd, M., Bouten, W., & Amar, A. (2021). A predictive model for improving placement of wind turbines to minimise collision risk potential for a large soaring raptor. *Journal of Applied Ecology*, 58 (4), 857-868.

Namakwa District Municipality Integrated Development Plan. 2020-2021.

National Heritage Resources Act NHRA of 1999 (Act 25 of 1999)

Nel, J.L., Driver, A., Strydom, N.A., Maherry, A.M., Peterson, C., Hill, L., Roux, D.J., Nienaber, S., van Deventer, H., Swartz, E.R. & Smith-Adao, L.B. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. WRC Report No. TT 500/11. Water Research Commission, Pretoria, South Africa.

Northern Cape Department of Environment and Nature Conservation. (2016). Northern Cape Critical Biodiversity Areas [Vector] 0. Available from the Biodiversity GIS website.

Northern Cape Department of Environment and Nature Conservation. 2016 Northern Cape Critical Biodiversity Areas Reason [Vector] 2016. Available from the Biodiversity GIS website.

Northern Cape Government . (2008). Provincial Growth and Development Strategy

Perold, V., Ralston-Paton, S. & Ryan, P. (2020): On a collision course? The large diversity of birds killed by wind turbines in South Africa, Ostrich, DOI: 10.2989/00306525.2020.1770889.

Ralston-Paton, S. (2017). Verreauxs' Eagle and Wind Farms: Guidelines for impact assessment, monitoring, and mitigation. BirdLife South Africa Occasional papers, Johannesburg.

Ralston-Paton, S., Smallie J., Pearson A., and Ramalho R. (2017). Wind energy's impacts on birds in South Africa: A preliminary review of the results of operational monitoring at the first wind farms of the Renewable Energy Independent Power Producer Procurement Programme in South Africa. BirdLife South Africa Occasional Report Series No. 2. BirdLife South Africa, Johannesburg, South Africa.

SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.

SANS 10210:2004. 'Calculating and predicting road traffic noise'.

SANS 10328:2008. 'Methods for environmental noise impact assessments'.

SANS 10357:2004 The calculation of sound propagation by the Concave method'.

Schulze, R.E. 2009. SA Atlas of Climatology and Agrohydrology. Available on Cape Farm Mapper.

South African National Biodiversity Institute (SANBI). (2018). Beta Vegetation Map of South Africa, Lesotho and Swaziland (File Geodatabase) [File geodatabase] 2018. Available from the Biodiversity GIS website (http://bgis.sanbi.org/SpatialDataset/Detail/670).

South African National Biodiversity Institute (SANBI). (2020). *Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa.* South African National Biodiversity Institute, Pretoria. Version 1.2020.

Taylor, M.R., Peacock, F. & Wanless, R.M. (eds). (2015). *The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Johannesburg, South Africa.

Urban-Econ. (2011). Hantam Local Municipality: Local Economic Development Strategy.

Van der Walt, J. 2011. Heritage scoping report for the proposed solar energy facility close to Loeriesfontein, Northern Cape. Unpublished report submitted to SAHRA.

Van der Walt, J. 2012. Archaeological Impact Assessment report for the proposed solar energy facility close to Loeriesfontein, Northern Cape. Unpublished report submitted to SAHRA.

Van der Walt, J. 2017. Heritage Walkthrough for Phase 2 and 3 of the proposed Hantam PV Solar Solar Energy Facility on the farm Narosies 228 North of Loeriesfontein, Northern Cape Province.

APPENDICES